APPENDIX H DRAFT PLAN OF DEVELOPMENT

ALASKA LNG

DRAFT PLAN OF DEVELOPMENT

AKLNG-6020-REG-PLN-DOC-00029

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1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

The Alaska Gasline Development Corporation (Applicant) plans to construct one integrated liquefied natural gas (LNG) Project (Project) with interdependent facilities for the purpose of liquefying supplies of natural gas from Alaska, in particular from the Point Thomson Unit (PTU) and Prudhoe Bay Unit (PBU) production fields on the Alaska North Slope (North Slope), for export in foreign commerce and for in-state deliveries of natural gas.

The Natural Gas Act (NGA), 15 U.S.C. § 717a(11) (2006), and Federal Energy Regulatory Commission (FERC) regulations, 18 Code of Federal Regulations (C.F.R.) § 153.2(d) (2014), define "LNG terminal" to include "all natural gas facilities located onshore or in State waters that are used to receive, unload, load, store, transport, gasify, liquefy, or process natural gas that is ... exported to a foreign country from the United States." With respect to this Project, the "LNG Terminal" includes the following: a liquefaction facility (Liquefaction Facility) in Southcentral Alaska; an approximately 807-mile gas pipeline (Mainline); a gas treatment plant (GTP) within the PBU on the North Slope; an approximately 63-mile gas transmission line connecting the GTP to the PTU gas production facility (PTU Gas Transmission Line or PTTL); and an approximately 1-mile gas transmission line connecting the GTP to the PBU gas production facility (PBU Gas Transmission Line or PBTL). All of these facilities are essential to export natural gas in foreign commerce and will have a nominal design life of 30 years.

These components are shown in Figure 1.1-1. Their proposed basis for design is described as follows.

The new Liquefaction Facility would be constructed on the eastern shore of Cook Inlet just south of the existing Agrium fertilizer plant on the Kenai Peninsula, approximately 3 miles southwest of Nikiski and 8.5 miles north of Kenai. The Liquefaction Facility would include the structures, equipment, underlying access rights, and all other associated systems for final processing and liquefaction of natural gas, as well as storage and loading of LNG, including terminal facilities and auxiliary marine vessels used to support Marine Terminal operations (excluding LNG carriers [LNGCs]). The Liquefaction Facility would include three liquefaction trains combining to process up to approximately 20 million metric tons per annum (MMTPA) of LNG. Two 240,000-cubic-meter tanks would be constructed to store the LNG. The Liquefaction Facility would be capable of accommodating two LNGCs. The size of LNGCs that the Liquefaction Facility would accommodate would range between 125,000–216,000-cubic-meter vessels.

In addition to the Liquefaction Facility, the LNG Terminal would include the following interdependent facilities:

- Mainline: A new 42-inch-diameter natural gas pipeline approximately 807 miles in length would extend from the Liquefaction Facility to the GTP in the PBU, including the structures, equipment, and all other associated systems. The proposed design anticipates up to eight compressor stations; one standalone heater station, one heater station collocated with a compressor station, and six cooling stations associated with six of the compressor stations; four meter stations; 30 Mainline block valves (MLBVs); one pig launcher facility at the GTP meter station, one pig receiver facility at the Nikiski meter station, and combined pig launcher and receiver facilities at each of the compressor stations; and associated infrastructure facilities.

  Associated infrastructure facilities would include additional temporary workspace (ATWS), access roads, helipads, construction camps, pipe storage areas, material extraction sites, and material disposal sites.

  Along the Mainline route, there would be at least five gas interconnection points to allow for future in-state deliveries of natural gas. The approximate locations of three of the gas

interconnection points have been tentatively identified as follows: milepost (MP) 441 to serve Fairbanks, MP 763 to serve the Matanuska-Susitna Valley and Anchorage, and MP 807 to serve the Kenai Peninsula. The size and location of the other interconnection points are unknown at this time. None of the potential third-party facilities used to condition, if required, or move natural gas away from these gas interconnection points are part of the Project. Potential third-party facilities are addressed in the Cumulative Impacts analysis found in Appendix L of Resource Report No. 1;

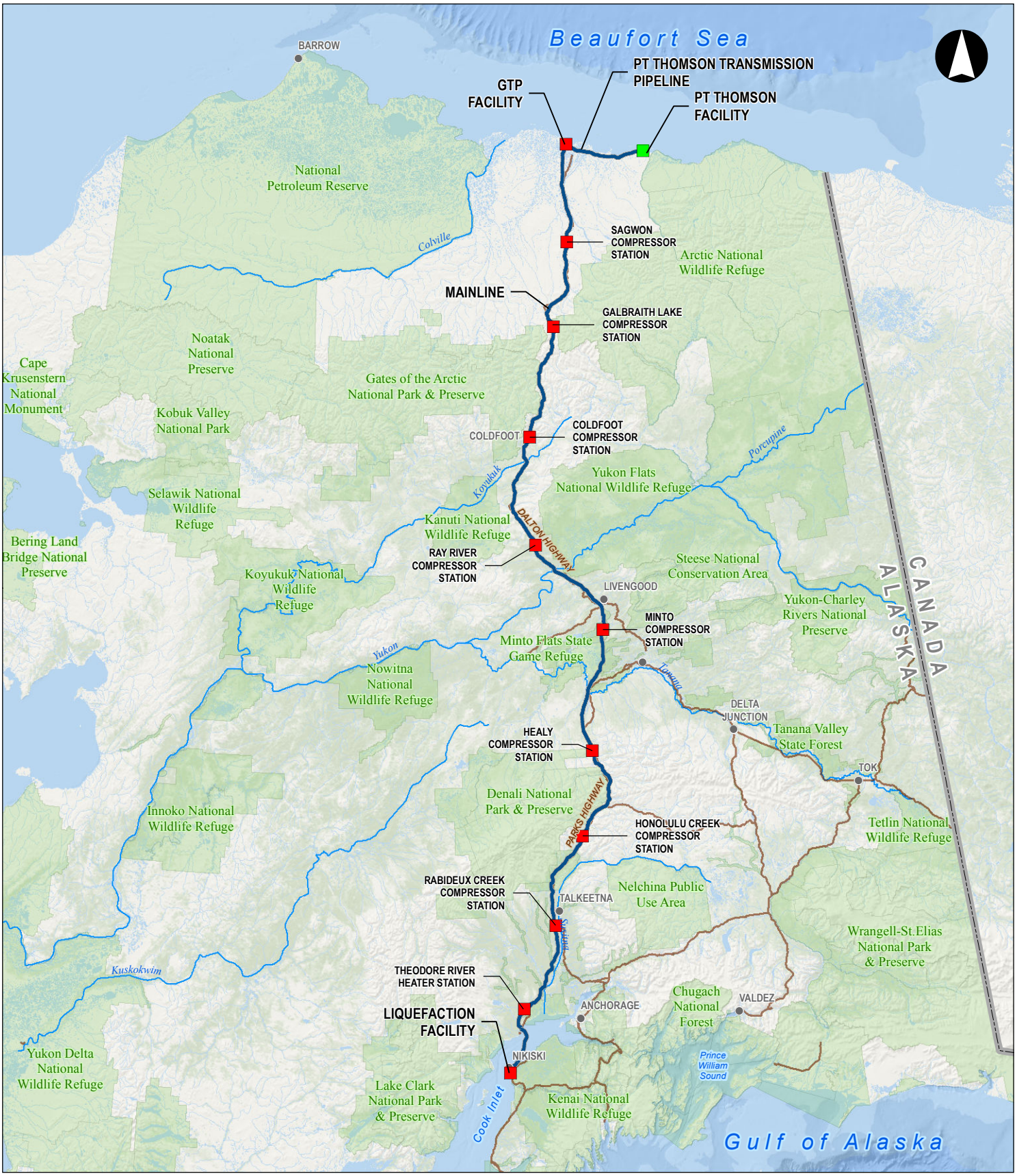
- GTP: A new GTP and associated facilities in the PBU would receive natural gas from the PBU Gas Transmission Line and the PTU Gas Transmission Line. The GTP would treat/process the natural gas for delivery into the Mainline. There would be custody transfer, verification, and process metering between the GTP and PBU for fuel gas, propane makeup, and by-products. All of these would be on the GTP or PBU pads;
- PBU Gas Transmission Line: A new 60-inch natural gas transmission line would extend approximately 1 mile from the outlet flange of the PBU gas production facility to the inlet flange of the GTP. The PBU Gas Transmission Line would include one-meter station on the GTP pad; and
- PTU Gas Transmission Line: A new 32-inch natural gas transmission line would extend approximately 63 miles from the outlet flange of the PTU gas production facility to the inlet flange of the GTP. The PTU Gas Transmission Line would include one meter station on the GTP pad, four MLBVs, and pig launcher and receiver facilities—one each at the PTU and GTP pads.

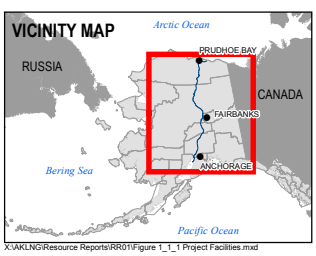
Existing State of Alaska transportation infrastructure would be used during the construction of these new facilities including ports, airports, roads, railroads, and airstrips (potentially including previously abandoned airstrips). A preliminary assessment of potential new infrastructure and modifications or additions to these existing in-state facilities is provided in Resource Report No. 1, Appendix L. The Liquefaction Facility, Mainline, and GTP would require the construction of modules that may or may not take place at existing or new manufacturing facilities in the United States.

Draft Resource Report No. 1, Appendix A, contains maps of the Project footprint. Appendices B and E of Resource Report No. 1 depict the footprint, plot plans of the aboveground facilities, and typical layout of aboveground facilities.

Outside the scope of the Project, but in support of or related to the Project, additional facilities or expansion/modification of existing facilities would be needed to be constructed. These other projects may include:

- Modifications/new facilities at the PTU (PTU Expansion project);
- Modifications/new facilities at the PBU (PBU Major Gas Sales [MGS] project); and
- Relocation of the Kenai Spur Highway.





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LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- State and Federal Conservation Lands

0 50 100 Miles

DISCLAIMER

The information contained herein is for informational or planning purposes only, It does not nor should it be deemed to be an offer, request or proposals for rights or occupation of any kind. The Alaska LNG Project Participants and their respective officers, employees and agents, make no warranty, implied or otherwise, nor accept any liability, as to the accuracy or completeness of the information contained in these documents, drawings or electronic files. Do not remove or delete this note from document, drawing or electronic file.

PREPARED BY:	AGDC		
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PROJECT FACILITIES OVERVIEW

FIGURE 1.1-1

ALASKA LNG

1.2 SUMMARY OF PROJECT REGULATORY FRAMEWORK

Project approval is regulated by the Federal Energy Regulatory Commission (FERC) under Section 3 of the Natural Gas Act (15 United States Code (U.S.C.) § 717b (2006)). Under FERC's regulations and through interagency agreements and Memorandums of Understanding (MOUs), FERC is the lead federal agency for conducting a review under the National Environmental Policy Act (NEPA). FERC's regulations require applicant development of environmental reports ("Resource Reports") which are included as part of the applicant's application for FERC approval. In conjunction with the application to FERC, draft applications for other major federal approvals with a federal nexus for NEPA review must also be filed to appropriate federal agencies[1,2]. A complete list of federal, state, and local permits and authorizations that may be required for the Project is provided in Resource Report No. 1, Appendix C.

1.3 DOCUMENT ORGANIZATION AND REVISION

The Project purpose and overview are provided in Section 2 and specific land requirements are described in Section 3. Additional components of the right-of-way are described in Section 4. Regulatory approvals and authorizations are listed in Section 5. Explanation of pipeline and ancillary facility construction are provided in Section 6. Resource and environmental analyses are provided in Section 7. Section 8 describes stabilization and restoration procedures. Section 9 provides information on operations and maintenance and Section 10 provides information on termination/abandonment.

Updated information regarding the Project scope will be provided through updates to this POD. The POD will also be modified to incorporate any applicable measures for pipeline route adjustment, construction practices and seasonality, mitigation requirements, or other requirements that may be developed and contained in the Record of Decision (ROD) for the environmental impact statement (EIS) or to address measures developed by the Bureau of Land Management (BLM) as a result of their review and authorization process for a ROW Grant and other authorizations associated with the Project.

[1] Required by TC-1 2884 to be concurrent with Natural Gas Act application: http://www.blm.gov/style/medialib/blm/wo/MINERALS__REALTY__AND_RESOURCE_PROTECTION_/lands_and_realty/row_manuals_2800-2889.Par.55361.File.dat/2884.pdf

[2] Earlier FERC guidance under Notice of Proposed Rulemaking (NOPR) §§ 153.8 and 157.14 required all Federal applications to have been filed prior to submitting NGA section 3 or 7 application else the application may be deemed incomplete. Final Rule promulgated under Docket No. RM06-1-000; Order No. 687 revised this guidance following applicant feedback that compliance with the previous guidance is unattainable.

> *"A project sponsor will now be required to state "the date each request for authorization was submitted; why any request has not been submitted and the date submission is expected; and the date by which final action on each Federal authorization has been requested or is expected." For requests that remain outstanding at the time an application is filed, the Commission will review the reasons given, the projected dates of submission, and an applicant's interactions with the agencies."*

Additionally, Order No. 687 identifies that needed consultations are federal authorizations

> *"To the extent recommendations and opinions are necessary for a federal agency, or state agency acting under federally delegated authority, to reach a decision on a request for a federal authorization that is needed for a proposed NGA section 3 or 7 project to go forward, the Commission interprets EPAct 2005's mandate as encompassing such recommendations and opinions as "federal authorizations.""*

2.0 PROJECT PURPOSE AND DESCRIPTION

The purpose of the Alaska LNG Project (Project) is to commercialize the vast natural gas resources[3] on Alaska's North Slope, principally by converting the available natural gas supply to LNG for export. There have been numerous unsuccessful efforts to bring this gas to market, including past projects to transport gas by pipeline to the continental United States.[4] As indigenous Lower 48 natural gas supply has increased, an interstate pipeline project from Alaska is currently not economically viable. Foreign demand for natural gas has increased,[5] making LNG export the best and only viable option to commercialize these abundant Alaskan resources at this time.

The Project's intention is to deliver natural gas from the PBU and PTU, which is a subset of total North Slope resources.[6] The U.S. Department of Energy (DOE) has conditionally approved an application for the Project to export 20 million metric tons per annum of LNG produced from Alaska for a 30-year period to Free Trade Agreement (FTA) or non-FTA nations.[7] Yet no infrastructure exists to deliver this natural gas to market.

Taking these and other factors into account, including economics, technical requirements and environmental considerations,[8] the Applicant, determined the location, throughput, and timing for the Project. A new LNG terminal[9] to export up to 20 MMTPA of LNG,[10] with projected start-up in approximately 2024-2025, would include year-round accessible marine facilities near Nikiski, Alaska,[11] as well as liquefaction, pipeline, and gas treatment facilities, connecting North Slope natural gas to foreign LNG markets. This integrated LNG terminal would be the largest LNG project constructed in the United States, with an estimated cost of $40 to $45 billion.

Several important objectives support this substantial investment. The Project would:

- Commercialize natural gas resources on the North Slope during the economic life of the PBU field and achieve efficiencies through the use of existing common oil and gas infrastructure and economies of scale;
- Bring cost-competitive Alaska LNG to foreign markets in a timely manner; and
- Provide at least five interconnection points to allow for in-state gas deliveries, benefiting in-state gas users and supporting long-term economic development.[12]

[3] *See* DeGolyer and MacNaughton, "Report on a Study of Alaska Gas Reserves and Resources for Certain Gas Supply Scenarios as of December 31, 2012" at Figure 5 (April 2014).

[4] http://www.arlis.org/docs/vol1/AlaskaGas/Report/Report_CRS_2011_AK_NGP_IssuesCongress.pdf

[5] https://www.mckinseyenergyinsights.com/insights/positive-outlook-for-lng.aspx

[6] DeGolyer and MacNaughton at 11.

[7] DOE/FE Order No. 3554 (granting authorization to export LNG to FTA nations); DOE/FE Order No. 3643 (granting authorization to export LNG to non-FTA nations conditioned on FERC's environmental review process). DOE's non-FTA approval is conditioned on the satisfactory completion of the ongoing FERC-led National Environmental Policy Act (NEPA) review process, in which DOE is a cooperating agency. DOE Order No. 3643, at 9, 42.

[8] *See* Resource Report No. 10 for a full discussion of the alternatives and reasons for selecting the Project.

[9] *See* 18 C.F.R. § 153.2(d)(defining "LNG terminal" to include "all natural gas facilities used to … transport, gasify, liquefy, or process natural gas that is … exported to a foreign country from the United States"); *supra* Section 1.1.

[10] DOE/FE Order No. 3554 and Order No. 3643.

[11] Because the Project requires year-round LNG export by waterborne vessels, the purpose and need of the Project is water-dependent.

[12] Id. (estimating demand for in-state use).

2.1 EXPECTED PUBLIC BENEFITS

In commercializing North Slope natural gas, the Project would offer multiple benefits, all of which are consistent with the public interest. The Project would:

- Stimulate local, state, regional, and national economies through job creation, an enhanced tax base, increased economic activity, and improved U.S. balance of trade, producing "unequivocally positive" economic impacts in Alaska and the United States as a whole;[13]
- Provide a long-term source of revenue to Alaska state and local governments, supporting public services;
- Create up to 15,160 jobs during peak construction and approximately 730 jobs for operation of the Project;
- Create numerous opportunities for Alaska businesses and contractors during construction and operation of the Project;
- Provide infrastructure that may provide opportunity for expansion and incentivize further investment, exploration, and production, leading to more industry activity in the state;
- Support the economic and national security interests of the United States by providing a secure source of energy for its trading partners and contributing to the long-term stability of international energy supply; and
- Produce local, regional, and global environmental benefits by providing, through natural gas and LNG, a cleaner source of energy than many existing alternatives.

2.2 PROJECT DESCRIPTION

2.2.1 Overview

The Natural Gas Act (NGA), 15 U.S.C. § 717a(11) (2006), and Federal Energy Regulatory Commission (FERC) regulations, 18 Code of Federal Regulations (C.F.R.) § 153.2(d) (2014), define "LNG terminal" to include "all natural gas facilities located onshore or in State waters that are used to receive, unload, load, store, transport, gasify, liquefy, or process natural gas that is ... exported to a foreign country from the United States." With respect to this Project, the "LNG Terminal" includes the following: Liquefaction Facility in Southcentral Alaska; an approximately 807-mile gas pipeline (Mainline); a gas treatment plant (GTP) within the PBU on the North Slope; an approximately 63-mile gas transmission line connecting the GTP to the PTU gas production facility (PTTL); and an approximately 1-mile gas transmission line connecting the GTP to the PBU gas production facility (PBTL). All of these facilities are essential to export natural gas in foreign commerce and will have a nominal design life of 30 years.

Their proposed basis for design is described as follows.

2.2.1.1 Liquefaction Facility

The Liquefaction Facility would be a new facility constructed on the eastern shore of Cook Inlet in the Nikiski area of the Kenai Peninsula, within the area depicted in the appendices. The proposed Liquefaction Facility would be approximately 921 acres (901 acres onshore and 20 acres offshore), approximately 3 miles from Nikiski, and 8.5 miles from Kenai. The Liquefaction Facility would consist of the LNG Plant and Marine Terminal.

[13] *Id.* at 4-5.

2.2.1.2 Interdependent Project Facilities

In addition to the Liquefaction Facility, Project facilities would include the Mainline, GTP, PBTL, and PTTL to move and process natural gas from the North Slope to the Liquefaction Facility. Preliminary pipeline route maps provided in Appendix A of Resource Report No. 1 have assigned mileposts (MPs) on the pipeline according to convention to reflect natural gas flow (i.e., from north to south in the case of the Mainline and from east to west in the case of the PTTL).

- Mainline: A new 42-inch-diameter natural gas pipeline approximately 807 miles in length extending from the GTP in the PBU to the Liquefaction Facility on the shore of Cook Inlet near Nikiski, including an offshore pipeline section crossing Cook Inlet. The Mainline will be designed for a maximum allowable operating pressure (MAOP) of 2,075 psig and an average stream day rate of 3.1 BSCF/D, and a 3.3 BSCF/D peak capacity.[14] The Mainline would include several types of aboveground pipeline facilities. The design would include eight compressor stations, one standalone heater station, two meter stations, multiple pig launching/receiving stations as part of one system (associated with meter stations, GTP, Liquefaction Facility and/or MLBV), multiple MLBVs, and a minimum of five gas interconnection points for in-state deliveries;
- Associated infrastructure facilities would include additional temporary workspace (ATWS), access roads, helipads, construction camps, pipe storage areas, material extraction sites, and material disposal sites.
- Along the Mainline route, there would be at least five gas interconnection points to allow for future in-state deliveries of natural gas. Gas interconnection points are likely to be located near the population centers of Fairbanks, Anchorage, and the Matanuska-Susitna Borough from the north side of Cook Inlet crossing, and the Kenai Peninsula from the south side of the Cook Inlet crossing. Other potential gas interconnection points are also being evaluated. To date, three of the locations for natural gas interconnection points have been identified:
    - Fairbanks/North Star Gas Interconnection Point – near MP 441 to serve the Fairbanks area;
    - Anchorage/Matanuska-Susitna Gas Interconnection Point – near MP 764 to connect to the existing ENSTAR pipeline system for delivery to serve the Anchorage/Matanuska-Susitna Valley area; and
    - Kenai Peninsula Gas Interconnection Point – near MP 807 to connect to the existing ENSTAR pipeline system to serve the Kenai Peninsula area.
- Gas Treatment Plant (GTP): A new GTP and associated facilities would treat natural gas received from PBU and PTU. The proposed GTP would be located in the PBU near the Beaufort Sea coast (see Figure 1.1-1). The GTP would be located on state land within the North Slope Borough and is designated for oil and natural gas development. The design of the GTP would have an average stream day inlet natural gas treating capacity of 3.7 BSCF/D and a 3.9 BSCF/D peak capacity[15], and would be able to accommodate varying compositions of natural gas received from the PBU and PTU. The GTP would treat/process the natural gas for delivery into the Mainline. There would be custody transfer, verification, and process metering between the GTP and PBU for fuel gas, propane makeup, and by-product. All of these would be on the GTP or PBU pads;
- Prudhoe Bay Gas Transmission Line (PBTL): The GTP and associated facilities, located in the PBU, would receive natural gas from the PBU by way of the PBTL. The PBTL would be an approximately 1-mile, 60-inch-diameter aboveground pipeline to transport natural gas from the PBU Central Gas Facility (CGF) to the GTP, with an average stream day rate of 2.8 BSCF/D, a

[14] Average stream day rate denotes the weighted 12-month average of monthly stream day rate values. Stream day rate represents the physical capacity of the facility at a particular ambient condition and does not account for planned or unplanned downtime (assume 100-percent uptime).

[15] Average stream day rate denotes the weighted 12-month average of monthly stream day rate values. Stream day rate represents the physical capacity of the facility at a particular ambient condition and does not account for planned or unplanned downtime (assume 100-percent uptime).

peak capacity of 4.0 BSCF/D[16] and a MAOP of 720 psig. The PBTL would be installed on horizontal support members connected to a steel pile, or vertical support members (VSMs), and would be located within the North Slope Borough, crossing lands managed by the State of Alaska; and

- Point Thomson Gas Transmission Line (PTTL): The GTP and associated facilities, located in the PBU, would receive natural gas from the PTU by way of the PTTL. The PTTL design includes an average stream day rate of 865 million standard cubic feet per day (MMSCF/D),[17] a peak capacity of 920 MMSCF/D,[18] and an MAOP of 1,150 psig. The PTTL would be located between the PTU and the GTP at Prudhoe Bay, aligned east-west and parallel to the coast of the Beaufort Sea (see Figure 1.1-1). The PTTL would be located entirely within the North Slope Borough, crossing lands managed by the State of Alaska. Intermediate natural gas compression or cooling facilities are not planned for the PTTL. There would be one meter station associated with this pipeline that would be built on the existing PTU Central Pad. A launcher located at the PTU meter station and a receiver located at the GTP inlet are currently planned. Three MLBVs and two isolation/sectionalizing valves coinciding with the PTU meter station and GTP inlet are planned for the PTTL.

Existing State of Alaska transportation infrastructure would be used during the construction of these new facilities including ports, airports, roads, railroads, and airstrips (potentially including previously abandoned airstrips). A preliminary assessment of potential new infrastructure and modifications or additions to these existing in-state facilities is provided in Appendix L of Resource Report No. 1.

Appendix A of Resource Report No. 1 contains maps of the entire Project footprint. Appendices B and E of Resource Report No. 1 depict the footprint, plot plans of the aboveground facilities, and typical layout of aboveground facilities.

Outside the scope of the Project, but in support of or related to the Project, additional facilities or expansion/modification of existing facilities would be needed to be constructed. These other projects may include:

- Modifications/new facilities at the PTU (PTU Expansion project);
- Modifications/new facilities at the PBU (PBU Major Gas Sales [MGS] project); and
- Relocation of the Kenai Spur Highway.

2.3 COMMODITY AND PURPOSE

Natural gas will be transported by pipeline to a Liquefaction facility on Cook Inlet for liquefying and exporting the natural gas to foreign markets as well as to provide access to natural gas in Alaska for potential residential, commercial, and/or industrial use.

3.0 PROJECT LOCATION AND LAND REQUIREMENTS

The Project's design includes approximately 68,000 acres of land that would be temporarily affected by construction of the Project. Following completion of construction, approximately 8,600 of these acres would be used for operation of the Project facilities. A summary of the acreages affected during construction and operation of the Project facilities is shown in Table 3.1-1.

[16] Average stream day rate denotes the weighted 12-month average of monthly stream day rate values. Stream day rate represents the physical capacity of the facility at a particular ambient condition and does not account for planned or unplanned downtime (assume 100-percent uptime).

[17] Variability due to changes in in-state gas interconnection points over 30-year design life.

[18] Average stream day rate denotes the weighted 12-month average of monthly stream day rate values. Stream day rate represents the physical capacity of the facility at a particular ambient condition and does not account for planned or unplanned downtime (assume 100-percent uptime).

The proposed locations of major facilities, mainline pipeline route (Revision C2), and offsite work areas are depicted on aerial imagery and USGS maps provided in Resource Report No. 1, Appendix A. Preliminary Plot Plans of aboveground facilities are provided in Resource Report No. 1, Appendix B.

TABLE 3.1-1

Estimated Land Required for Construction and Operation of the Project by Facility Type

Facility Name	Land Affected During Construction[a] (acres)	Land Affected During Operation (acres)
Liquefaction Facility		
LNG Plant	901.61	901.61
Marine Terminal		
Temporary MOF	28.30[b]	0.00*
MOF Dredging Area	50.70[b]	0.00
Dredge Disposal area	1,200 (600 acres/year during construction)	0.00
Shoreline Protection	1.54	0.00
PLF	18.67	18.67
LNG Associated Infrastructure		
LNG Construction Camp	81.31	0.00[c]
Liquefaction Facility Total	**2,265.15**	**920.28**
Pipelines ROW		
Mainline	12,487.76[c,d]	5,013.07[c,d]
Offshore	37,801.65[e]	330.11
PBTL	7.31	7.31
PTTL	1,726.62	613.62
Mainline Aboveground Facilities		
Compressor Stations		
Sagwon Compressor Station	30.30	30.30
Galbraith Lake Compressor Station	30.30	30.30
Coldfoot Compressor Station	30.30	30.30
Ray River Compressor Station	30.30	30.30
Minto Compressor Station	30.30	30.30
Healy Compressor Station	30.30	30.30
Honolulu Creek Compressor Station	22.73	22.73
Rabideux Compressor Station	30.30	30.30
Heater Station		
Theodor River Heater Station	22.73	22.73
Meter Stations		
GTP Mainline Meter Station	0.00[f]	0.00[f]
Nikiski Meter Station	0.00[f]	0.00[f]
MLBVs		
MLBVs	8.31	8.31
Pipeline Associated Infrastructure		
Additional Temporary Workspace (ATWS) (Mainline)	1,649.19	0.00
ATWS (PTTL)	20.97	0.00
Access Roads	3,016.22	631.36[d]
Ice Pad Access Roads (PTTL)	202.16	0.00
Construction Camp [f]	677.00	0.00[d]

TABLE 3.1-1

Estimated Land Required for Construction and Operation of the Project by Facility Type

Facility Name	Land Affected During Construction[a] (acres)	Land Affected During Operation (acres)
Construction Compressor Station Camps	0.00[f]	0.00[d]
Construction Camp (PTTL) [f]	97.22	0.00[d]
Pipe Storage Yards	474.20	0.00[d]
Pipe Storage Yards (PTTL)	28.01	0.00[d]
Disposal Sites	259.15	0.00
Double Joining Yards	199.74	0.00
Material Sites	5,755.45	0.00[d]
Railroad Spurs	10.87	0.00[d]
Railroad Work Pads	36.70	0.00[d]
Helipads (Mainline)	4.36	4.36
Helipad (PTTL)	0.57	0.57
PTTL Aboveground Facilities		
MLBVs	0.41	0.41
Point Thomson Meter Station	0.47	0.47
Mainline Total	**62,973.74**	**6,250.27**
PTTL Total	**2,076.4**	**615.07**
PBTL Total	**7.31**	**7.31**
GTP		
GTP Pad[g]	227.88	227.88
Operations Center Pad	56.00	56.00
GTP Associated Infrastructure		
Module Staging Area	86.58	0.00[h]
West Dock Modification/DH 4 Construction	31.05	0.00[h]
Barge Bridge	2.58	0.00[h]
Turning Basin	13.70	0.00
Access Roads	258.81	258.81
Material (Mine) Site	141.16	141.16
Water Reservoir and Pump Facilities	35.12	35.12
Associated Transfer Pipelines	70.32	70.32
Pioneer Camp	30.00	0.00[g]
Ice Pads	2.75	0.00
GTP Total	**955.95**	**789.29**
TOTAL FOOTPRINT	**68,290.94**	**8,576.77**

TABLE 3.1-1

Estimated Land Required for Construction and Operation of the Project by Facility Type

Facility Name	Land Affected During Construction[a] (acres)	Land Affected During Operation (acres)

Notes:

[a] Construction acreage includes operational areas.

[b] The MOF is a total of 28.3 acres; however, 16.98 acres is included within the MOF dredging footprint.

[c] Preliminary estimate of Mainline land affected during construction and land affected during operation is for the Revision C2 route. ROW widths vary by construction method across the route and would be 53.5 feet for operations. Includes travel and bypass lanes as temporary construction footprint.

[d] Although granular material would be used to expand/improve existing access roads, camp sites, pipe yard sites and the construction ROW and not removed after construction is completed, the impact is only reported as the permanently maintained footprint for operations. Any impact of granular material left in temporary work areas or along the ROW is addressed in Resource Report Nos. 2, 3, and 8. Leaving the granular material in place is subject to landowner agreements.

[e] Includes the width of anchoring the offshore pipelay barge, currently assuming a 2.5-mile-wide anchor spread (total). The majority of the construction ROW would not be disturbed during construction.

[f] Acreage used for the construction and operation of a facility is 0.0 when it occurs within the construction or operation footprint of another facility of the construction or permanent footprint for that facility. Additional acreage is noted if the facility is placed outside of these areas.

[g] Construction/Operations camp is located on a pad connected to the GTP Pad. The flare pad is contained within the footprint for the GTP Pad.

[h] Subject to commercial negotiations.

* When it is removed during LNG Plant operations.

3.1 LIQUEFACTION FACILITY

Approximately 2,265 acres (of which approximately 1,280 acres is offshore) would be affected during construction of the Liquefaction Facility. The acreage for the Liquefaction Facility would accommodate the associated infrastructure necessary to build the Liquefaction Facility as well as operational facilities. The current land ownership at the Liquefaction Facility site includes commercial, Kenai Peninsula Borough, State of Alaska, and private land holdings. The Marine Terminal portion of the Liquefaction Facility would be located on State of Alaska submerged land within Cook Inlet.

3.1.1 Marine Terminal

The Marine Terminal portion of the Liquefaction Facility would be located on State of Alaska submerged land within Cook Inlet. A summary of the acreage affected during construction and operation of the Marine Terminal is shown in Table 3.1-1. The Marine Terminal would require approximately 20 acres for fixed facilities (i.e., product loading facility (PLF), shoreline protection) during operation. During construction of the permanent facilities, approximately 28 acres would be used for the temporary material offloading facility (MOF) and construction areas, and 50 acres would be dredged. The MOF would be designed for approximately 10 years of use. The sheet piling and other structures would be removed when the MOF is no longer required. Because the marine facilities construction and MOF operation would limit the ability of the public to transit north/south along the beach, the Project representatives would consider mitigating this loss with measures such as installing an alternate public beach access point to the south since there is already one to the north.

3.2 INTERDEPENDENT PROJECT FACILITIES

3.2.1 Pipeline Facilities

3.2.1.1 Right-of-Way

3.2.1.1.1 Mainline

The Mainline would be sited on land composed of more than 98 percent federal, state, borough, and municipal land of various holdings, with the remainder on privately owned land (see Table 3.2-1). Typical construction ROW cross-section diagrams showing information such as widths and relative locations of existing ROWs, new ROW, and temporary construction ROW are provided in Resource Report No. 1, Appendix E. Table 3.2-2 provides the typical construction ROW configurations. For the Mainline, a permanent 53.5-foot-wide ROW would be acquired (50 feet plus pipe diameter). The construction ROW width would vary depending on the type of terrain, the season of construction, and the ease of access from nearby roads. The nominal construction ROWs level surface would be 110 feet wide, plus additional temporary workspace for travel and bypass lanes, where necessary. In addition, the construction footprint would be wider in areas where ATWS are required, such as at river or road crossings, side bends, and for cut/fill slope areas, as required. Any additional workspace would be restricted in areas of environmental or cultural sensitivity. A discussion of the rationale for the selection of pipeline ROW widths is presented in Resource Report No.1, Appendix G.

The offshore portion of the Mainline would be laid on the seafloor across Cook Inlet on state submerged and submersible lands. The construction ROW would be 13,200 feet wide to accommodate anchoring of the pipelay barge. The majority of the construction ROW for the offshore portion of the Mainline would not be disturbed during construction.

TABLE 3.2-1

Summary of Land Ownership/Management Intersected by Mainline Centerline [a]

Agency or Entity	Project Facility	Begin MP	End MP	Approximate Crossing Length (miles)	Percent of Total Project Length
Federal Land					
BLM	Mainline	Intermittently between 121.1 and 581.0		230.8	28.6%
State Land					
ADNR	Mainline	Intermittently between MP 0.0 and 804.5		352.5	43.7%
Mental Health Trust Authority	Mainline	Intermittently between 470.6 and 761.8		10.1	1.3%
ADF&G	Mainline	Intermittently between MP 430.9 and 752.4		32.3	4.0%
ADOT&PF	Mainline	Intermittently between MP 63.3 and 806.6		12.9	1.6%
Other State of Alaska	Mainline	Intermittently between MP 241.3 and 728.5		71.3	8.8%
University of Alaska	Mainline	514.3 514.7	514.7 515.3	1.0	0.1%
Municipal Land					
NSB	Mainline	83.3	85.5	2.2	0.3%

TABLE 3.2-1

Summary of Land Ownership/Management Intersected by Mainline Centerline [a]

Agency or Entity	Project Facility	Begin MP	End MP	Approximate Crossing Length (miles)	Percent of Total Project Length
Unorganized Borough	Mainline	473.2 473.8	473.6 473.8	0.4	<0.1%
FNSB	No municipal land intersected	N/A	N/A	N/A	0%
DB	Mainline	Intermittently between MP 497.8 and 545.3		15.5	1.9%
MSB	Mainline	Intermittently between 647.4 and 734.5		21.1	3.0%
KPB	Mainline	Intermittently between 763.1 and 804.6		5.8	0.7%
Private Land					
Private	Mainline	MP 4.6 to 5.7, and intermittently between MP 470.5 and 806.6		12.38	1.5%
Native Land					
Native Regional Corporation	Mainline	Intermittently between 545.3 and 803.1		32.1	4.0%
Native Village Corporation	Mainline	Intermittently between 468.6 and 802.3		6.2	0.8%
Native Allotments	Mainline	None intersected		N/A	0%
	Mainline Total	0.0	806.6	806.6	100%

Notes:
[a] Does not include land ownership impacted by associated facilities or temporary workspace

3.2.1.1.2 PBTL

A 120-foot-wide nominal construction ROW would be required for the PBTL (Table 3.2-1; see typical ROW configuration in Resource Report No.1, Appendix E). The PBTL would be installed on typical VSMs connected to a horizontal support member. A nominal 120-foot-wide ice road would be constructed along the construction ROW. In locations where additional laydown areas are needed, a wider construction ROW may be required. The VSM installation, pipeline assembly, and erection would be accomplished from the ice road. The PBTL would be located on State of Alaska land and following construction, a 100-foot-wide ROW would be acquired.

3.2.1.1.3 PTTL

The PTTL would be installed on typical VSMs connected to a horizontal support member. A 100-foot-wide nominal construction ROW would be required for the PTTL (Table 3.2-1; see typical ROW configuration in Resource Report No.1, Appendix E). The width of the construction ROW would likely be wider in areas where additional workspace is required, such as at river crossings. Additional workspace would be restricted in areas of environmental or cultural sensitivity. The PTTL would be located on State of Alaska land and following construction, an 80-foot-wide ROW would be acquired.

TABLE 3.2-2

Typical Pipeline Construction Right-of-Way Configurations

Pipeline/Construction Area	Construction Season	Nominal Construction Right-of-Way Width [b] (feet)	Right-of-Way Preparation
MAINLINE			
North of Brooks Range			
Ice Work Pad	Winter	145	
Granular material or mineral soil work pad	Summer or Winter	140 (+cut/fill slope areas)	Where required, additional 20 feet for travel lane would be added on working side and 15 feet for bypass lane added on spoil side.
Conventional [a] or cut and fill	Summer or Winter	150 (+cut/fill slope areas)	Where required, additional 20 feet for travel lane would be added on working side and 15 feet for bypass lane added on spoil side.
South of Brooks Range			
Frost packed	Winter	110	Where required, additional 20 feet for travel lane would be added on working side and 15 feet for bypass lane added on spoil side.
Granular material or mineral soil work pad	Summer or Winter	140 (+cut/fill slope areas)	Where required, additional 20 feet for travel lane would be added on working side and 15 feet for bypass lane added on spoil side.
Conventional [a] or cut and fill	Summer or Winter	150 (+cut/fill slope areas)	Where required, additional 20 feet for travel lane would be added on working side and 15 feet for bypass lane added on spoil side.
Matted Summer wetlands	Summer	110	Using heavy timbers or similar
Mountain cut only	Summer	65 (+ATWS for pad on slope)	May require shoo-flies or access roads
Cook Inlet	Ice-free period	13,200	Direct lay from lay vessel
PBTL			
Ice Work Pad	Winter	120	Built on VSMs
PTTL			
Ice Work Pad	Winter	100	Built on VSMs

Notes:

[a] Conventional preparation includes handling of organics material as detailed in the Alaska LNG Project *Procedures*.

[b] Right-of-way width excludes snow management areas. Snow will be blown off of the ROW, but no additional workspace will be required for this activity.

3.2.1.2 Additional Temporary Work Space

ATWS would be located outside of, but adjacent to and contiguous with, the pipeline construction ROW where construction activities cannot be executed safely within the ROW or where more equipment may be necessary (e.g., waterbody, road, utility, and other crossings; at bends and timber storage locations; and in other situations). Table 3.2-3 lists the typical sizes of ATWS that would be used for the Project. Each individual location requiring ATWS would be assessed and sized appropriately to account for terrain, soil conditions, site configuration, site-specific construction method, and construction season. Therefore, the exact dimensions of each ATWS may vary from those presented in Table 3.2-3. Typical ATWS that would be required for feature crossings are shown on typical drawings provided in Resource Report No.1, Appendix E. A description of the proposed ATWS is included in Resource Report No.1, Appendix J.

TABLE 3.2-3

Typical ATWS Dimensions Associated with the Pipeline Facilities

Segment/ATWS Location	Location	Length (feet)	Width (feet)
MAINLINE			
Waterbody Crossings			
Minor: Less than or equal to 10 feet wide (Summer and Winter)	Upstream/Workside	320	35
	Downstream/Workside	320	35
	Upstream/Spoilside	110	40
	Downstream/Spoilside	110	40
Intermediate: Greater than 10 feet wide but less than or equal to 100 feet wide	Upstream/Workside	340	50
	Downstream/Workside	340	50
	Upstream/Spoilside	130	50
	Downstream/Spoilside	130	50
Trenchless – Entry and Exit Points	Specific to every Crossing	200	250
Trenchless – pipeline drag section false ROW (ROW used to assemble/weld the pipe string before inserting into drill hole)	Specific to every Crossing	length of crossing a	100
Road Crossings			
Bored	Upstream/Workside	270	50
	Downstream/Workside	440	50
	Upstream/Spoilside	180	50
	Downstream/Spoilside	180	50
Open-Cut	Upstream/Workside	80	35
	Downstream/Workside	180	35
	Upstream/Spoilside	65	35
	Downstream/Spoilside	65	35
Utility crossings and or Third-Party pipelines	Upstream/Workside	80	35
	Downstream/Workside	180	35
	Upstream/Spoilside	65	35
	Downstream/Spoilside	65	35
Beginning or End of Construction Spread	Workside	600	250
Timber Decks	Workside	300	40
Horizontal Bends (>12 degrees)			
Left	Workside (one side of PI)	80	20
Right	Workside (wrap around PI)	60	15
POINT THOMSON GAS TRANSMISSION LINE			
Waterbody Crossing			
Minor: Less than or equal to 10 feet wide	Aboveground	N/A	N/A
Intermediate: Greater than 10-feet wide but less than or equal to 100 feet wide	Aboveground	N/A	N/A
Major: Greater than 100 -feet wide	Upstream	920 b	60
	Downstream	700 b	60
Road Crossing			
Primary-Secondary Road	Upstream/Workside	90	35
	Downstream/Workside	90	35
	Upstream/Spoilside	90	35
	Downstream/Spoilside	90	35
Winter Trails; Trails; Access Roads; Unknown	Aboveground	N/A	N/A
Utility crossings and or Third-Party pipelines	Aboveground	N/A	N/A
Horizontal Bends			
Left	Aboveground	N/A	N/A
Right	Aboveground	N/A	N/A

Notes:
a Dependent on crossing length of feature.
b Average length of identified crossing.

The Project's ATWS adjacent to the construction ROW (e.g., spoil storage areas) would vary depending on site-specific conditions. The estimated extent for travel lanes and bypass lanes is provided in Attachment A and is part of the ROW included in Table 3.2-2.

Travel lanes are needed to allow construction traffic to move along the ROW without interfering with the construction activities, as well as preventing construction activities from blocking traffic. Where easy access to the nearest existing public or private road exists, these lanes would likely not be needed. Travel lanes would be needed in locations where there are no access roads approximately every 2 to 3 miles.

In addition to travel lanes, bypass lanes would also be required when the spoil side of the ROW (i.e., location of excavated material) is next to the main access (e.g., Dalton Highway). Construction traffic reaching the ROW from that spoil side could be blocked from accessing the work side of the ROW or the travel lane by an open ditch or a welded pipe string. Use of the bypass lane would allow traffic to proceed parallel to the ROW until the next open "crossing" of the pipeline centerline before pipe is strung or the ditch excavated.

3.2.1.3 Pipeline Aboveground Facilities

Land requirements for the Project's Pipeline Aboveground Facilities are summarized below.

3.2.1.3.1 Compressor Stations

The Project design anticipates construction of eight compressor stations. Compressor station layouts are designed to accommodate both permanent operation facilities and temporary construction facilities (construction camp and laydown areas) within the same plot, which would be permanently fenced. Land requirements for compressor stations are provided in Table 3.1-1.

3.2.1.3.2 Heater Station

The heater station layout would be designed to accommodate permanent operation facilities and temporary construction facilities (construction camp and laydown areas) within the same plot, which would be permanently fenced. Land requirements for the heater stations are provided in Table 3.1-1.

3.2.1.3.3 Meter Stations

The meter stations would be located within the footprint of the other facilities (e.g., Liquefaction Facility, GTP, and PTU) such that no additional land requirements would be necessary beyond those already associated with construction of the other facilities.

3.2.1.3.4 MLBVs

Construction and operation of the MLBVs would take place within the pipeline ROW, compressor stations, heater station, and other facilities. Therefore, with the potential exception of access requirements, no additional land use would occur beyond those already associated with construction of the other facilities. Isolated MLBVs would be approximately 0.4 acre in size and would be fenced.

Helipads (see Resource Report No.1, Appendix F) would be required for those MLBVs outside of a compressor station site. However, they would be sited within the pipeline ROW.

3.2.1.3.5 Launchers and Receivers

Construction and operation of launchers and receivers would generally occur within a proposed aboveground facility site (e.g., compressor stations, GTP, and Liquefaction Facility) such that no additional land requirements would be necessary beyond those already associated with construction of the other facilities.

3.2.1.3.6 Gas Interconnection Points

Construction of a gas interconnection point would occur within the pipeline ROW. Therefore, no additional land use associated with the Project would be required beyond the construction ROW.

3.2.1.3.7 Cathodic Protection Facilities

Land requirements for the cathodic protection facilities would primarily be within the pipeline ROW or a compressor station site where practical. Test lead posts would also be located along the permanent pipeline ROW. The requirement for any additional land use associated with the cathodic protection facilities is currently under evaluation.

3.2.1.4 Pipeline Associated Infrastructure

The following sections discuss the land requirements for Pipeline Associated Infrastructure related to both the pipelines and aboveground facilities. The Project representatives would take an integrated approach to minimize the overall Project footprint as practicable.

3.2.1.4.1 Access Roads

A list and description of access roads and shoo-flies that would be used by the Project are included in Resource Report No.1, Appendix F and depicted on the maps in Resource Report No.1, Appendix A. In areas north of Livengood, construction crews and operations staff would use existing granular material access roads that were built for TAPS and for the Dalton Highway, where appropriate.

South of Livengood, the design is based on access from the nearest existing public or private road to the construction ROW where possible. This access would include improvements to existing roads (e.g., widening, granular material fill, culverts, reduce curvature of the road) or construction of new roads. For winter construction, access roads would be made of ice or granular material, depending on location and season.

Shoo-fly roads would be required where traffic access is not possible along the ROW due to severe slopes or other impediments. The shoo-flies would allow traffic to detour around the steep slope sections and maintain access along the ROW.

3.2.1.4.2 Helipads

Helipads would be constructed with dimensions of approximately 150 feet by 150 feet. The affected land most likely would be within a construction camp site and/or the permanent operations ROW of the pipeline or a compressor station (see Table 1.3.5-1). If so, no additional land requirements would be necessary beyond those already associated with construction of the other facilities. After construction, the land would be reclaimed as per landowner requirements.

3.2.1.4.3 Airstrips

No major upgrades to existing commercial airstrips are planned for the Project, but minor upgrades to some existing commercial and non-commercial airstrips may be necessary. Typical upgrades may include installation of buildings, fuel storage, lighting, secondary containment structures, navigation aids, and powered traffic controls where practical. These potential upgrades, except for lighting, are included in Resource Report No.1, Appendix L (Cumulative Impacts).

The main airstrips that might be used include: Deadhorse, Fairbanks, and Anchorage. Other airstrips that may be used include: Beluga, Galbraith, Dietrich, Coldfoot, Prospect Creek, Five Mile Camp, Kenai, and Livengood. A complete list of the airstrips being considered and evaluated for the Project are included in Table 1.3.6-1 of Resource Report No.1.

3.2.1.4.4 Construction Camps, Pipe Storage Areas, Contractor Yards, and Rail Spurs

Temporary construction camps, pipe storage yards, and contractor yards would be built at various locations to support pipeline construction (see Resource Report No.1, Appendices A and J). In general, construction camps would range in size depending on the number of workers housed there. Pipe storage yards would be spaced approximately every 20 miles along or near the pipeline construction ROW. Resource Report No.1, Appendix E provides typical drawings and the range of sizes for camps, pipe storage, and contractor

yards. In some cases, a pipe yard and contractor yard may be collocated together and/or with a construction camp, depending on available acreage, access, and topography. To the extent practical, these sites would be located on previously disturbed areas. Construction camps would be located such that they take into consideration the travel distance from camp to construction site, the duration the camp would remain in the same location, the design occupancy, available water sources, and available pre-existing disturbed areas.

The Mainline MOF on the west side of Cook Inlet will be further developed and the size of land required on and offshore will be provided as available.

3.2.1.4.5 Material Sites

In general, a material site would be required approximately every 5 to 15 miles of pipeline ROW to support construction. Potential granular material locations are being evaluated. A list of potential sites that could be used is provided in the Project's *Gravel Sourcing Plan and Site Reclamation Measures* which is included in Resource Report No. 6, Appendix F.

3.2.1.5 GTP

Approximately 956 acres would be affected during construction of the GTP. Of the approximately 956 acres, operations would require approximately 789 acres (none of which are offshore). The acreage for the GTP would accommodate the associated infrastructure necessary to construct, assemble, and operate the GTP.

3.2.1.5.1 GTP Pad and Operations Center Pad

The GTP Pad would be built using granular material to protect the tundra and permafrost and would require approximately 228 acres of land. The Operations Center Pad would be separate from the GTP Pad, and would include area for the Integrated Construction and Operations Camp along with some construction laydown area. Land required for this pad would impact approximately 56 acres and is expected to be used during construction and operation.

3.2.1.5.2 GTP Associated Infrastructure

3.2.1.5.2.1 GTP Associated Pipelines

The fuel gas and propane pipelines would be installed on the same VSM as the PBTL and share the same construction and operational ROWs (see Table 3.2-1). The water line from the reservoir to the GTP is above ground and would be installed on a VSM connected to a horizontal support member. An approximately 110-foot-wide nominal construction and 100-foot-wide operational ROW would be required for the new water supply pipeline.

ROW maintenance would occur during scheduled pipeline maintenance. Scheduled pipeline maintenance would be conducted during the winter, with access by foot or suitable low pressure type vehicle. Major maintenance would require an ice road be built alongside the pipeline (between the granular material road and pipeline).

3.2.1.5.2.2 Module Staging Area

Land required for the material module staging area would be approximately 86 acres during construction.

3.2.1.5.2.3 West Dock Modifications

Construction of the GTP would require a dock facility at Prudhoe Bay capable of receiving large modules for construction on the North Slope. Installation of the Dock Head 4 (DH4) facilities would require granular material fill to create a dock head of approximately 31 acres.

The proposed DH 4 design does not require dredging a navigation channel. The proposed DH 4 location/size/orientation is based on preliminary navigational requirements, PBU interface discussions, and currently available field data. Although very recent bathymetric survey data (2016) was used for DH 4 placement, the seafloor will continue to change by sediment erosion/deposition up until construction, which may require adjustments. Based on the development of this and similar items, the DH 4 location/size/orientation may require updates during future Project phases.

3.2.1.5.2.4 Barge Bridge

Dredging is not planned at the proposed barge bridge at this time.

3.2.1.5.2.5 Water Reservoir

The water reservoir is expected to cover approximately 35 acres, with a nominal depth of approximately 35–55 feet.

3.2.1.5.2.6 GTP Access Roads

Workers would use existing, modified, and new roads to access the GTP site from West Dock (see Resource Report No. 1, Appendix F). A total of approximately 258 acres of land would be used during construction and operation for access roads associated with the GTP. This acreage includes the new section of causeway that parallels the existing causeway between DH 3 and DH 4, widening the existing causeway road from the DH 3, widening and extending an existing haul road in the PBU, and constructing new access roads to the mine and reservoir sites as well as the access road to the PBU CGF.

3.2.1.5.2.7 Construction Camps

Pioneer Camp

A Pioneer Camp would be established to support development of construction infrastructure during GTP construction, including granular material mine operations and construction of access roads, granular material pads, water reservoir, VSMs, and pipelines. A specific location for the Pioneer Camp has not been identified at this stage of the Project design but is expected to be within the PBU or Deadhorse. The Pioneer Camp would require approximately 15 to 30 acres of land.

Temporary Construction and Permanent Operations Camp

An onsite Integrated Construction and Operations Camp would be constructed to support Project construction. The onsite construction camp would be located entirely within the GTP Operations Center Pad acreage and would remain as a permanent operations camp.

3.2.1.5.2.8 Material Sites

The sand and granular material required for construction of the GTP and related facilities would be obtained from a new material sites, the water reservoir, and an existing material site, if available to the Project. The new granular material mine would span up to approximately 141 acres. Additional details are provided in the Project's *Gravel Sourcing Plan and Site Reclamation Measures*, located in Resource Report No. 6, Appendix F.

3.3 SPECIAL MANAGEMENT AREAS

The BLM administers the federal lands within the Project area. Under the Federal Land Policy and Management Act (FLPMA) of 1976 (43 USC § 1761 et seq.), the BLM manages approximately 75 million surface acres of federal public land within Alaska through its Fairbanks and Anchorage district offices. Section 503 of the FLPMA provides for the designation of ROW corridors. In designating ROW corridors under Section 503, the BLM considers national and state land use policies, environmental quality, economic efficiency, national security, and good engineering and technological practices. Pursuant to the Mineral Leasing Act (MLA) (30 USC § 185) and 43 C.F.R. § 2881.11, an applicant must have a BLM grant under

the MLA for an oil or gas pipeline, or related facility, to cross federal lands either under BLM's jurisdiction or the jurisdiction of two or more federal agencies. If the application involves two or more federal agencies, the BLM will not issue or renew a grant until the heads of the agencies administering the lands involved have concurred (BLM, 2015).

3.3.1 Central Yukon and Utility Corridor Planning Area

As prescribed by the FLPMA, land use plans would be developed for public land "to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development, and enhancement of the public lands; and for other purposes" (BLM, 2001). The Project would encompass an area subject to the BLM's Utility Corridor Resource Management Plan (RMP)/ EIS from 1991. As taken from the RMP's Record of Decision, the Utility Corridor RMP is a comprehensive land use plan developed to direct the BLM's management of a portion of the lands and minerals it administers in northern Alaska (BLM, 1991a). The Utility Corridor RMP, established by Public Land Order 5150, is an essential component of the national oil and gas transportation system. In recognition of this fact, the RMP provides that the primary management direction and use of BLM-administered lands in the Utility Corridor is for energy transportation.

It should be noted that the BLM published a Notice of Intent in the Federal Register on June 14, 2013, announcing the beginning of a scoping process to prepare an RMP with an associated EIS for the Central Yukon Planning Area. The BLM has determined that revisions are needed to the existing Utility Corridor RMP (BLM, 1991a), Central Yukon RMP (BLM, 1986a), and Southwest Management Framework Plan (1986, as cited in BLM, 2015). The revised Central Yukon RMP will replace both the Utility Corridor and Central Yukon RMPs in their entirety and a small part of the Southwest Management Framework Plan if implemented. While a draft of the RMP/EIS is not yet available, key issues to be addressed by the RMP include the following:

- Management of land use and activities for recreational uses, vehicle access, minerals management, land ownership and assemblages, and easement access;
- Conservation of lands having special, critical, or unique features or resource values: Areas of Critical Environmental Concern (ACECs), Research Natural Areas (RNAs), Wild and Scenic Rivers (WSRs), and Wilderness Study Areas; and
- Management of natural resources, including effects to soil, air, and water; hazardous and solid waste; vegetation and forest products; and special-status species (Endangered Species Act).

Three federally designated corridors within the Utility Corridor's planning area accommodate ROWs:

- Alaska Utility Corridor – A corridor 6–24 miles wide that runs north-south through most of the planning area and consists of an inner and outer corridor, which is described subsequently;
- Section 201(4)(b) of the Alaska National Interest Lands Conservation Act (ANILCA) (ANILCA; Public Law 96-487) Corridor – Provides surface access for transportation purposes across public lands from the Ambler Mining District to the Dalton Highway; and
- Section 1431(j) of the ANILCA Corridor – A corridor 6–12 miles wide authorized by ANILCA across the Central Arctic Management Area to provide the Arctic Slope Regional Corporation (ASRC) an oil and gas pipeline ROW, including related facilities, across public lands from the Kurupa Lake and Killik River areas east to the TAPS corridor.

The Alaska Utility Corridor contains an inner and an outer corridor. The majority of the Mainline and associated infrastructure would be located within the inner utility corridor. Various non-energy transportation activities are restricted within the inner corridor (e.g., mineral resource development) and, with a few exceptions (e.g., ACEC), the area is devoted to the transportation of energy resources. It should be noted that the inner corridor generally corresponds to the Dalton Highway Recreation Management Area (RMA), which includes lands within the corridor adjacent to existing roadways, and the Dalton Corridor RMA, which includes the remainder of the utility corridor (BLM, 1991b).

3.3.2 Eastern Interior Planning Area

The BLM is currently preparing an RMP for the Eastern Interior Planning Area. The Final EIS for the RMP is due in 2017. The RMP would establish goals and objectives for managing resources, and would outline the measures needed to achieve those goals and objectives. The Project area would pass through the boundaries of the Eastern Interior Planning Area. However, the portion of the Project area that would occur within the Eastern Interior Planning Area would be located entirely on state, private, or municipal land; therefore, the Eastern Interior RMP would not apply to the Project. The Eastern Interior Planning Area encompasses the Yukon Flats National Wildlife Refuge (NWR) and the White Mountains National Recreation Area. The Project area would occur outside Yukon Flats NWR and the White Mountains National Recreation Area.

3.3.3 East Alaska Planning Area

The East Alaska Planning Area includes 6.8 million acres of BLM-administered public land in eastern Alaska and the Bering Glacier. The Project area is located in the western portion of the East Alaska Planning Area, where no special management areas are present.

3.3.4 Ring of Fire Planning Area

The Ring of Fire RMP was approved in July 2006 and spans a distance of 2,500 miles. The Project area is located within the boundaries of the southcentral region of the Ring of Fire Planning Area, which continues south to Anchorage and the surrounding area. However, the portion of the Project area that occurs within the Ring of Fire Planning Area is located entirely on state, private, or municipal land; therefore, the Ring of Fire RMP will not apply to the Project.

3.3.5 Special Designation Areas

Special designation areas are lands that are managed by federal agencies for the protection or enhancement of specific resource values (e.g., cultural, special-status species, visual, and/or wilderness). Lands categorized as special designation areas include ACECs, Extended RMAs, special management areas, Special RMAs, Wilderness Study Areas, WSRs, National Parks, and National Recreation Areas.

3.3.6 Areas of Critical Environmental Concern (ACECs)

Some areas under BLM management have been designated as ACECs. ACECs are areas within public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards (43 C.F.R. § 1601.0-5). Generally, development activities and future energy transportation systems are allowed.

3.3.7 Iditarod National Historic Trail

The INHT extends approximately 2,000 miles within a corridor between Seward and Nome. The Mainline ROW would intersect the INHT approximately 35 miles northwest of Anchorage at two separate locations, both of which are managed by the ADNR-DMLW. At MP 720.8 the Mainline crosses the Susitna Station to Old Skwentna (Yentna River) INHT System Connecting Trail. At MP 724.3 the Mainline crosses the Susitna Station to Finger Lake INHT System Primary Route.

For matters involving the INHT over State land where conveyances from the United States do not include a reservation under the National Trails System Act of 1968, as amended (NTSA), for the INHT, the State of Alaska manages the INHT. This is the case at Mainline pipeline MP 720.8 and MP 724.3. (See U.S. Patent No. 50-66-0093 dated September 17, 1965, and U.S. Patent No. 50-66-0319 dated February 7, 1966.) The NTSA provides that the INHT shall be administered by the Secretary of the Interior in cooperation with affected land owners and managers. The NTSA required the Secretary of the Interior to

prepare a Comprehensive Management Plan (CMP) for the INHT. The CMP is a congressionally mandated management plan for the collection of INHT resources. The CMP, recognizing that no single agency manages the entire trail, calls for cooperative management by federal, state, and local agencies. The CMP was completed and signed in 1986:

"The Secretary of the Interior is by law charged with the responsibility for the administration of the INHT. The responsibility is delegated to the Bureau of Land Management. Administration of the National Trail by the Department of the Interior involves coordinating trail management and historic preservation efforts on the Iditarod Trail system, but does not include management of non-Federal trail segments or sites. National Trail designation on any non-Federal site or trail segment will not transfer management responsibility to any Federal agency."

In 1988 the State and the BLM entered into a Memorandum of Agreement (MOA) regarding management of the INHT on both State and BLM-managed lands [AK-974-MU8-INHT-03 (1988)]. In the MOA, and using the CMP as a guide, the State agreed to: "protect continued public use of INHT segments in a manner which recognizes the historic values of the INHT." However, "Nothing in (the MOA) shall affect or interfere with fulfillment of the obligations and rights of the parties to manage the lands and programs administered by them in accordance with their other land management responsibilities."

The SOA, as a signatory and participant in the 1986 CMP, is the primary contact and land manager and manages the Trail consistent with the CMP where the INHT is located on State land (MP 720.8 and MP 724.3) that is not subject to an exception, exclusion or reservation for the INHT in conveyances from the US. When considering whether to grant a ROW for the proposed pipeline, ADNR would consider the historic values of the INHT and make a decision in the context of state laws, regulations, and policies. A State ROW Lease would be required for the Project.

3.3.8 Dalton Highway

The Dalton Highway RMP addresses approximately 1.1 million acres of public land within the Utility Corridor. It does not cover all Utility Corridor lands and only covers those lands in proximity to existing roads. The plan was developed so that the BLM could identify appropriate management objectives, policies, actions, future staffing, and funding requirements to accommodate current and future recreation demands, ensure visitor safety, manage the resources, and protect the integrity of the energy transportation corridor (BLM, 1991b). The Mainline would include lands covered by the Dalton Highway RMP.

3.3.9 National Park Service

No NPS-administered lands would be used by the Project. The Mainline would pass outside the boundaries of the Gates of the Arctic National Park and Preserve (NPP) and Denali National Park and Preserve (DNPP). The Mainline would pass through the Brooks Range outside the eastern boundary of the Gates of the Arctic NPP. It would approach DNPP (within 0.02 mile at its closest point).

3.3.10 Section 6(f) of the Land and Water Conservation Fund

Section 6(f) of the Land and Water Conservation Fund (LWCF; 16 USC 4601 et seq.) applies to public areas that have received LWCF funding to acquire or develop public recreational facilities. Section 6(f) (3) requires these areas be maintained for public outdoor recreational use, unless the NPS approves substitute land determined to be of equivalent location, suitability for recreation, and greater or equal to the fair market value of the original property. This statute would apply to lands that have received LWCF funding. Based on GIS analysis, the Mainline would pass through Section 6(f) lands within Denali State Park (subject to requirements of LWCF) and the process with the NPS would be completed to determine if the effects to public outdoor recreational use in this area would need further consideration.

3.3.11 U.S. Fish and Wildlife Service (USFWS)

The Mainline would approach a portion of the Arctic NWR, which is administered by the USFWS; however, construction and operational activities would not occur in the Refuge. Additional details concerning the Arctic NWR are provided in Section 3.3.15.5.1.1.

3.3.12 Summary of Applicable Federal Land Use Plans

3.3.12.1 Liquefaction Facility

The Liquefaction Facility would not affect federal lands.

3.3.12.2 Interdependent Project Facilities

3.3.12.2.1 Pipelines

Mainline

An overview of the potentially applicable stipulations for the federal land areas crossed by the Pipelines and Related Aboveground Facilities is provided in Table 3.3.12-1.

TABLE 3.3.12-1

Summary of Potentially Applicable Federal Land Use Plans and Documents for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs	Relationship with the Proposed Action
BLM	Utility Corridor RMP/EIS Record of Decision (1991)	Mainline MPs: 121.1 to 356.3 Pipeline Aboveground Facilities 3 compressor stations; 2 MLBV pads Pipeline Associated Infrastructure 48 36 borrow sites; 9 camps; 15 pipe storage yards; 214 access roads; 189 ATWS; 55 disposal sites; 2 helipads;	The proposed RMP/Final EIS identifies the inner and outer portions of the Utility Corridor within its planning area. The Project would be located within the Utility Corridor. The primary management direction and use of BLM-administered lands in the Utility Corridor is for energy transportation. In addition to the management practices and allowable uses for the Galbraith Lake, and Sukakpak Mountain ACECs and Toolik Lake RNA, the protection measures and stipulations are detailed in Appendices K and L of the proposed RMP/Final EIS.
	Central Yukon Planning Area RMP and Record of Decision (1986)	Mainline MPs: 356.3 to 358; 364.1 to 365; 414.5 to 421.9; 424.2 to 545.3* Pipeline Aboveground Facilities 2 compressor stations; 5 MLBV pads Pipeline Associated Infrastructure 4 railroad work pads and spurs; 33 borrow sites; 3 camps; 5 pipe storage yards; 75 access roads; 71 ATWS; 2 compressor stations; 19 disposal sites;	The following policies would apply for access to or across BLM lands managed under the RMP: Granting access to or across public lands would be considered on a case-by-case basis. Under this RMP, the use of vehicles greater than 1,500 pounds' gross vehicle weight would be allowed by authorization only. Vehicle use may be authorized under a mining plan of operations (43 C.F.R. 3809), with a permit (43 C.F.R .2800 or 43 C.F.R. 2920), or by other appropriate means. Approval would be subject to conditions that reduce the impact on other land uses and/or prevent

TABLE 3.3.12-1

Summary of Potentially Applicable Federal Land Use Plans and Documents for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs	Relationship with the Proposed Action
		5 helipads; 5 MLBV pads; 4 railroad spurs; 4 railroad work pads.	unnecessary damage to the environment.
	Central Yukon RMP and EIS (in development; Record of Decision and Approved RMP anticipated early 2019)	Encompasses the facilities shown for both the Utility Corridor Planning Area and the Central Yukon Planning Area	The BLM is revising the existing Utility Corridor RMP (BLM, 1991a), Central Yukon RMP (BLM, 1986a), and Southwest Management Framework Plan (1986). The revised Central Yukon RMP will replace both the Utility Corridor and Central Yukon RMPs in their entirety as well as a small part of the Southwest Management Framework Plan. A draft of the RMP/EIS will be available for public review in 2017.
	East Alaska RMP (2006)	Mainline MPs: 545.3 to 646.9 Pipeline Aboveground Facilities: 1 compressor station; 3 MLBV pads Pipeline Associated Infrastructure: 3 railroad work pads and spurs; 27 borrow sites; 3 camps; 5 pipe storage yards, 89 Access Roads; 74 ATWS; 5 disposal sites; 3 helipads; 3 railroad spurs; 3 railroad work pads.	The required operating procedures and oil and gas leasing stipulations are described in Appendix B of the RMP/Final EIS.
	Iditarod National Historic Trail Comprehensive Management Plan (1986)	Mainline MPs (but on state lands): 720.7 and 724.3 Pipeline Associated Infrastructure (but on state lands): 1 pipe storage yard (PSY) 1 access road 1 ATWS	The plan outlines the trail network and impacted communities, but does not provide guidance related to utility corridors (BLM, 1986b).
	Dalton Highway Recreation Area Management Plan (DHRMA) (1991)	Mainline MPs: 121.4 – 236.1, 237 – 237.2, 243.8 – 356.9 Pipeline Aboveground Facilities: 2 compressor stations 12 MLBVs Pipeline Associated Infrastructure: 8 construction camps 14 PSYs 31 material sites 225 access roads 1,297 ATWS	The plan states, “the primary function of the lands within the Dalton Highway Recreation Area Management Area (DHRMA) is the transportation of energy resources; therefore, actions or activities potentially averse to existing and future energy transportation systems will be avoided. Mineral material extraction is allowed within the DHRMA for maintenance and construction of transportation systems. This planning decision may be in conflict with

TABLE 3.3.12-1

Summary of Potentially Applicable Federal Land Use Plans and Documents for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs	Relationship with the Proposed Action
			recreation management objectives in some areas" (BLM, 1991b).
	Ring of Fire RMP/EIS	Mainline MPs: 646.9 to 766.0; 766.0 to 766.3; 793.0 to 793.3; 793.3 to 806.6 Pipeline Aboveground Facilities: 2 compressor stations; 6 MLBV pads 1 meter station Pipeline Associated Infrastructure: 61 Access Roads; 51 ATWS; 23 Material Sites; 7 Camps; 1 10 pipe storage yards; 1 railroad spur; 1 railroad work pad; 11 disposal sites; 6 helipads.	Potential increased levels of resource development, while providing site-specific and some area-wide protection of resources through future integrated implementation planning. Three SMAs are identified All BLM managed lands would be designated as "limited" to existing roads and trails for OHV use (consistent with the Generally Allowed Uses on State Land), which would result in less areas of resource degradation. However, limitations within the three SMAs would be defined through the development of implementation plans, and may include instituting seasonal closures, closure of some portions of the SMAs to OHVs, the designation of, and/or limitations to designated trails, and/or the opening of some portions of the proposed Knik River SRMA to OHV use.

PBTL

Based on the Project's proposed design, federal lands would not be crossed by the PBTL.

PTTL

Based on the Project's proposed design, federal lands would not be crossed by the PTTL.

3.3.12.2.2 Pipeline Aboveground Facilities

Some Pipeline Aboveground Facilities (e.g., compressor stations, heater stations, meter stations, MLBVs) would be located on BLM managed lands. An overview of the potentially applicable stipulations for the areas crossed is provided in Table 3.3.12-1.

3.3.12.2.3 Pipeline Associated Infrastructure

Some Pipeline Associated Infrastructure (e.g., access roads, ATWS, contractor yards, pipe yards, construction camps, rail spurs, temporary disposal sites, and material extraction sites) would be located on multiple federally managed lands. An overview of the potentially applicable stipulations for the areas crossed is provided in Table 3.3.12-1.

3.3.12.2.4 GTP

Federal lands would not be affected by the GTP.

3.3.12.2.5 GTP Associated Infrastructure

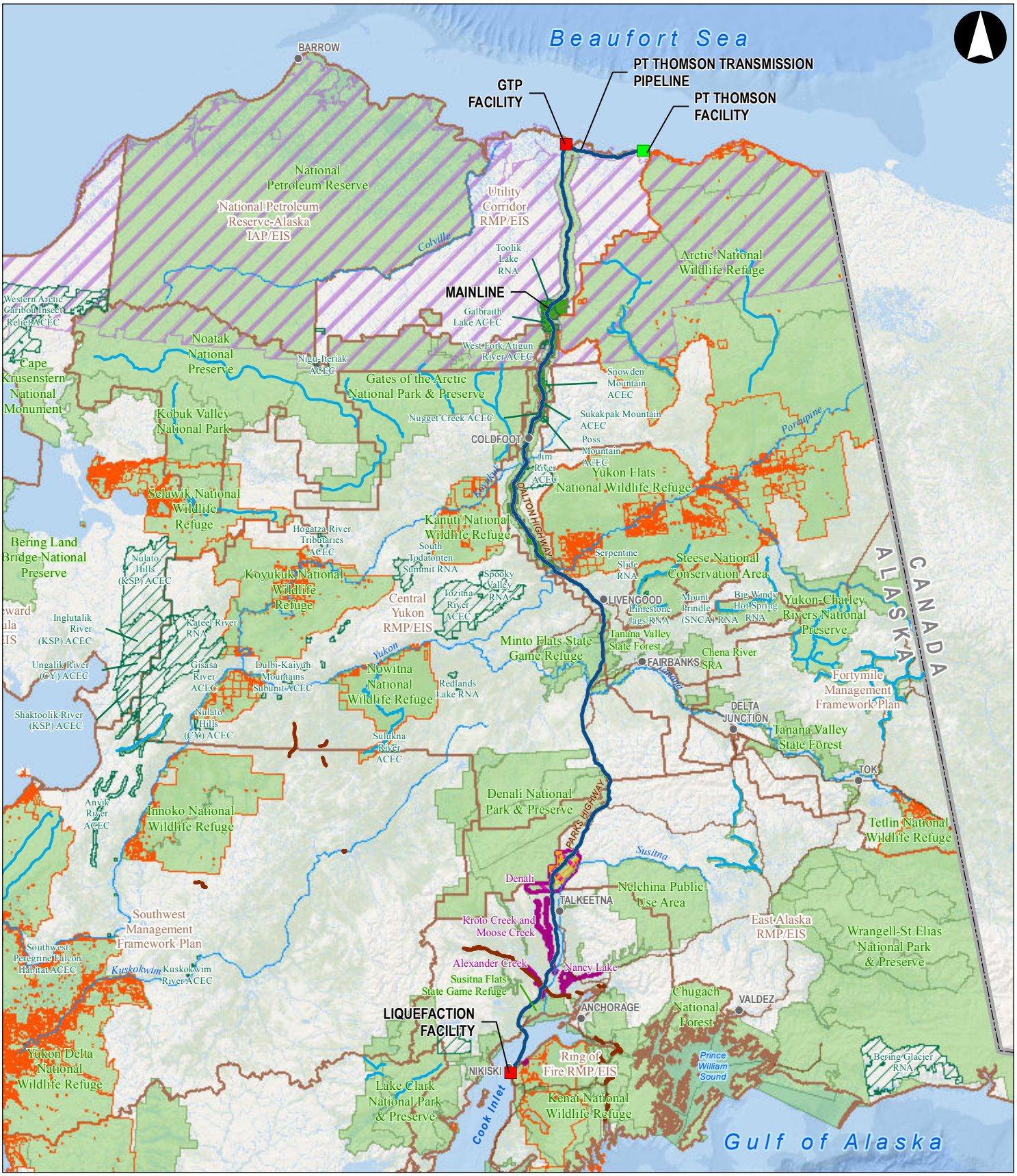
Federal lands would not be affected by the GTP Associated Infrastructure.

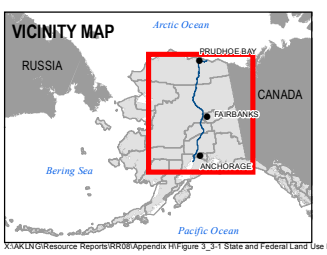
3.3.12.2.6 Non-Jurisdictional Facilities

Federal lands would not be affected by Non-Jurisdictional Facilities.

3.3.13 State-Owned and -Managed Land

State-owned and managed lands were identified in the Project area. A summary of the state-owned and -managed lands crossed is provided in Table 3.1-1. A depiction of the lands crossed by the proposed Project is provided in Resource Report No. 8, Appendix B. Figure 3.3-1 depicts the state land use planning areas crossed.





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LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Wild and Scenic Rivers
- Iditarod National Historic Trail
- Major Highways
- Major Rivers
- State Park Wilderness Areas
- Legislatively Designated Area
- Areas of Critical Environmental Concern
- National Wildlife Refuge Boundaries
- BLM Planning Area
- North Slope Borough Conservation Areas
- Dalton Highway Recreation Area
- State and Federal Conservation Lands

0 35 70 140 Miles

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PREPARED BY:	AGDC		
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DATE:	2017-04-10	SHEET:	1 of 1

STATE & FEDERAL LAND USE PLANNING AREAS

FIGURE 3.3-1

ALASKA LNG

3.3.13.1 Alaska Department of Natural Resources (ADNR)

AS 38.04.065, Land Use Planning and Classification, and 11 AAC 55.010-.030 require that the 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 State Pipeline Coordinator's Section (SPCS) within ADNR has authority under AS 38.35, the Pipeline Right of Way Leasing Act and it is responsible for managing the process for ADNR to grant leases of state land for pipeline ROW purposes for the Project. Currently, more than a dozen state-owned areas of Alaska are covered by management plans intended to establish goals, policies, management intent, and guidelines for state lands; allocate the use of state land through plan designations; and include recommendations to retain or sell land, open or close areas to development, and establish special land use designations.

ADNR land management divisions include the Division of Mining, Land & Water (DMLW); Forestry; and Parks and Outdoor Recreation (DPOR). For those lands that are owned by the State of Alaska and managed by the ADNR, but not covered by an existing resource-specific land management plan, the ADNR-DMLW, in coordination with the public, identifies important land resources and how its 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. All state lands must be classified prior to being included in a lease for pipeline ROW. Prior to issuing a ROW, ADNR conducts a site-specific classification of any land not already classified in a State Area Plan.

3.3.13.2 ADNR-DMLW

Within the DMLW, land use management plans are categorized as either area plans (covering large areas) or management plans (providing more detailed guidance for a specific resource or special area). Area plans applicable to the Project include the following:

- Kenai Area Plan;
- Susitna Area Plan;
- Southeast Susitna Area Plan;
- Susitna Matanuska Area Plan;
- Yukon Tanana Area Plan;
- Eastern Tanana Area Plan (not yet adopted), Tanana Basin Area Plan is still the active plan for these areas; and
- North Slope Management Plan (in development).

The state area plans designate primary uses on state land, provide general management guidelines for a variety of land uses and resources, and identify specific management intent for individual units of land. The management units that would be crossed by the Mainline are managed for a variety of purposes, including land disposals, coal development, continued use of material sites, and uses compatible with settlement, as well as protection of public recreation values, agricultural values, forest values, and habitat values. Prior to making an authorization decision, ADNR takes into account the management guidelines and statement of intent specific to each unit. The area plans emphasize 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 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)).

Management plans applicable to the Project include the Susitna Basin Recreation Rivers Management Plan. There are three State Recreation Rivers (SRRs) within the Project area managed by the DMLW:

- Kroto Creek & Moose Creek SRR;
- Alexander Creek SRR; and
- Little Susitna SRR.

The DMLW co-manages state game refuges (SGRs), sanctuaries, and critical habitat areas (CHAs) with ADF&G.

Much of the state land that would be crossed by the Project has been classified as Resource Management Land (RMG) by various classification orders—for example, Classification Order (CL) 618, CL 617, CL NC-02-002, and CL NC 88-004. A land classification establishes the apparent best use of an area, with the presumption that all other uses are compatible unless specifically prohibited (ADNR, 2012). According to 11 AAC 55.200, land classified as RMG is either land that might have a number of important resources, but for which a specific resource allocation decision is not possible at this time, or land that contains one or more resource values, none of which is of sufficiently high value to merit designation as a primary use. The RMG classification does not prohibit any specific uses for the lands in the Project area.

All state lands in the Umiat Meridian are classified as North Slope Area Special Use Lands (Alaska Division of Land [ADL] 50666). This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits are required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. The DMLW will issue permits for ice road and pad construction and off-road (tundra) travel. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.

3.3.13.3 ADNR Division of Forestry

The ADNR Division of Forestry manages forests for multiple uses and the sustained yield of renewable resources on 20 million acres of state land (ADNR, 2013b). Alaska state forests include the Tanana Valley, Haines, and Southeast State Forests. Of these, the Project area would include portions of the 1.81 million-acre Tanana Valley State Forest. This forest is open to timber extraction, mining, granular material extraction, oil and gas leasing, and grazing. Timber production is the major commercial activity (ADNR, 2013c). The DMLW adjudicates material sales from State Forest land, in consultation with the Division of Forestry. This forest also offers many recreational opportunities, including hunting, fishing, trapping, camping, hiking, dog mushing, cross-country skiing, wildlife viewing, snowmachining, gold panning, boating, and berry picking. The Tanana Valley State Forest is managed under the Tanana Valley State Forest Management Plan. The forest is discussed further in Table 3.3.15-2 and Section 3.3.15.5.1.

3.3.13.4 ADNR Division of Parks and Outdoor Recreation (DPOR)

The ADNR DPOR provides outdoor recreation opportunities, and conserves and interprets natural, cultural, and historic resources for the use, enjoyment, and welfare of the people. The Alaska State Park System contains 3.2 million acres, making it the largest in the United States. Units in the system include parks, historic parks and sites, marine parks, wilderness parks, recreation areas and sites, trails, preserves, and special management areas. The system provides more than 2,500 campsites, 128 trailheads, 37 boat launches, 43 scenic overlooks, and 340 toilets (ADNR, 2007).

Within the Project area, one Alaska State Park unit (Denali State Park) is managed by the ADNR DPOR.

3.3.13.5 ADNR State Pipeline Coordinator's Section (SPCS)

The ADNR SPCS manages pipeline ROWs and the lands encompassed by the ROW in accordance with the lease for the purposes of construction, operation, maintenance, and termination of a pipeline and all pipeline-associated actions. AS 38.35.010, the Right-of-Way Leasing Act, grants the State of Alaska all rights, powers, privileges, and immunities not pre-empted by federal interstate commerce laws and regulations in the ROW leasing of any state land for pipeline construction, transmission, or operation within its boundaries.

3.3.13.6 Alaska Mental Health Trust Lands

Alaska Mental Health Trust (Trust) Lands exist in the Project area. The Trust Land Office is a unit within the ADNR that is contracted exclusively by the Trust to manage approximately 1 million acres of land and

other non-cash assets to generate income (ADNR, 2013d). Revenue-generating uses of Trust lands include land leasing and sales; real estate investment and development; commercial timber sales; mineral exploration and production; coal, oil, and gas exploration and development; sand, granular material, and rock sales; and other general land uses. Income derived from Trust lands is used to fund a comprehensive integrated mental health program for the citizens of Alaska.

3.3.13.7 University of Alaska

The University of Alaska currently owns and manages approximately 150,000 acres in Alaska. Some of this land would be crossed by the Project. 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 its Land Grant Trust Fund (University of Alaska, 2006).

3.3.13.8 Alaska Department of Fish & Game (ADF&G)

The ADF&G's mission statement 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 and .990, activities except for lawful hunting, trapping, fishing, viewing, and photography occurring in special areas including state parks, SGRs, and state fish and game CHAs require a special area permit. In addition, the use of helicopters or motorized vehicles requires a permit.

The ADF&G and ADNR-DMLW co-manage the Minto Flats SGR, which is located adjacent to the Project area. The Minto Flats SGR encompasses approximately 500,000 acres and is located about 35 miles west of Fairbanks between the communities of Minto and Nenana (ADF&G, 2012). It was established by the Alaska Legislature in 1988 to ensure the protection and enhancement of habitat and 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). According to the Minto Flats State Game Refuge Management Plan issued in 1992, utility corridors and pipelines may be sited on refuge lands if they are determined to be compatible with the purposes for which the refuge was established (ADF&G, 1992). Proposals will be evaluated for compatibility with the refuge purposes listed in legislation and reflected in the goals of the management plan.

ADF&G and ADNR-DMLW also co-manage the Susitna Flats SGR (Susitna Flats), which encompasses approximately 300,800 acres (ADF&G, 1988) and would be crossed by the Mainline. Susitna Flats, located between Beluga River and Point MacKenzie on the western side of Cook Inlet, was established by the Alaska Legislature in 1976. It was created to ensure the protection of fish and wildlife populations, particularly waterfowl nesting, feeding, and migration; moose calving areas; spring and fall bear feeding areas; and salmon spawning and rearing habitats. It was also established for public use of fish and wildlife and their habitat, particularly waterfowl, moose, and bear hunting; viewing; photography; and general public recreation in a high-quality environment. Each year, approximately 10 percent of the waterfowl harvested in the state occurs in Susitna Flats. New utilities may be allowed to cross the refuge where no feasible off-refuge alternative exists, using existing corridors wherever possible, consistent with refuge goals and objectives. Two major utility lines cross Susitna Flats—the Chugach Electric Association, Inc., electric transmission line and the ENSTAR natural gas pipeline (ADF&G, 1988).

3.3.13.9 ADF&G Game Management Units

The State of Alaska is divided into 26 Game Management Units (GMUs) that dictate hunting seasons and other hunting regulations, such as bag limits. The Project area is located within GMUs 26B, 25A, 25D, 24A, 20A, 20B, 20C, 20F, 16A, 16B, 15A, and 13E (ADF&G, 2014).

3.3.13.10 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. The Project representatives would coordinate with ARRC for crossing ARRC lands.

3.3.13.11 Alaska Department of Transportation and Public Facilities (ADOT&PF)

The ADOT&PF designs, constructs, operates, and maintains the state's transportation infrastructure systems, buildings, and other facilities used by Alaskans and visitors. This includes more than 5,000 miles of paved and granular 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, the ADOT&PF has the authority to grant a permit authorizing an applicant to construct or install utility facilities within an ADOT&PF ROW on lands owned by the State of Alaska. However, under AS 38.35, a state ROW lease will apply to ADOT&PF managed lands. The Project representatives would coordinate with ADOT&PF in the state's role regarding application of the following plans:

- James Dalton Highway Master Plan; and
- George Parks Highway – Inventory and Management Recommendations.

3.3.13.12 Summary of Applicable State Land Use Plans

3.3.13.12.1 Liquefaction Facility

Components of the Liquefaction Facility would be located on state-owned lands, such as the Marine Terminal, which is located on state-owned submerged lands (Resource Report No. 8, Appendix B). An overview of potentially applicable stipulations for the areas crossed is provided in Table 3.3.13-1.

TABLE 3.3.13-1

Summary of Potentially Applicable State Land Use Plans and Documents for the Permanent Footprint of the Liquefaction Facility

Author/Agency	Land Use Plan/Document	Acres	Potential Applicable Stipulations
ADF&G	Game Management Unit (GMU) 15A	181.7 acres (Marine Terminal)	Within GMU 15A, the Kenai Controlled Use Area encompasses the Liquefaction Facility site. This area is closed to the use of aircraft (for hunting moose, including transportation of moose hunters) before 12:01 a.m. on September 11.
ADNR DMLW	Kenai Area Plan (2001)	181.7 acres (Marine Terminal)	The Kenai Area Plan directs how ADNR will manage state uplands, tidelands, and submerged lands within the planning boundary. ADNR has classified state lands to reflect the intent of land use designations. Land classified as transportation corridor (11 AAC 55.205) is land identified for the location of easements and ROW under AS 38.04.065(f), including transportation, pipeline, or utility purposes.

3.3.13.12.2 Interdependent Project Facilities

3.3.13.12.2.1 Pipelines

Mainline

The Mainline would pass through multiple state-managed lands (Resource Report No. 8, Appendix B). An overview of potentially applicable stipulations for the areas crossed is provided in Table 3.3.13-2

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TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
ADF&G	GMU 26B	Mainline MPs: Intermittently between 0.0 and 169.9 Pipeline Aboveground Facilities: 2 compressor station 2 MLBVs 1 meter station Pipeline Associated Infrastructure: 4 construction camps 10 PSYs 28 material sites 126 access roads 210 ATWS PBTL PTTL PTTL Aboveground Facilities: 1 meter station 2 MLBVs PTTL Associated Infrastructure: 3 construction camps 1 helipad 2 PSYs 2 access roads 54 access roads	Within Prudhoe Bay, closed to hunting of big game Within Dalton Highway Corridor Management Area, closed to hunting, unless taken in the area by bow and arrow only

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	GMU 24A	Mainline MPs: 177.4–315.1 Pipeline Aboveground Facilities: 1 compressor station 1 MLBV Pipeline Associated Infrastructure: 4 construction camps 8 PSY 21 material sites 145 access roads 138 ATWS	The area is closed to the use of aircraft for hunting moose. A. The area within the Prudhoe Bay Closed Area is closed to the taking of big game; the remainder of the Dalton Highway Corridor Management Area is closed to hunting; however, big game, small game, and fur animals may be taken in the area by bow and arrow only; B. no motorized vehicle may be used to transport hunters, hunting gear, or parts of game, within the Dalton Highway Corridor Management Area, except that 1. licensed highway vehicles may be used on the following designated roads: (1) Dalton Highway, (2) Bettles Winter Trail during periods when the Bureau of Land Management and the City of Bettles announce that the trail is open for winter travel, (3) Galbraith Lake Road from the Dalton Highway to the BLM campground at Galbraith Lake, including the gravel pit access road when the gate is open, (4) Toolik Lake Road, excluding the driveway to the Toolik Lake Research Facility, (5) the Sagavanirktok River access road two miles north of Pump Station 2, and (6) any constructed roadway or gravel pit within one-quarter mile of the Dalton Highway; 2. aircraft and boats may be used; 3. a snowmachine may be used to cross the management area from land outside the management area to access land on the other side of the management area; C. any hunter traveling on the Dalton Highway must stop at any check station operated by the department within the Dalton Highway Corridor Management Area
	Game Management UnitGMU 20F	Mainline MPs: 324.7–356.3 Pipeline Aboveground Facilities: 1 MLBV Pipeline Associated Infrastructure: 6 PSYs 9 material sites 67 access roads 77 ATWS	Closed to use of motor craft for hunting of big game Closed for hunting of big game Within Dalton Highway Corridor Management Area, closed to hunting, unless taken in the area by bow and arrow only

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	GMU 20B	Mainline MPs: 356.3–472.8 Pipeline Aboveground Facilities: 1 compressor station 2 MLBVs Pipeline Associated Infrastructure: 3 construction camps 3 PSYs 2 railroad work pads 11 material sites 20 access roads 271 ATWS	
	GMU 20C	Mainline MPs: 472.8–476.1, 489.1-532.1 Pipeline Aboveground Facilities: 1 compressor station 2 MLBVs Pipeline Associated Infrastructure: 2 construction camps 4 PSY 18 material sites 46 access roads 183 ATWS	

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	GMU 20A	Mainline MPs: 476.1–489.1, 532.1–559.2 Pipeline Aboveground Facilities: 3 MLBV Pipeline Associated Infrastructure: 1 railroad spur 1 railroad work pad 6 material sites 11 access roads 93 ATWS	
	Minto Flats State Game Refuge Management Plan (1992)	Mainline MPs: 431–441.2, 441.6–442.6, 446.5–446.7, 447.9–448.2, 453.7–454, 455–455.6, 455.9–458.1, 459.5–460.5, 461–461.2, 461.8–463.3, 463.8–468.7 Pipeline Aboveground Facilities: 1 MLBV Pipeline Associated Infrastructure: 1 construction camp 2 material sites 7 access roads 82 ATWS 3 disposal sites 1 helipad	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, power lines, 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 a significant public need for the corridor that cannot be reasonably met off-refuge, that the use of refuge lands and effects to refuge resources are avoided or reduced to the maximum extent feasible, that public access to the refuge is maintained, and that effects 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. The routing of the pipeline crosses a small portion of Minto Flats.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	GMU 13E	Mainline MPs: 559.2–641.6 Pipeline Aboveground Facilities: 1 compressor station 2 MLBVs Pipeline Associated Infrastructure: 1 construction camp 4 PSY 24 material sites 84 access roads 513 ATWS	The area is closed to use of any motorized vehicle or pack animal for hunting, including transportation of hunters, their hunting gear, or parts of game, from July 26 through September 30.
	GMU 16A	Mainline MPs: 641.6–720.9 Pipeline Aboveground Facilities: 1 compressor station 3 MLBVs Pipeline Associated Infrastructure: 2 construction camps 5 PSYs 16 material sites 29 access roads 374 ATWS	The area is open to hunting with restrictions on motorized access during certain times of the year.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	Susitna Flats Management Plan (1988) Includes Game Management Unit 16B	Mainline MPs: Intermittently between 575.4 and 752.4 Pipeline Aboveground Facilities: 21 compressor station Pipeline Associated Infrastructure: 2 construction camps 1 PSY 2 material sites 11 access roads 180 ATWS 3 disposal sites	New utilities may be allowed to cross the refuge where no feasible off-refuge alternative exists, using existing corridors wherever possible, consistent with refuge goals and objectives. A special use permit is required for any construction work in Susitna Flats SGR.
	GMU 15A	Mainline MPs: 777.6–806.6 Pipeline Associated Infrastructure: 125 ATWS	Within 15A, the Kenai Controlled Use Area (encompasses the Liquefaction Facility) the area is closed to use of aircraft for hunting moose, including transportation of moose hunters before 12:01 a.m. on September 11.
	GMU 16B	Mainline MPs: 720.9–777.6 Pipeline Aboveground Facilities: 2 MLBV Pipeline Associated Infrastructure: 2 construction camp 4 PSYs 7 material sites 23 access roads 301 ATWS	

ADNR Division of Forestry	Tanana Valley State Forest Management Plan (2001 update) Includes GMU 20B	Mainline MPs: Intermittently between 407.7 and 454.7 Pipeline Aboveground Facilities: 1 compressor station Pipeline Associated Infrastructure: 1 construction camp 1 PSY 7 material sites 11 access roads 259 ATWS 3 disposal sites	The plan contains the following policies: Other land management proposals may be initiated by other agencies or private individuals and may include requests for ROW, 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 & Water. The Division of Mining, Land & 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 & 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 & Water, applications must be consistent with the stipulations given by the Division of Forestry. No permits, leases, disposals, or ROW 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 G. Trail Crossings II. MANAGEMENT GUIDELINES When it is necessary for power lines, 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,

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
			fishing, recreation, timber harvest, settlement, and other uses or provide a mechanism to improve or develop future public crossings as the need arises.
ADNR Division of Parks and Outdoor Recreation (DPOR)	Denali State Park Management Plan (2006)	Mainline MPs: 609.1–646.9 Pipeline Aboveground Facilities: 1 MLBV Pipeline Associated Infrastructure: 1 PSY 12 material sites 37 access roads 176 ATWS 3 material sites	The plan designates land use within park boundaries (ADNR, 2006). 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 reduce effects to viewsheds, especially within the viewsheds of areas with high public use.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
ADNR DMLW	North Slope Management Plan (in development) Includes GMUs 26B, 25A, and 24A	Mainline MPs: 0-183.6 Pipeline Aboveground Facilities: 1 compressor station 4 MLBVs 1 meter station Pipeline Associated Infrastructure: 10 construction camps 19 PSYs 50 material sites 306 access roads 738 ATWS PBTL PTTL PTTL Aboveground Facilities: 1 meter station 2 MLBVs PTTL-Associated Infrastructure: 3 construction camps 1 helipad 2 PSYs 1 access road 19 road ATWS 10 stream ATWS	ADNR is developing a land use plan for the approximately 12 million acres of state lands north of Atigun Pass.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	North Slope Special Use Area (ADL 50666)	Mainline MPs: 0–4.8, 5.9–83.4, 86.2–121.5 Pipeline Aboveground Facilities: 2 compressor station 2 MLBVs 1 meter station Pipeline Associated Infrastructure: 3 construction camps 6 PSYs 17 material sites 89 access roads 321 ATWS PBTL PTTL PTTL Aboveground Facilities: 1 meter station 2 MLBVs PTTL-Associated Infrastructure: 3 construction camps 1 helipad 2 PSYs 2 access roads 52 icepad access roads 1 bypass lane 1 road ATWS 1 snow storage area 1 stream ATWS 1 travel lane	All state lands in the Umiat Meridian are classified as North Slope Area Special Use Lands (ADL 50666). This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits are required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	CL 618	Mainline MPs: 0–1.7, 4.2–4.8, 5.9–6.5	This classification order has designated land within the Project area as Resource Management Land (RMG). Land classified as RMG is either land that might have a number of important resources, but for which a specific resource allocation decision is not possible at this time, or land that contains one or more resource values, none of which is of sufficiently high value to merit designation as a primary use. The RMG classification does not prohibit any specific uses for the lands in the Project area.
	Dalton Highway Master Plan (1998)	Mainline MPs: Intermittently between 13.2 and 405.2	The plan specifies development nodes along the Dalton Highway Corridor at the following locations: Yukon River Crossing, Coldfoot, Chandalar Shelf, Happy Valley, and Deadhorse (ADNR, 1998). 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.
	CL 617	Mainline MPs: 26.1–27.9	This classification order has designated land within the Project area as RMG. Land classified as RMG is either land that might have a number of important resources, but for which a specific resource allocation decision is not possible at this time, or land that contains one or more resource values, none of which is of sufficiently high value to merit designation as a primary use. The RMG classification does not prohibit any specific uses for the lands in the Project area.
	CL NC-02-002	Intermittently between 27.9 and 178.9	This classification order has designated land within the Project area as Resource Management Land (RMG). Land classified as RMG is either land that might have a number of important resources, but for which a specific resource allocation decision is not possible at this time, or land that contains one or more resource values, none of which is of sufficiently high value to merit designation as a primary use. The RMG classification does not prohibit any specific uses for the lands in the Project area.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	Yukon Tanana Area Plan (2014) Includes GMUs 13E, 20A, 20B, 20C, 20F	Mainline MPs: Intermittently between 345.4 and 575.4 Pipeline Aboveground Facilities: 2 compressor stations 8 MLBVs Pipeline Associated Infrastructure: 6 construction camps 13 PSYs 5 railroad spur 5 railroad work pads 55 material sites 170 access roads 705 ATWS 8 helipads 34 disposal sites	The Area-wide Land Management Policies include management guidelines relevant to pipeline development. These guidelines are identical to those found in the Susitna Matanuska Area Plan.
	Eastern Tanana Area Plan (2015) (not yet adopted), Tanana Basin Area Plan is still the active plan for these areas Includes GMU 20B	Mainline MPs: 421.8–424.3 Pipeline Aboveground Facilities: 1 compressor station Pipeline Associated Infrastructure: 7 access roads 16 ATWS 1 djyard 4 material sites	The Eastern Tanana Area Plan replaces the regions of the Tanana Basin Area Plan that are not covered in the Yukon Tanana Area Plan. The portion of the Project that would be located within the Eastern Tanana Area Plan planning area is designated as a legislatively designated area (LDA). Management of LDAs under the Eastern Tanana Area Plan follows the requirements of the legislation authorizing each LDA as well as with specific management plans that have been adopted subsequent to the creation of the LDA. The LDA that would be crossed by the Project within the Eastern Tanana Area Plan planning area is the Tanana Valley State Forest. Therefore, compliance with the Tanana Valley State Forest Management Plan would also ensure compliance with the Eastern Tanana Area Plan.
	Nenana River Gorge & McKinley Village Subdivision Special Use Area	Mainline MPs: 532.8–533.6, 535.0–535.1, 535.4–535.8 Pipeline Associated Infrastructure: 2 access roads 21 ATWS	A permit is required for setting up and using a camp for personal or commercial purposes.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	Susitna Matanuska Area Plan (2011) Includes GMUS 13E, 14B, 16A, 16B	Mainline MPs: Intermittently between 575.4 and 755.3 Pipeline Aboveground Facilities: 3 compressor stations 4 MLBVs Pipeline Associated Infrastructure: 3 construction camp 9 PSYs 40 material sites 106 access roads 2197 ATWS 14 disposal sites 4 helipads 3 railroad spurs 3 railroad work pads	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 Susitna Matanuska Area Plan emphasizes minimizing land use conflicts through plan guidelines and intent rather than through prohibitions, although prohibitions are sometimes identified (ADNR, 2011). 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 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 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. 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.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	Southeast Susitna Area Plan (2008)	Mainline MPs: Intermittently between MP 737.3 and 752.4 Pipeline Aboveground Facilities: 1 compressor station Pipeline Associated Infrastructure: 12 access roads 180 ATWS 2 material sites 2 construction camps 3 disposal sites 1 dj yard 1 construction camp	The Area-wide Land Management Policies include management guidelines relevant to pipeline development. These guidelines are identical to those found in the Susitna Matanuska Area Plan.
	Susitna Area Plan (1985, as amended)	Mainline MPs: 600.1–603.5 Pipeline Aboveground Facilities: 1 compressor station 1 MLBV Pipeline Associated Infrastructure: 117 access roads 2381 ATWS 41 material sites 7 construction camps 15 disposal sites 1 dj yard 10 PSY 4 helipads 3 railroad spurs 3 railroad work pads	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 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.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
	Susitna Basin Recreation Rivers Management Plan	Mainline MPs: 703.6–704.3, 704.8–705.3, 726.7–728 Pipeline Associated Infrastructure: 2 access roads 25 ATWS	The plan includes goals and management practices for recreation, fish and wildlife habitat, and public access, among others. There is no specific mention of management guidelines relevant to pipeline development (ADNR, 1991).
	Kroto Creek & Moose Creek State Recreation River (SRR)	Mainline MPs: 704.0–705.8, 707.1–707.5 Pipeline Associated Infrastructure: 1 access road 33 ATWS	Managed in accordance with the Susitna Basin Recreation Rivers Management Plan.
	Alexander Creek SRR	Mainline MPs: 726.3–728.5 Pipeline Associated Infrastructure: 2 access road 26 ATWS	Managed in accordance with the Susitna Basin Recreation Rivers Management Plan.
	Kenai Area Plan (2001) Includes Game Management Unit 16B	Mainline MPs: 754.2–806.6 Pipeline-Associated Infrastructure: 16 access roads 505 ATWS 1 material site 2 camps 1 disposal site 3 helipads 3 MLBVs 1 meter station 3 PSY	The Kenai Area Plan directs how ADNR will manage state uplands, tidelands, and submerged lands within the planning boundary. While this plan provides general management intent for state lands, the plan does not make decisions about specific land-use authorizations. These decisions are made through the application review process. Land-use authorizations must, however, be consistent with the plan, and existing laws and regulations.

TABLE 3.3.13-2

Summary of Potentially Applicable State Land Use Plans, Documents, and Special Use Areas for the Pipelines and Related Aboveground Facilities

Author/Agency	Land Use Plan/Document	MPs/Facility Count	Potential Applicable Stipulations
ADOT&PF	James Dalton Highway (AS 19.40.010) Also includes GMU 20F, 24A, 25D	Intermittently between 85.0 and 347.9 Pipeline Aboveground Facilities: 2 compressor stations 4 MLBVs Pipeline Associated Infrastructure: 4 construction camps 21 PSYs 54 material sites 356 access roads 2066 ATWS PTTL Mainline PTTL Associated Infrastructure: 1 construction camps 1 PSY 8 road ATWS	Pursuant to 19.40.100, the department shall maintain the highway and keep it open to industrial traffic throughout the year, including travel necessary and related to resource exploration and development or to support of those activities, if the individual engaged in those activities has all necessary permits.

3.3.13.12.3 PBTL

The PBTL would be located on state-managed lands under lease to the PBU. This pipeline is subject to CL 618, and would be subject to the North Slope Management Plan, once that plan is developed and adopted.

3.3.13.12.4 PTTL

The PTTL would be located almost entirely on state-managed lands. The PTTL corridor would cross GMU 26B III (Table 3.3.13-2). This pipeline is subject to CL 618, and would be subject to the North Slope Management Plan, once that plan is developed and adopted.

3.3.13.12.5 Pipeline Aboveground Facilities

The locations of the aboveground facilities would cross state-managed lands. An overview of the applicable stipulations for the areas crossed is provided in Table 3.3.13-2.

3.3.13.12.6 Pipeline Associated Infrastructure

The locations of the associated facilities would cross state-managed lands. An overview of the applicable stipulations for the areas crossed is provided in Table 3.3.13-2.

3.3.13.12.7 GTP

The GTP would be located on state-managed lands (Resource Report No.8, Appendix B). An overview of the potentially applicable stipulations for the areas crossed is provided in Table 3.3.13-3.

3.3.13.12.8 GTP Associated Infrastructure

The GTP Associated Infrastructure would be located on state-managed lands (Resource Report No.8, Appendix B). An overview of the potentially applicable stipulations for the areas crossed is provided in Table 3.3.13-3.

Table 3.3.13-3

Summary of Applicable State Land Use Plans and Documents for the GTP and GTP Associated Infrastructure

Author/Agency	Land Use Plan/Document	MPs/Facility Count/ Acres	Potential Applicable Stipulations
ADF&G	GMU 26B	GTP: 179.6 GTP Associated Infrastructure: 363.4	Within Prudhoe Bay, closed to hunting of big game. Within the Dalton Highway Corridor Management Area, closed to hunting, unless taken in the area by bow and arrow only.
ADNR-DMLW	North Slope Management Plan (in development)	GTP: 179.6 GTP Associated Infrastructure: 363.4	ADNR is developing a land use plan for the approximately 12 million acres of state lands north of Atigun Pass.
	CL 618	GTP Associated Infrastructure: 19.1	This classification order has designated land within the project area as RMG. Land classified as RMG is either land that might have a number of important resources, but for which a specific resource allocation decision is not possible at

Table 3.3.13-3

Summary of Applicable State Land Use Plans and Documents for the GTP and GTP Associated Infrastructure

Author/Agency	Land Use Plan/Document	MPs/Facility Count/ Acres	Potential Applicable Stipulations
			this time, or land that contains one or more resource values, none of which is of sufficiently high value to merit designation as a primary use. The RMG classification does not prohibit any specific uses for the lands in the Project area.
	North Slope Special Use Area (ADL 50666)	GTP: 179.6 GTP Associated Infrastructure: 363.4	All state lands in the Umiat Meridian are classified as North Slope Area Special Use Lands (ADL 50666). This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits are required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.

3.3.13.12.9 Non-Jurisdictional Facilities

The footprint of the PBU MGS project would include lands managed primarily by the state (98 percent; 504 acres) and the remaining on private property. The PTU Expansion project would be located entirely on state land. The KSH relocation project footprint land ownership will be provided when a proposed route has been selected.

3.3.14 Local and Other Management Areas

Lands managed by boroughs and municipalities were identified in the Project area. The information in the following sections provides a brief overview of applicable locally managed areas.

3.3.14.1 Alaska Native Regional and Village Corporations

In 1971, President Richard Nixon signed into law the Alaska Native Claims Settlement Act (ANCSA) (43 USC § 1601 et seq.). Under ANCSA, aboriginal financial and land claims were settled in exchange for $962.5 million in compensation, as well as approximately 40 million acres (Norris, 2002). ANCSA established 12 for-profit Alaska Native Regional Corporations (a 13th corporation was later added for Alaska Natives living outside the state). In addition, more than 200 Alaska Native 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. The statute includes sand and gravel in the definition of surface rights, while these are included in the subsurface estate under ANCSA and are therefore owned by the Regional Corporations. The Village and Regional Corporations are owned by enrolled Alaska Natives. Approximately 80,000 Alaska Natives are enrolled under ANCSA, and receive 100 shares each for the Village Corporation and Regional Corporation in which they are enrolled.

Native Corporation land is often held in large tracts and used for subsistence purposes or developed to generate revenue for the corporation. The Toghotthele Corporation (a Native Village Corporation representing the Native Village of Nenana) and both Tyonek Corporation (A Native Village Corporation representing the Native Village of Tyonek) and the Salamatof Corporation (a Native Village Corporation representing the Native Village of Salamatof) own surface rights to parcels within the Project area, with Doyon, Limited and the Cook Inlet Region Inc. (CIRI) owning the subsurface rights, respectively. In addition, the Project area includes parcels with surface and subsurface rights held by Ahtna, Inc., and CIRI. As private land, uses on land owned by Native Corporations are subject to an easement with the surface landowners. If those uses extend below the vegetative mat an agreement with the Regional Corporation subsurface estate owner is generally also required. (ANCSA surface estate does not include sand and gravel.)

3.3.14.2 Native Allotments

Under the Alaska Native Allotment Act of 1906 (34 Stat 197), qualifying Alaska Natives were allotted up to 160 acres of non-mineral land. The Tanana Chiefs Conference manages a trust service with the Bureau of Indian Affairs (BIA) and acts as trustee for Native allotment property owners on behalf of the 42 Villages of Interior Alaska. The Inupiat Community of the Arctic Slope also manages a trust service with BIA to act as trustee for the Native allotment owners on the North Slope. The Mainline route does not intersect with Alaska Native allotments awarded under this Act (see Table 3.1-1).

3.3.14.3 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. Section 2.0-Landowner Notification of the FERC Guidance Manual for Environmental Report Preparation (FERC, 2002) requires that the applicant notify all affected landowners about the Project whose land: would be crossed or used by the Project facilities; contains a residence within 50 feet of the proposed construction work area; abuts on either side of an existing or proposed facility site or ROW; and/or contains a residence within one-half mile of proposed compressors (or their enclosures) or liquefaction facilities. Alaska LNG has conducted these notifications for meeting FERC requirements.

3.3.14.4 Summary of Applicable Local Land Use Plans

3.3.14.4.1 Liquefaction Facility

The footprint of the Liquefaction Facility, including associated facilities, would include lands managed by the KPB and within the unincorporated areas of Nikiski. Table 3.3.14-1 shows the potentially applicable stipulations for the Liquefaction Facility.

TABLE 3.3.14-1

Summary of Potentially Applicable Local Land Use Plans and Documents for the Liquefaction Facility

Document Name	Acres	Potential Applicable Stipulations
Kenai Peninsula Borough Comprehensive Plan (2005)	261.4	The KPB Comprehensive Plan's Goal 5.7, Objective 1, recognizes and encourages port and harbor expansion plans by others to promote economic development. Goal 6.5 calls for maintaining the freedom of property owners in rural areas of the KPB to make decisions and control use of their private land consistent with other goals and objectives of the comprehensive plan (KPB, 2005). The KPB regulates floodplain development, coastal zone development, and development near certain anadromous fish streams through the Borough. The KPB Code of Ordinances requires that property owners within the designated 100-year floodplain obtain a permit from the KPB prior to development on those lands, pursuant to Chapter 21.06, Floodplain Management. Because the portion of the Liquefaction Facility that would be on locally managed land would be located outside of the 100-year floodplain, this permit does not apply to this facility.

TABLE 3.3.14-1 Summary of Potentially Applicable Local Land Use Plans and Documents for the Liquefaction Facility		
Document Name	**Acres**	**Potential Applicable Stipulations**
Community Action Plan: Nikiski, Alaska (2012)	261.4	The Nikiski Community Council's (NCC) Action Plan Goal C is to promote the maintenance, improvement, and expansion of the North Peninsula Area Transportation Network. Objective 1 for this goal is to develop a long-term plan for residential and industrial traffic patterns, highway improvements, and identification of new highway corridors (NCC, 2012). The NCC Action Plan Goal D is to support and promote community development related projects that provide economic benefits to residents of the North Peninsula Area. Objective 1 for this goal is to promote the North Peninsula Area as the terminus for the proposed natural gas pipeline project (NCC, 2012). The NCC Action Plan Goal E is to promote the safety and health of the area's residents. Objective 2 is to develop long-term options for promoting safety and health and includes action item 2 to develop a land use plan that identifies heavy industrial land use corridors (NCC, 2012).

3.3.14.4.1 Interdependent Project Facilities

3.3.14.4.1.1 Pipelines

Mainline

The Mainline would cross lands that are locally managed. An overview of the potentially applicable stipulations for the areas crossed is provided in Table 3.3.14-2.

TABLE 3.3.14-2 Summary of Potentially Applicable Local Land Use Plans and Documents for the Pipelines and Related Aboveground Facilities		
Document Name	Project Facilities	Potential Applicable Stipulations
North Slope Borough Comprehensive Plan (2005)	Mainline MPs: Intermittently between MP 0.0 and 182.4 Aboveground Facilities Pipeline Associated Infrastructure	The NSB Comprehensive Plan contains policies related to the development of oil and gas resources: Issue #32: Drill pads and pipelines encroach upon subsistence areas. Goal: Reduce effects 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 effects to subsistence from development. Objective/Policy: Develop a program to compensate Village residents for effects to subsistence. Issue #118: Resource development changes the character of the landscape and alters the way local people use the land. Goal: Reduce visual and other effects on community character. Objective/Policy: Locate and design oil and gas facilities to reduce visual and other effects on community character. Issue #156: Oil field infrastructure, including roads, pads, and pipelines cause physical changes in the environment. Goal: Reduce physical changes in the environment from oil field infrastructure.

TABLE 3.3.14-2

Summary of Potentially Applicable Local Land Use Plans and Documents for the Pipelines and Related Aboveground Facilities

Document Name	Project Facilities	Potential Applicable Stipulations
		Objective/Policy: Work with industry in the permitting process to incorporate mitigation measures that reduce effects (Section 5.23). Objective/Policy: Develop incentives for industry to develop alternative designs to reduce development footprint and consolidate facilities. 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 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.
FNSB Regional Comprehensive Plan (2005)	Mainline MPs: Intermittently between MP 421.9 and 424.4	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 all zoning districts.
Denali Borough Comprehensive Plan (2009; amended 2011)	Mainline MPs: Intermittently between MP 488.7 and 575.4 Pipeline Aboveground Facilities Pipeline-Associated Infrastructure	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.]
YCC Area Comprehensive Plan (2007)	Pipeline Associated Infrastructure	The community-wide Development Standards would apply to development of the proposed access road, railroad work pad, and railroad spur within the community. The standards include required buffers and setbacks. Development of the proposed facilities is not prohibited by the plan.
Matanuska-Susitna Borough Wide Comprehensive Plan (2005 update)	Mainline MPs: Intermittently between 575.4 and 755.4 Pipeline Aboveground Facilities Pipeline Associated Infrastructure	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 multimodal transportation, including pipelines: Policy T1-4: Develop an effective multimodal transportation plan that provides recommendations for modes of transportation including surface, air, waterborne, rail, public transit and trails, pipeline,

TABLE 3.3.14-2

Summary of Potentially Applicable Local Land Use Plans and Documents for the Pipelines and Related Aboveground Facilities

Document Name	Project Facilities	Potential Applicable Stipulations
		electrical, and communications. Such a plan should strive to better connect the Borough's various communities and neighborhoods.
Kenai Borough Comprehensive Plan (2005)	Mainline MPs: Intermittently between MP 755.4 and 806.6 Pipeline Associated Infrastructure	The KPB Comprehensive Plan does not contain goals, objectives, or implementation actions specific to development of a utility crossing on lands within the KPB. However, Goal 6.5 calls for maintaining the freedom of property owners in rural areas of the KPB to make decisions and control use of their private land consistent with other goals and objectives of the comprehensive plan. Zoning in the KPB is unrestricted outside of the KPB's cities and eight Local Option Zone Districts, none of which are located within the Project area. While the KPB regulates floodplain development, coastal zone development, and development near certain anadromous fish streams (including the Beluga River), the portions of the Mainline that would intersect the 100-year floodplain and the Beluga River would not be located on locally managed lands; therefore, these regulations would not apply.
Community Action Plan: Nikiski, Alaska (2012)	Mainline MPs: MP 792.3 to 806.6 Pipeline Aboveground Facilities Pipeline Associated Infrastructure	The NCC's Action Plan Goal C is to promote the maintenance, improvement, and expansion of the North Peninsula Area Transportation Network. Objective 1 for this goal is to develop of a long-term plan for residential and industrial traffic patterns, highway improvements, and identification of new highway corridors (NCC, 2012). The NCC Action Plan Goal D is to support and promote community development related projects that provide economic benefits to residents of the North Peninsula Area. Objective 1 for this goal is to promote the North Peninsula Area as the terminus for the proposed natural gas pipeline project (NCC, 2012). The NCC Action Plan Goal E is to promote the safety and health of the area's residents. Objective 2 is to develop long-term options for promoting safety and health within includes action item 2 to develop a land use plan that identifies heavy industrial land use corridors (NCC, 2012).

PBTL

The PBTL would not occupy private land or land owned by a municipality.

PTTL

The PTTL would cross locally managed lands near the GTP and would be subject to the policies of the NSB Comprehensive Plan (see Table 3.3.14-2).

3.3.14.4.2 Pipeline Aboveground Facilities

The locations of the aboveground facilities would cross locally managed lands. An overview of the potentially applicable stipulations for the areas crossed is provided in Table 3.3.14-2.

Pipeline Associated Infrastructure

The locations of Pipeline Associated Infrastructure would cross locally managed lands. An overview of the potentially applicable stipulations for the areas crossed is provided in Table 3.3.14-2.

3.3.14.4.3 GTP

The GTP would not occupy private land or land owned by a municipality.

3.3.14.4.4 GTP Associated Infrastructure

GTP Associated Infrastructure would not occupy private land or land owned by a municipality.

3.3.14.4.5 Non-Jurisdictional Facilities

The PBU MGS project would occupy some private property. The PTU Expansion project would be located entirely on state land. The KSH relocation project footprint will be provided once a proposed route has been selected.

3.3.15 Recreation and Special Use Areas

Recreation and special use areas are identified and discussed in this section. Recreation and special use areas are described as state or nationally managed land having scenic, historic, archaeological, scientific, biological, recreational, or other special resource values that warrant additional protections and special requirements (e.g. trail systems, parks, wildlife refuges, etc.).

The Project will coordinate with local government planning departments, recreational service areas, and volunteer trail groups who maintain recreational trails traversed by the Project in order to avoid or reduce impacts to recreational use and access.

Recreation and special use areas were identified within 1 mile of the Project facilities and Project components as requested by FERC on May 15, 2015. A geospatial analysis overlaid planning boundaries with land ownership and Project features to determine the recreation and special use areas that would be affected by the Project. A summary of these recreation and special use areas is provided in Resource Report No. 8, Appendix D; acreage within the Project construction footprint is included in Table 3.3.15-1. The acreage of the recreation and special use areas within the footprint of Non-Jurisdictional Facilities is included in Table 3.3.15-2. Site-specific Public Land Use and Recreational Use Coordination Plans would be developed.

TABLE 3.3.15-1

State Recreational and Special Use Land Within the Construction Footprint of the Project (acres)

Liquefaction Facility	15.6
LNG Plant	3.5
LNG Construction Camp	12.1
Terminal MOF	0.0
Terminal MOF Dredging Area	0.0
Terminal PLF	0.0
Dredge Disposal	0.0
Pipeline	8,601.9
Onshore ROW	7,391.3
Offshore ROW	0.2
PBTL ROW	7.3
PTTL ROW	1,726.6
Pipeline Aboveground Facilities	172.7
Mainline Compressor Stations	165.1
MLBVs	4.1
Meter Stations	2.73
PTTL MLBVs	0.4
PTTL Meter Stations	0.4
Pipeline Associated Infrastructure	7,110.4
Mainline ATWS	802.4

TABLE 3.3.15-1

State Recreational and Special Use Land Within the Construction Footprint of the Project (acres)

Mainline Access Roads	1,807.5
Mainline Material Sites	3,329.0
Mainline Construction Camps (Excluding Compressor Station Camps)	363.3
Mainline Construction Compressor Station Camps	14.8
Mainline Pipe Storage Yards	274.0
Mainline Railroad Spur	1.5
Mainline Railroad Workpad	6.1
Mainline Disposal Sites	161.2
Mainline Double Joining Yards	0.0
Mainline Helipads	1.6
PTTL ATWS	21.0
PTTL Access Roads	202.2
PTTL Construction Camps	97.2
PTTL Helipad	0.6
PTTL Pipe Storage Yards	28.0
GTP	283.8
GTP Pad	227.8
GTP Operations Center Pad	56.0
GTP Associated Infrastructure	642.2
GTP Access Roads	258.8
GTP Dock Expansion	31.1
GTP Temporary Barge Bridge	2.6
GTP Material Site	141.2
GTP Module Staging Area	86.6
GTP Pipeline ROW	70.3
GTP Reservoir	35.1
GTP Berthing Basin	13.7
GTP Ice Pad	2.8
Footprint Total	16,811.0

TABLE 3.3.15-2

State Recreational and Special Use Land Within Construction Footprint of Non-Jurisdictional Facilities (acres)

PBU MGS Project	513.6
PTU Expansion	135.9
Relocation of the KSH	1.4
Total	650.9

3.3.15.1 National Wild and Scenic Rivers (WSRs) System

The U.S. Congress established the National and WSRs System in 1968 (Public Law 90-542; 16 USC Chapter § 1271 et seq.) for the purpose of preserving rivers that "possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or similar values." Rivers that qualify for preservation under this legislation can be designated by the U.S. Congress or by the Secretary of the Interior (USFWS, 2014). Within Alaska, 3,210 river miles are designated as Wild and Scenic, constituting approximately 1 percent of the total river miles within the state. NWR streams in the Atigun River Gorge have been assessed and evaluated through a formal WSR review process. These streams were found to be eligible and suitable for inclusion in the National WSR System. The streams have a classification of wild and outstandingly remarkable recreation and geologic values (USFWS, 2015). The Mainline is within an

established utility corridor in this area and streams in the Atigun River Gorge are not within the Project area. There are no additional known river segments currently being studied for eligibility determination in Alaska. Of the existing WSRs in Alaska, none occur within the Project area. The nearest WSR to the Project is the North Fork of the Koyukuk River, which is located in the Gates of the Arctic NPP, approximately 12 miles west of the proposed Mainline, at a point approximately 7 miles north of the southern limits of the national park (USFWS, 2014).

3.3.15.2 National Trails System

The federal National Trails System Act of 1968 (16 USC § 1241) instituted a national system of scenic, historic, and recreational trails throughout the United States. The purpose of the National Trails System Act was to provide federal assistance to volunteer citizen groups in the planning, development, maintenance, and management of designated trails (NPS, 2012). The only trail in Alaska within the National Trails System is the INHT, an approximately 2,000-mile trail that spans between Seward and Nome, Alaska.

3.3.15.3 Iditarod National Historic Trail

The INHT extends approximately 2,000 miles within a corridor between Seward and Nome. The INHT Comprehensive Management Plan is a congressionally mandated management plan for the collection of INHT resources. The INHT Comprehensive Management Plan, recognizing that no single agency manages the entire trail, calls for cooperative management by federal, state, and local agencies. For matters involving the INHT over State land (MP 720.8 and MP 724.3) that is not subject to an exception, exclusion or reservation for the INHT in conveyances from the US, the SOA as a signatory and participant in the 1986 INHT Cooperative Management Plan (CMP), is the primary contact and land manager and manages the Trail consistent with the CMP.

The Mainline ROW would intersect the INHT approximately 35 miles northwest of Anchorage at two separate locations, both of which are managed by the ADNR-DMLW. At MP 720.8 the Mainline crosses the Susitna Station to Old Skwentna (Yentna River) INHT System Connecting Trail. At MP 724.3 the Mainline crosses the Susitna Station to Finger Lake INHT System Primary Route.

When considering whether to grant a ROW for the proposed pipeline, ADNR would consider the historic values of the INHT and make a decision in the context of state laws, regulations, and policies. A state lands ROW permit would be required for the Project.

3.3.15.4 Areas of Historical or Cultural Significance

Information regarding areas of historical or cultural significance is provided in Resource Report No. 4.

3.3.15.5 Recreational Sites and Special Use Areas

3.3.15.5.1 Federally Managed Areas

3.3.15.5.1.1 Arctic National Wildlife Refuge (NWR)

The Arctic NWR consists of approximately 19.6 million acres of land and water in northeastern Alaska. It is administered by the USFWS as a unit of the NWR System. The Arctic NWR has no roads, so primary access is by air. However, the Dalton Highway, located west of the Arctic NWR boundary, provides access to the Refuge's perimeter in certain locations. Recreational opportunities in the Arctic NWR include hiking, hunting, camping, floating, and climbing. The proposed Mainline is located approximately 0.2 mile west of the western limits of Arctic NWR, just east of Galbraith Lake. The PTU, from which natural gas would be transported through the PTTL, is located to the west of Section 1002 of the Arctic NWR in the Beaufort Coastal Plain Ecoregion. Lands within the Arctic NWR would not be used by the Project.

3.3.15.5.1.2 Denali National Park and Preserve (DNPP)

The Mainline route would not be inside or cross the boundaries of the DNPP. The Mainline route would be located outside the eastern boundary of the DNPP. The DNPP encompasses approximately 6 million acres of land in and around the Alaska Range and includes North America's highest peak, Denali. The DNPP provides a variety of outdoor recreational opportunities, including backpacking, hiking, camping, and mountain climbing. The DNPP is managed by the NPS.

A route variation through the DNPP was evaluated. An approximately 8-mile route option was developed that extends from approximately MP 536.10 to MP 544.31 of the Mainline Route Revision C2. The DNPP variation passes through the Park entrance area, generally following the Parks Highway corridor.

3.3.15.5.1.3 ACECs

No ACECs would be intersected by the Liquefaction Facility, GTP, PBTL, or PTTL. The Mainline would cross two ACECs—Toolik Lake RNA ACEC, and Galbraith Lake Outstanding Natural Area (ONA) ACEC. In addition, Project-associated infrastructure would be located within 1 mile of Sukakpak Mountain ACEC and Snowden Mountain ACEC, and would intersect Galbraith Lake ACEC.

Toolik Lake RNA – The Toolik Lake RNA ACEC has been designated an ACEC to protect a natural land and tundra biome used for Arctic natural resources research, primarily associated with the Toolik Field Station through the University of Alaska Fairbanks. Although the BLM's RMP/EIS (1991a) acknowledges that energy transportation is the primary function of the utility corridor across this ACEC, protection of the area is to occur to the extent practical to protect data and research projects. This ACEC would be crossed by the Mainline. A ROW permit from BLM would be required;

Galbraith Lake ONA – The Galbraith Lake ONA ACEC is the largest of the five ACECs within the BLM's Central Yukon Field Office region. It encompasses the Atigun River Valley and portions of the mountains on both sides of the valley. The Galbraith Lake ONA ACEC also includes Galbraith Lake and several drainages that feed the lake. The area is managed to protect historical and archaeological sites, critical wildlife habitat, paleontological and geological sites, scenic values, and any rare and sensitive plants that may be present. This ACEC would be crossed by the Mainline. A ROW permit from BLM would be required;

Sukakpak Mountain ACEC – The Sukakpak Mountain ACEC has been designated to protect unique geologic buildings, folds, and faults, as well as views of the geologic processes of mountain building and erosional forces. Rare plant species are also present, and the area is accessible to the public via the Dalton Highway. The area is an available source of mineral materials with access via a material source access road. However, material sales on Sukakpak Mountain slopes are now discouraged to ensure the scenic qualities of the area (BLM, 1991b). This ACEC would be crossed by the Mainline. A ROW permit from BLM would be required; and

Snowden Mountain ACEC – The Snowden Mountain ACEC is located on the southern slopes of the Brooks Range within the Dietrich River drainage, immediately east of the Dalton Highway, the Trans-Alaska Pipeline, and Gates of the Arctic NPP. This rugged area was designated as an ACEC for the protection of sheep habitat. It contains a variety of undisturbed habitats supporting healthy populations of wildlife, including for Dall sheep. The Snowden Mountain ACEC contains the most critical habitats for this species compared with other ACECs in the region (USDOI, 2009). The Mainline ROW would intersect the western boundary of the ACEC and would require a ROW permit from the BLM.

3.3.15.5.2 State-Managed Areas

The 2015 Alaska Legislature approved a corridor through state lands, however a ROW lease will still be required.

3.3.15.5.2.1 Denali State Park

Portions of the Mainline, Pipeline Aboveground Facilities (e.g., MLBVs), and the Pipeline Associated Infrastructure (e.g., access roads, ATWS, material sites, and pipe storage yards) would be located within Denali State Park. The Park includes a 325,240-acre area located along the George Parks Highway Scenic Byway at the southeastern base of Denali. Denali State Park is managed by the ADNR DPOR. It occurs within 1 mile of the Project area. The Park provides a variety of formal and informal camping, fishing, hiking, and other recreational opportunities (ADNR, 2014b). The Mainline would cross an approximately 33-mile-long segment of the Park along the George Parks Highway Scenic Byway. This highway corridor bisects the Park into two tracts of land located east and west of the highway. Denali State Park is considered a 6(f) property under the LWCF Act (16 USC § 4601). Section 6(f) of the LWCF Act requires that no property acquired or developed with LWCF assistance should be converted to a use other than public outdoor recreational uses without the prior approval of the Secretary of the Interior. However, Alaska Senate Bill 70 (AK SB70) (Alaska State Legislature, 2015) passed on May 15, 2015, provides exceptions from designation as a special purpose site for portions of Denali State Park to allow for ROW leasing associated with natural gas pipelines. A ROW permit from ADNR would also be required for the Mainline crossing.

3.3.15.5.2.2 Nenana River Gorge Special Use Area

Portions of the Mainline and the Pipeline Associated Infrastructure (e.g., access roads and ATWS) would be located within the Nenana River Gorge Special Use Area. The ADNR-DMLW manages "special use lands" to protect areas that have been designated pursuant to 11 AAC 96.014 as having scenic, historic, archaeological, scientific, biological, recreational, or other special resource values that warrant additional protections and special requirements. The Nenana River Gorge Special Use Area, which forms the eastern boundary of DNPP, is an approximately 5-mile-long and 0.5-mile-wide area located on the eastern banks of the Nenana River, approximately 3,800 feet north of the intersection of Park Road and the George Parks Highway Scenic Byway.

3.3.15.5.2.3 North Slope Area Special Use Lands

The Mainline, Pipeline Aboveground Facilities (compressor station, meter station, and four MLBVs), and Pipeline Associated Infrastructure (access roads, ATWS, camps, pipe storage yards and material sites), PBTL, PTTL, GTP, and GTP Associated Infrastructure would be located within ADL 50666, North Slope Area Special Use Area. ADL 50666 designates all lands in the Umiat Meridian as special use lands. This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits are required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.

3.3.15.5.2.4 Alexander Creek State Recreation River (SRR)

Portions of the Mainline and the Pipeline Associated Infrastructure (e.g., access roads and ATWS) would be located within Alexander Creek SRR. The unit includes 40.2 miles of Alexander Creek from River Mile 3.8 to River Mile 44.0. The unit also includes the lower 5.5 miles of Sucker Creek. Alexander Creek is a slow, meandering stream that originates in Alexander Lake and flows south to the Susitna River. The terrain is generally flat to occasionally rolling. The SRR begins 3.5 miles above the confluence with the Susitna River, and extends up to Alexander Lake and the surrounding uplands. Alexander Creek SRR includes 19,995 acres of state land, 2,260 acres of MSB land, and 74 private parcels accounting for 381 acres.

Alexander Creek is popular for fishing, hunting, and trapping. There is extensive winter travel along Alexander Creek below Sucker Creek. Snowmachine use is by both recreational users and private property owners (ADNR, 1991).

3.3.15.5.2.5 Kroto Creek and Moose Creek SRRs

Portions of the Mainline and the Pipeline Associated Infrastructure (e.g., access roads and ATWS) would be located within the Kroto Creek and Moose Creek SRRs. The Kroto Creek SRR extends from the junction with Moose Creek to Kroto Lake. Kroto Creek provides fishing, hunting, and camping opportunities for power boaters, floaters, and bank fishermen. In the winter, trails in the area are used by snowmachines for dog mushing and cross-country skiing. Moose Creek begins at a small unnamed lake several miles east of Kroto Creek and flows roughly parallel to that creek for about 40 miles before the two join to become the Deshka. Because of extensive wetlands and the relatively remote location of Moose Creek, it is visited primarily by floaters in summer and snow travelers in winter. Recreation activities include fishing, hunting, and camping. In winter, the area is used by snowmachines and for dog mushing (ADNR, 1991).

3.3.15.5.2.6 Susitna Flats SGR

Portions of the Mainline, Pipeline Aboveground Facilities (e.g., MLBVs), and the Pipeline Associated Infrastructure (e.g., access roads, ATWS, camps and material sites) would be located within the Susitna Flats. Susitna Flats, which encompasses approximately 300,800 acres, is located between Beluga River and Point MacKenzie on the western side of Cook Inlet (ADF&G, 1988). It is managed by ADF&G and ADNR-DMLW to reduce effects on fish and wildlife populations, particularly waterfowl nesting, feeding, and migration; moose calving areas; spring and fall bear feeding areas; and salmon spawning and rearing habitats. It also provides public use of fish and wildlife and their habitat, particularly waterfowl, moose, and bear hunting; viewing; photography; and general public recreation. Each year, approximately 10 percent of the waterfowl harvest in the state occurs in Susitna Flats. New utilities may be allowed to cross the refuge where no feasible off-refuge alternative exists, using existing corridors wherever possible, consistent with refuge goals and objectives. Two major utility lines cross Susitna Flats: The Chugach Electric Association, Inc., electric transmission line and the ENSTAR natural gas pipeline (ADF&G, 1988).

3.3.15.5.2.7 Tanana Valley State Forest

Portions of the Mainline, Pipeline Aboveground Facilities (e.g., MLBVs), and the Pipeline Associated Infrastructure (e.g., access roads, ATWS, camps, pipe storage yards, and material sites) would be located within the Tanana Valley State Forest. The 1.81 million-acre forest extends 265 miles, from near the Canadian border to Manley Hot Springs. The forest was established in 1983 within Alaska's State Forest System for multiple purposes including timber management, subsurface mineral resources, oil and gas leasing, grazing, recreation, wildlife habitat, agriculture, and water quality (ADNR, 2001a; 2013b). The majority of the 1.78 million acres of this forest lies within the Tanana River basin in east-central Alaska. Timber production is the major commercial activity (ADNR, 2013c). The DMLW adjudicates the material sales from state forest land, in consultation with Division of Forestry. The forest also offers many recreational opportunities, including hunting, fishing, trapping, camping, hiking, dog mushing, cross-country skiing, wildlife viewing, snowmachining, gold panning, boating, and berry picking. The Tanana Valley State Forest is managed under the Tanana Valley State Forest Management Plan. A ROW permit from ADNR would be required for use of lands within the Tanana Valley State Forest. Timber with commercial or personal use values would be required to be salvaged from lands that would be cleared for the Mainline ROW.

Almost 90 percent of the area is forested, productive, and accessible. Natural and anthropogenic disturbance maintains the structure and function of the forest, and ensures productivity of its natural resources and sustained biological diversity (ADNR, 2001a). ADNR makes state forest management decisions based in accordance with statutes and regulations, as well as consideration of biological, economic, and social conditions. The Tanana Valley State Forest Management Plan was designed to promote multiple uses with minimal conflict, including potential development activities in the region.

3.3.15.5.2.8 Minto Flats SGR

Portions of the Mainline, Pipeline Aboveground Facilities (e.g., MLBVs), and the Pipeline Associated Infrastructure (e.g., access roads, ATWS, camps, pipe storage yards, and material sites) would be located within Minto Flats SGR. The Refuge encompasses approximately 500,000 acres and is located about 35 miles west of Fairbanks between the communities of Minto and Nenana (ADF&G, 2012). Minto Flats SGR was established by the Alaska Legislature in 1988 to ensure the protection and enhancement of habitat and 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). Minto Flats SGR is comanaged by ADF&G and ADNR-DMLW. According to the Minto Flats State Game Refuge Management Plan issued in 1992, utility corridors and pipelines may be sited on refuge lands if they are determined to be compatible with the purposes for which the refuge was established (ADF&G, 1992). Proposals will be evaluated for compatibility with the refuge purposes listed in legislation and reflected in the goals of the management plan.

3.3.15.5.2.9 Scenic Byways

The Scenic Byways Program was established by the State of Alaska in 1993 and is administered by ADOT&PF's DPOR. The program allows for grant funding to be obtained to promote the byways' special qualities and also makes these routes eligible for designation as scenic byways through the National Scenic Byways Program administered by the Federal Highway Administration (ADOT&PF, 2011). There are no state restrictions that apply to scenic byways.

Portions of the Mainline, Pipeline Aboveground Facilities (four compressor stations and 19 MLBVs), and the Pipeline Associated Infrastructure (e.g., access roads, ATWS, camps, pipe storage yards, and material sites) would be located within the Dalton Highway Scenic Byway. Additional portions of the Mainline and Pipeline Associated Infrastructure would be located within the George Parks Highway Scenic Byway. The Dalton Highway Scenic Byway and George Parks Highway Scenic Byway (AS 19.40.010) are designated scenic byways through the Alaska Scenic Byways program administered by ADOT&PF. Corridor Partnership Plans have been developed for the Dalton Highway and George Parks Highway Scenic Byway (ADNR, 2008, 2010) that serve as guides for the management, protection, and enhancement of the qualities of the scenic byways. These plans are not mandates but provide information for use in the evaluation of the visual resources on along the Project corridor. As previously noted, there are no state restrictions that apply to scenic byways. The state lands within the corridor are managed by ADNR-DMLW. A state lands ROW permit would be required for the Project. A visual impacts assessment was completed in 2015 and is provided in Resource Report No. 8, Appendix L.

In addition, the Seward Highway holds a triple designation as a United States Department of Agriculture Forest Service Scenic Byway, Alaska Scenic Byway, and an All-American Road. The Seward Highway lies within the Kenai Mountains-Turnagain Arm Corridor National Heritage Area (KMTA NHA, 2012). Although the Project does not have a proposed construction or operations footprint through this corridor, increased traffic related to logistics would impact scenic byways.

3.3.15.5.2.10 Revised Statute 2477 Rights-of-Way and 17(b) Easements

Revised Statute (RS) 2477 of 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 RS 2477 trails established under the statute remain in effect. While the existence and exact nature of RS 2477 ROWs may be subject to legal determination, such ROW, where established, may include ongoing access rights to many rural destinations, including by snowmachines, dogsled teams, and four-wheel, all-terrain vehicles. The Project Planning Area, defined as the Liquefaction Facility, the Mainline ROW, associated facilities, PBTL, PTTL, and the area where the GTP would be constructed, includes 28 described RS 2477 trails (Appendix F). There may be additional RS 2477 easements in the Project area that lack formal recognition (by a court, the Alaska Legislature, or ADNR administrative decision). These currently unrecognized easements, if found in the Project area, would be designated with a creation date, for third-

party review purposes, as their initial use/establishment. The ADNR ROW permit would have stipulations to avoid or reduce effects to RS 2477 trails.

The Project area intersects special use areas, which are easements designated under ANCSA Section 17(b), which authorizes reserving easements on lands that will be conveyed to Alaska Native Corporations to allow public access to public land and water. 43 C.F.R. § 2650.4-7 describes the guidelines that are used in reserving easements in conveyance documents. Easements under Section 17(b) are reserved and managed by the federal government. Eleven 17(b) easements have been identified in the Project area (Resource Report No. 8, Appendix F).

3.3.15.6 Summary of Applicable Recreational Sites and Special Use Area Stipulations

3.3.15.6.1 Liquefaction Facility

The Liquefaction Facility site would include two 17(b) easements: Easement No. 10 and Easement No. 11. Table 3.3.15-1 provides the applicable stipulations of recreational sites and special use areas for the Liquefaction Facility.

TABLE 3.3.15-1

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations for the Liquefaction Facility

Name	Type of Recreational Site or Special Use Area	Construction ROW (Acres)	Potential Applicable Stipulations
ANCSA Easement No. 10	17(b) easements	3.2	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
ANCSA Easement No. 11	17(b) easements	0.7	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.

3.3.15.6.2 Interdependent Project Facilities

3.3.15.6.2.1 Pipelines

Mainline

The Mainline would include two ACECs, one scenic byway, two SGRs, one state forest, one national historic trail, two SRR areas, one special use area, 20 RS 2477 easements, and eight 17(b) easements. Table 3.3.15-2 provides the potentially applicable stipulations of recreational sites and special use areas for the Mainline.

TABLE 3.3.15-2

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations intersected by the Mainline

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
Dalton Highway Scenic Byway	Scenic Byway	Intermittently between 14.3 – 356.3	There are no state restrictions that apply to scenic byways.
RST 450 – Hickel Highway	RS 2477	62.8/301.6	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
Toolik Lake RNA	ACEC	127.2 - 137.3	The BLM's Utility Corridor Proposed RMP, which includes Toolik Lake RNA, specifies that management of the ACEC will not restrict existing or future energy transportation systems (BLM, 1989).
Galbraith Lake ACEC	ACEC	139.2 - 150.5	The BLM's Utility Corridor Proposed RMP, which includes Galbraith Lake ACEC, specifies that management of the ACEC would not restrict existing or future energy transportation systems (BLM, 1989).
RST 254 – Wiseman-Chandalar	RS 2477	218.6	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 262 – Caro-Coldfoot	RS 2477	241.1	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 412 – Slate Creek	RS 2477	241.1	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 591 – Coldfoot-Junction Trail 49	RS 2477	241.1	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 9 – Coldfoot Chandalar Lake Trail	RS 2477	241.1	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 468 – Hunter Creek-Livengood	RS 2477	400.6	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RTE 66 – Dunbar-Brooks Terminal	RS 2477	Intermittently between 401.8–454.7	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.

TABLE 3.3.15-2

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations intersected by the Mainline

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
Minto Flats SGR	SGR	Intermittently between 430.9–468.6	According to the Minto Flats State Game Refuge Management Plan issued in 1992, utility corridors and pipelines may be sited on refuge lands if they are determined to be compatible with the purposes for which the refuge was established (ADF&G, 1992). Proposals would be evaluated for compatibility with the refuge purposes listed in legislation and reflected in the goals of the management plan.
RST 1595 – Dunbar-Minto-Tolovana	RS 2477	455.9	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
George Parks Highway Scenic Byway	Scenic Byway	Intermittently between 470–700	There are no state restrictions that apply to scenic byways.
RST 346 Nenana-Kantishna	RS 2477	473.9	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 345 Kobi-McGrath	RS 2477	497.3	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 343 – Kobi-Kantishna	RS 2477	498.3	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 491 – Rex-Roosevelt	RS 2477	498.1	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 344 – Lignite-Kantishna	RS 2477	523.3	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RTE 340 – Lignite-Stampede	RS 2477	523.3	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 709 – Healy Diamond Coal Mine Dirt Road	RS 2477	527.9	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.

TABLE 3.3.15-2

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations intersected by the Mainline

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
ANCSA 17(b) Easements – Easement Number 21	17(b) Easement	547.3	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
ANCSA 17(b) Easements – Easement Number 17a	17(b) Easement	551.2	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
RST 625 Easements – Cantwell Small Tracts Road	RS 2477	566.5	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
ANCSA 17(b) Easements	17(b) Easement	574.1	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
RST 198 Susitna-McDougal	RS 2477	721.2	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 199 – Susitna-Rainy Pass	RS 2477	723.5	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 1862 – Beluga Indian Trail	RS 2477	751.5	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
ANCSA 17(b) Easements – Easement Number 5h	17(b) Easement	794.5	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.

TABLE 3.3.15-2

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations intersected by the Mainline

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
Tanana Valley State Forest	State Forest	Intermittently between 407.7–454.6	The Tanana Valley State Forest is managed under the Tanana Valley State Forest Management Plan. A ROW permit from ADNR would be required for use of lands within the Tanana Valley State Forest. Timber with commercial or personal use values would be required to be salvaged from lands that would be cleared for the Mainline ROW.
Nenana River Gorge Special Use Area	Special Use Area	534.7 – 534.8 / 536.3 – 537.6	Pipeline or utility line construction is not listed as a generally allowed use on special use land (11 AAC 96.020). Therefore, a permit from ADNR-DMLW would be required.
North Slope Special Use Area (ADL 50666)	Special Use Area	Intermittently between 0.0 – 182.4	This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits are required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.
Denali State Park	State Park	609.1–646.9	Denali State Park is considered a 6(f) property under the LWCF Act (16 USC § 4601). Section 6(f) of the LWCF Act requires that no property acquired or developed with LWCF assistance should be converted to a use other than public outdoor recreational uses without the prior approval of the Secretary of the Interior. A ROW permit from ADNR would also be required for the Mainline crossing.
Kroto and Moose Creek SRR	SRR	703.9 – 705.8 / 707.1 – 707.5	Oil and gas gathering and feeding lines will be addressed on a case-by-case basis. Utilities shall be designed so as not to be a hazard to river or air navigation or public safety, so that there is little or no maintenance required and be designed to cross the river and the corridors at 90 degrees or as near perpendicular as possible. Construction of utility projects below ordinary high water or in the airspace above waterbodies may be allowed if the project is in the best public interest. Utilities that serve only a few users and cross waterbodies that receive high public use shall be discouraged. All construction below ordinary high water shall normally occur between May 15 and July 15 when there is the least potential for damage to fish. This period may vary depending on the ADF&G Title 16 Permit (ADNR, 1991).
Iditarod National Historic Trail	National Historic Trail	720.8 and 724.3	Most of the Historic Trail is located on public lands managed by the State of Alaska or federal agencies,

TABLE 3.3.15-2

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations intersected by the Mainline

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
			while some segments of the trail pass over private lands. The trail crosses lands owned by municipal governments, the State of Alaska, and several Native Corporations as well as federal lands managed by the BLM, U.S. Forest Service (USFS), USFWS, and Department of Defense. The State of Alaska and the BLM entered into a MOA regarding management of the INHT on both State and BLM-managed lands.
Alexander Creek Recreation River	SRR	727.3–728.5	Section 6(f)(3) requires LWCF areas be maintained for public outdoor recreation use unless the NPS approves substitute land determined to be of equivalent location, suitability for recreation, and greater or equal to the fair market value of the original property.

PBTL

The PBTL would not include any recreational sites or special use areas.

PTTL

The PTTL would include one scenic byway and an RS 2477 easement. Table 3.3.15-3 provides the applicable stipulations of recreational sites and special use areas for the PTTL.

TABLE 3.3.15-3

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations Intersected by the PTTL

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
Dalton Highway Scenic Byway	Scenic Byway	52.6 / 52.7	There are no state restrictions that apply to scenic byways.
North Slope Special Use Area (ADL 50666)	Special Use Area	0–62.5	This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits are required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.
RST 1043 – Bullen-Staines River	RS 2477	1.8 / 3.3–3.4 / 8.0	Easement must be surveyed before crossed/used (no restrictions on development of a pipeline ROW across this area). Any access restrictions on any ROWs managed by the ADNR-DMLW, including but not limited to those identified in AS 19.30.400 or acquired under former 43 U.S.C. 932 require prior written approvals by the Pipeline Coordinator and the DMLW. In the event that future

TABLE 3.3.15-3 Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations Intersected by the PTTL			
Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
			upgrades to these ROWs are approved, the Lessee may be responsible for accommodating these upgrades.

3.3.15.6.3 Pipeline Aboveground Facilities

Two ACECs, one scenic byway, two SGRs, one state forest, one state park, and one special use area would be impacted by the footprint of the Pipeline Aboveground Facilities. Table 3.3.15-4 provides the applicable stipulations of recreational sites and special use areas for the Pipeline Aboveground Facilities.

TABLE 3.3.15-4

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations Impacted by Pipeline Aboveground Facilities

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
Toolik Lake RNA	ACEC	130	The BLM's Utility Corridor Proposed Resource Management Plan, which includes Toolik Lake RNA, specifies that management of the ACEC will not restrict existing or future energy transportation systems (BLM, 1989).
Galbraith Lake	ACEC	147	The BLM's Utility Corridor Proposed Resource Management Plan, which includes Galbraith Lake ACEC, specifies that management of the ACEC will not restrict existing or future energy transportation systems (BLM, 1989).
Dalton Highway Scenic Byway	Scenic Byway	Intermittently between 36.7 – 332.6	There are no state restrictions that apply to scenic byways.
Minto Flats SGR	SGR	467.1	According to the Minto Flats State Game Refuge Management Plan issued in 1992, utility corridors and pipelines may be sited on refuge lands if they are determined to be compatible with the purposes for which the refuge was established (ADF&G, 1992). Proposals will be evaluated for compatibility with the refuge purposes listed in legislation and reflected in the goals of the management plan.
Tanana Valley State Forest	State Forest	421.6	The Tanana Valley State Forest is managed under the Tanana Valley State Forest Management Plan. A ROW permit from ADNR would be required for use of lands within the Tanana Valley State Forest. Timber with commercial or personal use values would be required to be salvaged from lands that would be cleared for the Mainline ROW.
Denali State Park	State Park	625.8	Denali State Park is considered a 6(f) property under the LWCF Act (16 USC § 4601). Section 6(f) of the LWCF Act requires that no property acquired or developed with LWCF assistance should be converted to a use other than public outdoor recreational uses without the prior approval of the Secretary of the Interior. A ROW permit from ADNR would also be required for the Mainline crossing. Alaska Senate Bill 70 (AK SB70) (Alaska State Legislature, 2015) passed on May 15, 2015, provides exceptions from designation as a special purpose site for portions of Denali State Park to allow for ROW leasing associated with natural gas pipelines.

TABLE 3.3.15-4

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations Impacted by Pipeline Aboveground Facilities

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
Susitna Flats SGR	SGR	749.2	According to the Susitna Flats State Game Refuge Management Plan issued in 1988, utility corridors and pipelines may be sited on refuge lands if they comply with the goals and objectives for the protection of fish and wildlife populations, including moose calving areas, spring and fall bear feeding areas, and salmon spawning and rearing habitat (ADF&G, 1988).
North Slope Special Use Area (ADL 50666)	Special Use Area	36.7, 75.9, 112.0, 148.5	This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits are required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.

3.3.15.6.4 Pipeline Associated Infrastructure

Multiple recreational sites and special use areas would be impacted by the proposed pipeline infrastructure facilities. Table 3.3.15-5 provides the applicable stipulations of recreational sites and special use areas for the Pipeline Associated Infrastructure. Since the current Mainline route is located outside DNPP, the Project as proposed would avoid direct impacts to DNPP.

TABLE 3.3.15-5

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations for Pipeline Associated Infrastructure

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
Denali State Park	LWCF Land	Intermittently between 609.1 and 646.9	Section 6(f)(3) requires LWCF areas be maintained for public outdoor recreation use unless the NPS approves substitute land determined to be of equivalent location, suitability for recreation, and greater or equal to the fair market value of the original property. Alaska Senate Bill 70 (AK SB70) (Alaska State Legislature, 2015) passed on May 15, 2015, provides exceptions from designation as a special purpose site for portions of Denali State Park to allow for ROW leasing associated with natural gas pipelines.
Alexander Creek Recreational River	SRR	Intermittently between 727.4 and 728.6	Oil and gas gathering and feeding lines will be addressed on a case-by-case basis. Utilities shall be designed so as not to be a hazard to river or air navigation or public safety, so that there is little or no maintenance required and be designed to cross the river and the corridors at 90 degrees or as near perpendicular as possible. Construction of utility projects below ordinary high water or in the airspace above waterbodies may be allowed if the Project is in the best public interest. Utilities that serve only a few users and cross waterbodies that receive high public use shall be discouraged. All construction below ordinary high water shall normally occur between May 15 and July 15 when there is the least potential for damage to fish. This period may vary depending on the ADF&G Title 16 Permit (ADNR, 1991).

TABLE 3.3.15-5

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations for Pipeline Associated Infrastructure

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
ANCSA 17(b) Easements – Easement Number 5	17(b) Easement	794.5	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
ANCSA 17(b) Easements – Easement Number 5h	17(b) Easement	570.9	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
ANCSA 17(b) Easements – Easement Number 6b	17(b) Easement	581.9	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
ANCSA 17(b) Easements – Easement Number 15	17(b) Easement	559.6	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
ANCSA 17(b) Easements – Easement Number 16	17(b) Easement	556.4	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
ANCSA 17(b) Easements – Easement Number 17a	17(b) Easement	551.2	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
ANCSA 17(b) Easements – Easement Number 100	17(b) Easement	581.9	Uses allowed on a 17(b) easement are limited, and they are described in the conveyance document issued to a Native Corporation. Any use other than what is described in the conveyance document would require coordination with the agency managing the easement and/or with the owner of the land it crosses.
Dalton Highway Scenic Byway	Scenic Byway	Intermittently between 11.4 – 356.2	There are no state restrictions that apply to scenic byways.
Galbraith Lake ACEC	ACEC	Intermittently between 139 and 150	The BLM's Utility Corridor Proposed RMP, which includes Galbraith Lake ACEC, specifies that management of the ACEC will not restrict existing or future energy transportation systems (BLM, 1989).
Iditarod National Historic Trail	National Historic Trail	Intermittently between 720.7 and 724.3	Most of the Historic Trail is located on public lands managed by the State of Alaska or federal agencies, while some segments of the trail pass over private lands. The trail crosses lands owned by municipal governments, the State of Alaska, and several Native Corporations as well as federal

TABLE 3.3.15-5

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations for Pipeline Associated Infrastructure

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
			lands managed by the BLM, USFS, USFWS, and the Department of Defense. The federal BLM coordinates cooperative management of the trail including being the primary contact for matters involving the trail.
Kroto & Moose Creek SRR	SRR	Intermittently between 704.0 and 707.3	Oil and gas gathering and feeding lines will be addressed on a case-by-case basis. Utilities shall be designed so as not to be a hazard to river or air navigation or public safety, so that there is little or no maintenance required and be designed to cross the river and the corridors at 90 degrees or as near perpendicular as possible. Construction of utility projects below ordinary high water or in the airspace above waterbodies may be allowed if the Project is in the best public interest. Utilities that serve only a few users and cross waterbodies that receive high public use shall be discouraged. All construction below ordinary high water shall normally occur between May 15 and July 15 when there is the least potential for damage to fish. This period may vary depending on the ADF&G Title 16 Permit (ADNR, 1991).
Minto Flats SGR	SGR	Intermittently between 431.6 and 468.6	According to the Minto Flats State Game Refuge Management Plan issued in 1992, utility corridors and pipelines may be sited on refuge lands if they are determined to be compatible with the purposes for which the refuge was established (ADF&G, 1992). Proposals will be evaluated for compatibility with the refuge purposes listed in legislation and reflected in the goals of the management plan.
Nenana River Gorge Special Use Area	Special Use Area	Intermittently between 532.4 and 537.6	Pipeline or utility line construction is not listed as a generally allowed use on special use land (11 AAC 96.020). Therefore, a permit from ADNR-DMLW would be required.
North Slope Special Use Area (ADL 50666)	Special Use Area	Intermittently between 0.0 and 182.3	This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits are required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.
Snowden Mountain ACEC	ACEC	199	The BLM's Utility Corridor Proposed RMP, which includes Snowden Mountain ACEC, specifies that management of the ACEC will not restrict existing or future energy transportation systems (BLM, 1989).
Sukakpak Mountain ACEC	ACEC	209	The BLM's Utility Corridor Proposed RMP, which includes Sukakpak Mountain ACEC, specifies that management of the ACEC will not restrict existing or future energy transportation systems (BLM, 1989).
Susitna Flats SGR	SGR	Intermittently between 737.3 and 752.3	According to the Susitna Flats State Game Refuge Management Plan issued in 1988, utility corridors and pipelines may be sited on refuge lands if they comply with the goals and objectives for the protection of fish and wildlife populations, including moose calving areas, spring and fall bear feeding areas, and salmon spawning and rearing habitat (ADF&G, 1988).
Tanana Valley State Forest	State Forest	Intermittently between 406.8 – 466.6	The Tanana Valley State Forest is managed under the Tanana Valley State Forest Management Plan. A ROW permit from ADNR would be required for use of lands within

TABLE 3.3.15-5

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations for Pipeline Associated Infrastructure

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
			the Tanana Valley State Forest. Timber with commercial or personal use values would be required to be salvaged from lands that would be cleared for the Mainline ROW.
Toolik Lake RNA	ACEC	Intermittently between 128 and 137	The BLM's Utility Corridor Proposed RMP, which includes Toolik Lake RNA, specifies that management of the ACEC will not restrict existing or future energy transportation systems (BLM, 1989).
RST 1595 – Dunbar-Minto-Tolovana	RS 2477	455.8	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 1611 – Bergman-Cathedral Mountain	RS 2477	280.4	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 1862 – Beluga Indian Trail	RS 2477	752.0	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 198 Susitna-McDougal	RS 2477	721.1	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 200 – Susitna-Tyonek	RS 2477	Intermittently between 746.5 and 766.2	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 254 – Wiseman Chandalar	RS 2477	218.6	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 262 – Caro-Coldfoot	RS 2477	241.2	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 346 Nenana-Kantishna	RS 2477	473.8	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 412 – Slate Creek	RS 2477	241.1	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 450 – Hickel Highway	RS 2477	299.3, 300.5, 301.6	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 468 – Hunter Creek-Livengood	RS 2477	400.6	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 591 – Coldfoot-Junction Trail 49	RS 2477	241.1	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 625 – Cantwell Small Tracts Road	RS 2477	566.5	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RTE 66 – Dunbar-Brooks Terminal	RS 2477	Intermittently between 402.0 and 454.7	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.

TABLE 3.3.15-5

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations for Pipeline Associated Infrastructure

Name	Type of Recreational Site or Special Use Area	MPs	Potential Applicable Stipulations
RST 709 – Healy Diamond Coal Mine Dirt Road	RS 2477	526.7, 527.0, 528.8	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.
RST 9 – Coldfoot Chandalar Lake Trail	RS 2477	241.2	Certain land use actions on R.S. 2477 ROWs, including road construction, may require a permit under 11 ACC 96.010, or other authorization by ADNR.

3.3.15.6.5 GTP

The GTP, including associated facilities, would be located within the North Slope Special Use Area shown in Resource Report No. 8, Appendix B. Table 3.3.15-6 and Table 3.3.15-7 show the potentially applicable stipulations of this special use area.

Table 3.3.15-6

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations for the GTP

Name	Type of Recreational Site or Special Use Area	Acres	Potential Applicable Stipulations
North Slope Special Use Area (ADL 50666)	Special Use Area	227.9	This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits would be required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.

3.3.15.6.6 GTP Associated Infrastructure

Table 3.3.15-7

Summary of Potentially Applicable Recreational Sites and Special Use Area Stipulations for GTP Associated Infrastructure

Name	Type of Recreational Site or Special Use Area	Acres	Potential Applicable Stipulations
North Slope Special Use Area (ADL 50666)	Special Use Area	817.5	This designation requires that, in addition to permitting requirements under 11 AAC 96.010, permits would be required for geophysical activity, other exploration activity, construction activity, and transportation activity, except along established roads. This requirement does not prohibit the development of lands within the Umiat Meridian or the development of permitted easements and ROWs.

3.3.15.6.7 Non-Jurisdictional Facilities

PBU MGS project is located within the North Slope Special Use Area (ADL 50666) and would therefore be subject to the requirements of ADL 50666 (which are summarized in Tables 3.3.15-6 and 3.3.15-7).

The PTU Expansion project is located within the North Slope Special Use Area (ADL 50666) and would therefore be subject to the requirements of ADL 50666 (which are summarized in Tables 3.3.15-6 and 3.3.15-7).

The relocation of the KSH would not be located within any special use areas or recreational sites.

3.4 FEDERAL LAND REQUIREMENTS

The Project area would intersect federal lands managed by the BLM, as shown in Table 3.4-1. The Project's proposed design includes approximately 67,000 acres of land, of which 6,485.7 acres are on federal lands, that would be temporarily affected by construction of the Project. Following completion of construction, approximately 8,600 of these acres, of which 1,546.7 acres are on federal lands, would be used for operation of the Project facilities. The actual construction and operation of the Project would not occur on National Park Service (NPS), USACE, DOD, or U.S. Fish and Wildlife Service (USFWS) land.

Figure 3.3-1 depicts the federal land use planning areas that would be crossed by the Project. The proposed locations of major facilities, pipeline route, and offsite work areas on federal lands are depicted on maps provided in Resource Report No.8, Appendix B.

TABLE 3.4-1

Acres of Federal Land Affected by Construction and Operations

	Project Facility															
Landowner/ Manager	**Liquefaction Facility**		**Mainline**		**PBTL**		**PTTL**		**Pipeline Aboveground Facilities & Associated Infrastructure**		**GTP**		**GTP Associated Infrastructure**		**Total**	
	Construction	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**
Federal																
BLM	-	-	3,486.6	1,480.1	-	-	-	-	2,919.5	65.3	-	-	-	-	6,406.1	1,545.4
Federal Other	-	-	2.8	1.3	-		-	-	76.8	-	-	-	-	-	79.6	1.3
Federal Total			**3,489.40**	**1,481.4**					**2996.3**	**65.3**					**6,485.7**	**1,546.7**
State	129.7	52.3	45,651.8	3,243.4	7.3	7.3	1,721.4	611.3	7,396	770.4	283.9	283.9	640.3	503.6	56,166.5	5,473.7
City/Borough	62.9	60.8	6894.6	289.6	-	-	-	-	617.8	50.1	-	-	-	-	1365.3	400.6
Native	79.9	-	602.9	247.7	-	-	-	-	663.4	15.5	-	-	1.8	1.8	1347.8	265
Private	809.6	807.3	190.9	80.9	-	-	5.2	2.3	675.4	0.4	-	-	-	-	1694.6	890.9
Total	**1,082.1**	**920.4**	**50,619.6**	**5,343**	**7.3**	**7.3**	**1,726.6**	**613.6**	**12,348.9**	**901.70**	**283.9**	**283.9**	**642.1**	**505.4**	**66,710.5**	**8,575.40**

3.4.1 Description of Project Facilities on Federal Lands

3.4.1.1 Liquefaction Facility

The Liquefaction Facility would not affect federal lands. The Liquefaction Facility land used to be owned by a mixture of KPB, State of Alaska, Alaska Native Corporation, and private land holdings. The Marine Terminal portion of the Liquefaction Facility is located on State of Alaska land within Cook Inlet.

3.4.1.2 Interdependent Project Facilities

3.4.1.2.1 Mainline

The Mainline would pass through approximately 3,489.4 acres of federal land, managed by the BLM, during construction and 1,481.4 acres during operations as detailed in Table 3.4-1.

3.3.1.2.2 PBTL

Based on the Project's proposed design, federal lands would not be crossed by the PBTL.

3.3.1.2.3 PTTL

Based on the Project's proposed design, federal lands would not be crossed by the PTTL.

3.4.1.2.2 Pipeline Aboveground Facilities

The Pipeline Aboveground Facilities (e.g., compressor stations, heater stations, meter stations, MLBVs) would be located on BLM managed lands. The locations of these areas are on the maps provided in Resource Report No. 8, Appendix B.

3.4.1.2.3 Pipeline Associated Infrastructure

Pipeline Associated Infrastructure (e.g., access roads, ATWS, contractor yards, pipe yards, construction camps, rail spurs, temporary disposal sites, and material extraction sites) would be located on multiple federally managed lands. The locations of these areas are provided on the maps provided in Resource Report No. 8, Appendix B.

3.4.1.2.4 GTP

Federal lands would not be affected by the GTP.

3.4.1.2.5 GTP Associated Infrastructure

Federal lands would not be affected by the GTP Associated Infrastructure.

3.4.1.3 Non-Jurisdictional Facilities

Federal lands would not be affected by Non-Jurisdictional Facilities.

3.5 STATE-OWNED AND -MANAGED LAND

State-owned and managed lands were identified in the Project area. A summary of the state-owned and -managed lands crossed is provided in Table 3.5-1. A depiction of the lands crossed by the proposed Project is provided in Resource Report No.8, Appendix B. Figure 3.3-1 depicts the state land use planning areas crossed.

TABLE 3.5-1

Acres of State Owned and -Managed Land Affected by Construction and Operations

Landowner/ Manager	Project Facility															
	Liquefaction Facility		Mainline		PBTL		PTTL		Pipeline Aboveground Facilities & Associated Infrastructure		GTP		GTP Associated Infrastructure		Total	
	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations
Federal	-	-	3,489.4	1,481.4	-	-	-	-	2,996.3	65.3	-	-	-	-	6,485.7	1,546.7
State																
ADOT&PF	29.4	29.4	377.8	86.2	-	-	-	-	643.5	196.7	-	-	-	-	1,050.7	312.3
Mental Health Trust Authority	-	0	161	65.4	0	0	0	0	109.9	0	0	0	0	0	270.9	65.4
ADNR	100.3	22.9	43,387.3	2,420.0	7.3	7.3	1,721.4	611.3	4,978.6	410.6	283.9	283.9	640.3	503.6	51,119.1	4,259.6
State Forest	-	0	492.4	189.9	0	0	0	0	750.1	103.1	0	0	0	0	1,242.5	293
State Game Refuge (SGR)	-	0	576.1	207.2	0	0	0	0	403.6	59.6	0	0	0	0	979.7	266.8
Other State of Alaska	-	0	7.2	3.1	0	0	0	0	25.1	0	0	0	0	0	32.3	3.1
State Park	-	0	565.2	238.4	0	0	0	0	449.8	0.4	0	0	0	0	1,015.0	238.8
State Rec. Area	-	0	70.5	26.9	0	0	0	0	17.6	0	0	0	0	0	88.1	26.9
University of Alaska	-	0	14.3	6.3	0	0	0	0	17.8	0	0	0	0	0	32.1	6.3
State Total	**129.7**	**52.3**	**45,651.8**	**3,243.4**	**7.3**	**7.3**	**1,721.4**	**611.3**	**7,396**	**770.4**	**283.9**	**283.9**	**640.3**	**503.6**	**55,830.4**	**5,472.2**
City/Borough	62.9	60.8	6894.6	289.6	-	-	-	-	617.8	50.1	-	-	-	-	1365.3	400.6
Native	79.9	-	602.9	247.7	-	-	-	-	663.4	15.5	-	-	1.8	1.8	1347.8	265

TABLE 3.5-1

Acres of State Owned and -Managed Land Affected by Construction and Operations

Landowner/ Manager	Project Facility															
	Liquefaction Facility		Mainline		PBTL		PTTL		Pipeline Aboveground Facilities & Associated Infrastructure		GTP		GTP Associated Infrastructure		Total	
	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations
Private	809.6	807.3	190.9	80.9	-	-	5.2	2.3	675.4	0.4	-	-	-	-	1694.6	890.9
Total	1,082.1	920.4	50,619.6	5,343	7.3	7.3	1,726.6	613.6	12,348.9	901.7	283.9	283.9	642.1	505.4	66,710.5	8,575.40

3.5.1 Description of Project Facilities on State Owned and -Managed Lands

3.5.1.1 Liquefaction Facility

Components of the Liquefaction Facility would be located on state-owned lands, such as the Marine Terminal, which is located on state-owned submerged lands (see Resource Report No. 8, Appendix B). Approximately 129.7 acres of state lands, of which 100.3 acres are managed by the ADNR and 29.4 acres are managed by the ADOT&PF, will be affected during construction operations (see Table 3.5-1). During operations, approximately 52.3 acres of state lands, of which 22.9 are managed by ADNR and 29.4 are managed by ADOT&PF, will be affected as shown in Table 3.5-1.

3.5.1.2 Interdependent Project Facilities

3.5.1.2.1 Pipelines

3.5.1.2.1.1 Mainline

The Mainline would pass through multiple state-managed lands, as shown in Table 3.5-1 and on the maps included in Resource Report No. 8, Appendix B. The Mainline would cross approximately 45,651.8 acres of state-owned lands, during construction and 3,243.4 acres during operations as detailed in Table 3.5-1.

3.5.1.2.2 PBTL

The PBTL would be located entirely on state-managed lands under lease to the PBU (see Table 3.5-1).

3.5.1.2.3 PTTL

The PTTL would be located almost entirely on state-managed lands. Of the total 1,726.6 acres required for construction, 1,724.4 will be on state-managed lands. A total of 613.6 acres will be required for operations, of which 611.3 are located on state-managed lands.

3.5.1.2.4 Pipeline Aboveground Facilities

The Pipeline Aboveground Facilities (e.g., compressor stations, heater stations, meter stations, MLBVs) would be located on BLM managed lands. The locations of these areas are on the maps provided in Resource Report No. 8, Appendix B.

3.5.1.2.5 Pipeline Associated Infrastructure

Pipeline Associated Infrastructure (e.g., access roads, ATWS, contractor yards, pipe yards, construction camps, rail spurs, temporary disposal sites, and material extraction sites) would be located on state-managed lands. The locations of these areas are provided on the maps provided in Resource Report No. 8, Appendix B.

3.5.1.2.6 GTP

The GTP would be located entirely on state-managed lands (see Table 3.5-1).

3.5.1.2.7 GTP Associated Infrastructure

The GTP Associated Infrastructure would be located almost entirely on state-managed lands. Of the total 642.1 acres required for construction, 640.3 will be on state-managed lands. A total of 505.4 acres will be required for operations, of which 503.6 are located on state-managed lands.

3.5.1.3 Non-Jurisdictional Facilities

The footprint of the PBU MGS project would include lands managed primarily by the state (approximately 504 acres) and the remaining on private property. The PTU Expansion project would be located entirely on state land. The KSH relocation project footprint land ownership will be provided when a proposed route has been selected.

3.6 LOCAL AND OTHER MANAGEMENT AREAS

Local and other management areas include boroughs and municipalities, native lands and private lands crossed by the Project. A summary of the state-owned and -managed lands crossed is provided in Table 3.6-1

TABLE 3.6-1

Acres of Local and Other Management Areas Affected by Construction and Operations

	Project Facility															
Landowner/ Manager	**Liquefaction Facility**		**Mainline**		**PBTL**		**PTTL**		**Pipeline Aboveground Facilities & Associated Infrastructure**		**GTP**		**GTP Associated Infrastructure**		**Total**	
	Construction	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**	**Construction**	**Operations**
Federal			3,489.40	1,481.4					2996.3	65.3					6,485.7	1,546.7
State	129.7	52.3	45,651.8	3,243.4	7.3	7.3	1,721.4	611.3	7,396	770.4	283.9	283.9	640.3	503.6	56,166.5	5,473.7
City/Borough																
Borough Land	62.9	60.8	678.1	286.7	-	-	-	-	612.2	50.1	-	-	-	-	1,353.2	397.7
City	-	-	6.5	2.9	-	-	-	-	5.6	-	-	-	-	-	12.1	2.9
City/Borough Total	**62.9**	**60.8**	**6894.6**	**289.6**	**-**	**-**	**-**	**-**	**617.8**	**50.1**	**-**	**-**	**-**	**-**	**1365.3**	**400.6**
Native																
Native Allotments	-	-	0.0	0.0	-	-	-	-	-	-			1.8	1.8	1.8	1.8
Native Regional Corporation	-	-	504.8	207.8	-	-	-	-	545.8	15.5	-	-	-	-	1,050.6	223.3
Native Village Corporation	79.9	-	98.1	39.9	-	-	-	-	117.6	-	-	-	-	-	295.4	39.9
Native Total	**79.9**	**-**	**602.9**	**247.7**	**-**	**-**	**-**	**-**	**663.4**	**15.5**	**-**	**-**	**1.8**	**1.8**	**1347.8**	**265**

TABLE 3.6-1

Acres of Local and Other Management Areas Affected by Construction and Operations

Landowner/ Manager	Project Facility															
	Liquefaction Facility		Mainline		PBTL		PTTL		Pipeline Aboveground Facilities & Associated Infrastructure		GTP		GTP Associated Infrastructure		Total	
	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations	Construction	Operations
Private																
Private	153.8	153.6	67.0	28.2	-	-	-	-	153.7	0.4	-	-	-	-	374.5	182.2
Private Corp.	655.8	653.7	123.9	52.7	-	-	5.2	2.3	521.7	-	-	-	-	-	1,320.1	708.7
Private	**809.6**	**807.3**	**190.9**	**80.9**	**-**	**-**	**5.2**	**2.3**	**675.4**	**0.4**	**-**	**-**	**-**	**-**	**1694.6**	**890.9**
Total	**1,082.1**	**920.4**	**50,619.6**	**5,343**	**7.3**	**7.3**	**1,726.6**	**613.6**	**12,348.9**	**901.70**	**283.9**	**283.9**	**642.1**	**505.4**	**66,710.5**	**8,575.40**

3.6.1 Description of Project Facilities on Local and Other Management Areas

3.6.1.1 Liquefaction Facility

The footprint of the Liquefaction Facility, including associated facilities, would include lands managed by the KPB and within the unincorporated areas of Nikiski.

3.6.1.2 Interdependent Project Facilities

3.6.1.2.1 Pipelines

3.6.1.2.1.1 Mainline

The Mainline would pass through boroughs, municipalities, native lands and private lands, as shown in Table 3.6-1.

3.6.1.2.2 PBTL

The PBTL would not occupy private land or land owned by a municipality.

3.6.1.2.3 PTTL

The PTTL would cross locally managed lands near the GTP.

3.6.1.2.4 Pipeline Aboveground Facilities

The locations of Pipeline Associated Infrastructure would cross locally managed lands.

3.6.1.2.5 Pipeline Associated Infrastructure

Pipeline Associated Infrastructure (e.g., access roads, ATWS, contractor yards, pipe yards, construction camps, rail spurs, temporary disposal sites, and material extraction sites) would be located on state-managed lands. The locations of these areas are provided on the maps provided in Resource Report No. 8, Appendix B.

3.6.1.2.6 GTP

The GTP would not occupy private land or land owned by a municipality.

3.6.1.2.7 GTP Associated Infrastructure

Approximately 1.8 acres (see Table 3.6-1) of GTP Associated Infrastructure would be located on native lands.

3.6.1.3 Non-Jurisdictional Facilities

The PBU MGS project would occupy some private property. The PTU Expansion project would be located entirely on state land. The KSH relocation project footprint will be provided once a proposed route has been selected.

3.7 ALTERNATIVES

A detailed discussion of alternatives for the Mainline are provided in Resource Report No. 10, Sections 10.4 and 10.6.1 through 10.6.5.

4.0 ADDITIONAL COMPONENTS OF THE RIGHT-OF-WAY

4.1 CONNECTIONS TO EXISTING RIGHTS-OF-WAY

The Alaska LNG Project footprint parallels and crosses the TAPS ROW from MP 0 to approximately MP 440. The Alaska LNG ROW does not connect to the existing TAPS ROW or any other ROW.

4.2 FUTURE LAND USE REQUIREMENTS

As described in Resource Report No. 1, at this time, three interconnection points have been identified: (i) near MP 441 (Fairbanks/North Star Gas Interconnect Point); (ii) near MP 764 (Anchorage/Matanuska-Susitna Gas Interconnect Point); and (iii) near MP 807 (Kenai Peninsula Gas Interconnect Point). The location of other interconnection points is unknown at this time, as are the owner/operator, facilities and size/configurations, route/location and timing for construction and operation. There are no currently pending proposals for any Gas Interconnect Point Facilities, and the likelihood and timing for such proposals applicable to one or more of the interconnection points is uncertain.

5.0 REGULATORY APPROVALS/AUTHORIZATIONS

As indicated in Section 1.2, Project approval is regulated by the Federal Energy Regulatory Commission (FERC) under Section 3 of the Natural Gas Act (15 United States Code (U.S.C.) § 717b (2006)). A complete list of federal, state, and local permits and authorizations that may be required for the Project is provided in Resource Report No. 1, Appendix C.

5.1 FEDERAL LANDS

5.1.1 Bureau of Land Management

The BLM administers the federal lands within the Project area. Under the Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C. § 1761 et seq.), the BLM manages approximately 75 million surface acres of federal public land within Alaska through its Fairbanks and Anchorage district offices. Section 503 of the FLPMA provides for the designation of ROW corridors. In designating ROW corridors under Section 503, the BLM considers national and state land use policies, environmental quality, economic efficiency, national security, and good engineering and technological practices. Pursuant to the Mineral Leasing Act (MLA) (30 U.S.C. § 185) and 43 C.F.R. § 2881.11, an applicant must have a BLM ROW Grant under the MLA for an oil or gas pipeline, or related facility, to cross federal lands either under BLM's jurisdiction or the jurisdiction of two or more federal agencies. If the application involves two or more federal agencies, the BLM will not issue or renew a grant until the heads of the agencies administering the lands involved have concurred (BLM, 2015).

This POD is being developed in support of the Project ROW Grant and Temporary Use Permit (TUP) application to cross BLM-managed lands to address specific construction or operation measures that would be implemented to promote conformance with the BLM land use plans.

5.2 STATE OWNED AND -MANAGED LANDS

AS 38.04.065, Land Use Planning and Classification, and 11 AAC 55.010-.030 require that the 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 State Pipeline Coordinator's Section (SPCS) within ADNR has authority under AS 38.35, the Pipeline Right of Way Leasing Act and it is responsible for managing the process for ADNR to grant leases of state land for pipeline ROW purposes for the Project. Currently, more than a dozen state-owned areas of Alaska are covered by management plans intended to establish goals, policies, management intent, and guidelines for state lands; allocate the use of state land through plan designations; and include recommendations to retain or sell land, open or close areas to development, and establish special land use designations.

ADNR land management divisions include the Division of Mining, Land & Water (DMLW); Forestry; and Parks and Outdoor Recreation (DPOR). For those lands that are owned by the State of Alaska and managed by the ADNR, but not covered by an existing resource-specific land management plan, the ADNR-DMLW, in coordination with the public, identifies important land resources and how its 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. All state lands must be classified prior to being included in a lease for pipeline ROW. Prior to issuing a ROW, ADNR conducts a site-specific classification of any land not already classified in a State Area Plan.

5.3 LOCAL AND OTHER MANAGED LANDS

5.3.1 Alaska Native Regional and Village Corporations

In 1971, President Richard Nixon signed into law the Alaska Native Claims Settlement Act (ANCSA) (43 USC § 1601 et seq.). Under ANCSA, aboriginal financial and land claims were settled in exchange for $962.5 million in compensation, as well as approximately 40 million acres (Norris, 2002). ANCSA established 12 for-profit Alaska Native Regional Corporations (a 13th corporation was later added for Alaska Natives living outside the state). In addition, more than 200 Alaska Native 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. The statute includes sand and gravel in the definition of surface rights, while these are included in the subsurface estate under ANCSA and are therefore owned by the Regional Corporations. The Village and Regional Corporations are owned by enrolled Alaska Natives. Approximately 80,000 Alaska Natives are enrolled under ANCSA, and receive 100 shares each for the Village Corporation and Regional Corporation in which they are enrolled.

Native Corporation land is often held in large tracts and used for subsistence purposes or developed to generate revenue for the corporation. The Toghotthele Corporation (a Native Village Corporation representing the Native Village of Nenana) and both Tyonek Corporation (A Native Village Corporation representing the Native Village of Tyonek) and the Salamatof Corporation (a Native Village Corporation representing the Native Village of Salamatof) own surface rights to parcels within the Project area, with Doyon, Limited and the Cook Inlet Region Inc. (CIRI) owning the subsurface rights, respectively. In addition, the Project area includes parcels with surface and subsurface rights held by Ahtna, Inc., and CIRI. As private land, uses on land owned by Native Corporations are subject to an easement with the surface landowners. If uses of ANCSA land extend below the surface estate, which is the case with a buried pipeline, an agreement with the Regional Corporation subsurface estate owner will also be required. (ANCSA surface estate does not include sand and gravel.)

5.3.2 Native Allotments

Under the Alaska Native Allotment Act of 1906 (34 Stat 197), qualifying Alaska Natives were allotted up to 160 acres of non-mineral land. The Tanana Chiefs Conference manages a trust service with the Bureau of Indian Affairs (BIA) and acts as trustee for Native allotment property owners on behalf of the 42 Villages of Interior Alaska. The Inupiat Community of the Arctic Slope also manages a trust service with BIA to act as trustee for the Native allotment owners on the North Slope. The Mainline route does not intersect with Alaska Native allotments awarded under this Act.

5.3.3 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. Section 2.0-Landowner Notification of the FERC Guidance Manual for Environmental Report Preparation (FERC, 2002) requires that the applicant notify all affected landowners about the Project whose land: would be crossed or used by the Project facilities; contains a residence within 50 feet of the proposed construction work area; abuts on either side of an existing or proposed facility site or ROW; and/or contains a residence within one-half mile of proposed compressors (or their enclosures) or liquefaction facilities. In accordance with the requirements of 18 C.F.R. § 157.6(d), the Project has identified all affected landowners and Project representatives have provided correspondence to all affected landowners. Filed under separate cover is an updated list of affected landowners and adjacent landowners in Resource Report No. 1, Appendix K as “Privileged and Confidential.”

6.0 PIPELINE AND ANCILLARY FACILITY CONSTRUCTION

6.1 OVERVIEW

Construction of the proposed Project would begin once the Applicant obtains the necessary permits, approvals and authorizations. It is anticipated that construction would begin no later than late 2018, and construction and commissioning of the facilities is estimated to take approximately eight years to complete. Construction activities would be divided into phases. The first phase is planned to last from 2019–2024 and would include construction related to the first LNG and GTP trains, marine facilities, Mainline, PBTL, and PTTL, resulting in first production of LNG. After 2024, the installation of the remaining Project facilities needed for full production would take place. Table 6.1-1 summarizes the planned Project schedule.

TABLE 6.1-1

Project Schedule

Major Milestone	**Start Date**	**End Date**
Application Submittal		4Q 2016
Anticipated Draft EIS	4Q 2016	4Q 2017
Anticipated Final EIS	4Q 2017	2Q 2018
Anticipated FERC Order		3Q 2018
Anticipated FERC Notices to Proceed for Construction Start	3Q 2019	1Q 2020
LNG Facility		
Construction Infrastructure Development (Camps, Granular Material, Access, etc.)	4Q 2019	2Q 2022
Site Preparation Activities, Commence Piling and Equipment Concrete Foundations	1Q 2020	3Q 2023
Commence LNG Tank Construction	2Q 2021	4Q 2024
Installation and Interconnection of Train 1 and 2 Modules and Equipment, Power and Utilities	2Q 2022	2Q 2025
Mechanical Complete of Train 1, Power and Utilities. LNG Product Loading (Trestle) Mechanically Complete. Installation and Interconnection of Train 2 and 3 Modules/Equipment. Commence Pre-Commissioning.	1Q 2024	3Q 2025
Train 2 and Train 3 Mechanically Complete	1Q 2025	4Q 2025
LNG Train 1 Commissioning and Start-up (with GTP Train 1 Gas)	3Q 2024	4Q 2025
LNG Train 2 Commissioning and Start-Up (with GTP Train 1 Gas)	4Q 2025	1Q 2026
LNG Train 3 Commissioning and Start-Up (with GTP Train 2 Gas)	2Q 2026	3Q 2026
Kenai Spur Highway Relocation	1Q2019	1Q2020
Marine Terminal		
Site Preparation Activities, MOF Construction	4Q 2019	2Q 2021
Dredging, Complete MOF	1Q 2021	2Q 2021
Commence Installation of Trestle and Berths, Quadropod Installation	1Q 2022	4Q 2022
Complete Installation of Trestle, Continue Installation of Berths, Commence Installation of PLF Modules, Berths, and Mooring Dolphins	1Q 2023	4Q 2023
Complete Installation of PLF	1Q 2024	4Q 2024
MOF Reclamation/Demobilization	3Q 2026	3Q 2027

TABLE 6.1-1

Project Schedule

GTP		
Construction Infrastructure Development (Camps, Granular Material, Access, Etc.)	3Q 2019	1Q 2023
Site Preparation Activities and Field Erected Equipment Delivery/Setting	4Q 2019	2Q 2023
Sealift # 1		
Offload/Set Modules	3Q 2023	3Q 2023
Install Plant Utilities, Flares and Flare Pipe-Racks	3Q 2023	1Q 2024
Make Utility Interconnects and Start-Up	1Q 2024	2Q 2024
Sealift # 2		
Offload/Set Modules	3Q 2024	3Q 2024
Install Train 1 and Propane Modules and Make Interconnects	3Q 2024	1Q 2025
Commissioning and Start-Up Train 1 and Propane Refrigeration	4Q 2024	2Q 2025
Sealift # 3		
Offload/Set Modules	3Q 2025	3Q 2025
Install Train 2 and Make Interconnects	3Q 2025	1Q 2026
Commissioning and Start-Up Train 2	4Q 2025	2Q 2026
Sealift # 4		
Offload/Set Modules	3Q 2026	3Q 2026
Install Train 3 and Make Interconnects	3Q 2026	1Q 2027
Commissioning and Start-Up Train 3	4Q 2026	2Q 2027
PBTL Construction		
Install VSMs and Supports	1Q 2022	3Q 2022
Pipeline Construction	1Q 2022	3Q 2023
Hydrostatic test and Final Tie-In	3Q 2023	3Q 2022
Mainline		
Spread 1		
Construction Infrastructure Development (Camps, Borrow Sites, Access and Pads)	2Q 2020	4Q 2022
Site Preparation Activities (ROW Construction)	2Q 2021	3Q 2023
Pipeline Construction	4Q 2022	4Q 2024
Hydrostatic test and Final Tie-In (Summer months only)	2Q 2023	4Q 2024
Spread 2		
Construction Infrastructure Development (Camps, Borrow Sites, Access and Pads)	2Q 2020	4Q 2022
Site Preparation Activities (ROW Construction)	4Q 2020	4Q 2022
Pipeline Construction	4Q 2022	4Q 2024
Hydrostatic test (Summer months only) and Final Tie-In	2Q 2023	4Q 2024
Spread 3		
Construction Infrastructure Development (Camps, Borrow Sites, Access and Pads)	2Q 2020	3Q 2022

TABLE 6.1-1

Project Schedule

Site Preparation Activities (ROW Construction)	3Q 2020	3Q 2022
Pipeline Construction	4Q 2021	4Q 2023
Hydrostatic test (Summer months only) and Final Tie-In	2Q 2022	4Q 2023
Spread 4		
Construction Infrastructure Development (Camps, Borrow Sites, Access and Pads)	2Q 2020	4Q 2022
Site Preparation Activities (ROW Construction)	4Q 2020	1Q 2023
Pipeline Construction	4Q 2021	4Q 2023
Hydrostatic test (Summer months only) and Final Tie-In	2Q 2022	4Q 2023
Aboveground Mainline Facilities Construction[a]		
Sagwon Compressor Station	2Q 2025	2Q 2026
Galbraith Lake Compressor Station	2Q 2024	2Q 2025
Coldfoot Compressor Station	2Q 2025	2Q 2026
Ray River Compressor Station	2Q 2023	2Q 2024
Minto Compressor Station	2Q 2024	2Q 2025
Healy Compressor Station	2Q 2023	2Q 2024
Honolulu Creek Compressor Station	2Q 2025	2Q 2026
Rabideux Creek Compressor Station	2Q 2024	2Q 2025
Theodore Heater Station	2Q 2023	2Q 2024
Point Thomson Meter Station	1Q 2024	1Q 2025
GTP/Mainline Meter Station	1Q 2024	1Q 2025
Nikiski Meter Station	1Q 2024	1Q 2025
Fill Main Pipeline and Commissioning/Start-up Facilities (with GTP Gas)	2Q 2024	3Q 2025
Offshore (Cook Inlet) Spread		
Offshore Pipeline Construction	2Q 2022	1Q 2023
Hydrostatic test and Final Tie-In	2Q 2023	3Q 2023
PTTL		
Spread 1		
Construction Infrastructure Development (Ice Road Construction)	4Q 2022	1Q 2023
Site Preparation Activities (ROW Construction)	4Q 2022	1Q 2023
Pipeline Construction	4Q 2022	1Q 2023
Hydrostatic test and Final Tie-In	2Q 2023	3Q 2023
Spread 2		
Construction Infrastructure Development (Ice Road Construction)	4Q 2022	1Q 2023
Site Preparation Activities (ROW Construction)	4Q 2022	1Q 2023
Pipeline Construction	4Q 2022	1Q 2023
Hydrostatic test and Final Tie-In	2Q 2023	3Q 2023

TABLE 6.1-1

Project Schedule

Project Commissioning/In-Service		
First LNG Product, Train 1 Start-up	3Q 2024	4Q 2025
Intermediate LNG Product, Train 2 Start-Up		1Q 2026
Full LNG Product, Train 3 Start-Up		3Q 2027

[a] The construction schedule for compressor stations and the heater station is preliminary and subject to further optimization.

Note:

Construction Quarters (Q)

1Q = Jan-01 to Mar-31; 2Q = Apr-01 to June-30; 3Q = Jul-01 to Sept-30; 4Q = Oct-31 to Dec-31

6.1.1 Liquefaction Facility Construction Schedule

Liquefaction Facility site preparation would commence after acquisition of necessary property rights, permits, and authorizations, and construction would generally proceed as follows:

- Site preparation activities (e.g., clearing, grubbing) and infrastructure development would begin in the first quarter of 2020 and are planned to occur over a two-year period, along with MOF construction, trestle/PLF substructure installation, and site cut and fill work;
- A significant number of the major facilities for the LNG Plant would be built as modules off site and delivered by vessel from 2021 through 2024. Other major facilities would be "stick-build" (i.e., constructed fully on site) at the LNG Plant itself. Stick-build facilities, including the LNG storage tanks, would be erected at the site over the course of three to four years; and
- Commissioning of the tanks and processing units would occur as natural gas is delivered to the site.

6.1.2 Mainline Construction Schedule

Mainline site preparation would commence after acquisition of necessary property rights, permits, and authorizations. Pipeline work would be divided among a number of different construction spreads determined based on logistics, construction, and other planning considerations. Construction would generally proceed as follows:

- The Mainline infrastructure construction and logistical support is planned to begin during 2020. One to three years of infrastructure construction and ROW clearing would take place before primary pipeline construction activities begin. The construction of the Mainline is planned to occur over a two- to three-year period using a number of different construction spreads in winter and summer seasons;
- The offshore portion of the Mainline across Cook Inlet would be laid in the ice-free season. The Project representatives would plan to avoid conflicts with other waterway and nearshore users to the extent practicable, including commercial, subsistence, and recreational vessels and activities (see Resource Report No. 5). Hydrostatic testing would occur shortly after installation; and
- Aboveground facilities (e.g., compressor stations, meter stations, heater station, and other associated pipeline infrastructure) would also be constructed per Table 6.1-1.

6.1.3 GTP Construction Schedule

GTP site preparation would commence after acquisition of necessary property rights, permits, and authorizations, and construction would generally proceed as follows:

- The Pioneer construction camp would be established at or near Deadhorse or the PBU in the winter of 2019;
- Additional infrastructure construction activities are planned to start in the winter of 2019. The majority of this work would be associated with mine/reservoir overburden removal and granular mining, and construction of granular pads and access roads to support the aboveground facility construction efforts as well as construction of the mine site and water reservoir;
- Major components of the GTP would be built as modules off site and delivered in a series of sealifts. Four consecutive summer sealift seasons and corresponding construction periods are planned. As installation of the trains is completed each year, the facilities would be released to the facility operations team for commissioning and start-up;
- Due to the size of the modules required for the GTP, large oceangoing vessels would be used; and
- In total, construction for the GTP facility would last eight years.

6.1.4 PBTL and PTTL Construction Schedule

Site preparation for the PBTL and PTTL would commence after acquisition of necessary property rights, permits, and authorizations. Construction work on the PTTL is scheduled to commence in the 2022–2023 timeframe and take approximately one to two years to complete.

The PBTL would be constructed concurrent with the GTP construction and take approximately one year to complete.

6.1.5 Non-jurisdictional Facilities Construction

Site preparation for the PTU modification/new facilities would commence after acquisition of necessary permits and authorizations. Construction is anticipated to be conducted over approximately four years beginning in 2021 with start-up timing to coincide with GTP start-up. Drilling would occur over approximately five years and would begin in 2023. Initial activities would include mobilization of camp and construction equipment, as well as mining, conditioning, and placement of granular material. Gathering lines would be installed. Modules fabricated off- site would be mobilized to site via truck and sealift. The modules arriving by barge would be moved to shore using a barge bridge. The modules would then be installed and commissioned.

The PBU MGS project would occur generally over the same time period as the GTP construction.

Relocation of the Kenai Spur Highway is planned to be completed before construction of the Liquefaction Facility begins to minimize disruption to community traffic requirements.

6.2 PROJECT CONSTRUCTION PROCEDURES

Except where otherwise authorized, the proposed facilities would be designed and constructed in accordance with applicable federal, state, and local regulations, permits, and industry-recognized standards. Applicable federal regulations that apply to some or all of the facilities included as a part of this Project include 49 C.F.R. Part 193, Liquefied Natural Gas Facilities: Federal Safety Standards; 49 C.F.R. Part 192, Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards; 18 C.F.R. § 2.69, Guidelines To Be Followed by Natural Gas Pipeline Companies in the Planning, Clearing and Maintenance of Rights-of Way and the Construction of Aboveground Facilities; 33 C.F.R Part 127, Waterfront Facilities handling Liquefied Natural Gas and Liquefied Hazardous Gases; and American

Society of Mechanical Engineers' Process Piping (ASME B31.3). Any modifications to the provisions of the 49 C.F.R. Part 192 regulations would be addressed through PHMSA special permits in accordance with 49 C.F.R. § 190.341, Pipeline Safety Enforcement and Regulatory Procedures. A complete list of the construction procedures for the Project is provided in Resource Report No.1, Section 1.5.2.

Alaska presents unique and challenging Arctic construction and operating conditions. The oil and gas industry has successfully operated in this environment since the late 1970s. As a result, modified procedures have been proposed where the measures contained in the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (FERC *Plan*) and *Wetland and Waterbody Construction and Mitigation Procedures* (FERC *Procedures*) are not considered applicable, are technically infeasible, or are unsuitable due to Alaska conditions. The Applicant has prepared and would implement Applicant's *Upland Erosion Control, Revegetation, and Maintenance Plan* (Applicant's *Plan,* Appendix D of Resource Report No. 7) and *Wetland and Waterbody Construction and Mitigation Procedures* (Applicant's *Procedures*, Appendix N of Resource Report No. 2). The Applicant's *Plan* and *Procedures* have been developed using the 2013 versions of the FERC *Plan* and FERC *Procedures* as a basis. The Applicant's *Plan* and *Procedures* have been based upon the FERC *Plan* and FERC *Procedures* and applicable permit conditions using known Alaska or Arctic best management practices (BMPs) consistent with the FERC guidance. In addition, a Project-specific *Winter and Permafrost Construction Plan* has been prepared and is an appendix to Resource Report No. 1.

Mitigation plans are listed in their respective resource report. A brief description of some of these plans are noted below:

- The *Avian Protection Plan* describes the procedures that would be followed during Project construction for avian protection following the guidelines established by the Avian Power Line Interaction Committee and the USFWS (see Appendix E, Resource Report No. 3). The Project will follow, to the extent practicable, the most recent guidance from USFWS, Region 7 regarding the recommended time periods to avoid vegetation clearing. In general, clearing of the construction ROW will occur in the winter prior to a particular construction season. Alaska LNG will work with the USFWS on other means to avoid impacts or remove habitat if clearing is required during the nesting season
- The *Blasting Plan* describes the measures that would be taken during Project construction to ensure that blasting operations are safely carried out in accordance with the manufacturers' prescribed safety measures; in compliance with applicable federal, state, and local regulations; and prevent damage to natural resources or otherwise jeopardize public safety (see Appendix B, Resource Report No. 6).;
- The *Construction Unanticipated Discoveries Plan for Cultural Resources and Human Remains* describes the procedures to be used in the event that previously unreported historic properties or human remains are found during construction of the Project (see Appendix F, Resource Report No. 4);
- The *Fugitive Dust Control Plan* describes the procedures that would be used to minimize fugitive dust during Project construction (see Appendix J Resource Report No. 9);
- The *Gravel Sourcing Plan and Reclamation Measures* describes the material requirements, sources, extraction protocols, transportation logistics, and reclamation measures during the construction and reclamation phases of the Project (see Appendix F, Resource Report No. 6);
- The *Horizontal Directional Drill (HDD) Inadvertent Release Contingency Plan* describes the procedures that would be followed should an inadvertent fluid release occur during HDD activities (see Appendix L, Resource Report No. 2);
- The Project *Waste Management Plan* describes the procedures that would be followed for managing hazardous and non-hazardous solid and liquid wastes generated by the proposed Project (see Appendix J, Resource Report No. 8);

- The *Noxious/Invasive Species Control Plan* describes preventative and control measures that would be used to avoid or minimize the spread of noxious weeds during the construction and reclamation phases of the Project (see Appendix K, Resource Report No. 3);
- The *Wildlife Avoidance and Interaction Plan* describes the avoidance, early detection, and deterrence procedures that would be implemented during construction of the Project (see Appendix J, Resource Report No. 3);
- The *Paleontological Resources Unanticipated Discoveries Plan* discusses the procedures that would be used to reduce the potential for damage in the event that significant unanticipated paleontological resources were encountered during construction of the Project (see Appendix D, Resource Report No. 6);
- The *SPCC Plan* describes the management procedures for the prevention of releases of fuels, lubricants, and coolants, as well as potentially hazardous materials, that would be implemented during construction of the Project (see Appendix M, Resource Report No. 2);
- The *Stormwater Pollution Prevention Plan* describes the potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges from Project construction, describes the practices that would be used to reduce the pollutants in stormwater discharges, and assures compliance with the terms and conditions of the Alaska Construction General Permit (see Appendix J, Resource Report No. 2);
- A *Timber Management Plan* that would describe the timber removal protocols, including those for salvage timber, that would be used during construction of the Project will be developed through the course of the development of this POD;
- The *Unanticipated Contamination Plan* describes the processes that would be followed by the Project in the event of finding undocumented or anticipated contaminated material during construction of the Project (see Appendix I, Resource Report No. 8);
- The *Lighting Plan* describes the measures that would be followed by the Project to provide adequate lighting for the prevention of accidents and compliance with Occupational Safety and Health Administration (OSHA) requirements while reducing visible light disturbance to the public and wildlife, as practicable, and reduce the potential for light pollution, including backscatter into the sky (see Appendix O, Resource Report No. 8); and
- The *Traffic Mitigation Plan* describes the measures that would be implemented to mitigate for potential traffic impedance during construction (see Appendix N, Resource Report No. 8).

6.2.1 Construction Logistics

Logistics activities include the transporting of personnel, equipment, construction materials, camps, and supplies to construction sites via sea, road, rail, and/or air transportation infrastructure. Although site preparation and construction would be phased to lessen impacts to local infrastructure and communities, the size of this Project and duration of construction would require detailed planning with state and local agencies to reduce impacts to existing infrastructure. Logistics activities would begin prior to Project infrastructure construction subject to necessary regulatory approvals. The Project representatives are evaluating opportunities to further consolidate and/or coordinate facilities and activities, where practicable.

The majority of materials and equipment would be unloaded and enter Alaska through the following points of entry:

- The Port of Anchorage – Barge and vessel routes;
- The Port of Seward – Barge and vessel routes;
- The Port of Whittier – Barge routes;
- The Port of Valdez – Barge and vessel routes;
- ALCAN Highway U.S.–Canada border crossing – Trucking routes;
- Direct delivery to the Mainline MOF, Liquefaction Facility MOF, and West Dock.

After construction, it is anticipated that equipment that was brought to Alaska by construction contractors would be demobilized back to its respective point of origin.

A detailed discussion on the existing conditions of Alaska's transportation infrastructure and potential impacts related to Project construction and operations is provided in Resource Report No. 5. A brief overview of the predominant transportation modes in Alaska anticipated for the Project is provided in the following section. Even without the Mainline route passing through Fairbanks, the Fairbanks area would serve as a logistics hub for Project construction activities given its central location in the state and existing transportation infrastructure (i.e., highway, railroad, and air).

It is anticipated that a major hub for moving materials from the Lower 48 states would be through the Ports of Seattle and Tacoma on the West Coast. Other key ports are anticipated to be Houston, Texas, and Panama City, Florida. In addition, the Seattle-Tacoma International Airport would likely be a personnel hub and collection point for other Lower 48 and international labor pools for consolidated transportation to Alaska.

Based on the results of current engineering studies and discussions with potential vendors and contractors regarding the logistics associated with construction of the Project, there may be additional work required to upgrade existing facilities in Alaska to build, store, and transport the pipe, modules, turbines, and equipment. The extent of the work required is under evaluation, as well as the responsible permitting party (if any permits are required), for this additional work. As the Project team works with contractors and vendors, additional information will be provided as it is developed.

6.2.1.1 Transportation Modes

6.2.1.1.1 Marine Transportation

The main method for marine transportation of construction materials would be through the use of break bulk and container vessels, however tugs/barge and heavy lift Ro/Ro vessels would also be used. The Project would require the use of multiple, existing ports in Southcentral Alaska for both vessel offloading, storage, and docking including:

- Port of Anchorage – The Port of Anchorage is located at the head of Cook Inlet, approximately 180 miles north of the ocean entrance to the Gulf of Alaska. Cook Inlet provides navigable, year-round access to the Port, which is commercially served with intermodal rail access to Fairbanks, and road access that connects to Fairbanks, Nikiski, and the North Slope. Anchorage would be the predominant point of entry for most of the Project's general freight (i.e., non-modularized items). Once received at the Port, the materials would be deployed outward from Anchorage via rail, truck, and barge;

- Port of Seward – The Port of Seward is an ice-free port located in Resurrection Bay opening to the Gulf of Alaska and the Great Circle Route. The Port has an ARRC dock rail that connects to Anchorage, Fairbanks, and southern sections of the Mainline corridor south of Fairbanks. Road access connects the Port of Seward to Nikiski, Anchorage, Fairbanks, and the North Slope. The Port of Seward would be used primarily by the Project for the receipt of pipe; and

- Port of Whittier – The Port of Whittier is located in Prince William Sound and it is the only port in Alaska that is able to accept rail barge operations. Whittier is connected to the Alaska road and rail system by the 2.5-mile-long Anton Anderson Memorial Tunnel. The snowfall and accumulation in the area can negatively impact marine operations and productivity. The Port of Whittier would be used by the Project primarily for containerized cargo, pipe, and fuel.

Additional sites such as the Port of Homer, Offshore Systems Kenai dock, or other industrial areas in the port area of Kenai, north of the Liquefaction Facility site, may also be used in a limited capacity by the Project until the temporary, onsite MOF is developed to support construction of the Liquefaction Facility.

The Project could potentially use Port MacKenzie as a distribution center for the concrete coated offshore pipe. Port MacKenzie is located near the mouth of Knik Arm in Cook Inlet, directly north of Anchorage. Further potential use of the port would be dependent upon the completion of the ARRC rail spur.

The Project could potentially use the Port of Valdez as an alternative port for receiving truckable modules, and other materials with destinations in Fairbanks and north of Fairbanks. The Port of Valdez is located in Prince William Sound. The Port has road access that connects it to Fairbanks and the North Slope. The snowfall and accumulation in the area can hinder marine operations and productivity.

At the northern end of the Project, West Dock in Prudhoe Bay would be used for module offloading. Pipe, camps, materials, equipment, fuel, supplies, and food would be transported by truck to the Alaska North Slope from the south via the Dalton Highway. However, the use of or upgrades to the docks at Badami, West Dock, East Dock, Kuparuk and Endicott would also be studied and assessed as an optimization to mitigate trucking, fuel, supplies, and piping over the Dalton Highway. The evaluation of these docks would also consider the absence/presence of associated required infrastructure, such as connecting access roads, and any new work or upgrades required to ensure these docks are viable alternatives to meet Project requirements.

6.2.1.1.2 Road Transportation

The Project area, including the North Slope, would be accessible year-round using ADOT&PF's State Highway System; however, the over-the-road transport network is limited with few, if any, alternative routes. Limited highway routes connecting ports and cities currently exist, all of which are anticipated to be used by the Project (see Table 6.2.1-1).

TABLE 6.2.1-1

Existing Highway Routes Anticipated to be Used by the Project

Connection Points	Highways	Distance (miles)
Port of Anchorage to the Port of Seward	Seward Highway	127
Port of Anchorage to Fairbanks	Glenn and Park Highways	359
Port of Anchorage to Nikiski	Seward, Sterling, and Kenai Spur Highways	171
Port of Seward to Nikiski	Seward, Sterling, and Kenai Spur Highways	117
Fairbanks to Deadhorse	Steese, Elliott, and Dalton Highways	495
Canadian border to Fairbanks	Alaska Highway and Richardson Highway	292

Large trucks such as on- and off-road dump trucks, dry van trucks, dry van trailer trucks, flatbed trucks, and oversize transport trailers, dry van trailers, and flatbed trailers would transport materials over the course of construction, which would require transportation permits for those that surpass weight and size standards. Bridges would often be the primary constraints, limiting weight and width of loads. Additional pullouts and weigh station enhancements, truck staging, and waiting areas may be needed by the Project and would be identified when a more precise schedule of deliveries along these routes is identified.

In addition to permanent highways, ice roads would also be constructed to Project sites. Most ice roads constructed on the North Slope are typically operational between the middle of February (sometimes as early as January) through early April. The weather conditions at the time of construction, as well as the temperatures during operation, affect the level of maintenance required and the duration an ice road can be in operation.

6.2.1.1.3 Air Transportation

Air transportation will be used for mobilizing personnel and materials from out of state. While origins of flights from the continental United States have yet to be decided, the following local Alaska airports would be used for Project commercial transportation needs:

- Deadhorse Airport, a state-owned-public use airport with access to Prudhoe Bay, would function as a final destination for personnel involved in construction of the GTP, PBTL, PTTL, and some portions of the Mainline;

- Fairbanks International Airport would function as an interim destination for pipeline personnel en route to Project job sites located along the Mainline corridor. Project personnel would be received in Fairbanks and then transferred to smaller craft or buses destined for the final Project sites;

- Kenai Municipal Airport, owned by the City of Kenai and open to the public, with access to the nearby Sterling Highway, would function as a final destination for personnel involved in construction of the Liquefaction Facility and some portions of the Mainline. The Project representatives are evaluating the need to add a new light metal building at the airport, which would be a dedicated arrival and departure area with seating and room for expansion; and

- Ted Stevens Anchorage International Airport would function as the primary point of entry for personnel to Alaska. Project personnel from out of state, as well as the local Anchorage-based labor pools, would use Project-chartered planes destined for Kenai, Fairbanks, Deadhorse, or local airfields along the Mainline corridor for deployment to their final Project sites.

In addition, these 10 existing airstrips would be used for the distribution of personnel along the Mainline corridor:

- Beluga airport is a continuous operational private airport located on the west coast of Cook Inlet. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support from the Kenai and Anchorage area to the pipeline's southern spread;

- Cantwell airport is a privately owned, public use airport located in the Denali Borough. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support for remote sites along the Parks Highway;

- Chandalar Shelf airport is a state-owned, public use airport with access to the Dalton Highway. It is located in the in the Yukon-Koyukuk census area. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support for remote sites along the Dalton Highway;

- Coldfoot Airport is a state-owned, public use airport with access to the Dalton Highway. It is located in the Yukon-Koyukuk census area. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support for remote sites along the Dalton Highway. North of Coldfoot there are no services offered for 240 miles to Deadhorse;

- Galbraith Lake Airport is a state-owned, public use airport with direct access to the Dalton Highway. It is located in the North Slope Borough. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support for remote sites along the Dalton Highway;

- Livengood Airport is a state-owned, public use airport with access to the Dalton Highway. It is located in the Yukon-Koyukuk census area. This airport would likely be used by personnel

involved in construction of portions of the Mainline, providing support for remote sites along the Dalton Highway;

- Nenana Municipal Airport is an operational city-owned, public use airport located 1 mile south of the central business district of Nenana, a city in the Yukon-Koyukuk census area with direct access to the Parks Highway. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support for remote sites along the Parks Highway;

- Prospect Creek Airport is a state-owned, public use airport located approximately 3.5 miles northeast of Prospect Creek in the Yukon-Koyukuk census area with direct access to the Dalton Highway. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support for remote sites along the Dalton Highway;

- Summit Airport is a state-owned, public use airport located in Summit with direct access to the Parks Highway. It is located in the Matanuska-Susitna Borough approximately 6 miles south-southwest of Cantwell. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support for remote sites along the Parks Highway. Preliminary estimates are that a 200-foot extension of the runway may be necessary at this site; and

- Talkeetna Airport is a state-owned, public use airport with direct access to the Parks Highway. It is located approximately 1.2 miles east of Talkeetna, in the Matanuska-Susitna Borough. This airport would likely be used by personnel involved in construction of portions of the Mainline, providing support for remote sites along the Parks Highway.

Helicopters would also be used to transport personnel, including emergency transport.

6.2.1.1.4 Rail Transportation

Rail transportation would be used as practical. The ARRC is the only railroad company in Southcentral and Interior Alaska with one main line from Seward to Fairbanks. The Port of Whittier has rail lines that connect to the main line and currently receives rail barges that connect the Alaska rail system to the Lower 48 states. Of note, the Anton Anderson Memorial Tunnel accessing Whittier has published limits on load sizes and cargo types for its use. There are three railroad tunnels between Seward and Anchorage that also have limits on load sizes. The Project representatives would consider use of the Port MacKenzie rail spur if completed prior to the start of this Project.

The North Slope is currently not accessible via rail because the rail ends in Fairbanks. However, rail transportation could be used to transport construction materials to Fairbanks and trucks could be used to transport materials the remainder of the distance. Similarly, because rail transportation does not extend to Nikiski, materials for Nikiski could be trucked directly from Seward or Anchorage from their main railroad depots.

6.2.1.1.5 Transport Logistics

The following sections describe the anticipated material transport required to support Project construction.

6.2.1.1.5.1 Liquefaction Facility

The primary mode of transportation for the Project equipment materials would be via marine vessels. It is estimated that approximately 60 shipments of modules would be made directly to the MOF from the fabrication yards during construction. In addition, the Pioneer MOF is expected to receive approximately 20 shipments of small modules for construction of the Marine Terminal during the third year of construction.

The remaining material and equipment not originating from prefabrication yards would also predominantly be delivered to the site by sea and road. It is anticipated that approximately 10 barges would be circulating from the ports of Anchorage and Seward to the Project's onsite MOF on a weekly basis for three years. Over the same time period, it is estimated overland shipments that could include up to 20,000 to 25,000 trucks would also be used to transport materials from Seward and Anchorage, respectively. The concrete batch plants would be located on site, receiving deliveries of material from local suppliers. Overall, it is estimated that deliveries to the Liquefaction Facility site would include 48,000 truckloads of equipment/materials and 192,000 truckloads of civil material, much of which would be cut-and-fill from the site or from nearby.

6.2.1.1.5.2 Mainline and PTTL

The 42-inch pipe for the Mainline would be shipped coated from the mills in 40-foot joint lengths. Once offloaded at the port of entry, the 40-foot pipe would be trucked or railed to a double-jointing plant near the port of entry and/or near Fairbanks for double-jointing. The coated double-jointed 42-inch pipe (80 feet in length) would then either be trucked or railed to the spread sections south of Fairbanks. For spreads north of Fairbanks, the 42-inch pipe would be railed to a facility in Fairbanks and then distributed by truck to the various pipe storage yards located along the Dalton Highway.

Double-jointed pipe from a new jointing and weld coating facility at/near the Port of Seward would be distributed via barge to the Beluga area and via rail and specialized pipe haulers for the southern spreads south of Fairbanks along the rail corridor and Parks Highways.

The PTTL's 32-inch, 40-foot bare pipe would be railed to a double-jointing plant near Fairbanks from either the Port of Anchorage or Seward. The pipe would then be double-jointed, coated, and insulated. Pipe would be trucked to storage and laydown areas along the PTTL route. There is an alternative consideration to use the existing Badami dock facilities and upgraded or new laydown areas along Mikkleson Bay to receive the 32-inch pipe and material for the PTTL, as well as the modules for the Sagwon Compressor Station and the 42-inch piping and valves north of the Atigun Pass.

A preliminary estimate of the truckloads and rail cars required to support the logistic requirements for construction of the Mainline, PTTL, and associated aboveground facilities includes:

- Approximately 30,000 truckloads of 42-inch pipe (Mainline);
- Approximately 1,100 truckloads of 32-inch pipe (PTTL);
- Approximately 10,500 rail car loads of 42-inch pipe (Mainline);
- Approximately 475 rail car loads of 32-inch pipe (PTTL);
- Approximately 57,000 truckloads of other materials and equipment (e.g., MLBVs, pipe bends, fuel, consumables, etc.); and
- Approximately 4,000 rail carloads of materials (e.g., MLBVs, pipe bends, fuel, consumables, etc.).

For the Pipeline Aboveground Facilities, truckable modules and components would be transported in their largest possible size, based on physical Project constraints and the most direct routing from the point of fabrication to the various facility sites. An estimated 320 truckable pipeline modules for various facility sites would be assembled and shipped from the Anchorage area or brought in and dispersed along the pipeline from Southcentral Alaska ports.

GTP and PBTL

During GTP construction, it is anticipated that approximately 116 modules would be delivered to West Dock, approximately 65 modules during pre-sealift and 51 modules as part of four planned sealifts:

- Sealift 1 – 17 modules (12 barges);
- Sealift 2 – 15 modules (12 barges);
- Sealift 3 – 10 modules (10 barges); and
- Sealift 4 – 9 modules (9 barges).

In addition to the proposed pre-sealifts, it is estimated that approximately 7,000 to 10,000 truckloads would also be required to transport the camps, equipment, electrical cables, piping, pump stations, and other materials (e.g., consumables and supplies) to the GTP. The estimated number of truckloads for the first pre-sealift is approximately 5,500.

6.2.2 Construction Workforce

Based on the design, preliminary estimates of the number of personnel required to construct each facility are detailed in Resource Report No. 5 and outlined in the following sections.

6.2.2.1 Liquefaction Facility

It is estimated that a total peak workforce of approximately 4,400 to 5,000+ persons would be needed during the seven-year construction of the LNG Plant and the Marine Terminal facilities.

6.2.2.2 Interdependent Project Facilities

6.2.2.2.1 Mainline

The Mainline would require a peak workforce of approximately 5,000 to 7,000 employees over several summer and winter construction seasons, with individual spreads using a peak workforce of approximately 1,400 (750 to 1,600).

6.2.2.2.2 Compressor Stations, Meter Stations, and Heater Station

The design anticipates that an individual compressor station would be built in approximately one year and require approximately 160 personnel (on average) to construct, inspect, and precommission the station. It is anticipated that an individual meter station would be constructed in approximately three to four months and would require approximately 100 personnel to construct, inspect, and precommission the station. An individual heater station is estimated to be built in approximately one year using a workforce of 110 personnel.

6.2.2.2.3 GTP and PBTL

The design anticipates that construction of the GTP, including GTP infrastructure and dock modifications and pipelines between the GTP and PBU CGF, (including PBTL) would require approximately 500 to 2,000 personnel at peak work.

6.2.2.2.4 PTTL

The PTTL would require a peak workforce of approximately 800 to 1,000 over a single winter pipeline construction season with a summer hydrotest in the same year. Two pipeline spreads will operate simultaneously during the single winter construction season for construction of VSMs and mainline aboveground pipeline.

7.0 RESOURCE VALUES AND ENVIRONMENTAL CONSIDERATIONS

This section summarizes the resource impacts and environmental considerations for the Project. Impacts to resources are expected to be temporary and associated primarily with the Construction phase.

7.1 AIR

A complete summary of air quality for the Project area and potential impacts from the construction and operation of the Project are included in Resource Report No. 9. Specifically, the purpose of Resource Report 9 is to:

- Describe the existing air quality in the general vicinity of the Project;
- Summarize potential impacts to these resources resulting from construction and operation of the Project; and
- Identify appropriate mitigation measures to avoid or minimize potential adverse impacts to air quality and noise in the vicinity of the Project.

7.1.1 Applicable Air Quality Regulatory Requirements – Construction

Air quality regulations, both federal and state, address some aspects of the proposed construction activities. Table 7.1.1-1 lists potentially applicable federal regulations under Title 40 of the C.F.R. The cited regulations may apply directly to some construction equipment or activities.

TABLE 7.1.1-1

Federal Air Quality Regulations Potentially Applying to the Project – Construction

Citation/Part of 40 C.F.R.	Title	Description
50	NAAQS	Modeling and any monitoring must comply with NAAQS.
51 Appendix W	Guideline on Air Quality Modeling	Dispersion modeling in support of permit applications must comply with this regulation.
58 Appendix E	Air Quality Monitoring	Applies for stationary sources that submit ambient air monitoring data in support of applications
60 Subpart A	General Provisions for New Source Performance Standards (NSPS)	Includes general notifications, recordkeeping, reporting, and sampling requirements for affected units
60 Subpart Db	NSPS for boilers and heaters > 100 MMBtu/hr	Regulates NOx, SO_2, PM emissions from boilers and heaters from stationary sources
60 Subpart Dc	NSPS for boilers and heaters > 10 MMBtu/hr	Standards for small boilers, generally regulating SO_2 and PM emissions from oil (and solid fuel) fired units.
60 Subpart Kb	NSPS for Tanks <75 m^3	Can apply to tanks storing volatile organic liquids
60 Subpart OOO	NSPS for Non-metallic mineral processing plants	Applies to crushed stone, and sand and gravel processing plants above thresholds with crushers or grinding mills
60 Subpart IIII	NSPS for Compression Ignition Engines	Emissions limits, monitoring, testing requirements for diesel-fired engines based on use, horsepower, and engine sizes
60 Subpart JJJJ	NSPS for Spark Ignition Engines	Emissions limits, monitoring, testing requirements for spark ignition natural gas-fired engines based on use, horsepower, and engine sizes
68	Chemical Accident Prevention	Applies to stationary sources that have more than the threshold quantity of a regulated toxic or flammable substance
63 Subpart ZZZZ	National Emission Standards for Hazardous Air Pollutants (NESHAPs) for stationary engines	Applies to reciprocating internal combustion engines (RICE), including generators, emergency generators, firewater pumps, etc. Generally excluded if complying with NSPS Subparts IIII or JJJJ.
63 Subpart CCCCCC	NESHAPs for Gasoline Dispensing Facilities	Applies to an onsite gasoline dispensing facility, with requirements based on monthly throughput.
80 Subpart I	Emission Control Act (ECA) Marine Fuel Standards	May apply to end-users of marine fuel
82	Stratospheric Ozone Protection	Applies to facilities with listed refrigerants, to manage and control emissions or releases from those units

TABLE 7.1.1-1

Federal Air Quality Regulations Potentially Applying to the Project – Construction

Citation/Part of 40 C.F.R.	Title	Description
89	Non-road compression ignition engines	Applies to pre-2014 non-road compression-ignition engines, including portable units
91	Marine spark-ignition engines	May apply to specific marine spark-ignition engines.
93 Subpart B	General Conformity	May apply to construction activities within the Fairbanks $PM_{2.5}$ nonattainment area
94	Marine compression-ignition engines	May apply to specific marine compression-ignition engines.
98 Subparts A and C	Mandatory GHG reporting rule	Sources with > 25,000 metric tons/year of CO_2e emissions must calculate and submit annual reports of GHG emissions.
1042	Marine compression-ignition engines	May apply to certain end-users of marine compression-ignition engines
1043	Control of Emissions under Marine Pollution Protocol (MARPOL)	Controls NOx, SO_2, and PM emissions from marine vessels subject to MARPOL Protocol.

Table 7.1.1-2 provides a listing and brief description of the potentially applicable Alaska air quality regulations in Title 18 of the AAC.

TABLE 7.1.1-2

Alaska Air Quality Regulations Potentially Applying to the Project – Construction

Citation to 18 AAC 50	Title	Description
50.010	Ambient air quality	Facility must be designed and permitted to operate in compliance with ambient air quality standards
50.020	PSD Baseline dates and maximum allowable increases	Facility must be designed and permitted to operate in compliance with applicable PSD increments. Affects permitting of major sources (LNG and GTP, based on preliminary information)
50.025	Visibility and other special protection areas	Establishes visibility protections for three areas, including (1) Mt. Deborah and the Alaska Range East, as viewed from approximately the Savage River Campground area, (2) Mt. McKinley, Alaska range, and Interior Lowlands as viewed from the vicinity of wonder Lake, and (3) geographic areas classified as Class I under 18 AAC 50.15(c). This last group is also an area with federally enforceable visibility protection, but this provision allows ADEC to interpret and regulate visibility impacts under its own rules.
50.035 (a) (1) and (2)	Documents adopted by reference	Adopts the (1) ADEC *In situ Burning Guidelines for Alaska, Revision 1, revised August 2008* and (2) *Workbook for Plume Visual Impact Screening and Analysis (Revised)* EPA 454/R-92-023, October 1992 as a means of addressing visibility impacts.
50.040 (a)	New Source Performance Standards	Adopts the Federal New Source Performance Standards, including Subpart A general provisions, Subpart IIII for compression ignition reciprocating internal combustion engine, Subpart JJJJ for spark ignition reciprocating internal combustion engines, and subpart KKKK for stationary combustion turbines.
50.040(c)	National Emission Standards for Hazardous Air Pollutants	Adopts the Federal National Emission Standards for Hazardous Air Pollutants, including Subpart ZZZZ for stationary reciprocating internal combustion engines.

TABLE 7.1.1-2

Alaska Air Quality Regulations Potentially Applying to the Project – Construction

Citation to 18 AAC 50	Title	Description
50.045 (d)	Prohibitions.	A person who causes or permits bulk materials to be handled, transported, or stored, or who engages in any industrial activity or construction project shall take reasonable precautions to prevent particulate matter from being emitted into the ambient air. No specific permitting or approval for compliance is required; however, the agency may take action if this provision is violated, particularly in response to a complaint by the general public.
50.050	Incinerator emission standards.	Requires opacity to be 20 percent or less averaged over any six consecutive minutes. No limit exists for particulate matter emissions for incinerators that have a rated capacity less than 1,000 pounds per hour. Project design indicates that no incinerators will exceed that design threshold, but if rated capacity is above that level, the PM emission standards would apply.
50.055	Industrial Processes and fuel burning equipment.	This rule limits visible emissions from industrial process or fuel-burning equipment to 20 percent or less for any consecutive six-minute period. Particulate matter emissions from fuel-burning equipment also must comply with grain loading standards in § (b) of the regulation. Sulfur compound emissions from an industrial process or fuel-burning equipment may not exceed 500 ppm averaged over three hours.
50.065	Open burning	The rule specifies requirements for open burning standards. The regulation includes an array of requirements, including minimizing emissions, prohibiting combustion of toxic compounds, and avoidance of open burning during periods of adverse dispersion, as well as provisions for dealing with complaints. When construction contractors are selected, the Open Burning Plan for the Project would address the requirements of this regulation.
50.070	Marine Vessel visible emission standards	Establishes marine vessel visible emission standards and would apply to marine vessels that are used in support of construction both of the pipeline across Cook Inlet and of the LNG terminal facilities. Specific visibility standards apply to these vessels.
50.080	Ice fog standards	Allows ADEC to require a permit to reduce water vapor emissions for fuel burning equipment or an incinerator in areas of potential ice fog
50.100	Nonroad engines	Specifies that the emissions from non-road engines (heavy equipment, portable generators, and any engines that are temporary) are not included when determining the classification of a stationary source or modification for a permit
50.110	Air pollution prohibited	ADEC can restrict emissions which may be injurious to health, welfare, property or unreasonably interfere with the enjoyment of life or property. Construction activities that may cause excessive dust, particularly near residences or sensitive receptors, may be curtailed under this regulation if a complaint is received and ADEC considers the impacts to be within these adverse determinations.
50.215	Ambient air quality analysis methods	Provides methods for analyzing (or modeling) ambient air quality impacts for permitting
50.215 (b)(2)(A)	Ambient air quality analysis methods	Excludes temporary construction emissions from the need to predict ambient air quality compliance with PSD increments
50.220	Test methods	References test methods for demonstrating compliance with emission limits
50.225	Owner requested limits	Operators and owners can request emission limits that limit applicability of other air quality regulations

TABLE 7.1.1-2

Alaska Air Quality Regulations Potentially Applying to the Project – Construction

Citation to 18 AAC 50	Title	Description
50.235	Unavoidable emergencies	Establishes rules for reporting and responding to emergencies related to air pollution
50.240	Excess emissions	Provides requirements for reporting excess emissions including startup and shutdown.
50.245 and 50.246	Air Quality episodes	Allows ADEC to declare an air quality episode based on actual or potential impacts, and subsequently request voluntary reductions in emissions from stationary sources.
50.326	Title V operating permits	Sources with emissions of 100 ton/year or greater of any regulated criteria pollutant (not GHG) must obtain an operating permit, renewable on a five-year basis, and when new applicable requirements affect the source.
50.345 50.346	Construction minor and operating permits standard permit conditions	Compliance requirements (standard conditions) for Title V operating and minor sources permits and for modifications to existing stationary sources. Includes requirements for notifications, document submittals, and inventory reporting.
50.400 - 50.499	User Fees	Establishes fee schedules for permits and permit renewals.
50.502	Minor construction permits	Specifies provisions for requiring a minor source construction permit for certain activity, based on the potential emissions from a stationary source or modification. Certain components of the construction activity may qualify as a stationary source depending on the duration of activity at a specific location. Minor permits must be obtained for the following potential activities under §(b) of this regulation: (1) An asphalt plant with a rated capacity of at least 5 tons/hour of product (2) A rock crusher with a rated capacity of 5 tons/hour (3) One or more incinerators with a cumulative rated capacity of 1,000 lbs./hour or more
50.508	Minor permits requested by owner or operator	Owner or operator can establish enforceable emission limits in a permit to avoid applicability of specific regulations.
50.540	Minor Permits	A minor source construction permit is required based on potential emissions.
50.544	Minor permits: content	Requires permit conditions for minor sources.
50.990	Definitions	Includes specific definitions for activity regulated under state air quality rules. Includes (107) temporary construction activity is defined as a construction activity that is 24 months or less (including intervening periods of inactivity).

7.1.2 Affected Environment and Resources

7.1.2.1 Regional Climate

Alaska's diverse climate is characterized by widely varying temperature ranges and weather phenomena due to the state's size, highly variable topographical features, and location within the high latitudes. The climate and meteorological conditions in localized areas of the Project will influence the design and operation of Project facilities. Meteorological conditions will also play an important role in determining (1) the direction of atmospheric transport and (2) the degree of dispersion of air pollutants emitted from emission sources associated with Project construction and operation.

7.1.2.1.1 Topographic Features and Elevation

Climate conditions are dramatically affected by topography and elevation, especially in Alaska where the influences of the Arctic Ocean and the Pacific Ocean are demarcated by major mountain ranges. The Brooks Range extends across northern Alaska and the Alaska Range extends across the southern third of Alaska, eastward into Canada. These two mountain ranges delineate the major climatic zones that affect the Project, with smaller transitional areas between each of the zones.

7.1.2.1.2 Climate and Regional Zones

The National Oceanic and Atmospheric Administration (NOAA) recently established 13 climate divisions for Alaska. Four of those divisions are relevant to the Project:

- North Slope;
- Central Interior;
- Cook Inlet; and
- Northwest Gulf.

The number of discrete climatic zones has sometimes been expanded to include two smaller, transitional alpine regions between the Central Interior and Cook Inlet zones (the Alaska Range) and between the North Slope and Central Interior zones (the Brooks Range) (see Resource Report No. 9). The applicable regions within these zones are as follows:

- North Slope – The North Slope region, north of the Brooks Range, is within the Beaufort Coastal Plain Ecoregion and is dominated by a traditionally described Arctic climate, with elevations ranging from sea level to approximately 1,500 feet in the Brooks Range foothills.
- Brooks Range – The Brooks Range, with elevations reaching 4,800 feet at Atigun Pass, is not a separate climatic zone; however, local elevation and topography, especially at locations in narrow valleys, leads to unique climate features in this region.
- Central Interior of Alaska – The Interior of Alaska, between the Brooks Range and the Alaska Range, is dominated by a traditionally described continental climate, with elevations ranging from a few hundred feet to approximately 1,000 feet.
- Alaska Range – The Alaska Range is not a separate climatic zone; however, local elevation and topography dominate the local climatic features. Elevations along the Project corridor range from approximately 1,000 feet in the foothills to 2,400 feet.
- Cook Inlet – The Southcentral portion of Alaska, south of the Alaska Range and including lands around Cook Inlet, is dominated by a traditionally described maritime climate, with a transitional zone in the southern foothills of the region. Elevations along the Project corridor range from approximately 1,000 feet in the Alaska Range foothills to sea level along Cook Inlet.
- Northwest Gulf – The climate conditions in and around Kodiak Island and over the open waterbodies, including Shelikof Strait and the Kennedy Entrance to Cook Inlet, represent climate conditions for LNG carriers (LNGCs) entering and exiting Cook Inlet for access to the Marine Terminal.

7.1.2.1.2.1 Liquefaction Facility

At the proposed location of the Liquefaction Facility on Cook Inlet, a maritime climate prevails. The maritime climate is influenced by exposure to the Gulf of Alaska and is wetter and, overall, warmer than the climate in the rest of the Project area. Frequent precipitation occurs in all months, with average precipitation above 3 inches in July and a seasonal peak in the fall. Snowfall occurs in winter months, with an average snow depth of 1 foot in January and February, along with cloudiness and comparatively milder temperatures than the other regions of the Project. Summer daily maximum temperatures average slightly above 60 degrees Fahrenheit (°F) and winter average daily minimum temperatures are below 10 °F. LNGCs would transit Cook Inlet from the Marine Terminal at Nikiski 115 nautical miles south to Kennedy Entrance, which is the recommended passage to and from Cook Inlet. It is also possible to use Stevenson Entrance (125 nautical

miles south of the Marine Terminal) or Shelikof Straight Entrance (235 nautical miles south of the Marine Terminal). As the LNGCs approach the Gulf, the climate becomes increasingly mild and wet.

7.1.2.1.2.2 Interdependent Project Facilities

In addition to the Liquefaction Facility, Project facilities would include the Mainline, GTP, PBTL, and PTTL to move and process natural gas from the North Slope to the Liquefaction Facility. On the North Slope, the Project facilities, including Mainline, GTP, PBTL, and PTTL, would be exposed to cold Arctic weather and associated windflow patterns. The Arctic climate is characterized by very cold winters, persistent high wind episodes (any season), and frequent fog conditions that are influenced by windflow from the ice shield, especially in the warmer months.

For the Mainline components in the Alaska Interior, there are very cold, stable air episodes in the winter with a warmer growing season in the summer. Occasional periods of high temperature, dry conditions, and stable atmospheric conditions occur in the summer.

The Mainline corridor will cross mountain range transition zones, which generally involve cold winter conditions, an abundance of precipitation (mainly snow), and rapidly changing weather. Local climatic conditions are heavily influenced by local topographic features in these mountainous regions.

In Southcentral Alaska, the southernmost portion of the Mainline corridor, a maritime climate similar to the one described for the Liquefaction Facility prevails.

In subsequent sections of this Resource Report, climatological and air quality data are provided for the Project area, including data from some stations that are representative of the Brooks and Alaska Ranges.

7.1.2.1.2.3 Non-jurisdictional Facilities

As outlined in Resource Report No. 1, there are three categories of non-jurisdictional facilities, discussed in more detail in the following sections, that warrant environmental analysis as connected actions: (i) the PTU Expansion project; (ii) the PBU MGS project; and (iii) the Kenai Spur Highway relocation project.

The PTU Expansion project and PBU MGS project located on the North Slope would be subject to similar North Slope climatic conditions as the existing Point Thomson project and GTP, respectively.

The Kenai Spur Highway relocation project would be subject to Cook Inlet climatic conditions similar to those at the Liquefaction Facility.

7.1.3 Air Quality Emissions and Potential Impacts from Construction Sources

Impacts to air quality from Project construction would include temporary emissions from construction equipment and support operations (e.g., construction camps), as well as fugitive dust from soil handling, storage, and replacement activities; and from gravel and other dust generating materials. The estimated construction emissions for the major Project facilities are supported by calculations based on Project execution data provided in Resource Report No. 9, Appendix C:

7.1.3.1 Methodology for All Project Components

Project construction would result in air emissions of federal and Alaska criteria air pollutants (nitrogen oxides [NO_X], SO_2, CO, PM_{10}, $PM_{2.5}$, and volatile organic compounds [VOCs]) and greenhouse gases (GHGs) (carbon dioxide [CO_2], methane [CH_4], and nitrous oxide [N_2O]). Emissions of these pollutants are estimated from available data for the full range of construction activities, including combustion, non-combustion, and fugitive sources, using generally accepted emission factors for construction equipment and activity.

7.1.3.1.1 Combustion Emissions

Combustion sources include tailpipe emissions from heavy equipment (non-road engines used to power construction equipment), mobile vehicles used to support construction, diesel-fired engines to support power generation, portable equipment, and support systems such as construction camps. Typical non-road engines, portable equipment, and mobile sources include:

- Surface operations, including excavators, trenchers, graders, scrapers, and compactors, which are used to build roads, structure foundations, laydown areas, and temporary surfaces;
- Construction equipment, including cranes, loaders, forklifts, pile drivers, and aerial lifts;
- Support equipment engines, including pumps, compressors, electric power generators, saws, and welders; and
- On-road support vehicles and trucks, including construction and use of access roads.

Construction of each Project facility and the pipeline would include the installation of a construction camp to house employees near the Project site. The camp would provide a full range of services related to maintaining a construction crew, including sleeping quarters, a dining hall, personnel comfort features, and other services to support construction. Camp operations would require several combustion sources, including power generators, waste incinerators, and space heating operations. Camp operation would also provide urban-style commuter buses to transport crew members between camps and construction sites.

Estimated combustion emissions are based on the equipment design (e.g., horsepower), projected fuel use or hours of operation, fuel type, and an average load factor for equipment operation from available emissions databases. Key emission factors were based on the following:

- Vendor-specific emission factors, where available;
- EPA diesel engine “Tier” standards in 40 C.F.R. Part 89 and Part 1039;
- EPA (2009) emission factors for non-road equipment operating in Alaska;
- EPA (2014b) MOVES2014 data for on-road vehicles;
- EPA (1995) AP-42 emission factors for internal and external combustion equipment; and
- Specific emission factors for marine sources, locomotives, aircraft, and other equipment.

Operational data for equipment and other construction activities, including a listing of equipment, horsepower, and hours of operation, were used to estimate the combustion emissions in Resource Report No.9, Appendix C. Emissions from construction camp electric power generators and waste incinerators are estimated based on expected peak personnel at each camp. Generally, however, engine horsepower ratings for specific construction equipment are estimated from typical equipment.

Open burning of brush cleared from the construction right-of-way would generate combustion emissions. Open burning activity levels will be determined when construction contractors are selected.

7.1.3.1.1.1 Non-Combustion Point Sources

Construction may also include non-combustion emissions, such as vented vapors from tanks. Estimates of these emissions are included in Resource Report No.9, Appendix C.

7.1.3.1.1.2 Fugitive Emissions

Civil construction leads to fugitive dust and particulate matter emissions from a wide array of activities. Clearing, grubbing, site preparation, excavation, drilling and blasting, soil handling, storage piles, construction materials handling, vehicular traffic on paved or unpaved roads, and other activities emit fugitive dust. Emission calculations for fugitive dust are based on commonly accepted methods, including the EPA’s AP-42, which often include site-specific parameters such as soil moisture, silt content, exposed acreage, wind speed, and frequency of precipitation. Activity levels are derived from estimates of parameters, such as vehicle weight, vehicle speed, volumes handled, and hours of operation. Additionally,

fugitives may result from activities that emit organic compounds, such as solvent application, coatings, and painting during construction. Except for emission from storage piles, fugitive emissions from construction activities are transient in nature and likely to occur at any one location for a few hours within a single day.

7.1.3.2 Liquefaction Facility

Construction of the Liquefaction Facility would take place over an eight-year period and include construction equipment both on the Project site and within Cook Inlet waters. A construction camp for workers would be operated during construction.

7.1.3.2.1 LNG Plant Construction Emissions

Total annual emissions during construction of the LNG Plant and adjacent Marine Terminal have been summarized in Table 7.1.3-1. Construction activities would begin with site clearing and stabilization, and include roadway construction, installation of a worker camp, and operating specific project construction equipment noted earlier in this report.

TABLE 7.1.3-1

Total Annual Construction Emissions for the Liquefaction Facility and Marine Terminal (Combined)

Project Construction Year	Tons/Year						Data in Metric Tonnes CO_2e/Year
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	GHG
2	19	366	60	649	76	6	28,534
3	29	637	80	483	62	17	46,077
4	106	1,260	705	2,555	285	27	158,307
5	125	836	1,047	4,701	503	15	170,477
6	97	293	1,004	4,509	478	8	83,941
7	76	224	774	4,227	446	7	64,595
8	43	157	435	3,522	368	4	42,951
9	33	110	396	2,120	222	3	27,043
TOTAL	528	3,883	4,501	22,766	2,440	87	621,925

7.1.3.2.2 Marine Terminal Construction Emissions

Construction of the Marine Terminal adjacent to the LNG site would include the installation of various in-water structures related to the Marine Terminal operations. Many construction activities would take place from barges and tugs, and include cranes, loaders, pile drivers, and support vehicles and operations. Support equipment includes power generators and compressors and haul trucks during construction.

Construction of the Marine Terminal is planned for a two-year period beginning in Year 2 of the Liquefaction Facility construction schedule. The total annual emissions for each of those years are included in Table 7.1.3-1.

7.1.3.3 Interdependent Project Facilities

7.1.3.3.1 Pipeline Construction Emissions

7.1.3.3.1.1 Mainline

The Mainline pipeline would be constructed simultaneously in four separate spreads of approximately 200 miles each, over six years. Eight compressor stations, including one combined compressor station and collocated heater station, plus one standalone heater station would be constructed over a three-year period

at same time as construction of the Mainline. The location of each station is identified in Table 7.1.3-2. Due to their proximity to Mainline pipeline construction, each station's emissions were included in the emissions with the associated construction spread at that location. Actual station construction would occur using three separate pipeline facility construction contractors operating independently from Mainline spread contractors.

TABLE 7.1.3-2

Compressor and Heater Station Locations for Mainline Pipeline

Compressor or Heater Station	MP	Pipeline Facility Construction Contractor (CC)	Mainline Spread
Sagwon Compressor Station	75.97	CC1	1
Galbraith Lake Compressor Station	148.51	CC1	1
Coldfoot Compressor Station	240.10	CC1	2
Ray River Compressor Station	332.64	CC2	2
Minto Compressor Station	421.55	CC2	3
Healy Compressor Station	517.62	CC2	3
Honolulu Creek Compressor Station	597.35	CC3	3/4
Rabideux Creek Compressor Station	675.23	CC3	4
Theodore River Heater Station	749.11	CC3	4

Pipeline construction for all four spreads would begin in the first year following authorization. The depictions of the areas of the separate spreads are provided in Resource Report No. 1. Emissions from marine construction of the pipeline section crossing Cook Inlet are included in Spread 4.

Table 7.1.3-3 lists the estimated construction emissions for each spread for each of the six years of planned construction. Each spread covers a distance of approximately 200 miles; as such, the emissions are spread over 200 miles instead of being concentrated. To illustrate the spread/distribution of construction over time, Figure 7.1.3-1 provides the total annual PM_{10} construction emissions for each Mainline spread, and the data depict the comparative level of construction activity for each Mainline spread for each year of construction. Data include fugitive and equipment PM_{10} emissions. The highest yearly emissions for each spread corresponds with the highest level of construction activity. For example, construction activities and emissions for Spread 3 and 4 peak in Years 3 and 4, respectively. Combined PM_{10} emissions from all spreads peaks in Year 5.

TABLE 7.1.3-3

Total Annual Construction Emissions for the Mainline Spreads

Data in ton/year								Data in Metric Tonnes CO_2e/year
Project Construction Year		**VOC**	**NOx**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**GHG**
	Spread							
2	1	8	43	44	273	33	1	12,212
	2	15	95	110	451	85	3	26,782
	3	12	80	63	417	53	1	21,664
	4	11	56	63	321	40	1	15,327
	Total	46	274	280	1,462	211	6	75,985
3	1	17	118	107	757	120	2	37,971
	2	21	139	194	710	143	4	43,885
	3	26	164	148	1,469	181	2	53,448

TABLE 7.1.3-3

Total Annual Construction Emissions for the Mainline Spreads

Data in ton/year								Data in Metric Tonnes CO_2e/year
Project Construction Year		**VOC**	**NOx**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**GHG**
	4	14	76	80	542	64	2	21,130
	Total	78	497	529	3,478	508	10	156,434
4	1	19	139	130	678	104	3	38,658
	2	14	117	113	401	82	3	26,041
	3	21	125	110	694	82	3	33,030
	4	39	386	187	1,498	173	7	74,543
	Total	93	767	540	3,271	441	16	172,272
5	1	33	236	176	1,911	243	5	68,321
	2	35	253	196	1,229	167	5	69,744
	3	36	244	179	1,518	183	5	68,158
	4	208	5,001	521	1,104	185	150	261,141
	Total	312	5,734	1,072	5,762	778	165	467,364
6	1	24	212	117	1,936	229	3	57,717
	2	20	168	87	953	118	2	46,861
	3	15	125	74	863	105	2	31,419
	4	19	237	68	862	95	5	36,487
	Total	78	742	346	4,614	547	12	172,484
7	1	4	27	16	275	29	0	8,994
	2	2	11	4	87	9	0	3,201
	3	2	7	9	1	1	0	2,958
	4	1	5	2	31	3	0	1,463
	Total	9	50	31	394	42	0	16,616
Spread								
All	1	105	775	590	5,830	758	14	223,873
	2	107	783	704	3,831	604	17	216,514
	3	112	745	583	4,962	605	13	210,676
	4	292	5,761	921	4,358	560	165	410,092
	Total	6,16	8,064	2,798	18,981	2,527	209	1,061,155

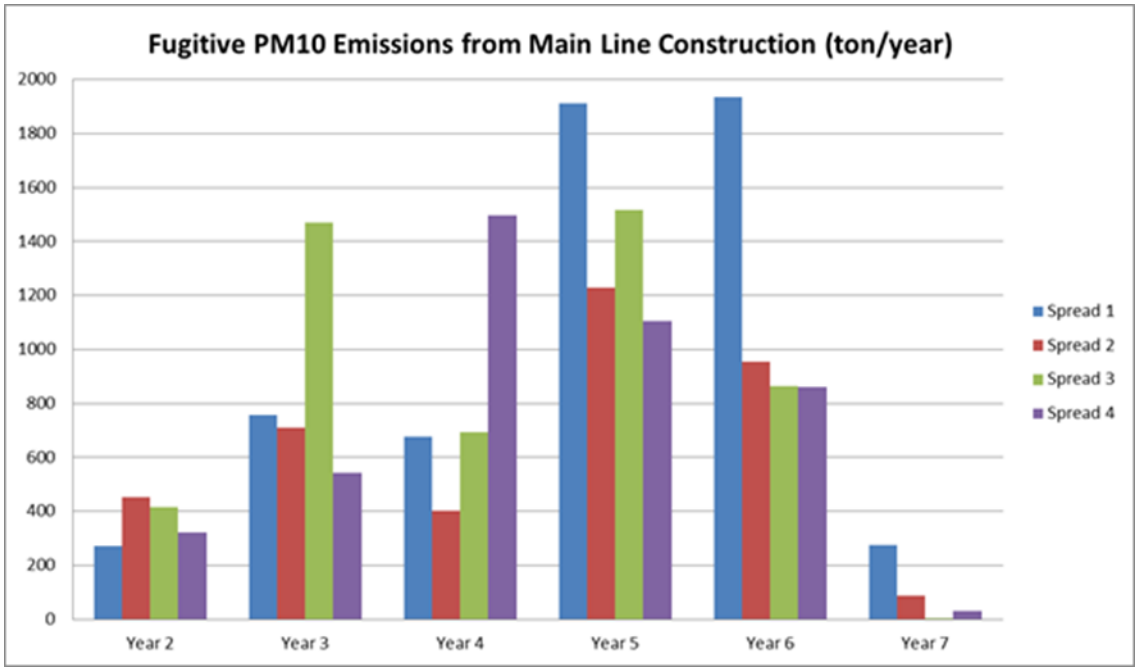

FIGURE 7.1.3-1 Total Annual PM_{10} Construction Emissions for the Mainline Spreads

7.1.3.3.1.2 Prudhoe Bay Gas Transmission Line (PBTL)

As noted in Resource Report No. 1, the PBTL would be constructed during the winter. Because there are no trees or brush on the PBTL corridor, there would be no open burning. Emissions from construction of this line would occur within a one- to two-year period, and would not involve a separate construction camp.

Table 7.1.3-4 provides a summary of the total annual emissions of criteria air pollutants and GHGs for construction of the PBTL. Due to its proximity, PBTL construction emissions are also included in the total GTP construction emissions.

TABLE 7.1.3-4

Total Annual Construction Emissions for the Prudhoe Bay Gas Transmission Line

Project Construction Year	tons/year						Metric Tonnes CO_2e/year
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	GHG
2	0.0	0.1	0.0	2.1	0.2	0.0	11
3	0.5	4.0	1.9	11.4	2.0	0.0	940
TOTAL	0.5	4.1	1.9	13.5	2.2	0	951

7.1.3.3.1.3 Point Thomson Gas Transmission Line (PTTL)

As noted in Resource Report No. 1, the PTTL would be constructed during the winter. Because there are no trees and limited brush on the PTTL corridor, there would be no open burning. Emissions from construction of this line occur within a two-year period, beginning in Year 3 and completing in Year 4, and do not involve a separate construction camp. Pipeline construction would occur over two spreads.

Table 7.1.3-5 provides a summary of the total annual emissions of criteria air pollutants and GHGs for construction of the PTTL.

TABLE 7.1.3-5

Total Annual Construction Emissions for the Point Thomson Gas Transmission Line (PTTL)

Project Construction Year	tons/year						Metric Tonnes CO_2e/year
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	SO_2	GHG
3	9	62	56	395	49	1	15,279
4	15	56	87	374	52	2	21,877
5	0	0	0	0	0	0	0
6	0	2	1	24	2	0	352
TOTAL	24	120	144	793	103	3	37,508

7.1.3.3.1.4 Gas Treatment Plant (GTP) Construction Emissions

Construction activities for the GTP would take place over nine years, beginning in Year 1 of the Project construction schedule. Table 7.1.3-6 provides a summary of the total annual emissions of criteria air pollutants and GHGs for construction of the GTP and appurtenant facilities, including the PBTL.

TABLE 7.1.3-6

Total Annual Construction Emissions for the Gas Treatment Plant (GTP)

Project Construction Year	tons/year						Metric Tonnes CO_2e/year
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	GHG
1	3	29	20	140	15	0	6,897
2	17	147	141	683	137	3	50,110
3	21	244	184	597	117	7	49,861
4	18	217	168	515	73	6	45,462
5	22	245	223	572	71	8	58,961
6	23	241	234	565	70	8	61,684
7	21	227	198	604	72	6	55,536
8	14	187	93	537	64	6	32,979
9	4	28	22	247	26	0	11,475
TOTAL	143	1,565	1,283	4,460	645	44	372,965

7.1.3.4 Non-jurisdictional Facilities

Construction emissions from the PTU Gas Expansion project and PBU MGS project would be similar to GTP, PBTL, and PTTL project elements based on the following:

- North Slope construction methods for logistics and winter/summer timing of activities;
- Use of granular pads for infrastructure components;
- Aboveground pipeline design and installation methods;
- Use of modular facilities that are fabricated elsewhere; and
- Use of drilling equipment and procedures adapted to North Slope conditions.

The PTU Gas Expansion is expected to begin construction in Year 3 and with construction completed in Year 7. PTU drilling to support the Project would begin in Year 5 and would be completed in Year 8. For the PBU MGS project, construction would begin in Year 2 and would be completed in Year 6. Drilling at the PBU to support the Project would begin in Year 6 and be completed in Year 10.

Kenai Spur Highway relocation project construction emissions would be similar to site preparation, granular material source development, and road construction elements for the Liquefaction Facility and site clearing construction elements of the Mainline based on the following:

- Kenai and Nikiski area construction methods and logistics based on vegetation, soil, and groundwater conditions;
- Use of local area material sources; and
- Typical paved road design and construction methods for classified fill, compaction, and paving.

Construction to relocate the Kenai Spur Highway would begin in Year 1 and would be complete in two construction seasons.

Table 7.1.3-7 provides a summary of the total annual emissions of criteria air pollutants and GHGs for construction of the non-jurisdictional facilities, including the PTU Expansion project, PBU MGS project, and Kenai Spur Highway relocation. These emissions include drilling at the PTU and PBU.

TABLE 7.1.3-7

Total Annual Construction and Drilling Emissions for Non-Jurisdictional Facilities

Project Construction Year	tons/year						Metric Tonnes CO_2e/year
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	GHG
1	1	9	6	8	2	0	1,384
2	4	26	30	105	13	0	7,490
3	363	911	1,450	274	134	2	73,827
4	720	1,732	2,864	558	267	3	139,301
5	949	3,214	3,525	589	306	76	310,684
6	1,007	3,749	3,679	541	312	76	358,659
7	1,006	4,461	3,669	312	288	76	355,720
8	176	1,619	501	47	35	37	137,732
9	60	545	165	13	13	1	50,859
10	60	545	165	13	13	1	50,859
TOTAL	4,347	16,811	16,054	2,460	1,382	271	1,486,513

7.1.4 Air Quality Emissions and Potential Impacts from Operations Sources

Federal and state air quality regulations govern emissions of criteria air pollutants, hazardous air pollutants (HAPs), state-only specified pollutants (ammonia), VOCs in general, ozone-depleting substances, and GHGs in certain cases. Under its New Source Review (NSR) and Title V operating permit programs, ADEC issues construction and/or operating permits to new, modified, and existing stationary sources or facilities. These permits would establish terms and conditions for compliance with air quality standards, require compliance with source-specific emission standards, and provide a monitoring, recordkeeping, and reporting mechanism to verify continued compliance. Specific air permitting and regulatory requirements are discussed in Section 7.1.1. Compliance with these regulations requires, among other things, detailed Project data on operations and emissions, as well as analyses of potential ambient air quality impacts and impacts on other air quality related values.

The assessments provided in this section evaluate air quality emissions and impacts from Project operations and include emissions from facility equipment and marine vessels in the immediate vicinity of the berths. Specifically, marine operations occurring within 1,640 feet (500 meters) of the berths were modeled, which includes: loading and hoteling operations for LNGCs while in port, maneuvering of the carriers into and out of port, and maneuvering and idling of marine tugs while assisting the carriers. Support

equipment sources, such as onsite vehicles, are not included in modeling impacts because they are negligible.

7.1.4.1 Liquefaction Facility

7.1.4.1.1 LNG Plant Emissions

Natural gas delivered via the Mainline would flow from the LNG Plant receipt point (plant inlet flange) through a pressure regulating station and undergo flow control, separation, and filtration. A detailed process description is provided in Resource Report No. 1. LNG would then be transferred to the LNG storage tanks for subsequent delivery to LNGCs. The processing operations would include the following general sources of emissions:

- Approximately 550 megawatts (MW) of natural gas turbine compressor capacity. These turbines are expected to be equipped with lean premix air/fuel controls designed to reduce NO_x and CO emissions to nominally 10 ppm, respectively, at 15 percent O_2. Precise emissions performance data was genericized as potentially commercially sensitive information, and the use of installed capacity is a better reflection of potential impacts;
- Natural gas power generation turbines with potential for supplemental firing and heat recovery steam generators. Total power generation capacity will be approximately 115 MW;
- A gas-fired thermal oxidizer for controlling breathing and working losses from the C5+ storage tank and the C5+ loading facilities;
- One reciprocating internal combustion engine for an emergency firewater pump, and one for auxiliary air compression;
- Four flares, including ground flares and elevated low pressure flare for emergency and routine control of excess gas; and
- At least one liquid-fired auxiliary diesel-generator set of docked LNGCs handling the hotel load, sea water, and freshwater cooling pumps, as well as ballast pumps.

Emissions estimates are based on Project design data for equipment and operations. Key input data are the total firing rate for turbines, hours of operation, projected load, projected gas heat content, and projected use of diesel fired engines, including air compression and support for LNGC hoteling and running equipment when at berth. Emission factors are derived from standard databases or vendor data from typical sources such as turbines, heaters, and engines. Vendor data that are used are considered representative of emissions, but should not be treated as a representation of equipment to be used in the final design. Details of the equipment design, fuel use, hours of operation, emission factors, projected load factors, and other operational considerations are provided in Resource Report No. 9, Appendix D.

Fugitive emissions of volatile organic compounds and methane would be emitted from piping components and connectors throughout the LNG Plant. Emissions are estimated from component counts (valves, flanges, pumps, compressors, etc.) and EPA and industry emission factors.

Based on the design that is available, short-term and annual emissions from operation of this equipment, including fugitive emissions and potential HAPs, are provided in Table 7.1.4-1. Emission calculations are included in Appendix D. Hourly and short-term emissions are based on worst-case assumptions regarding performance and maximum facility design capabilities, using vendor-supplied emission data, where available, or standard emission factors. Emissions are for normal operation of the LNG Plant and include mobile and non-road emissions associated with operation, but do not include flaring except for pilot/purge.

TABLE 7.1.4-1

Total Emissions from LNG Plant Operations

Pollutant	Potential to Emit (pounds per hour)	Potential to Emit (tons per year)
Nitrogen Oxides (NO_X)	363	1,181
Carbon Monoxide (CO)	741	1,734
Volatile Organic Compounds (VOCs)	609	216
Particulate Matter (PM_{10})	91	260
Particulate Matter ($PM_{2.5}$)	91	260
Sulfur Dioxide (SO_2)	24.7	90
Largest Individual Hazardous Air Pollutant (Formaldehyde)[c]	7.0	25.8
Total Hazardous Air Pollutants (HAPs)	11.5	37.7
Total Greenhouse Gas (GHG) Emissions (CO_2e)[a,b]	Not Applicable	3,850,732

[a] Annual emissions of GHGs are reported in metric tons (tonnes) per year.

[b] The total GHG emissions are calculated as CO_2 equivalent (CO_2e) emissions, i.e., the sum of individual GHGs with the annual tons of each gas multiplied by its Global Warming Potential (GWP) relative to CO_2. CH_4 is converted to CO_2e by multiplying its emissions by the GWP of 25, and N_2O is converted to CO_2e by multiplying its emissions by the GWP of 298.

[c] Product of incomplete combustion

7.1.4.1.2 LNG Carrier Emissions

Marine vessels (both LNGCs and support vessels) would be used to transport LNG from the Marine Terminal in Cook Inlet to various international destinations. On March 26, 2010, the International Maritime Organization (IMO) amended the International Convention for the Prevention of Pollution from Ships (Marine Pollution Protocol [MARPOL]) designating specific portions of U.S., Canadian, and French waters as an Emission Control Area (ECA), including the waters of Cook Inlet and the Nikiski vicinity. Vessels subject to the rule and operating in ECAs must use fuel (typically marine diesel oil) with sulfur no greater than 0.1 percent and must use engines on new or reconstructed ships that meet Tier III NO_X standards. See 40 C.F.R. § 1043.60 for details.

In compliance with 40 C.F.R. § 1043, vessels subject to the rule operating in U.S. ECA waters are generally required to obtain from EPA an Engine International Air Pollution Prevention (EIAPP) Certificate or otherwise provide evidence of conformance with MARPOL Annex VI. Compliance requirements for various potentially applicable regulations could include engine design data, certifications, date of engine manufacture, emissions test data, and in-use fuel specifications, including sulfur limits in fuel. Tugs used in marine operations must comply with rules distinct from the IMO/MARPOL rules. The rules applicable to tugs are administered by EPA and require engines to meet tier standards based on year of manufacture. In addition, the tugs using diesel engines must fuel those engines with ultra-low sulfur diesel containing 15 ppm sulfur or less.

Emissions estimates for marine operations are provided in Resource Report No. 9, Appendix D for tugs and LNGCs both in transit through Alaska waters and in dock. Consistent with guidance from FERC, marine operations transit emissions are limited to those emitted while a vessel is within “state waters.” The Project design is for production up to 20 million metric tonnes per year of LNG shipping (44 million cubic meters per year for average density LNG). LNG carriers are assumed to hold 216,000 cubic meters, resulting in about 204 calls per year, with a mix of 98 percent of the units driven by combustion engines and two percent by steam turbines. Five percent of each group arrives in a “warm” status and would have to be cooled down prior to loading. Emissions were calculated for this mix of carriers based on 18 hours of LNG loading (including potentially 18 hours of hoteling and running auxiliary machinery) and a total of 16.5 hours in all phases of transit. Four tugs of 90-ton bollard pull capacity would support each carrier arrival and departure

at the terminal and one tug would be in standby near the LNGC while the carrier is at berth. Total emissions for these operations, including transit, loading, and hoteling, are provided in Table 7.1.4-2. Detailed calculations of LNGC and marine emissions are provided in Resource Report No.9, Appendix D.

TABLE 7.1.4-2

Total Annual Emissions from LNGC and Tug Support Operations (tons per year)

Pollutant	Total
Nitrogen Oxides (NO_X)	380
Carbon Monoxide (CO)	630
Volatile Organic Compounds (VOCs)	117
Particulate Matter (PM_{10})	14.0
Particulate Matter ($PM_{2.5}$)	13.0
Sulfur Dioxide (SO_2)	1.2
Total Hazardous Air Pollutants (HAPs)	0.3
Total GHG Emissions (CO_2e)[a,b]	81,248

[a] Annual emissions of GHGs are given in metric tons (tonnes) per year.

[b] The total GHG emissions are calculated as CO_2 equivalent (CO_2e) emissions, i.e., the sum of individual GHGs with the annual tons of each gas multiplied by its Global Warming Potential (GWP) relative to CO_2. CH_4 is converted to CO_2e by multiplying its emissions by the GWP of 25, and N_2O is converted to CO_2e by multiplying its emissions by the GWP of 298.

Note that LNGCs, when not loading, and tug emissions are not included in LNG Plant emissions for permit applicability purposes.

7.1.4.2 Interdependent Project Facilities

7.1.4.2.1 Mainline

The Mainline would be an approximately 806-mile, 42-inch natural gas pipeline transporting 3.3 billion cubic feet per day of treated gas at 2,075 psig MAOP from the GTP to the Liquefaction Facility. Once in operation, emission sources from the Mainline would include eight compressor stations, and one standalone heater station. Based on the proposed design, other aboveground pipeline facilities, such as metering stations, would not have permitted emission "point" sources, but would include fugitive emissions. Each compressor and heater stations, is anticipated to trigger the minor air quality control permit requirements under 18 AAC 50.502(c)(1).

7.1.4.2.1.1 Compressor and Heater Stations Emissions

The Sagwon Compressor Station would operate two turbine-driven compressors, with one available for standby. The other compressor stations have single-unit turbine-driven compressors. All sites would include power generators, auxiliary glycol heaters or indirect fired heaters, and waste incinerators. Operation of these units is described in Resource Report No. 9, Appendix E.

TABLE 7.1.4-3

Compressor Station Emission Unit Inventory

Station	Station Type (Nominal Horsepower [HP])	Major Equipment (Number of Units)
Sagwon	Multi-Unit with Cooling (~68,000 HP)	Turbine-driven Compressors (3) Power Generators (4) Auxiliary Utility Glycol Heaters (2) Waste Incinerator (1)

TABLE 7.1.4-3

Compressor Station Emission Unit Inventory

Station	Station Type (Nominal Horsepower [HP])	Major Equipment (Number of Units)
Galbraith Lake, Coldfoot, Ray River, Minto, Healy	Single-Unit with Cooling (~42,000 HP)	Turbine-driven Compressor (1) Power Generators (3) Auxiliary Utility Glycol Heaters (2) Waste Incinerator (1)
Honolulu Creek, Rabideux Creek	Single-Unit without Cooling (~33,000 HP)	Turbine-driven Compressor (1) Power Generators (3) Auxiliary Utility Glycol Heaters (2) Waste Incinerator (1)
Theodore River	Heater Station	Power Generators (3) Indirect Fired Gas Heaters (9) Waste Incinerator (1)

Total estimated annual emissions of criteria air pollutants from each type of compressor stations is shown in Table 7.1.4-4 with further details included Appendix F of Appendix E in Resource Report No. 9. Based on these data, each of the compressor and heater stations would require an air quality construction permit from ADEC prior to construction.

TABLE 7.1.4-4

Total Annual Emissions from Compressor and Heater Station Operations (tons/year)

Pollutant	Multiple Turbine Compressor Station with Cooling (Sagwon)	Single Turbine Compressor Station with Cooling (Galbraith Lake, Coldfoot, Ray River, Minto, Healy)	Single Turbine Compressor Station without Cooling (Honolulu Creek), Rabideux Creek	Heater Station (Theodore River)
NOx	185	161	131.2	49
CO	248	244	200	103
VOCs	34	21	13.9	16.2
$PM/PM_{10}/PM_{2.5}$ [a]	29	13.1	10.6	8.7
SO_2	4.8	4.3	3.5	2.6
Maximum HAP	7.9	6.3	5.0	2.1
Total HAPs	10.7	8.3	6.6	4.2
GHGs[b]	233,784	206,382	166,013	125,201

[a] Potential PM_{10} and $PM_{2.5}$ emissions are conservatively assumed to equal potential PM emissions.

[b] Annual emissions of GHGs are given in metric tons (tonnes) of CO_2e per year.

Fugitive emissions of organic compounds, including some HAPs, would be emitted from piping components and connectors throughout the compressor station. The total estimated fugitive emissions of GHGs, VOCs, and HAPs from normal operation of each compressor station are included in Table 7.1.4-4, along with the emission rate for the highest (maximum) emitted HAP, which is essential in determining the requirements for emissions of HAPs. Fugitive emissions for each of the compressor stations were calculated based on preliminary component counts and the EPA emission factors found in Table 2-4 of the EPA Protocol for Equipment Leak Emissions (EPA-453/R-95-017, November 1995) and subsequent procedures.

7.1.4.2.2 Other Aboveground Pipeline Facilities

There are no proposed combustion sources emission units at other aboveground facilities along the Mainline.

Fugitive emissions of organic compounds, including the GHGs methane and CO_2, would be emitted from piping components and connectors along the pipelines (Mainline, PTTL, and PBTL). The Interstate Natural Gas Association of America has created guidance for calculating CH_4 and CO_2 leak emissions from a natural gas pipeline. The methodology uses the length of the aboveground pipeline, based on the assumption of cathodic protection, and the number of meter stations to determine an estimate of the annual fugitive emissions. There are four metering stations planned—three in the vicinity of the GTP and one at the inlet to the Liquefaction Facility. There are 30 mainline block valves (MLBVs) in the proposed design.

Table 7.1.4-5 provides the estimated annual fugitive GHG emissions for these pipeline operations (excluding the GTP and compressor station fugitives, which are included in those facilities).

TABLE 7.1.4-5

Estimated Pipeline Fugitive Greenhouse (GHG) Gas Emissions

Pollutant	Segment	No. of stations or miles	Emission Factor [a,b]	Emissions (tonnes per year)
MAINLINE				
Methane (CH_4)	Meter/Regulator	2	2,533 lb CH_4/station-yr	2.30
	Pipeline Length	806	23.08 lb CH_4/mile-yr	8.44
Carbon Dioxide (CO_2)	Meter/Regulator	2	146.34 lb CO_2/station-yr	0.13
	Pipeline Length	806	1.52 lb CO_2/mile-yr	0.56
CO_2 from CH_4 Oxidation	Pipeline Length	806	7.59 lb CO_2/mile-yr	2.77
			Mainline Total GHG Emissions (CO_2e)[c]	271.86
PTTL				
Methane (CH_4)	Meter/Regulator	1	2,533 lb CH_4/station-yr	1.15
	Pipeline Length	63	23.08 lb CH_4/mile-yr	0.66
Carbon Dioxide (CO_2)	Meter/Regulator	1	146.34 lb CO_2/station-yr	0.07
	Pipeline Length	63	1.52 lb CO_2/mile-yr	0.04
CO_2 from CH_4 Oxidation	Pipeline Length	63	7.59 lb CO_2/mile-yr	0.22
			PTTL Total GHG Emissions (CO_2e)[c]	45.54
PBTL				
Methane (CH_4)	Meter/Regulator	1	2,533 lb CH_4/station-yr	1.15
	Pipeline Length	1	23.08 lb CH_4/mile-yr	0.01
Carbon Dioxide (CO_2)	Meter/Regulator	1	146.34 lb CO_2/station-yr	0.07
	Pipeline Length	1	1.52 lb CO_2/mile-yr	0.001
CO_2 from CH_4 Oxidation	Pipeline Length	1	7.59 lb CO_2/mile-yr	0.003
			PBTL Total GHG Emissions (CO_2e)[c]	29.06
			Total Pipeline Fugitive GHG Emissions (CO_2e)[c]	346.46

[a] The meter/regulator emission factor is in units of pounds per station per year.

[b] The pipeline length emission factor is in units of pounds per mile per year.

[c] The total GHG emissions are calculated as CO_2e emissions, i.e., the sum of individual GHGs with the annual tons of each gas multiplied by its GWP relative to CO_2.

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Source: Interstate Natural Gas Association of America 2005, Table 4-3.

7.1.4.2.3 Point Thomson and Prudhoe Bay Gas Transmission Lines

There are no combustion emission sources required for operation of either the PTTL or PBTL. Estimates of fugitive GHG emissions from operation of these pipelines are provided in Table 7.1.4-5.

7.1.4.2.4 Gas Treatment Plant Emissions

The design of the GTP consists of three identical gas processing trains that receive gas from the PTU and PBU, clean the gas by removing CO_2 and H_2S and send this By-product stream back to Prudhoe Bay, remove any water and inject it down a Class I well, then ship the remaining natural gas down the Mainline to the LNG Plant in Nikiski. See Resource Report No. 1 for a complete description of the GTP.

A number of air emission units are required to operate the GTP:

- Approximately 298,000 International Organization for Standardization (ISO) horsepower of mechanical drive natural gas turbine capacity to support treated gas compression;
- Approximately 205,000 ISO horsepower of mechanical drive natural gas turbine capacity to support Byproduct gas (CO_2) compression;
- Approximately 230 ISO MW of natural gas turbine capacity to support power generation;
- Supplemental firing of waste heat recovery units associated with mechanical drive;
- Natural gas-fired common utility heaters (two primary, one reserve);
- Diesel-fired essential generator;
- Diesel-fired firewater pumps;
- A dormitory emergency diesel generator;
- A communications tower diesel generator;
- Buyback gas bath heaters;
- Camp heaters;
- Low pressure CO_2 flares;
- High pressure CO_2 flares;
- Low pressure hydrocarbon flares; and
- High pressure hydrocarbon flares.

Emissions estimates are based on preliminary Project design data for equipment and operations. Key input data are the total firing rate for turbines and heaters, hours of operation, projected load, the projected gas heat content, and projected use of diesel fired engines. Emission factors are derived from standard databases or vendor data from typical sources such as turbines, heaters, and engines. Vendor data that are used are considered representative of emissions, but are not implied as the data for the final design equipment. Details of the equipment design, fuel use, hours of operation, emission factors, projected load factors, and other operational considerations are provided in Resource Report No.9, Appendix F.

Fugitive emissions of organic compounds would be emitted from piping components and connectors throughout the GTP. Emissions are estimated from component counts (valves, flanges, pumps, compressors, etc.) and EPA and industry emission factors.

Based on the proposed design, short-term and annual emissions from operation of this equipment, including fugitive emissions and potential HAPs, are provided in Table 7.1.4-6. Emission calculations are included in Resource Report No.9, Appendix F. Hourly and short-term emissions are based on worst-case assumptions regarding performance and maximum facility design capabilities, using vendor-supplied emission data, where available, or standard emission factors that are cited in the Appendix. Emissions are for normal operation of the GTP. Sulfur dioxide emissions reflect the use of “raw” fuel gas, which is

expected to be used on initial facility commissioning. Use of "treated" fuel gas after commissioning is expected to reduce sulfur dioxide emissions by approximately 80 percent.

TABLE 7.1.4-6

Total Emissions from GTP Operations

Pollutant	GTP Potential to Emit (pounds per hour)	GTP Potential to Emit (tons per year)
Nitrogen Oxides (NO_X)	682	2,242
Carbon Monoxide (CO)	767	2,080
Volatile Organic Compounds (VOCs)	97	354
Particulate Matter (PM_{10})	69	264
Particulate Matter ($PM_{2.5}$)	69	264
Sulfur Dioxide (SO_2)[c]	157	593
Largest Individual Hazardous Air Pollutant (Formaldehyde)	5.9	25.8
Total Hazardous Air Pollutants (HAPs)	9.8	42
Total GHG Emissions (CO_2e)[a,b]	Not Applicable	4,201,860

[a] Annual emissions of GHGs are given in metric tons (tonnes) per year.

[b] The total GHG emissions are calculated as CO_2 equivalent (CO_2e) emissions.

[c] SO_2 emissions based on commissioning when part of the facility will combust raw gas with 90 ppmv H_2S. This severely overstates PTE for normal GTP operations which will likely be based on 16 ppmv H2S. Normal operations PTE can be estimated by multiplying listed values by 16/90

7.1.4.3 Non-jurisdictional Facilities

Operations emissions from PBU MGS project and new facilities are anticipated to be limited to insignificant sources associated with new valve module heating and fugitive emissions of organic compounds emitted from piping components and connectors. Rather, net PBU emissions would actually decrease once the PBU MGS project begins because PBU turbine capacity currently needed for gas re-injection would be reduced. Future PBU emissions from CGF and CCP under the PBU MGS project are summarized in Table 7.1.4-6. These emissions are the net change from baseline (i.e., the no action alternative) for the MGS build alternative. See Resource Report No. 9, Appendix G for more details.

Operations emissions from the PTU Expansion project and new facilities are anticipated to be similar to current operating emission for the PTU Initial Production System (IPS) including natural gas production, and gas transportation. Like the PBU MGS project, PTU expansion emissions for the build alternative have been estimated and summarized in Table 7.1.4-6 as the net change in emissions from baseline (i.e., IPS with no gas expansion).

Kenai Spur Highway relocation project operation emissions are limited to assorted vehicle emissions that use the highway. However, relocation of the Kenai Spur Highway is not expected to have a material change in traffic emissions.

TABLE 7.1.4-6

Total Annual Operations Emissions for Non-Jurisdictional Facilities[a]

Project Construction Year	tons/year						tonnes/year[b]
	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2e
Year 10	-17	-3,038	-415	-51	-51	-39	-784,058
Year 15	-35	-6,020	-811	-110	-110	-84	-1,740,665
Year 20	-51	-10,427	-1,236	-174	-174	-98	-2,661,040
Year 25	-62	-13,021	-1,420	-211	-211	-128	-3,260,432

[a] Operations emissions are the net change from the baseline, which is the build alternative emissions less the no action alternative.
[b] Annual emissions of GHGs are reported in metric tons (tonnes) per year.

7.1.5 Applicable Air Quality Regulatory Requirements – Operations

7.1.5.1 Summary of Federal and State Regulatory Requirements

This section provides an overview of applicable regulations and expected compliance requirements. Some of the more significant provisions are discussed in more detail in the subsequent sections.

The federal programs discussed below are implemented by ADEC, which is the regulatory agency for state-only programs. A summary of applicable regulations is provided for federal rules in Table 7.1.5-1 and for Alaska state regulations that are implemented by ADEC in Table 7.1.5-2.[19]

Note that the regulations identified in Tables 7.1.5-1 and 7.1.5-2 may apply at one Project site, but not another. For example, based on design information, the PSD rules would apply to permitting the LNG Plant and the GTP, but not other stationary sources.

TABLE 7.1.5-1

Federal Air Quality Regulations Potentially Applying to the Project – Operation

Citation/Part of 40 C.F.R.	Title	Description
50	NAAQS	Modeling and any monitoring must comply with NAAQS.
51 Appendix W	Guideline on Air Quality Modeling	Dispersion modeling in support of permit applications must comply with this regulation.
§ 52.21	PSD Regulations	Applies to major stationary sources and modifications; see Section 9.2.6.2
58 Appendix E	Air Quality Monitoring	Applies for stationary sources that submit ambient air monitoring data in support of applications
60 Subpart A	General Provisions for NSPS	Includes general notifications, recordkeeping, reporting, and sampling requirements for affected units
§ 60.18	Flare compliance requirements	Includes flare design standards and monitoring requirements for flares used as NSPS emission control devices
60 Subpart Db	NSPS for boilers and heaters > 100 MMBtu/hr	Regulates NOx, SO_2, PM emissions from boilers and heaters
60 Subpart Dc	NSPS for boilers and heaters > 10 MMBtu/hr	Standards for small boilers, generally regulating SO_2 and PM emissions from oil (and solid fuel) fired units
60 Subpart Kb	NSPS for Tanks < 75 m^3	Can apply to tanks storing volatile organic liquids
60 Subpart IIII	NSPS for Compression Ignition Engines	Emissions limits, monitoring, testing requirements for diesel-fired engines based on use, horsepower, and engine sizes

[19] This summary reflects the United States Supreme Court decision in UARG v. EPA, 573 U.S. __ (2014) and the July 24, 2014, EPA Guidance indicating that EPA will no longer treat GHGs as an air pollutant for purposes of determining whether a source is a major source required to obtain a PSD or Title V permit. However, GHG emissions would trigger a BACT review under PSD if total annual emissions are 75,000 tons or more.

TABLE 7.1.5-1

Federal Air Quality Regulations Potentially Applying to the Project – Operation

Citation/Part of 40 C.F.R.	Title	Description
60 Subpart JJJJ	NSPS for Spark Ignition Engines	Emissions limits, monitoring, testing requirements for spark-ignition natural gas-fired engines based on use, horsepower, and engine sizes.
60 Subpart KKKK	NSPS for Combustion Turbines including Supplemental Firing	Includes NOx and SO_2 limits for turbines > 10 MMBtu/hour heat rate, monitoring, testing, recordkeeping and reporting requirements
60 Subpart OOOOa	NSPS for Natural Gas Production and Transmission	Applies to onshore operations, including processing, transmission, and storage facilities. Contains monitoring, notification, recordkeeping and reporting requirements.
63 Subpart A	NESHAPs General Provisions	General compliance for listed sources of hazardous air pollutants, includes permitting requirements, monitoring, recordkeeping, reporting, and includes standards for flares used as NESHAPs emission control devices.
63 Subpart HH	NESHAP for oil and gas production facilities	Applies to VOC/HAP emission from major and area sources including glycol dehydration units, tanks and compressors. May be exempt based on liquid hydrocarbon production rates (<39,700 liter/day), (10,500 gal) and other factors.
63 Subpart HHH	NESHAP for natural gas transmission and storage	Applies to natural gas transmission and storage facilities, but only at sites with a glycol dehydration unit.
63 Subpart YYYY	NESHAPs for combustion turbines	Applies at major HAP sources, but not on the North Slope, except for notifications
63 Subpart ZZZZ	NESHAPs for stationary engines	Applies to RICE, including generator engines, emergency generator engines, firewater pump engines, etc. Compliance generally demonstrated by complying with NSPS Subparts IIII or JJJJ.
63 Subpart DDDDD	NESHAPs for Boilers and heaters at major sources	Applies to boilers and process heaters at major HAP sources. Natural gas fired units must conduct five-year tune-ups.
63 subpart CCCCCC	NESHAPs for Gasoline Dispensing Facilities	Applies to an onsite gasoline dispensing facility, with requirements based on monthly throughput.
68	Chemical Accident Prevention	Applies to stationary sources that have more than the threshold quantity of a regulated toxic or flammable substance.
71	Title V operating Permits	Major sources > 100 ton/year and certain NSPS and NESHAP sources must obtain an operating permit from ADEC.
80 Subpart I	ECA Marine Fuel Standards	May apply to end-users of marine fuel.
82	Stratospheric Ozone Protection	Applies to facilities with listed refrigerants, to manage and control emissions or releases from those units.
89	Non-road compression ignition engines	Applies to pre-2014 non-road compression-ignition engines, including portable units
91	Marine spark-ignition engines	May apply to specific marine spark-ignition engines
94	Marine compression-ignition engines	May apply to specific marine compression-ignition engines
98 Subparts A, C, and W	Mandatory GHG reporting rule	Sources with > 25,000 metric tons/year of CO_2e emissions must calculate and submit annual reports of GHG emissions.
1042	Marine compression-ignition engines	May apply to certain end-users of marine compression-ignition engines
1043	Control of Emissions under MARPOL	Controls NOx, SO_2, and PM emissions from marine vessels subject to MARPOL Protocol.

TABLE 7.1.5-2

Alaska Air Quality Regulations Potentially Applying to the Project – Operation

Citation to 18 AAC 50	Title	Description
50.010	Ambient air quality	Facility must be designed and permitted to operate in compliance with ambient air quality standards.
50.020	PSD Baseline dates and maximum allowable increases	Facility must be designed and permitted to operate in compliance with the PSD increments. PSD increments will be evaluated for LNG and GTP operation.
50.025	Visibility and other special protection areas	Establishes visibility protections for three areas, including (1) Mt. Deborah and the Alaska Range East, as viewed from approximately the Savage River Campground area, (2) Mt. McKinley, Alaska range, and Interior Lowlands as viewed from the vicinity of wonder Lake, and (3) geographic areas classified as Class I under 18 AAC 50.15(c). This last group is also an area with federally enforceable visibility protection, but this provision allows ADEC to interpret and regulate visibility impacts under its own rules.
50.035 (a) (2)	Documents adopted by reference	Adopts the *Workbook for Plume Visual Impact Screening and Analysis (Revised)* EPA 454/R-92-023, October 1992 as a means of addressing visibility impacts.
50.040 (a)	New Source Performance Standards	Adopts the Federal New Source Performance Standards, including Subpart A general provisions, Subpart IIII for compression ignition reciprocating internal combustion engines, Subpart JJJJ for spark ignition reciprocating internal combustion engines, Subpart KKKK for stationary combustion turbines, and Subpart OOOO for natural gas production and transmission.
50.040(c)	National Emission Standards for Hazardous Air Pollutants	Adopts the Federal National Emission Standards for Hazardous Air Pollutants, including the Subpart A for general provisions, Subpart YYYY for stationary combustion turbines, Subpart ZZZZ for stationary reciprocating internal combustion engines, and Subpart DDDDD for industrial, commercial, and institutional boilers and process heaters located at major HAP sources.
50.045 (d)	Prohibitions	A person who causes or permits bulk materials to be handled, transported, or stored, or who engages in any industrial activity or construction project shall take reasonable precautions to prevent particulate matter from being emitted into the ambient air. No specific permitting or approval for compliance is required; however, the agency may take action if this provision is violated, particularly in response to a complaint by the general public.
50.050	Incinerator emission standards	Requires opacity to be 20 percent or less averaged over any six consecutive minutes. No limit exists for particulate matter emissions for incinerators that have a rated capacity less than 1,000 pounds per hour. Project design indicates that no incinerators will exceed that design threshold, but if rated capacity is above that level, the PM emission standards would apply.
50.055	Industrial Processes and fuel burning equipment	This rule limits visible emissions from industrial process or fuel-burning equipment to 20 percent or less for any consecutive six-minute period. Particulate matter emissions from fuel-burning equipment also must comply with grain loading standards in § (b) of the regulation. Sulfur compound emissions from an industrial process or fuel-burning equipment may not exceed 500 ppm averaged over three hours.
50.070	Marine Vessel visible emission standards	Establishes marine vessel visible emission standards and would apply to marine vessels that are used in support of construction both of the pipeline across Cook Inlet and of the LNG terminal facilities. Specific visibility standards apply to these vessels.

TABLE 7.1.5-2

Alaska Air Quality Regulations Potentially Applying to the Project – Operation

Citation to 18 AAC 50	Title	Description
50.080	Ice fog standards	Allows ADEC to require a permit to reduce water vapor emissions for fuel burning equipment or an incinerator in areas of potential ice fog
50.100	Non-road engines	Specifies that the emissions from non-road engines (heavy equipment, portable generators, and any engines that are temporary) are not included when determining the classification of a stationary source or modification for a permit.
50.110	Air pollution prohibited	ADEC can restrict emissions which may be injurious to health, welfare, property or unreasonably interfere with the enjoyment of life or property. Construction activities that may cause excessive dust, particularly near residences or sensitive receptors, may be curtailed under this regulation if a complaint is received and ADEC considers the impacts to be within these adverse determinations.
50.215	Ambient air quality analysis methods	Provides methods for analyzing (or modeling) ambient air quality impacts for permitting.
50.220	Test methods	References test methods for demonstrating compliance with emission limits.
50.225	Owner requested limits	Operators and owners can request emission limits that limit applicability of other air quality regulations.
50.235	Unavoidable emergencies	Establishes rules for reporting and responding to emergencies related to air pollution
50.240	Excess emissions	Provides requirements for reporting excess emissions including startup and shutdown.
50.245 and 50.246	Air Quality episodes	Allows ADEC to declare an air quality episode based on actual or potential impacts, and subsequently request voluntary reductions in emissions from stationary sources.
50.306	Prevention of Significant Deterioration (PSD) Permits	Applies to major stationary sources for construction. Applies to LNG at GTP based on preliminary data.
50.316	Preconstruction review for major source of HAPs	Provides ADEC review of federal standards under 40 C.F.R. Part 63 (Maximum Achievable Control Technology Standards). Includes obtaining a permit from ADEC.
50.326	Title V operating permits	Sources with emissions of 100 tons/year or greater of any regulated criteria pollutant (not GHG) must obtain an operating permit, renewable on a five-year basis, and when new applicable requirements affect the source.
50.345 50.346	Construction minor and operating permits standard permit conditions	Compliance requirements (standard conditions) for PSD, Title V operating, and minor sources permits and for modifications to existing stationary sources. Includes requirements for notifications, document submittals, and inventory reporting.
50.400 - 50.499	User Fees	Establishes fee schedules for permits and permit renewals
50.502	Minor construction permits	Specifies provisions for requiring a minor source construction permit for certain activity, based on the potential emissions from a stationary source or modification. Certain components of the construction activity may qualify as a stationary source depending on the duration of activity at a specific location. Minor permits must be obtained for the following potential activities under §(b) of this regulation: (1) An asphalt plant with a rated capacity of at least 5 tons/hour of product (2) A rock crusher with a rated capacity of 5 tons/hour (3) One or more incinerators with a cumulative rated capacity of 1,000 lbs./hour or more

TABLE 7.1.5-2

Alaska Air Quality Regulations Potentially Applying to the Project – Operation

Citation to 18 AAC 50	Title	Description
50.508	Minor permits requested by owner or operator	Owner or operator can establish enforceable emission limits in a permit to avoid applicability of specific regulations
50.540	Minor Permits	A minor source construction permit is required based on potential emissions.
50.544	Minor permits: content	Requires permit conditions for minor sources
50.990	Definitions	Provides regulatory definitions for air quality regulations. Should be consulted in reviewing permit and compliance requirements, including any changes or modifications.

7.1.5.2 New Source Review (NSR) and Prevention of Significant Deterioration (PSD)

Both the LNG Plant and the GTP would be major sources subject to PSD review. An applicability summary is provided in Table 7.1.5-3 based on Project information. Compressor stations are not included in the list of 28 sources provided in 40 C.F.R. § 52.21[b][1][i][a]), so are not considered major sources subject to PSD review for the Project because their total annual potential emissions of any criteria air pollutant are below 250 tons per year.

TABLE 7.1.5-3

PSD Applicability for the Liquefaction Facility and GTP – Operation

Pollutant	Liquefaction Facility Potential to Emit (tons per year)	LF PSD	GTP Potential to Emit (tons per year)	GTP PSD
Nitrogen Oxides (NO_X)	1,170	Yes	2,231	Yes
Carbon Monoxide (CO)	1,728	Yes	2,073	Yes
Volatile Organic Compounds (VOCs)	195	Yes	304	Yes
Particulate Matter (PM_{10})	259	Yes	263	Yes
Particulate Matter ($PM_{2.5}$)	259	Yes	263	Yes
Sulfur Dioxide (SO_2)	90	Yes	99[b]	Yes
Lead (Pb)	TBD	TBD	TBD	TBD
Total GHG Emissions (CO_2e)[a]	3,846,143	Yes	4,196,914	Yes

[a] GHG are reported in metric tons (tonnes) per year.

[b] Value based on 15 ppmv sulfur in the fuel gas which is representative of permitted long-term, normal operations. For a short-period of time during facility commissioning, the sulfur content of the fuel gas will be 90 ppmv sulfur in the fuel gas which is not expected to become an enforceable permit limit applicable to long-term, normal operations.

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7.1.5.3 Preconstruction Review of Major Sources of Hazardous Air Pollutants

Stationary sources that emit more than 10 tons per year of a single HAP or 25 tons per year of all HAPs combined are classified as major sources under 40 C.F.R. § 63.2. Major HAP sources are required by 40 C.F.R. § 63.5 to obtain a permit prior to construction. The construction permit required by major HAP sources is administered by ADEC under a SIP-approved program through 18 AAC 50.316.

Both the LNG Plant and the GTP would be major HAP sources subject to preconstruction review. An applicability summary is provided in Table 7.1.5-4, based on preliminary Project information. Compressor

stations would not be major HAP sources. As a result, a preconstruction review is not required for those facilities.

TABLE 7.1.5-4

Preliminary HAP-Major Applicability for the Liquefaction Facility and GTP – Operation

Pollutant	Liquefaction Facility Potential to Emit (tons per year)	LF HAP Major	GTP Potential to Emit (tons per year)	GTP HAP Major
Largest Individual Hazardous Air Pollutant (Formaldehyde)	25.8	Yes	25.8	Yes
Total Hazardous Air Pollutants (HAPs)	37.7	Yes	42.4	Yes

7.1.5.4 Minor New Source Review Permits

For new stationary sources, a minor permit is required under 18 AAC 50.502(c) (1) if (1) the source is not a major source, and (2) the potential to emit one or more criteria pollutants exceeds the following:

- 15 tons per year of PM_{10};
- 40 tons per year NO_X;
- 40 tons per year of SO_2;
- 0.6 tons per year of Pb;
- 100 tons per year of CO within 10 kilometers of a CO non-attainment area; or
- 10 tons per year of direct $PM_{2.5}$.

None of the compressor or heater stations would be major stationary sources subject to PSD, but all compressor and heater stations would be subject to minor NSR permitting. Therefore, these sources require minor source permits from ADEC prior to beginning construction.

At this time, no minor NSR permits have been identified for construction sources. A final determination would be made after construction contractors are selected.

7.1.5.5 Title V Operating Permits

Title V of the CAA requires that sources that either emit more than 100 tons per year of any criteria air pollutant or are subject to certain NSPS or NESHAP subparts obtain an operating permit under this rule. ADEC is responsible for issuing operating permits in Alaska pursuant to 18 AAC 50.326. A new source must submit a complete application for an operating permit within 12 months after the start of operation.

Based on information available at this time, the Liquefaction Facility, GTP, and all compressor and heater stations would each be required to obtain a Title V permit.

7.1.5.6 New Source Performance Standards (NSPS)

Pursuant to Section 111 of the CAA, EPA promulgates NSPS, codified in 40 C.F.R. Part 60, for certain newly constructed, modified, or reconstructed sources of emissions of criteria pollutants. These standards are based on best demonstrated technology for air pollution control of specified equipment and may be expressed as numerical emission limits, performance standards, or work practices. Subpart A of Part 60 establishes general provisions for sources subject to the various NSPS subparts, including general performance testing, monitoring, notification, reporting, and recordkeeping requirements.

Table 7.1.5-5 provides a summary of the NSPS categories under 40 C.F.R. Part 60 that are potentially applicable to emission units included in the Project. Further details regarding applicability and requirements are provided in Resource Report No.9, Appendix H. Final NSPS applicability determinations would be made after construction contractors are selected.

TABLE 7.1.5-5

Preliminary NSPS Applicability Summary for Operations

NSPS Subpart	Applicability		
	Liquefaction Facility	Compressor and Heater Stations	GTP
Subpart A – General Provisions	Yes	Yes	Yes
Subpart Da – Electric Utility Steam Generation Units	No	No	No
Subpart Db – Industrial, Commercial, and Institutional Steam Generating Units	No	No	Yes
Subpart Dc – Small Industrial, Commercial, and Institutional Steam Generating Units	No	Yes	No
Subpart Kb – Volatile Organic Liquid Storage Vessels	TBD	No	TBD
Subpart CCCC – Commercial and Industrial Solid Waste Incineration Units	No	Yes	No
Subpart IIII – Stationary Compression Ignition Internal Combustion Engines	Yes	No	Yes
Subpart JJJJ – Stationary Spark Ignition Internal Combustion Engines	No	Yes	No
Subpart KKKK – Stationary Combustion Turbines	Yes	Yes	Yes
Subpart OOOOa – Crude Oil and Natural Gas Production, Transmission and Distribution	Yes	Yes	Yes

7.1.5.7 National Emission Standards for Hazardous Air Pollutants (NESHAPs)

The 1970 CAA required that the EPA develop health risk-based standards for regulating HAP emissions. These regulations are codified in 40 C.F.R. Part 61, National Emission Standards for Hazardous Air Pollutants (NESHAPs) and apply to specific pollutants and source categories. The Project is not one of the source categories regulated under 40 C.F.R. Part 61 and, as such, the requirements of 40 C.F.R. 61 do not apply to the Project.

The 1990 CAA Amendments expanded EPA obligation to regulate HAPs and required EPA to set technology-based standards for a larger list of HAPs and for many more source categories. These NESHAPs are codified in 40 C.F.R. Part 63, also referred to as MACT standards, and regulate HAP emissions from major sources of HAPs and area sources of HAPs within specific source categories. Part 63 defines a major source of HAPs as any stationary source or group of stationary sources located within a contiguous area and under common control that has the potential to emit more than 10 tons per year of any single HAP or more than 25 tons per year of all HAPs combined. Part 63 defines an area source of HAPs as any stationary source of HAPs that is not a major source of HAPs. Preliminary HAPs emission calculations indicate that the Liquefaction Facility and the GTP are each anticipated to have the potential to emit a single HAP, formaldehyde (which is formed by chemical reaction of the products of combustion), at a rate greater than 10 tons per year. As a result, these facilities are expected to be major sources of HAPs. The compressor stations, heater stations, and metering station potential to emit total HAPs and any single HAP would be below the 25 tons per year and 10 tons per year thresholds, respectively, and would be classified as area sources of HAPs.

Subpart A of Part 63 provides the general provisions of the MACT standards, which includes monitoring, notification, and reporting requirements for sources subject to certain subparts within 40 C.F.R. Part 63. Each subpart provides a table identifying which general provisions apply to that subpart. Table 7.1.5-6 provides a summary of the MACT standards in 40 C.F.R. Part 63 that may apply to the proposed Project

facilities. Further details regarding applicability and requirements are provided in Appendix H. Final NESHAPs applicability determinations would be made after construction contractors are selected.

TABLE 7.1.5-6

Preliminary NESHAPs Applicability Summary for Operations

NESHAPs Subpart	Applicability		
	LNG Plant	Compressor and Heater Stations	GTP
Subpart A – General Provisions	Yes	Yes	Yes
Subpart Y – National Emission Standards for Marine Tank Vessel Loading Operations	No	No	No
Subpart EEE – NESHAPs from Hazardous Waste Combustors	No	TBD	No
Subpart EEEE – NESHAPs for Organic Liquids Distribution (Non-Gasoline)	TBD	No	TBD
Subpart H – Organic HAPs for Equipment Leaks	TBD	TBD	TBD
Subpart HH – NESHAPs for Oil and Natural Gas Production Facilities	TBD	No	TBD
Subpart HHH – NESHAPs for Natural Gas Transmission and Storage Facilities	No	No	Yes
Subpart YYYY – NESHAPs for Stationary Combustion Turbines	Yes	No	Yes
Subpart ZZZZ – NESHAPs for Stationary Reciprocating Internal Combustion Engines	Yes	Yes	Yes
Subpart DDDDD – NESHAPs for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters	No	No	Yes
Subpart JJJJJJ – NESHAPs for Industrial, Commercial, and Institutional Boilers Area Sources	No	No	No

7.1.5.8 Chemical Accident Prevention (40 C.F.R. 68)

Section 112(r) of the 1990 CAA Amendments requires the EPA to publish regulations and guidance for chemical accident prevention at facilities for substances that pose the greatest risk of harm from accidental releases. The chemical accident prevention provisions, also referred to as the Risk Management Program (RMP), are codified in 40 C.F.R. Part 68. The regulations include a list of regulated substances that include methane, propane, and ethylene. The regulation also includes threshold quantities (TQs) for determining applicability to stationary sources. If a stationary source stores, handles, or processes one or more regulated substances in a quantity equal to or greater than the TQ as determined per 40 C.F.R. § 68.115, the facility must prepare and submit a risk management plan to the EPA.

A preliminary Risk Management Program applicability analysis that may apply to the proposed Project facilities is summarized in Table 7.1.5-7. See Resource Report No.9, Appendix H for further details. Final applicability determinations would be made based on final facility design.

TABLE 7.1.5-7

Preliminary Risk Management Plan Applicability Summary

40 C.F.R. Part 68 - Chemical Accident Prevention Provisions	Applicability		
	Liquefaction Facility	Compressor and Heater Stations	GTP
Subpart F – Regulated Substances for Accidental Release Prevention	No	No	Yes

7.1.5.9 The Federal Greenhouse Gas Reporting Rule

EPA's Greenhouse Gas Monitoring Recordkeeping and Reporting Rule (40 C.F.R. Part 98) requires reporting of GHG emissions from suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit greater than or equal to 25,000 metric tons of GHG (as CO_2e) per year. The Liquefaction Facility, GTP, compressor stations, and heater station would all exceed 25,000 tonnes per year; therefore, they would all be subject to the GHG reporting rule. Additionally, construction of the Liquefaction Facility, GTP, and possibly Mainline could also exceed 25,000 tonnes per year, triggering GHG reporting requirements.

Reporting would be required for the first year of operation or construction that exceeds 25,000 tonnes per year. A report needs to be submitted on EPA's electronic database by March 31 of each year for the previous calendar year's emissions. Reporting is not required for construction activities from portable equipment unless stationary sources (e.g., heaters, compressors, engines) have combined emissions above 25,000 tons per year and are at the same location for 12 consecutive months.

7.1.5.10 General Conformity with Non-Attainment SIPs

Promulgated under 40 C.F.R. Part 51 Subpart W and 40 C.F.R. Part 93 Subpart B, the General Conformity Rule is used to determine if non-transportation-related federal actions meet the requirements of the CAA and the applicable SIP by ensuring that air emissions related to the action do not cause or contribute to new violations of a NAAQS or increase the frequency or severity of any existing violation of a NAAQS or interim emission reduction. A General Conformity Determination is required for federally sponsored or federally approved actions in non-attainment areas, or in certain maintenance areas, when the total direct and indirect net emissions of non-attainment pollutants (or their precursors) exceed specified thresholds (40 C.F.R. § 93.153). This regulation ensures federal actions conform to the SIP and state attainment plans.

Project representatives reviewed air pollutant emissions associated with Project activities that would be emitted within air quality non-attainment areas or maintenance areas identified in Table 7.1.5-8.

TABLE 7.1.5-8

Non-Attainment and Maintenance Areas in the Project Vicinity

Area	Relevant Emissions Type
Fairbanks North Star Borough 2006 $PM_{2.5}$ Non-attainment Area	$PM_{2.5}$ emissions and $PM_{2.5}$ precursors (SO_2 and NOx)
Fairbanks Area CO Maintenance Area (including the Fairbanks and Fort Wainwright portion and the North Pole portion of the Maintenance Area)	Carbon Monoxide
Municipality of Anchorage CO Maintenance Area	Carbon Monoxide
Eagle River PM_{10} Maintenance Area	PM_{10}

Relevant emissions would result from Project transportation/logistics activities that occur within specific non-attainment or maintenance areas and from a pipeline construction support facility that may be located in Fairbanks during Project construction. Neither Project physical construction activities nor facility operations would occur within any of the areas listed in Table 7.1.5-8.

Under Section 93.153(b) of the General Conformity rule, a conformity determination is required for each criteria pollutant or precursor where the total of direct and indirect emissions of the pollutant or precursor would equal or exceed specified "de minimis" emissions levels. For $PM_{2.5}$ nonattainment areas, CO maintenance areas, and PM_{10} maintenance areas, Section 93.153(b)(1) and (2) specifies that the de minimis emissions level for the relevant pollutants is 100 tons per year.

Table 7.1.5-9 summarizes the peak annual emissions for relevant pollutants or precursors expected to occur within each nonattainment or maintenance area within Alaska that potentially could be affected by the proposed Project.

TABLE7.1.5-9

Applicability of General Conformity to Project Emissions

Area	Relevant Emissions Type	Direct/Indirect Project Emissions (tons per year)	Does General Conformity Apply?
Fairbanks North Star Borough 2006 $PM_{2.5}$ Nonattainment Area	$PM_{2.5}$ emissions and $PM_{2.5}$ precursors (SO_2 and NOx)	3.55 tons $PM_{2.5}$/year 5.46 tons NOx/year 0.014 tons SO_2/year	No No No
Fairbanks Area CO Maintenance Area (including the Fairbanks and Fort Wainwright portion and the North Pole portion of the Maintenance Area)	Carbon Monoxide	1.90 tons CO/year	No
Municipality of Anchorage CO Maintenance Area	Carbon Monoxide	0.37 tons CO/year	No
Eagle River PM_{10} Maintenance Area	PM_{10}	0.01 tons PM_{10}/year	No

As can be seen in Table 7.1.5-9, emissions for each pollutant or precursor is far below the 100 tons per year de minimis emissions threshold. Therefore, as specified in 40 C.F.R. § 93.153(c)(1), the General Conformity provisions of 40 C.F.R. Part 93, Subpart B do not apply to federal approvals required for the Project.

7.1.5.11 Federal Marine Vessel Regulations

Several regulations could potentially apply to marine vessel emissions ranging from small service vessels to oceangoing vessels. Emission standards and certification requirements are provided in 40 C.F.R. Parts 89, 94, and 1042, based on engine size and date of manufacture. Emissions from Project-operated vessels and carriers are based on assumptions about fleet engine sizes and dates of manufacture. General compliance provisions are provided in 40 C.F.R. Part 1068 with further regulations in 40 C.F.R. Part 1043 related to implementing MARPOL Protocol for in-use fuels.

7.1.5.12 Regional Haze Rule

The federally mandated Regional Haze Rule (40 C.F.R. Part 51 Subpart P) establishes regulations to improve and protect visibility in designated Class I areas (see Section 9.2.2.2). For new sources, the program is implemented through 40 C.F.R. Subpart P § 53.307 as part of the existing NSR Program for major stationary sources and major modifications.

The EPA adopted the Regional Haze Rule to protect visibility in Class I areas. The rule lays out the specific requirements to ensure improvements in visibility in the DNPP and other large national parks and wilderness areas across the country through the mitigation of human-caused air pollution impacts. The

Regional Haze Plan describes how the State of Alaska will meet federal requirements to measure and monitor visibility, aerosols, and air pollution at Alaska's four Class I areas, how Alaska will evaluate the factors reducing visibility at each site, and how Alaska plans to identify and implement air pollution control measures on a case-by-case basis to reach natural visibility conditions by the 2064 Regional Haze Rule target date. There are no applicable requirements for the proposed facilities beyond the AQRV analyses that may be required for the PSD sources in the Project.

ADEC is required to notify the appropriate federal land managers of any proposed PSD major project that has the potential to impact a Class I area (generally within 62 miles [100 kilometers] of the Class I area). This notification must include an analysis of the project's impact on visibility in the Class I area. Impacts are assessed to ensure continued "reasonable further progress" toward attaining visibility goals in the Class I areas. Compliance can require visibility monitoring as well as the imposition of control technologies based on cost and other factors. Analyses would generally be completed as part of the PSD application.

7.1.6 Construction Regulatory Compliance and Mitigation Measures

Air quality impacts would be minimized through the use of construction equipment that is compliant with applicable NSPS, NESHAPs, and other emission standards. Impacts may also be minimized through such means as best management practices (BMPs) for construction, optimization of site layouts, and efficiency assessments of electric power and process heat uses.

The Project *Construction Emissions Control Plan* (see Resource Report No. 9, Appendix I) would discuss BMPs for how construction practices would comply with applicable requirements. A template is provided in Appendix I. Other construction mitigation plans are the Project *Fugitive Dust Control Plan* (See Resource Report No. 9, Appendix J) and the Project *Open Burning Plan* (See Resource Report No.9, Appendix K). Each of these plans would be used to identify controls and BMPs for applicable construction equipment and construction activities. Site/activity-specific plans won't be able to be developed until construction contractors are appointed, and completed versions the referenced appendix plans would be provided at that time.

7.1.7 Operational Regulatory Compliance and Mitigation Measures

Modeling analyses of the Liquefaction Facility, compressor stations, and GTP have not identified any instances where facility operations would not comply with applicable ambient air quality standards.

Air quality impacts would be minimized through the use of turbines and generators that are compliant with applicable NSPS, NESHAPs, and BACT determinations. Facilities impacts may also be minimized through such means as optimization of Project design parameters such as stack heights, building heights (which affect downwash), and efficiency assessments of electric power and process heat uses.

A Project *Operations Emission Control Plan* (see Resource Report No.9, Appendix L) would be developed that sets forth how facilities would ensure compliance with applicable requirements.

7.1.8 Greenhouse Gas (GHG) Impacts and Mitigation Measures

Observations of climate trends in Alaska and the Arctic region have been well documented in recent years. There are many causes of global climate change, and the nature of climate change is affected by complex interactions within the earth-atmosphere-ocean system. Many of these causes are undergoing extensive research, and the results of these studies may play a role in developing a deeper understanding of global climate change and its relation to local emissions.

7.1.8.1 GHG Emissions Quantification

The GHG emissions associated with the Project are calculated and summarized in Sections 9.2.3 and 9.2.5, along with other air quality emissions, and the analysis includes both construction and operating activities.

The information in Tables 7.1.8-1 and 7.1.8-2 includes emissions from construction and operation of jurisdictional facilities and non-jurisdictional connected actions.

TABLE 7.1.8-1

Total GHG Emissions from Construction (CO_2e, tonnes)

Year	Liquefaction Facility	Pipeline Spread 1	Pipeline Spread 2	Pipeline Spread 3	Pipeline Spread 4	PTTL	GTP & PBTL	NJF [a]	Totals
1							6,897	1,384	**8,281**
2	28,534	12,212	26,782	21,664	15,327		50,110	7,490	**162,119**
3	46,077	37,971	43,885	53,448	21,130	15,279	49,861	73,827	**341,478**
4	158,307	38,658	26,041	33,030	74,543	21,877	45,462	139,301	**537,219**
5	170,477	68,321	69,744	68,158	261,141	0	58,961	310,684	**1,007,486**
6	83,941	57,717	46,861	31,419	36,487	352	61,684	358,659	**676,768**
7	64,595	8,994	3,201	2,958	1,463		55,536	355,720	**492,467**
8	42,951						32,979	137,732	**213,662**
9	27,043						11,475	50,859	**89,377**
Total	**621,925**	**223,873**	**216,514**	**210,677**	**410,091**	**37,508**	**372,965**	**1,435,654**	**3,528,855**

[a] NJF = non-jurisdictional facilities

TABLE 7.1.8-2

Annual GHG Emissions from Operations

Facility	CO_2e (tonnes per year)
LNG Plant and Marine Terminal	3,850,732
LNG Carriers and Support Tugs	81,248
Compressor and Heater Stations	1,722,921
Gas Treatment Plant	4,201,860
Pipeline Fugitives	346
Non-Jurisdictional Facilities (Year 10)	-784,058
Total GHG Emissions (CO_2e)[a]	**9,073,049**

[a] The total GHG emissions are calculated as CO_2 equivalent (CO_2e) emissions, i.e., the sum of individual GHGs with the annual tons of each gas multiplied by its Global Warming Potential (GWP) relative to CO_2.

7.1.8.2 Potential Impacts

While the GHG emissions from a single project can be estimated with an acceptable level of confidence, the potential influence of those GHG emissions on global climate change is not measurable with an acceptable level of confidence and, therefore, is not addressed in this POD. The increased availability of natural gas in the world market (and potentially within Alaska) is likely to replace current use or displace future use of some higher-carbon fossil fuels, thereby resulting in an overall reduction in global GHG emissions. However, the extent to which air quality, GHG emissions, and climate might be improved

through this replacement cannot be quantified at this time[20]. Estimates for GHG emissions from jurisdictional and non-jurisdictional connected actions are provided in Table 7.1.8-1.

7.1.8.3 Mitigation Measures

Generally, mitigation measures include unit fuel combustion efficiency, management of flaring and venting, protocols for reducing and minimizing fugitive leaks of methane from the pipeline system, and management of construction and maintenance operations to minimize overall GHG emissions.

7.2 NOISE

A complete summary of potential noise impacts from construction and operation activities to fish, wildlife, and marine mammals are addressed in Resource Report No. 3. Impacts to the human environment are summarized in Resource Report No. 9.

7.2.1 Regulatory Requirements for Noise – Construction

For construction, the applicable noise limit is 55 dBA L_n, which means that between the hours of 10:00 p.m. and 7:00 a.m. local time, the equivalent sound level ($L_{eq}t$) must not exceed 55 dBA. See 18 C.F.R. § 157.206(b)(5)(iii). There are no other identified numeric regulatory requirements specific to project construction noise for any of the Project components.

7.2.2 Regulatory Requirements for Noise – Operations

7.2.2.1 Federal

At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions, but also by the effects of seasonal groundcover and other activity. Two measures used by federal agencies to relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level (L_{eq} (24)) and the L_{dn}. The L_{eq} (24) is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The L_{dn} is the L_{eq} (24) with 10 decibels added to the nighttime sound levels between the hours of 10:00 pm and 7:00 am to account for people's greater sensitivity to sound during nighttime hours.

In 1974, EPA published "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." This publication evaluated the effects of environmental noise with respect to human health and safety. EPA identified an L_{dn} of 55 dBA as a threshold for outdoor noise in residential areas (EPA, 1974). This noise level is often used by federal and state agencies to establish noise limitations for cumulative noise exposure. With a 10 decibel nighttime weighting penalty, a 55 dBA L_{dn} noise level equates to a 24-hour continuous noise level of 48.6 dBA L_{eq}(24). FERC limits the noise attributable to stationary energy facilities (such as compressor stations) to 55 dBA L_{dn} at noise-sensitive areas such as schools, hospitals, or residences.

The NPS and USFWS manage lands near the Project and may have an interest in potential noise impacts. The locations of federal lands with respect to the Project is shown on Figure 3.3.-1. The NPS does not have a numeric noise criterion for human exposure applicable to the Project. However, the NPS has a Soundscape Management Policy that states, "Using appropriate management planning, superintendents will identify what levels and types of unnatural sound constitute acceptable impacts on park natural soundscape. In and adjacent to parks, the NPS will monitor human activities that generate noise that

[20] For comparison, EPA emission factors for CO_2 are 53.06 kg/mmBtu of natural gas, 73.96 kg/mmBtu of #2 fuel oil, and 95.52 kg/mmBtu for thermal coal. See 40 C.F.R. Part 98, Subpart C, Table C-1. Thus, #2 fuel oil produces about 40% more CO_2 than natural gas and coal produces about 80 percent more CO_2 than natural gas. (EPA, 2009b).

adversely affects park soundscapes, including noise caused by mechanical or electronic devices" (NPS, 2006). As shown in Figure 3.3-1, the DNPP and Gates of the Arctic National Park and Preserve, both managed by the NPS, are adjacent to the Mainline corridor.

The USFWS does not have a numeric noise criterion for human exposure applicable to the Project. The USFWS does preserve "natural soundscapes" as an "aspect of wilderness character" to "prevent or minimize…unnatural sounds that adversely affect wilderness resources or values or visitors' enjoyment of them" (USFWS, 2008). Four NWRs managed by the USFWS are near the Mainline corridor: ANWR, Yukon Flats NWR, Kanuti NWR, and Kenai NWR.

7.2.2.2 State

The State of Alaska has not adopted noise regulations applicable to the Project. In the absence of an applicable state noise level limit, the FERC noise criterion of 55 dBA L_{dn} would be used to ensure the Project's compliance with noise regulatory requirements.

7.2.2.3 Local

Except for the Matanuska-Susitna Borough (MSB), none of the local jurisdictions have adopted noise regulations applicable to the Project.

The MSB has a noise standard that limits noise for Core Area Conditional Use Permits according to the applicable zoning district classification (e.g., residential, commercial, industrial) of the noise source and the NSAs (MSB, 2013). A portion of the Mainline corridor is located in the MSB area and would be considered an industrial entity, but it is more than 20 miles from the designated Core Area. Regardless, the FERC criterion of 55 dBA L_{dn} is equivalent to a 24-hour continuous noise level of 48.6 dBA L_{eq} (24), which is less than the 60 dBA daytime and 50 dBA nighttime limits of the MSB. Thus, the more-stringent FERC noise criterion of 55 dBA L_{dn} will be applicable to the Project.

7.2.3 Regulatory Compliance and Mitigation Measures – Construction

Noise mitigation plans are not yet available for any of the Project components. The template for a Project *Construction Noise Abatement Plan* is attached as Resource Report No. 9, Appendix V.

7.2.3.1 Liquefaction Facility

The generally applicable noise limit at the Liquefaction Facility is 55 dBA Ln because there are no other specific component noise requirements for construction of the Liquefaction Facility. Predicted noise levels are as high as 67 dBA at nearby noise sensitive areas (NSAs). Determination of noise mitigation measures will be completed prior to the issuance of the DEIS. At this time, it is anticipated that a vegetative buffer would be left in place along the eastern and southern boundaries of the site. The presence of the buffer would reduce noise levels during construction and operations.

7.2.3.2 Interdependent Project Facilities

7.2.3.2.1 Pipeline

Predicted noise levels at the two buried trenchless sites modeled would be within the applicable regulatory requirement of 55 dBA L_n at nearby NSAs. Noise modeling of construction of Coldfoot compressor stations predicts that noise levels at the nearest NSAs would be less than 55 dBA L_{dn}. Modeling of the Healy Compressor Station resulted in a prediction of maximum noise levels at nearby NSAs 61.5 dBA L_{dn} Determination of applicable noise mitigation measures will be completed prior to the issuance of the DEIS.

7.2.3.2.2 GTP

The GTP would be constructed in a heavily industrialized area. Because adjacent land uses are compatible, noise from construction of the GTP is of low concern.

7.2.4 Regulatory Compliance and Mitigation Measures - Operations

7.2.4.1 Liquefaction Facility

All significant noise sources at the Liquefaction Facility would have noise mitigation measures applied to them, as detailed in Resource Report No. 9, Appendix P. The mitigation measures include noise specifications, acoustical duct or pipe lagging, combustion turbine exhaust silencers, acoustical enclosures, inline piping silencers, and enclosing noisy skids inside buildings. With the identified mitigation measures applied, predicted noise levels for the Liquefaction Facility demonstrate compliance with the 55 dBA L_{dn} regulatory limit at nearby NSAs.

7.2.4.2 Interdependent Project Facilities

7.2.4.2.1 Pipeline Aboveground Facilities

All significant noise sources at compressor and heater stations would have noise mitigation applied to them as indicated in the sound level assessments results provided in Resource Report No. 9, Appendices Q through T. The mitigation measures include noise specifications, acoustical duct or pipe lagging, combustion turbine exhaust silencers, acoustical enclosures, inline piping silencers, blowdown silencers, and enclosing noisy skids inside buildings. With the identified mitigation measures applied, predicted noise levels for the modeled compressor and heater stations demonstrate compliance with the 55 dBA L_{dn} regulatory limit at nearby NSAs.

7.2.4.2.2 GTP

The GTP would be located in a heavily industrialized area, therefore, would be a compatible land use. Mitigation measures that address opportunities to minimize noise from the facility during operations would be incorporated into the Project design.

7.3 GEOLOGIC HAZARDS

Geologic hazards are naturally occurring events or conditions arising from the geologic environment or geological processes that can lead to damage of property, injury to people, and/or modification of landscapes. Potential geologic hazards that could impact the Project include:

- Seismic Hazards;
- Volcanic Hazards;
- Mass Wasting/Slope Stability;
- Acid Rock Drainage and Metal Leaching (ARD/ML);
- Naturally Occurring Asbestos (NOA); and
- Hydrologic Processes (Erosion and Scour).

A discussion of potential geologic hazards encountered in the proposed Project area is provided in the Resource Report No. 6. Related permafrost hazards are addressed in Section 7.6 and Resource Report No. 7.

7.3.1 Potential Construction Impacts and Mitigation Measures

Adverse effects to the Project resulting from geologic hazards, or increases to geologic hazard risks due to construction, would be avoided or greatly reduced through route selection, engineering design, monitoring, and agency consultation. In addition to these reports, industry BMPs and engineering design would be

used to prevent or mitigate adverse effects wherever possible. Overarching construction environmental management plans and operations environmental management plans would be prepared for the Project.

7.3.1.1 Liquefaction Facility

7.3.1.1.1 Surface and Subsurface Geology

Adverse effects to surface and subsurface geology would occur during site development. Impacts would be minor, including displacement of sediment changes to drainage patterns, but would remain during operation of the Liquefaction Facility. Facility design would consider site surface and subsurface geology, including sediment structure and texture and drainage patterns.

7.3.1.1.1.1 Seismicity Hazards

Fault Rupture Displacement

The Liquefaction Facility would not be located above any known active faults, and thus fault rupture displacement is not anticipated to be a hazard for this facility. However, mitigation strategies would be considered in the design of the Liquefaction Facility to reduce fuel spills. These strategies may include use of thick reinforced concrete mat foundations to prevent damage from underlying ground movements and increasing the flexibility of fuel storage facilities rigid attachments.

Seismic Wave Propagation

Ground shaking from seismic wave propagation is a significant potential hazard during construction of the Liquefaction Facility. Potential exists for damage to facility components, equipment, and construction personnel if a major earthquake would strike during the construction process. Ground shaking can occur from earthquakes on proximal crustal faults, as well as earthquakes from the Aleutian subduction zone.

The facilities would be designed to withstand the anticipated forces based on the probabilistic seismic hazard analysis (Fugro Consultants, Inc. [Fugro]. 2015c. Alaska LNG Facilities Seismic Hazard Analysis. Report No. USAL-FG-GRHAZ-00-002015-001).

Soil Liquefaction

All potential adverse soil liquefaction effects caused by an earthquake during construction would likely be localized and discontinuous. Soil liquefaction could potentially occur on a local scale due to vibratory construction activities. Areas known to be prone to soil liquefaction would be assessed in advance. Areas found to be susceptible to soil liquefaction would be avoided to the extent possible. If it is necessary to construct on soils prone to liquefaction, the Liquefaction Facility structures would be constructed using piles for settlement-sensitive structures with high lateral loads (Fugro Consultants, Inc. [Fugro]. 2015b. Alaska LNG Facilities Seismic Engineering Report. Report No. USAL-FG-GRZZZ-00-002015-003).

Tsunamis and Seiches

Tsunamis and seiches are not anticipated to be significant hazards during Liquefaction Facility construction, except for initial marine facility construction along the beach and in nearshore water. A tsunami's impact is dependent on basin bathymetries and coastline configurations and can, in particular, depend on tsunami-tide interactions (Kowalik and Proshutinsky, 2009). Cook Inlet's strong tides may intensify or dampen a tsunami, depending on mean basin depth, which is regulated by tides.

Volcanism

The most significant potential hazard that the volcanoes in the Cook Inlet area could pose to the Project is ashfall. Many of the other volcanic hazards, such as lahars, lava flows, or pyroclastic flows, are not a significant concern to the Liquefaction Facility area due to (1) the distance from the volcanoes and (2) the separation provided by Cook Inlet.

In the event of ashfall due to a volcanic eruption, every precaution would be taken to reduce damage to equipment, facilities, and personnel, including use of personal protective equipment or even evacuation of

personnel, as necessary. The effects of this hazard would be temporary as it could cause delays to the Project construction schedule.

7.3.1.1.1.2 Mass Wasting

Falls, Slides and Slumps
The Liquefaction Facility would be located on fairly flat and stable ground where falls and slides are not considered a hazard. Slumps from coastal erosion processes along the western edge of the site are possible, though not considered a significant threat to the Project as the facilities would be located sufficiently inland from the bluff to allow for both natural erosion or sluffing due to seismic activity. Design of the heavy haul road in this area would take into consideration the potential for slumps with any required ground improvements.

Flows
The Liquefaction Facility would be located on fairly flat and stable ground without major topographical features. Therefore, mudflows are not considered to be a risk at this location.

Avalanches
The Liquefaction Facility would be located on fairly flat and stable ground without major topographical features. Therefore, avalanches are not considered to be a risk at this location.

Creep and Solifluction
Creep and solifluction are not anticipated to be a hazard at the Liquefaction Facility, because permafrost is absent in this location. Solifluction is addressed in more detail in Resource Report No. 7.

Rock Glaciers
The Liquefaction Facility would be located on fairly flat and stable ground without major topographical features. Therefore, rock glaciers are not considered to be a risk at this location.

Frozen Debris Lobes (FDLs)
FDLs are not a potential hazard in the vicinity of the proposed Liquefaction Facility.

Subsidence
Subsidence hazards are not expected to be a concern at the Liquefaction Facility during construction. Regional subsidence is unlikely to occur in the Project area and the potential for localized collapse features to develop in the Project area is low. In the unlikely event of a collapse structure developing beneath any pipelines in the Liquefaction Facility, the strength and ductility of the pipeline could allow it to span over short distances without threatening the integrity of the pipeline. Thaw-settlement may occur in localized areas, as discussed in Resource Report No. 7.

Based on geologic origins and supported by geologic field mapping, no karst collapse hazards occur in the vicinity of the Project; therefore, karst collapse around the Liquefaction Facility would be unlikely.

Acid Rock Drainage
Preliminary research and field reconnaissance has shown that ML/ARD is not a concern for the Liquefaction Facility area.

Hydrologic Processes (Vertical Scour)
There are no identified flowing waterbodies within the proposed footprint of the LNG Plant. Therefore, vertical scour is not considered to be a risk at this location.

Risks due to coastal erosion processes would be assessed and standard coastal engineering shoreline protection measures such as breakwaters, rip-rap, armor stone blankets, or beach nourishment would be considered as potential alternatives to address any risk of shoreline erosion that may endanger the Liquefaction Facility.

7.3.1.2 Interdependent Project Facilities

7.3.1.2.1 Seismicity Hazards

7.3.1.2.1.1 Fault Rupture Displacement

Fault zones have been identified near the proposed Project area considered critical for potential facility strain and stress from dynamic ground motion associated with earthquakes. The pipeline would be realigned to cross active faults in the safest manner possible. All pipelines and associated facilities would be designed to withstand the predicted levels of ground deformation and incorporate current seismological engineering standards where applicable. Aboveground facilities would be sited to avoid known faults or features that would propagate impacts from a fault (see Resource Report No. 10 on facility siting).

Fault crossings for the Mainline will be constructed aboveground in an unrestrained configuration on sliding supports to avoid complications presented by frozen soil and chilled gas operation. However, for certain faults with relatively minor design displacements, it may be feasible to cross them with a berm constructed with well drained uniform-graded gravel or crushed rock backfill. In other cases, an aerial crossing would be recommended. Proposed mitigation ranges from above-ground crossing on sleepers using sliding pipe shoes (similar to the design of the Denali Fault crossing on TAPS) to aerial crossing of a steep ravine near Lynx Creek. These fault-crossing designs are expected to reduce fault displacement hazard to an acceptable level.

A commentary on possible design strategies for each confirmed or potential fault crossing would be as follows:

- Northern Foothills Thrust fault (~MP 500.04 to 500.61). Current characterization of this fault defines multiple splays distributed over a pipeline crossing width of approximately 3,000 ft. Unless the fault splays can be located rather precisely (within about 50 to 100 ft.), design of a trapezoidal aboveground configuration similar to TAPS is expected. If the fault splays can be located with precision, a berm crossing may be feasible.
- Stampede-Little Panguingue Creek faults (~519.96 to 520.96). This fault is potentially active, but whether or not it intersects the pipeline is uncertain. Further field investigation is required to be undertaken, and if determined to be active and intersect the route, a crossing design will be required.
- Healy Creek fault (~MP 522.41 to 522.52). Investigation to date has failed to confirm that this fault extends to the pipeline route. Further field investigation is required to be undertaken, and if determined to be active and intersect the route, a crossing design will be required.
- Healy fault (~526.91 to 527.02). Investigation to date has failed to confirm that this fault extends to the pipeline route. Further field investigation is required to be undertaken, and if determined to be active and intersect the route, a crossing design will be required.
- Park Road fault (~MP 538.01 to 538.24). The current route alignment would cross this fault near Lynx Creek, which is incised in a deep canyon. Based on current knowledge, an aerial crossing, likely a suspension bridge similar to the TAPS crossing at the Tazlina River, would be designed. A route alternative west of the Nenana River alongside the Parks Highway through Denali Park is under consideration which would simplify the fault crossing design if adopted. The fault is well-constrained in DNP at that location and crosses the highway near Riley Creek.
- Denali fault (~560.31 to 561.49). The fault is crossed east of the Nenana River where the location of the fault is well-established, and the crossing zone can be minimized to a length of about 1000 ft. To ensure that the crossing zone would span the possible surface location, it would be necessary to extend an aboveground crossing over a length of about 2,600 feet. The aboveground crossing configuration would be similar to TAPS.

- Castle Mountain fault (~MP 743.21 to 743.40). Based on geologic investigation completed thus far, the most likely intersection point is near MP 743.3. A crossing configuration would be aboveground in a configuration similar to TAPS Denali crossing.

The remaining onshore faults are much shorter in length with associated reduced rupture hazard. The two offshore fault features do not require special design. Additional mitigation strategies would be decided on a case-by-case basis and would be outlined in more detail in Resource Report No. 6, Appendix G.

If a fault rupture occurs during construction of the Mainline, no significant impacts to the existing environment from the Project are anticipated. After an earthquake occurs, the integrity of completed portions of the line would need to be inspected and repairs made as necessary to ensure that it would still be structurally sound prior to regular operations. The effects of the Project on the natural environment due to this hazard would be minor to nonexistent and temporary, so long as inspections and repair procedures are followed.

There are no known Holocene active fault lines north of the Brooks Range where the GTP facility and PTTL and PBTL would be located. The risk of a fault rupture occurring underneath one of these facilities would be extremely low. However, in the event of a contaminable fuel or fluids spill caused by fault rupture displacement, general mitigation measures to limit or control impacts would be followed, including the construction and operations of structures to provide edge containment to prevent large lateral spreading.

7.3.1.2.1.2 Seismic Wave Propagation

Very small strains on the pipeline from seismic wave propagation during construction are predicted. Seismic waves that could affect the Interdependent Project Facilities during construction could cause safety concerns or delays to the Project, but no significant impacts to the existing environment would result due to the Project. The integrity of completed portions of pipelines and structural facilities would need to be inspected and repairs made as necessary to ensure that they would still be structurally sound after an earthquake.

7.3.1.2.1.3 Soil Liquefaction

Liquefaction could cause catastrophic loss of strength along any of the Interdependent Project Facilities. Susceptible areas identified are primarily in floodplains associated with waterbodies. The mitigation options selected to address lateral spread at watercourse crossings may involve modified burial depth and crossing geometry at conventional trenched crossing locations. To address areas of potentially liquefiable materials, mitigation may include techniques such as interceptor ditches and vertical drains. Techniques would be developed on a case-by-case basis as additional data becomes available and engineering design is refined.

All potential adverse soil liquefaction effects caused by a large and prolonged earthquake during construction could be considered significant.

Soil liquefaction could potentially occur on a local scale due to vibratory construction activities. These effects would likely be minor and temporary. General mitigation measures would be adhered to in order to limit or control impacts caused by liquefiable soils including:

- In situ stabilization by ground densification;
- Construction of structures to provide edge containment to prevent large lateral spreading;
- Construction of deep foundations; and
- Reinforced shallow foundations.

Soil liquefaction is not believed to be a risk in the Beaufort Coastal Plain Ecoregion due to lower earthquake frequency and intensities, as well as widespread continuous bonded permafrost. Therefore, this hazard would have no effect on the GTP, PTTL, and PBTL facilities or associated infrastructure.

Tsunamis and Seiches

Tsunami/seiche may affect the Mainline in the vicinity of the Cook Inlet crossing. Tsunamis and seiches are not anticipated to be significant hazards within the GTP, PTTL, or PBTL facilities and associated infrastructure area.

7.3.1.2.1.4 Volcanism

Given the distance of these volcanoes from the Project (volcanoes are located across Cook Inlet from the Project), most adverse effects of volcanism are not expected. The most-significant potential hazard that these volcanoes could pose to the Project is ashfall. Should there be ashfall related to an eruption, every precaution would be taken to reduce damage to equipment, facilities, and personnel, including use of personal protective equipment or even evacuation of personnel, as necessary. The effects of this hazard would be temporary, because it could cause delays to the Project construction schedule.

The nearest volcanoes are located in the Kenai Peninsula Borough, more than 40 miles from the proposed Mainline at the closest point, and are not considered a hazard to the proposed GTP, PTTL, or PBTL facilities and associated infrastructure.

7.3.1.2.1.5 Mass Wasting

Pipeline milepost ranges prone to mass wasting are listed in Table 6.4.3-1. To the extent practicable, general mass wasting avoidance measures would be adhered to, including:

- Avoiding pre-existing landslides;
- Avoiding cutting into steep, sidelong ground;
- Ensuring that permanent stabilization and drainage measures are constructed where cuts are required;
- Maximizing the use of stable ridgelines and plateaus;
- Routing preferentially along ridges by using slopes with steep ascents and descents along stable spurs; and
- Ensuring that the design of river and stream crossings account for possible river bank undercutting.

When crossing identified potential landslide areas, to the extent practicable:
Construction impacts to slope stability would be mitigated;

- Drainage would be installed to lower the water table in the slope, thereby reducing the driving force in the slide; and
- Engineered structures would be constructed to provide additional resistance against movement, if deemed necessary.

Additionally, the area would be monitored using visual techniques, surface monuments, inclinometers, piezometers, and/or aerial photography.

7.3.1.2.1.6 Falls, Slides, and Slumps

To reduce the effects from landslides, the pipeline route selection criteria includes avoiding steep slopes, minimizing exposure to unstable landforms, and following the fall line (perpendicular to the slope contour) when traversing a slope, as discussed in Resource Report No. 10 Section 10.1.1.1 Feasibility Analysis. By following existing or previously studied corridors, the large majority of potential slope instability hazards have been avoided. If areas prone to these effects are unavoidable, the primary risk during construction would be to personnel and equipment. Safety plans would be in place to protect workers from exposure.

The risk of the Project causing a fall, slide, or slump is low. Environmental impacts from falls, slides, and slumps during construction are limited to areas of potential static and dynamic instability. The effects of this occurrence would be temporary, but likely significant to the immediate area of occurrence. Appropriate erosion control measures would be installed during and following construction to mitigate landslides and slope instability. Mitigation plans for areas prone to deep-seated landslides would be included in Resource Report No.6, Appendix G.

Falls, slides, and slumps are not considered to be a serious risk to the proposed GTP, PTTL, or PBTL facilities located in the Beaufort Coastal Plain Ecoregion due to low relief. Risks due to coastal erosion processes would be assessed and standard coastal engineering shoreline protection measures such as breakwaters, rip-rap, armor stone blankets, or beach nourishment would be considered as potential alternatives to address the risk of shoreline erosion that may endanger the GTP, PTTL, and PBTL. The only infrastructure with offshore contact associated with the GTP would be West Dock, which would be protected from coastal erosion through the placement and use of bags filled with granular material along the shoulder of the causeway as discussed in Resource Report No. 10 Section 10.5.7.1 West Dock.

7.3.1.2.1.7 Flows

Debris flows and mudflows can mobilize due to heavy and/or prolonged rainfall events. If these occur, they can pose a risk to Project personnel and equipment. Areas prone to these flows would be evaluated and construction activities postponed (or other safety measures enacted as necessary) if weather conditions create an increased risk of flows. Additional mitigation strategies are outlined in Appendix H.

Pipeline associated facilities could be at risk due to mudflows, as these flows could potentially damage aboveground facilities. This effect would be significant, adverse, and direct. To mitigate this, every precaution would be taken to minimize exposure to possible flows by locating and designing facilities outside of potential high-risk mudflow and debris flow areas.

Construction of the Mainline is not anticipated to increase the risk of a flow event occurring.

Flows are not considered to be a risk to the GTP, PTTL, or PBTL facilities on the shallow and flat coastal plains of the Beaufort Coastal Plain Ecoregion.

7.3.1.2.1.8 Avalanches

Snow avalanche chutes and slushflow avalanche chutes (some of which are collocated) cross the Project area (see Resource Report No. 6). Avalanches are a potential hazard in all mountainous regions where the pipeline or aboveground facilities would be located near the bottom of an avalanche chute. Specific areas, such as Atigun Pass, would be addressed in the design process to incorporate appropriate mitigation measures. Avalanches can occur naturally or can be initiated by human activities. Vibrations, such as those caused by blasting or heavy machine work, may act to trigger avalanches during construction.

For those areas along the proposed Mainline that are avalanche-prone, precautions would be taken to ensure that personnel would be protected. These precautions would include constructing only in the summer, inspecting snow conditions with snow pits or other means to assess current risk conditions, or intentionally attempting to set off avalanches prior to beginning work in the runout area. If the Project crosses through avalanche-prone zones in populated areas, additional precautions would be taken to ensure that the public are kept out of harm's way during construction activities.

The potentially large run-out distances for snow avalanches during selection of sites for aboveground facilities, parking and storage areas, and materials sites in mountainous terrain would be considered.

The effects of an avalanche would be significant and direct, but temporary. Additional avalanche risk mitigation techniques are discussed in Appendix H.

Avalanches are not considered to be a risk to the GTP, PTTL, or PBTL facilities.

7.3.1.2.1.9 Creep and Solifluction

During the summer thaw season in the Arctic and Subarctic, thawing ice-rich soils on slopes may be susceptible to creep and solifluction. For a full discussion of this and other frozen soils-related geohazards for the Project, see the Permafrost discussion in Resource Report No. 7.

7.3.1.2.1.10 Rock Glaciers

Based on preliminary assessments, known rock glaciers along the Mainline would not have an impact due to the slow rate of movement. Rock glaciers are not considered to be a risk to the GTP, PTTL, or PBTL facilities located in the Beaufort Coastal Plain Ecoregion.

7.3.1.2.1.11 Frozen Debris Lobes

The advance of FDLs could become a geologic hazard in the Mainline in certain segments of the southern Brooks Range. At least one FDL in particular is currently within 200 feet of the Dalton Highway, and has been advancing toward the highway/Mainline at approximately 150 feet per year for multiple years (Daanen et. al., 2012). If an FDL reaches the Mainline, environmental impacts may include the deposition of many tons of rock, sediment, soil, and debris on the corridor daily. The Project representatives would work with the ADOT&PF on routing through this area and the measures to take to protect the pipeline.

No known FDLs exist within the vicinity of the GTP, PTTL, or PBTL facilities.

7.3.1.2.1.12 Subsidence

Subsidence hazards are addressed in more detail in Resource Report No. 7, including thaw-settlement anticipated throughout the northern portions of the Project corridor.

Review of available route data indicates no evidence of shallow karst features prone to collapse beneath the Mainline. Likewise, there are no known underground mines along the route that may pose a collapse hazard. In the unlikely event of a collapse structure developing beneath the pipeline, the strength and ductility of the pipeline could allow it to span a short distance without threatening the integrity of the pipeline.

Review of available data indicates no evidence of shallow karst features or known underground mines within the area of the GTP, PTTL, or PBTL facilities located in the Beaufort Coastal Plain Ecoregion.

Specific geotechnical studies would be conducted as necessary to characterize subsurface conditions, and ground would be compacted as necessary as part of the construction process of buildings and associated infrastructure. Due to these standard engineering precautions and design and construction process, any effects from subsidence hazards caused by the Project facilities would likely be of minor significance, although they may develop over a long-term or permanent timespan.

7.3.1.2.1.13 Acid Rock Drainage

Construction activities along the Mainline, infrastructure, and facilities (e.g., roads, compressor stations, etc.) may be affected to different degrees by acid rock drainage and metal leaching (ARD/ML) if these activities expose or disturb the bedrock or formation containing coal seams. For example, environmental impacts from the effect of ARD/ML on construction on the North Slope would be negligible to null because the bedrock is deep and is unlikely to be exposed during construction or operation. Conversely, construction activities in areas classified as high or moderate ARD/ML would be impacted where it is found during pre-construction sampling (see Resource Report No. 6).

ARD/ML mitigations and control measures would be based on the geochemical characteristics and behavior of the rock excavated and may include the following:

- Segregation of rocks with potential for ARD/ML from benign rock;
- Protection (cover) of the grade, ditch, and exposed slopes at ARD sites with low permeability clay, soil, or impervious layer (or a combination of these) to prevent water and oxygen contact with reactive rock;
- Design and construction of stockpiles for the long-term storage of excavated ARD/ML material;
- Diversion of surface runoffs away from ARD/ML sites and stockpile and the collection and testing of contact water before release into the environment; and
- Monitoring measures at ARD/ML sites.

Potential ARD/ML effects due to construction of the Mainline and associated facilities would generally be temporary in duration, as excavation would be filled back in as the pipeline construction is completed. As previously stated, ARD/ML effects are expected to be negligible to null on the North Slope, so are not considered to be a hazard for the GTP, PTTL, PBTL, or associated facilities.

7.3.1.2.1.14 Hydrologic Processes (Vertical Scour)

Site-specific waterbody crossing plans (See Resource Report No. 2, Appendix J) would be developed, as applicable for areas crossed by the Mainline that are susceptible to vertical scout, channel migration, avulsion, rapid lake drainage, and flooding. The Applicant's Plan and Procedures would be adhered to during construction of the Pipeline Facilities to avoid and mitigate the potential for erosion and scour.

Vertical scour is not considered a hazard to the GTP, PTTL, or PBTL facilities.

7.3.1.2.1.15 Non-Energy Mineral Sources

Potential geohazards associated with being in the close and immediate proximity of mineral claims could include, but would not be limited to, ground subsidence, contaminated water or soils, toxic gas, mud pits, tailings, open boreholes, and the presence of waste chemicals, shock-sensitive materials, and explosives. Evaluation of the potential hazards associated with active and abandoned mine claims within the proposed Project area suggests tailings are likely to be the only significant potential hazard. Contamination from these tailings would have a significant adverse effect, but would be temporary, if procedures for isolation and cleaning of the contaminated sites would be followed. If tailings would be found within the Project footprint during construction, or if it would be determined that runoff from these deposits could impact the Project area, their presence would be reported to the appropriate federal and/or state regulatory agency, and further actions would be complied with as necessary.

7.3.1.3 Non-Jurisdictional Facilities

Both the PTU Expansion project and the PBU MGS project have a low risk of construction-related geologic hazards associated with seismic hazards, volcanism, mass wasting, and acid rock drainage. Potential erosion and scour impacts associated with flooding in the Beaufort Coastal Plain Ecoregion are provided in Section 2.5 of Resource Report No. 2.

The Kenai Spur Highway relocation project area is similar to the area described for the Liquefaction Facility and susceptible to the same geohazards.

7.3.2 Potential Operational Impacts and Mitigation Measures

Adverse effects to the operation of the Project (design life 30 years) resulting from geologic hazards, or increases to geologic hazard risks due to operation of the Project, would be avoided or greatly reduced through engineering design and monitoring.

Completed geological hazard assessments (see Resource Report No.6, Appendix H) detail potential operational impacts and mitigations for the Project associated with geohazards. In addition to these plans, industry BMPs and engineering design would be used to prevent or mitigate adverse effects wherever possible.

The following sections briefly summarize operational impacts and mitigations for geohazards anticipated at the Liquefaction Facility and the Interdependent Project Facilities and associated infrastructure).

7.3.2.1 Liquefaction Facility

7.3.2.1.1 Seismicity Hazards

Site-specific seismic hazard design criteria specific to the Liquefaction Facility are included in Resource Report No. 13. This includes measures to mitigate the potential loss of containment.

7.3.2.1.2 Fault Rupture Displacement

The Liquefaction Facility would not be located above any known active fault lines; therefore, this is not anticipated to be a hazard for this facility. However, mitigation strategies would be included in the design of the Liquefaction Facility. These strategies may include use of thick reinforced concrete mat foundations to prevent damage from underlying ground movements.

7.3.2.1.3 Seismic Wave Propagation

Ground shaking from seismic wave propagation is a significant potential hazard during operation of the Liquefaction Facility. The potential exists for damage to facility components, equipment, and personnel if a major earthquake struck during operation. Ground shaking can occur from earthquakes on proximal crustal faults, as well as earthquakes from the Aleutian subduction zone.

Site-specific structural engineering analysis would be performed to ensure that all buildings and infrastructure associated with the Liquefaction Facility would meet current design codes (International Building Code [IBC] for buildings and the American Association of State Highway and Transportation Officials) for seismic wave propagations associated with design-level seismic events in the Nikiski area (ASCE 7-05 and Marine Oil Terminal Engineering and Maintenance Standards (MOTEM)). These codes ensure that buildings are able to withstand the forces associated with these seismic events. If a large earthquake would occur such that inspections are warranted, all facilities associated with the Liquefaction Facility would be inspected for structural integrity and repairs made as necessary. Any effects that would occur could be significant, but temporary, in nature, as long as all appropriate repairs are made if damage occurs.

7.3.2.1.4 Soil Liquefaction

It is not anticipated that operational activities at the Liquefaction Facility would cause soil liquefaction. Soil liquefaction may occur as a result of a large or prolonged earthquake event. Site-specific structural and geotechnical engineering analyses would be performed to ensure that all buildings and infrastructure associated with the Liquefaction Facility are designed to meet current design codes for liquefaction effects associated with seismic events. If soil liquefaction associated with a large earthquake occurs, all facilities associated with the Liquefaction Facility would be inspected for structural integrity and repairs made as necessary. Additional measures may be developed as engineering design progresses and may be included in Resource Report No. 6, Appendix H.

7.3.2.1.5 Tsunamis and Seiches

Tsunamis and seiches are not anticipated to be a hazard during operation of the Liquefaction Facility. The anticipated design tsunami wave run-up at Nikiski is estimated to be the +35 foot mean lower low water contour. The bluff along the Liquefaction Facility site's shoreline would be affected by a tsunami run-up.

7.3.2.1.6 Volcanism

Ashfall is the only likely volcanic hazard that poses a threat to Project operations near the Liquefaction Facility, and this has been factored into the design. Should there be ashfall related to an eruption during operations, every precaution would be taken to reduce damage to equipment and facilities and injury to personnel. If very heavy ashfall is expected during a particular volcanic eruption, certain nonessential operations may be temporarily and partially shut down at the Liquefaction Facility. There is potential for

ashfall to reach the Liquefaction Facility and for ash to reach machinery through air intake valves or other openings and damage or destroy machines.

7.3.2.1.7 Mass Wasting

7.3.2.1.7.1 Falls, Slides and Slumps

In accordance with the Upland Erosion Control, Revegetation, and Maintenance Plan (the Applicant's Plan), appropriate erosion control measures would be installed as required to mitigate slope instability (see Resource Report No. 6, Appendix H). However, the Liquefaction Facility would be located on relatively flat, stable ground and this is not expected to pose a risk to operations.

A geotechnical analysis was completed to assess the risk from deep-seated landslides. Any risks to the Liquefaction Facility due to deep-seated landslides will require a site-specific plan, which is included in Resource Report No. 6, Appendix H.

In accordance with the Applicant's Plan, appropriate erosion control measures would be installed during and following construction to mitigate landslides and slope instability. During operations, an Integrity Management Program would be implemented, as identified in Resource Report No. 11.

7.3.2.1.7.2 Flows

The Liquefaction Facility would be located on fairly flat and stable ground without major topographical features. Therefore, debris flows and mudflows are not considered to be a risk at this location.

7.3.2.1.7.3 Avalanches

The Liquefaction Facility would be located on fairly flat and stable ground without major topographical features. Therefore, avalanches are not considered to be a risk at this location.

7.3.2.1.7.4 Creep and Solifluction

Creep and solifluction are not anticipated to be a hazard during operation of the Liquefaction Facility, as no permafrost conditions exist at this proposed location.

7.3.2.1.7.5 Rock Glaciers

The Liquefaction Facility would be located on fairly flat and stable ground without major topographical features. Therefore, rock glaciers are not considered to be a risk at this location.

7.3.2.1.7.6 Frozen Debris Lobes

There are no FDLs in the vicinity of the proposed Liquefaction Facility, so they are not a potential hazard.

7.3.2.1.7.7 Subsidence

There is no known history of subsidence in the proposed Liquefaction Facility area. Geophysical and geotechnical investigations indicate the majority of the subgrade materials are dense sands and gravels not generally susceptible to subsidence. Subsidence is not anticipated to represent a potential hazard.

7.3.2.1.7.8 Acid Rock Drainage

Preliminary research and field reconnaissance has shown that ML/ARD is not a concern for the Liquefaction Facility area.

7.3.2.1.7.9 Hydrologic Processes (Vertical Scour)

There are no identified flowing waterbodies within the footprint of the Liquefaction Facility. Therefore, vertical scour is not considered to be a risk at this location.

Impacts to operations from coastal erosion could include delays to marine or other terminal processes. If this were to occur, the effect would be significant and adverse, but depending on severity and the required repair measures that would result, the effect duration could range from temporary to long-term, especially if the erosion is a recurring problem. However, risks due to coastal erosion processes would be assessed as part of the design process to elevate the Marine Terminal above storm wave heights and standard coastal engineering shoreline protection measures such as breakwaters, rip-rap, armor stone blankets, or beach nourishment would be considered as potential alternatives to address any risk of erosion of the shoreline that may endanger the Liquefaction Facility. Erosion and scour risks are further discussed in Resource Report No. 2, Appendix G.

7.3.2.2 Interdependent Project Facilities

Interdependent Project Facilities considered in the following discussions include Pipelines (PTTL, PBTL, and Mainline) and GTP.

7.3.2.2.1 Seismicity Hazards

A discussion of site-specific seismic hazard design specific to the Pipeline, including consultations with PHMSA, is included in Resource Report No. 11.

7.3.2.2.2 Fault Rupture Displacement

If an earthquake would occur along a fault during operation of the Mainline and the pipeline ruptures, then a significant, direct, adverse effect would occur due to a gas leak or the spilling of stored fuel at the pipeline aboveground facilities into the existing environment. Depending on the severity of the rupture and the amount of spilled liquids, the effect could be temporary to short-term. The primary mitigation for this potential effect is proper engineering design to withstand these forces, storage tanks set on firm foundations, and protective berms around the fuel storage facilities to prevent this from occurring at all. Clean-up activities conducted in accordance with the Spill Prevention, Control, and Countermeasure Plan (see Resource Report No. 2, Appendix M), along with repairs to the storage facility and further engineering to prevent a repeat occurrence would complete this mitigation strategy.

A fault displacement rupture along the Mainline would be primarily mitigated by avoidance. Facilities would be intentionally located at sites with very low likelihood of surface fault rupture. However, in the instances in which the Mainline pipeline must cross areas where surface fault rupture is more likely, designs, including pipeline above ground on sleepers, as well as route optimization for proper orientation of pipe relative to fault movement would be used as mitigation tools. These designs would be included in Resource Report No. 6, Appendix H.

The risk of a fault rupture occurring underneath the GTP, PTTL and PBTL facilities s would be extremely low.

During operations, monitoring of seismic ground motions would be developed or arranged in accordance with the Integrity Management Program.

7.3.2.2.3 Seismic Wave Propagation

Seismic waves are a risk to the Mainline during operations due to the potential for sudden and large vertical and horizontal accelerations that may occur. Risks due to seismic wave propagation are similar to those posed by fault ruptures. Site-specific structural engineering analysis would be performed to ensure that the Mainline, GTP, PTTL, PBTL, and all buildings and infrastructure associated with these facilities meet current design codes for seismic wave propagation associated with design-level seismic events. These codes ensure that facilities are able to withstand the forces associated with these seismic events.

7.3.2.2.4 Soil Liquefaction

Liquefaction causes ground strains and movement transferred to the buried pipeline, potentially resulting in a pipeline rupture. Operations of the Mainline and associated infrastructure are not expected to cause any local liquefaction effects. Mitigation of soil liquefaction hazard to the pipeline is achieved through routing and design.

Soil liquefaction is not a risk in the Beaufort Coastal Plain Ecoregion due to lower earthquake frequency and intensities, and widespread continuous bonded permafrost, as such, this hazard would have no effect on the GTP, PTTL, and PBTL facilities or associated infrastructure.

7.3.2.2.5 Tsunamis and Seiches

Tsunamis and seiches would not be a potential hazard during operation of the Interdependent Project Facilities. There are no water bodies capable of sustaining such waves in the Project corridor.

7.3.2.2.6 Volcanism

Ashfall is the only potential volcanic hazard that poses a threat to Mainline aboveground facilities near Cook Inlet. There is potential for ashfall to reach machinery through air intake valves or other openings and damage or destroy machines. Every precaution would be taken to reduce damage to equipment and facilities and injury to personnel.

Volcanism does not pose any risk to the Mainline pipeline, GTP, PTTL, or PBTL.

7.3.2.2.7 Mass Wasting

7.3.2.2.7.1 Falls, Slides and Slumps

In accordance with the Applicant's Plan, appropriate erosion control measures would be installed during and following construction to mitigate slope instability. During operations, an Integrity Management Program would also be implemented, as identified in Resource Report No. 11.

By following existing or previously studied corridors, the large majority of potential slope instability hazards in the Project area have been avoided. Falls, slides, and slumps are not considered to be a risk to the GTP, PTTL, or PBTL facilities located in the Beaufort Coastal Plain Ecoregion.

7.3.2.2.7.2 Flows

Mudflows and debris flows are depositional in nature where they cross the Mainline, therefore, are not considered a threat to the underground pipeline. However, pipeline associated facilities could be at risk due to mudflows, as these flows could negatively impact aboveground facilities. This effect would be significant, adverse, and direct. To mitigate this, every precaution would be taken to minimize exposure to possible flows by locating and designing facilities outside of potential high-risk mudflow and debris flow areas.

Flows are not considered to be a risk to the GTP, PTTL, or PBTL facilities located in the Beaufort Coastal Plain Ecoregion.

7.3.2.2.7.3 Avalanches

Avalanches are a potential hazard in all mountainous regions where the pipeline or aboveground facilities would be located near the terminus of an avalanche run-out zone. Avalanches can occur naturally or can be initiated by human activities. The potentially large run-out distances for snow avalanches during selection of sites for all aboveground facilities, infrastructure (i.e., camps, storage areas) and materials sites in mountainous terrain would be considered.

For those areas along the Mainline that would be avalanche-prone, precautions would be taken to ensure that personnel would be protected by avoiding these areas during high-risk periods or by triggering avalanches intentionally prior to activities such as inspections and maintenance.

None of the aboveground facilities are sited in an avalanche prone or susceptible areas.

Avalanches are not considered to be a risk to the GTP, PTTL, or PBTL facilities located in the Beaufort Coastal Plain Ecoregion.

7.3.2.2.7.4 Creep and Solifluction

Creep and solifluction would be a significant, long-term concern during operation of northern portions of the Mainline, GTP, PTTL, and PBTL. During the summer thaw season in the Arctic and Subarctic, thawing ice-rich soils on slopes may be susceptible to solifluction. For a full discussion of this and other frozen soil-related geohazards for the Project, see the Permafrost discussion in Resource Report No. 7.

7.3.2.2.7.5 Rock Glaciers

Based on preliminary assessments, known rock glaciers in the Mainline area would not have an impact due to the slow rate of movement.

Rock glaciers are not considered to be a risk to the GTP, PTTL, or PBTL facilities located in the Beaufort Coastal Plain Ecoregion.

7.3.2.2.7.6 Frozen Debris Lobes (FDLs)

The advance of FDLs could become a geologic hazard in the Mainline in certain segments of the southern Brooks Range. At least one FDL in particular is currently within 200 feet of the Dalton Highway, and has been advancing toward the highway/Mainline at some 150 feet-per-year for multiple years (Daanen et. al., 2012). If an FDL reaches the Mainline, it would be capable of depositing many tons of rock, sediment, soil and debris on the corridor daily. The Project representatives would work with the ADOT&PF on routing through this area and the measures to take to protect the pipeline. FDLs are not a potential hazard in the vicinity of the GTP, PTTL, or PBTL facilities.

7.3.2.2.7.7 Subsidence

Review of available route data indicates no evidence of shallow karst features prone to collapse beneath the Mainline. Likewise, there are no underground mines along the route that may pose a collapse hazard (See Resource Report No. 6). In the unlikely event of a collapse structure developing beneath the pipeline, the strength and ductility of the pipeline could allow it to span a short distance without threatening the integrity of the pipeline.

Specific geotechnical investigations would be completed as necessary to characterize subsurface conditions, and ground would be compacted as necessary as part of the construction process of buildings and associated infrastructure. Due to these standard engineering precautions and design and construction process, any effects from subsidence hazards caused by the Project facilities are likely to be of minor significance, although they could likely develop over a long-term period.

Gradual subsidence due to building loads may occur over the lifetime of the various structures and is normal. However, a site-specific geotechnical investigation to determine soil characteristics, combined with stabilization methods, can greatly reduce the risk or magnitude of subsidence during operations. These studies are underway for the GTP, Liquefaction Facility, and compressor station locations.

Subsidence hazards are addressed in more detail in Resource Report No. 7, including thaw-settlement anticipated throughout northern portions of the Project corridor.

7.3.2.2.7.8 Acid Rock Drainage

ARD/ML mitigations and control measures during operations may be required for ongoing operations, especially near borrow material sites, and would be handled with the same procedures described previously under construction impacts (Section 7.3.1.2).

ARD/ML effects are expected to be negligible to null in the Beaufort Coastal Plain Ecoregion and are not considered to be a hazard for the GTP, PTTL, or PBTL or associated facilities.

7.3.2.2.7.9 Hydrologic Processes (Vertical Scour)

The Pipeline Facilities would be designed and constructed in accordance with 49 C.F.R Part 192 as well as in accordance with the Applicant's Procedures to provide adequate protection from bank erosion, scour, and/or channel migration. Further details can be found in Resource Report No. 2, Appendix I.

7.3.2.3 Non-Jurisdictional Facilities

Both the PTU Expansion project and the PBU MGS project would have low risk of operations geologic hazards associated with seismic hazards, volcanism, mass wasting, and acid rock drainage. Potential erosion and scour impacts associated with flooding in the Beaufort Coastal Plain Ecoregion are provided in Section 2.5 of Resource Report No. 2.

The Kenai Spur Highway relocation project area is similar to the area described for the Liquefaction Facility and susceptible to the same geohazards.

7.4 MINERAL AND ENERGY RESOURCES

7.4.1 Industrial Material Resources

The proposed Project area contains many potential material resources, including borrow sites for sand, gravel, and rock. A number of existing permitted aggregate mines as granular material sources would be planned to be used to the greatest extent practicable. However, because of the remoteness of many locations, new borrow sources would need to be developed. The *Gravel Sourcing and Reclamation Measures Plan* in Resource Report No. 6, Appendix F provides a listing of the potential new and existing material sites that are being explored for Project use. Potential industrial material resource sites within 35 miles of the proposed Mainline are also summarized in Resource Report No. 6, Appendix F. The purpose of this *Gravel Sourcing and Reclamation Measures Plan* is to provide an overview of the material needs, potential sources to meet those material needs, general extraction/transportation protocols, and reclamation methods for the extraction sites.

7.4.1.1 Liquefaction Facility

After clearing and grubbing, the Liquefaction facility would require approximately 4.7 million cubic yards of granular material for fill. The gravel, rock, and other aggregate imported for construction of the Liquefaction Facility would be sourced from local quarries where practical.

7.4.1.2 Interdependent Project Facilities

The estimated need for granular material is approximately 9 million cubic yards for the work pad and an additional 1.95 million cubic yards for bedding and padding of the pipe. Minor amounts would also be needed for weight bags, as fill to protect the ditch and workspace areas, and for slope stabilization, all estimated at approximately 0.56 million cubic yards. Material sites would be developed along the Mainline ROW, particularly at hilltops, to provide work pad material within the valleys, as practicable.

Granular material for the PTTL would be needed for construction of new granular material pads for three Mainline block valves, however the construction camps and pipe storage yards would be located on existing sites or ice pads.

Approximately 6.9 million cubic yards of material would be required for the construction of GTP features including: DH 4, the GTP Facility Pad, the Integrated Construction and Operations Camp Pad, access roads, upgrades along the West Dock causeway, and other supporting infrastructure. Granular material requirements for construction of the PBTL are anticipated to be minimal and are accounted for in the granular material requirements described for the GTP.

The PTTL, PBTL and GTP facilities' primary source of material for construction would be a new mine (quarry) site located southwest of the GTP site and just north of the Putuligayuk River.

7.4.1.3 Non-Jurisdictional Facilities

The Point Thomson Gas Expansion, PBU MGS projects, and the Kenai Spur Highway relocation project would determine the sources of their granular materials at a later date. The PTU Expansion Project would develop and rehabilitate a new granular mine site to provide the approximately 1–2 million cubic yards of granular material required for Project development."

7.4.2 Potential Construction Impacts and Mitigation Measures

Potential construction impacts of the Project on mineral resources such as claims and leases, active mines, oil and gas wells, access, and commercial viability could include:

- Blasting for the installation of some facilities;
- Extraction of granular resources required for construction, including blasting to loosen resources;
- Short-term restrictions on exploration and development within a certain distance to the Project for activities deemed a safety hazard;
- Short-term restrictions to access of claims or leases within the construction ROW during construction activities in a specific area;
- Short-term disruption of the land surface within the construction ROW during construction activities, which may disturb surface or subsurface mineral resources; and
- Limitations on the recovery of mineral sources because of the physical presence of the Project; this impact depends on the location of the Project within the boundaries of the lease relative to the location of the mineral resources.

Preliminary assessments show that the subsurface estate of oil and gas resources would not be impacted and that the proposed footprint does not currently overlap with any entry points. Although the Project footprint would cross areas that could potentially be used for oil and gas development, it is not anticipated to inhibit development because the pipeline would require shallow excavation and would not be buried deep enough to directly or indirectly impact the relatively deep oil and gas resources.

Preliminary assessment also indicates construction would not impact the subsurface estate of coal resources and that the proposed footprint does not currently overlap with any entry points. Although the Project footprint would cross areas currently used or that could potentially be used for coal development, it is not anticipated that development would be inhibited because the pipeline would not be buried deep enough to directly or indirectly impact a coal operation.

A reasonable effort to maintain communications with parties affected by construction activities would be made to reduce adverse effects of construction on energy resources. Work with parties associated with energy resource claims and leases in an attempt to preserve the mining and commercial viability of these resources while protecting the integrity of the Project facilities would be done. If third-party facilities are located within construction work areas, well or pipeline sites would be avoided or appropriate precautions would be taken to protect the integrity of such facilities.

A reasonable effort would be made to maintain communications with parties affected by construction activities to reduce adverse effects of the Project on industrial resources and extraction activities. Work with parties associated with future industrial resource leases would be done in an attempt to preserve the

commercial viability of such leases and permit the mining of these resources while protecting the integrity of the Project.

Material resources, such as gravel and sand, would be used during construction. Resource Report No. 6, Appendix F provides a summary of material resources, including impacts and mitigation measures, as well as reclamation procedures.

7.4.2.1 Liquefaction Facility

7.4.2.1.1 Non-Energy Mineral Resources

The Liquefaction Facility would not be located on or within 0.5 mile of any known active or abandoned producing surface or underground mines, or advanced exploration projects. However, 5 mining claims are within 0.5 mile of the Liquefaction Facility.

7.4.2.1.2 Oil and Natural Gas Resources

No actively leased areas or known oil or gas wells are within the proposed footprint of the Liquefaction Facility.

7.4.2.1.3 Coal Resources

There are no active coal mines within 0.5 miles of the proposed footprint of the Liquefaction Facility.

7.4.2.1.4 Industrial Materials

Potential granular material and other industrial material sources needed for construction of the proposed Liquefaction Facility would be identified in Resource Report No. 6, Appendix F.

7.4.2.2 Interdependent Project Facilities

7.4.2.2.1 Non-Energy Mineral Resources

The Mainline, GTP, PBTL, and PTTL would not cross any known active or abandoned producing surface, underground mines, or advanced exploration projects. However, 170 mining claims are within 0.5 mile of the proposed Mainline pipeline and associated facilities, 56 of which are within the proposed Project footprint.

7.4.2.2.2 Oil and Natural Gas Resources

The proposed Project footprint for the Interdependent Project Facilities crosses a significant area of leased land covered by the area-wide lease tract program (236 tracts), some actively leased areas (128 tracts), and a few known oil or gas wells (12) (Resource Report No. 6, Appendix A, Table 4). The Mainline would be designed to avoid all known wells and oil and gas surface facilities.

Oil and gas are generally produced from depths of more than 1,000 feet, as a result of this, construction of the proposed Interdependent Project Facilities is not anticipated to inhibit development because the pipeline would not be buried deep enough to directly or indirectly impact an oil and gas field. In the unlikely event of construction-related damages to unknown oil and gas wells, impacts would be limited to surface or near-surface components of the wells and gathering systems, which could temporarily disrupt production until repairs are made.

Prior to ground-disturbing activities, underground utilities in the construction area would be identified by contacting Alaska's One-Call system. If facilities were to be located within construction work areas, well or pipeline sites would be avoided or appropriate precautions would be taken to protect the integrity of such facilities. Mitigation measures would be implemented as necessary to avoid damage to oil and gas wells during construction of the Project. However, if unexpected damage to oil and gas well facilities were to

occur during construction of the Project, all facilities would be repaired to preconstruction condition or better. Communication would be maintained with parties affected by construction activities to reduce adverse effects of the Project on energy resources. Work would be done with all parties associated with energy resource claims and leases in an attempt to preserve the mining and commercial viability of these resources while protecting the integrity of Project facilities.

7.4.2.2.3 Coal Resources

There are no active coal mines within 0.5 mile of the proposed footprint of the Mainline, PTTL, PBTL, and GTP facilities.

7.4.2.2.4 Industrial Materials

Potential granular material and other industrial material sources needed for construction of the proposed Mainline, PTTL, and PBTL would be identified in Resource Report No. 6, Appendix F.

7.4.2.3 Non-Jurisdictional Facilities

7.4.2.3.1 Non-Energy Mineral Resources

No mining claims registered under ADNR or USGS were identified within 0.5 mile of the proposed PTU Expansion, PBU MGS project, or the proposed Kenai Spur Highway relocation project.

7.4.2.3.2 Oil and Natural Gas Resources

The PTU Expansion project facilities and PBU MGS project facilities are located within the PTU and PBU, respectively. The purpose of these projects is the development and commercialization of natural gas resources located within these units. Drilling activities associated with subsurface development and maintenance would be conducted responsibly using prudent technology and industry practice and according to regulations. Construction activities that occur at the surface would not affect the oil and gas resources located beneath the surface.

7.4.2.3.3 Coal Resources

There are no active coal mines within 0.5 mile of the proposed PTU Expansion, PBU MGS project, or the proposed Kenai Spur Highway relocation project.

7.4.2.3.4 Industrial Materials

Granular material required for the PTU Expansion project would be obtained from a new material site as described in Resource Report No. 1. The PTU operator would develop and submit a Gravel Mining and Rehabilitation Plan to applicable regulatory agencies.

7.4.3 Potential Operational Impacts and Mitigation Measures

7.4.3.1 Liquefaction Facility

7.4.3.1.1 Non-Energy Mineral Resources

No anticipated impacts would be expected to non-energy mineral resources during the operation of the Liquefaction Facility. Gravel, sand, and other resources would be excavated within the footprint of the facility for construction on site.

7.4.3.1.2 Oil and Natural Gas Resources

No anticipated impacts would be expected to oil and natural gas resources during the operation of the Liquefaction Facility.

7.4.3.1.3 Coal Resources

No anticipated impacts would be expected to coal resources during the operation of the Liquefaction Facility.

7.4.3.1.4 Industrial Resources

Activities outside the Liquefaction Facility's fenced areas during operations would be very limited and non-intrusive in nature. These activities should be of very little consequence to any industrial or mineral resource undertaking.

7.4.3.2 Interdependent Project Facilities

7.4.3.2.1 Non-Energy Mineral Resources

The potential operational impacts of the Interdependent Project Facilities on mineral resources include:

- Restrictions on exploration and development within a certain distance for activities deemed a safety hazard;
- Temporary disruption of the land surface within the pipeline ROW during maintenance activities, which may disturb surface or subsurface mineral resources;
- Limitations on the mining process that can be used to recover minerals because of considerations of Project safety (e.g., vibration impacts on the pipeline);
- Limitations on the recovery of mineral sources because of the physical presence of the Project; and
- Potential expansion of existing extraction activities due to proximity to pipeline and associated facilities.

7.4.3.2.2 Oil and Natural Gas Resources

No anticipated impacts would be expected to oil and natural gas resources during the operation of the Interdependent Project Facilities.

7.4.3.2.3 Coal Resources

No anticipated impacts would be expected to coal resources during the operation of the Interdependent Project Facilities.

7.4.3.2.4 Industrial Resources

Activities outside of the fenced areas of the Interdependent Project Facilities during operations would be very limited and non-intrusive in nature. These activities should be of very little consequence to any industrial or mineral resource undertaking.

On the occasions that the pipeline or its ROW would require maintenance, Project personnel and contractors would mobilize with construction equipment to very specific areas of the ROW. Among the activities to potentially be performed could be the placement of granular materials as fill to improve the access and working surfaces.

A reasonable effort would be made to maintain communications with parties affected by operational activities to reduce adverse effects of the Project on resource exploration and development activities. Work would be done with parties associated with future resource leases in an attempt to preserve the commercial viability of such leases and permit the mining of these resources while protecting the integrity of the Project.

7.4.3.3 Non-Jurisdictional Facilities

7.4.3.3.1 Non-Energy Mineral Resources

Because non-energy mineral resources are not known to be located in proximity to both the PBU MGS and PTU Expansion projects, no impacts to non-energy mineral resources are anticipated from the development projects.

7.4.3.3.2 Oil and Natural Gas Resources

No anticipated impacts would be expected to oil and natural gas resources during the operation of the PBU MGS project, or the proposed Kenai Spur Highway relocation project. PTU Expansion project development would result in approved depletion of the Thomson Sand reservoir via production of natural gas and natural gas condensate. PBU MGS project development would result in approved depletion of reservoirs via production of natural gas.

7.4.3.3.3 Coal Resources

Because coal resources are not known to be located in proximity to PTU Expansion project, no impacts to coal resources are anticipated from this development.

7.4.3.3.4 Industrial Materials

Following construction, the proposed PTU Expansion, PBU MGS project, and the proposed Kenai Spur Highway relocation project are anticipated to have no impacts to industrial material resources.

7.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

Phase I surveys sought to identify cultural resources located within a 300-foot-wide survey corridor for the Mainline, PBTL, and PTTL which included the direct APE or, in some cases, a 600-foot-wide study corridor (in some earlier investigations) which included the direct APE (Greiser et al., 2013a). Cultural resource surveys conducted after the 2013 field season were confined to a consistent 300-foot-wide survey corridor containing the direct APE for the Mainline, the PBTL, and the PTTL. For access roads, a 150-foot-wide survey corridor encompassed the direct APE. For facilities, the actual facility footprint plus a buffer zone was subjected to survey. The results of the field surveys are provided in Resource Report No. 4.

7.5.1 Cultural Resources Construction Impacts and Mitigation Measures

The Project recognizes that there are limitations to assessing effects and developing avoidance, minimization, and mitigation measures at this time since no indirect area of potential effect (APE) has been established and since final eligibility determinations have not been completed for all identified cultural resources. However, studies conducted to date indicate that the Project has the potential to impact cultural resources that are eligible for listing in the NRHP (historic properties as defined at 36 C.F.R. § 800.16[l[ ). A total of 94 cultural resources were identified within the surveyed areas for the Mainline, 12 cultural resources were identified in the surveyed areas for the Liquefaction Facility, and 52 cultural resources were identified within the surveyed areas for facilities associated with the Project (total of 158 cultural resources). Most of the cultural resources were evaluated for NRHP eligibility by applying the National Register Criteria for Evaluation (36 C.F.R. § 60.4 [a-d]). Seventy of the evaluated cultural resources were determined eligible, recommended as eligible, or to be treated as eligible for NRHP listing (See Resource Report No. 4, Table 4.7.2-1). The historic properties are varied, including prehistoric camps and pit house villages, historic gold rush related sites, Iditarod-related trails, and trails/highways built as a result of the discovery of oil in Prudhoe Bay. The potential Project construction impacts on the historic properties depend on the specific type of construction activity, as well as the features and character-defining attributes of each property.

In general, any ground-disturbing activity, including activities such as removal of the vegetative mat, grading, trenching, earth-moving, blasting, and driving equipment across a site, may result in direct adverse effects to cultural resources. Indirect effects on cultural resources must also be considered; however, the indirect APE for the Project has not been determined. Indirect effects may result from changes in the landscape that could impact the viewshed of historic or traditional cultural properties or by increasing access to areas with NRHP-eligible cultural resources. Because the plans for aboveground facilities are still developing, consultation with FERC, OHA/SHPO, BLM, and possibly other parties to define the APE for indirect effects has not been initiated.

Once engineering studies and planning are complete, the cultural resources determined, in consultation with FERC, OHA/SHPO and other consulting parties, to be historic properties would be assessed to determine the impacts that the Project would have on each. Although the Project plans to avoid affecting historic properties to the extent practicable, it is unlikely that it would be possible to avoid impacting all historic properties. An engineering review would be conducted for each historic property to determine which could be avoided. A variety of avoidance measures such as horizontal directional drilling, reconfiguration of workspaces, or narrowing the construction workspace could be applied. Should it be impossible to avoid adversely affecting a cultural resource, a detailed data recovery plan would be developed for concurrent review by FERC, OHA/SHPO, and other appropriate parties.

Although most cultural resources are identified through surveys conducted for the Project, it is possible that some cultural resources could escape detection and be discovered during construction. For this reason, the Unanticipated Discovery Plan was prepared to provide protocols for identifying cultural resources and human remains discovered during construction, evaluating their eligibility for listing in the NRHP, and resolving effects if necessary (see Resource Report No. 4, Appendix F). Potential impacts to visual resources have been analyzed using the BLM's Visual Resource Management methodology. This includes evaluation of reserves, wildlife management areas, special management areas, recreation areas, historic trails, scenic byways, and other resources. Mitigation of potential visual resource impacts involves maximizing Project collocation with existing infrastructure and locating nonessential features (e.g., storage areas, work camps) away from key observation points. Locating proposed facilities near existing features would result in less potential contrast to a given viewshed because changes in form, line, color, and texture through vegetation clearing, grading, and the addition of buildings have already been introduced by previous construction. Recommendations for mitigation also include maintaining vegetative screens between Project sites and public spaces such as roads, and angling entry roads to camps and other sites so that equipment and associated materials are not visible from public roads. Construction during times when recreational use is minimal would also reduce visual effects.

7.5.2 Potential Operation Impacts and Mitigation Measures

Prior to the FERC issuing any Order for the Project, a cultural resources survey will have been completed for the entire operational area of the Project along with mitigations for all known historic properties. While the probability of discovering previously undocumented cultural resources or human remains during maintenance or repair activities is unlikely, operations personnel will be trained in the procedures for implementing the Unanticipated Discovery Plan (see Resource Report No. 4, Appendix F) as would be appropriate in an operations setting. In the event of a discovery, the Project would retain the services of a qualified archaeologist or cultural resources specialist to ensure that all appropriate notifications are made, that the resource is properly recorded, and that any necessary treatment is carried out.

7.5.3 Paleontological Resources

Known paleontological resources were identified by Project field assessments in 2015. The results of these assessments, in combination with previous investigations, provided in Resource Report No. 6.

7.5.3.1 Potential Construction Impacts and Mitigation Measures

As detailed in *2015 Paleontological Resources Survey and Inventory Report* (see Resource Report No. 6, Appendix G), the Liquefaction Facility, GTP, PTTL ROW and off-ROW facilities, the PTU Expansion, PBU MGS project, and the Kenai Spur Highway relocation project could be constructed without further paleontological resources assessment, survey, or monitoring. Ground-disturbing activities at each of these Project components have little potential to impact significant paleontological resources. Potential impacts to unanticipated significant paleontological resources would be mitigated by providing workforce paleontological sensitivity training and adhering to the *Paleontological Resources Unanticipated Discovery Plan* (see Resource Report No. 6, Appendix D).

The Mainline and off-ROW Project footprint intersect geologic units with a high probability of significant paleontological resources like vertebrate remains, both from the Cretaceous period (dinosaurs) and Pleistocene (Ice Age). Construction activities for the Mainline and off-ROW work areas listed in Table 4-1 of the *Paleontological Resources Management Plan* (see Resource Report No.6, Appendix E), have the potential to adversely impact significant paleontological resources.

Paleontological resources could be damaged or destroyed during construction activities in areas where the resources are present. Potential impacts could result from construction activities including:

- Excavation and earthmoving activities;
- Erosion of the fossil-bearing strata from slope grading, vegetation clearing, etc.;
- Increased public access to the area leading to a higher risk for being removed or damaged; and/or
- Blasting.

Potential construction impacts and mitigation measures would be addressed in *Paleontological Resources Management Plan* (see Resource Report No. 6, Appendix E), as well as, *Paleontological Resources Unanticipated Discovery Plan* (see Resource Report No. 6, Appendix D).

7.5.3.2 Potential Operational Impacts and Mitigation Measures

In general, sensitive paleontological resources could be damaged or destroyed during maintenance activities that cause ground disturbance, however, the probability is extremely low. Following the *Paleontological Resources Unanticipated Discovery Plan* (see Resource Report No. 6, Appendix D) would mitigate any impacts during operations.

7.6 SOILS AND PERMAFROST

Soil properties crossed by the Project include permafrost, erodible soils, hydric soils, compaction prone soils, topsoil, rocky soils, and prime farmland are summarized in Resource Report No. 7. Although Local NRCS Soil Survey information is typically used to identify soil properties of potentially impacted areas, due to the general lack of intensive land use, the rugged nature of the landscape, and relative inaccessibility of the area, limited comprehensive NRCS Soil Survey Geographic (SSURGO) database information exists for areas crossed by the Project. To effectively identify physical and interpretive characteristics of soils that would be impacted by the construction and operation of the Project, supplemental data sources were analyzed and evaluated to develop Project-specific soil and geotechnical datasets for use in engineering analyses and execution planning. These data sources are described in the following sections.

Additional geotechnical engineering analyses have been and will continue to be conducted to further evaluate soil resources in the Project area as the footprint of the Project facilities are refined based on pre-FEED data and subsequent phases of the Project. Existing Project geotechnical information, including physiography, topography, and surface bedrock data, is discussed in detail in Resource Report No. 6.

7.6.1 Potential Construction Impacts and Mitigation Measures

Potential impacts to soil resources from Project construction and the potential soil-related impacts encountered would vary with the properties of the soil types impacted, including the presence of permafrost and thaw-sensitive areas. Potential construction activities of the Project that may impact soil properties could include:

- Clearing to remove trees and vegetation;
- Grading and excavation to prepare the pipeline ROW and facility sites, including cut and fills along longitudinal and cross slopes;
- Placement of work pads (granular or snow/ice) to support construction equipment;
- Installation of pipe support structural members in areas of aboveground pipe construction;
- Pipe stringing, welding, and coating activities to prepare the pipe for burial or placement on vertical support members (VSMs);
- Pipeline trench excavation, pipelaying, and backfill activities in areas of pipe burial;
- Erosion and drainage control activities during construction;
- Watercourse crossings for pipelines, including open-cut, isolated, buried trenchless (HDD), and aerial crossings, as well as temporary bridges (ice, snow-fill or structural) for construction traffic;
- Borrow source development;
- Reclamation activities following pipe installation;
- Aboveground facility construction;
- Installation of foundations, underground structures, and utilities;
- Offshore construction, including shore crossings;
- Hydrostatic testing water discharge; and
- General infrastructure activities, including construction of camps, laydown areas, stockpile areas, and airstrips.

These activities could result in impacts to soils throughout the Project including:

- Soil erosion due to wind or water;
- Reduced re-vegetation potential;
- Differential thaw settlement along and across the ROW within thaw-sensitive permafrost;
- Contamination (e.g., spills);
- Groundwater depletion or recharge; and
- Fugitive dust generated by operation activities on granular pads.

Inadvertent spills of fluids used during construction, such as fuel, lubricants, antifreeze, detergents, paints, solvents, and herbicides, could contaminate soils. A *Spill Prevention, Control and Countermeasure Plan* (*SPCC Plan*) has been developed that describes measures that would be implemented to prevent and, if necessary, control any inadvertent spill of hazardous substances (See Resource Report No. 2, Appendix N). During construction, all hazardous materials would be handled in accordance with the *SPCC Plan*.

Herbicides may be applied to noxious weeds, stumps, and low-growing brush for conducting vegetation control where necessary before and after construction as described in the *Noxious/Invasive Plant and Animal Control Plan* (see Resource Report No. 3, Appendix K). Herbicides may be toxic to soil organisms and affect the revegetation potential of the area depending on the type used and the concentration. During construction, any herbicides would be handled in accordance with the label instructions; in compliance with any local, state, and federal regulations; and in accordance with landowner agreements as required by land use (organic farms, wetland reserves, etc.).

Adverse effects resulting from soil-related potential impacts due to construction would be avoided or greatly reduced through route selection, engineering design, monitoring, and agency consultation. In addition to these reports, industry best-management practices (BMPs) and engineering design would be used to prevent or mitigate adverse effects wherever possible. Induced impacts will be addressed in overarching

construction environmental management plans and operations environmental management plans prepared by the Project and prior to construction or during permitting (see Section 6.2). These documents include, but may not be limited to:

Many of the Project-specific plans and procedures were developed from public reports, guidelines, and best practices published by state or federal agencies and departments, including: ADOT&PF, ADNR, USACE, and BLM.

The following sections briefly summarize construction impacts to soil resources from Project construction and mitigations for potential soil-related impacts anticipated at the Liquefaction Facility and Interdependent Project Facilities.

7.6.1.1 Liquefaction Facility

The construction of the Liquefaction Facility may have several impacts on the native soils within the facility footprint. Anticipated impacts associated with construction of the Liquefaction Facility include: clearing and grubbing, excavation of overburden soils, borrow source development, foundation construction, aboveground facility construction, and general infrastructure activities.

7.6.1.1.1 Permafrost

No known permafrost exists at the Liquefaction Facility.

7.6.1.1.2 Erodible Soils

The native soil at the Liquefaction Facility consists primarily of silts and loams that can have the potential to be erodible. During construction, clearing and grubbing operations would expose topsoil. To reduce potential impacts due to soil erosion and associated sedimentation, erosion and sedimentation control methods described in the Applicant's Plan would be followed. Exposed soils have an increased potential to be eroded via wind and water, as discussed in the previous sections; to combat this, measures would be taken to reduce the time that soils are left exposed during construction. The Applicant's Plan has adapted and modified the FERC *Plan* to accommodate Alaska-specific conditions. The Applicant's Plan employs a toolbox approach of BMPs for selection and implementation based on site-specific conditions at the time of construction.

It would take approximately seven years to complete construction, which would likely result in work being completed in stages to limit the amount of soil that has been cleared and exposed to erosive forces. As work progresses on the property, surfacing materials (granular materials, asphalt, concrete) would be placed as soon as practical to reduce exposure and risk of erosion; where unfinished surfaces must remain exposed for extended durations, dust suppressants/soil binders would be used to provide protection, and stable contour grading would be used to minimize soil runoff from the site.

7.6.1.1.3 Hydric Soils

No impacts to mapped hydric soils are anticipated to take place during Project construction of the Liquefaction Facility.

7.6.1.1.4 Compaction-Prone Soils

Construction activities, including clearing to remove trees and vegetation, aboveground facility construction, and general infrastructure activities grading and excavation, may cause soil compaction. Compaction impacts could result in loss of soil productivity due to damage to soil structure from heavy equipment. To minimize potential impact to soil resources, soil would be prepared after final grading to facilitate revegetation in undeveloped areas of the Liquefaction Facility site as outlined in the *Plan*. This could include tilling compacted soil or other measures depending on the extent and severity of compaction.

7.6.1.1.5 Topsoil

In the initial stages of construction, topsoil would be stripped, segregated, and stored on site for use during final grading and restoration of areas not paved or occupied by plant facilities. Maintenance of the stripped topsoil would include best management practices to prevent erosion, inadvertent mixing, and excessive compaction. If excess topsoil would remain, procedures for the disposal of materials for beneficial reuse would be followed, as detailed in a final grading plan.

7.6.1.1.6 Stony/Rocky Soils

There are no stony or rocky soils within the upper 72 inches of any soil that could be impacted by the Liquefaction Facility.

7.6.1.1.7 Prime Farmland Soils

No Prime Farmland Soils exist in Alaska and no Soils of Local Importance would be impacted by the construction of the Liquefaction Facility.

7.6.1.2 Interdependent Project Facilities

The construction of the Interdependent Project Facilities may have several impacts on the native soils within the facilities' footprints. These anticipated impacts would be associated with the clearing and grading along the ROW, placement of work pads, borrow source development, aboveground facility construction, pipeline excavation (trenching, backfilling, and reclamation), hydrostatic testing water withdrawal, trenchless methods of burial, and general infrastructure activities.

7.6.1.2.1 Permafrost

During construction the pipeline excavation could cause freezing and thaw-related effects that could include:

- Freezing of unfrozen ground leading to frost-bulb formation and potential frost heave;
- Solifluction and soil creep;
- Thawed layer detachment; and
- In-situ effects including subsidence and thaw consolidation, thermokarsting, and thaw bulb formation.

Approximately 348.7. miles of the Mainline portion of the route cross thaw-stable soils. The majority of these soils are eolian, colluvial, and alluvial in nature. These soils should have few limitations due to effects of pipeline construction on permafrost characteristics. Where the Mainline crosses thaw-sensitive soils, there is the potential for problems with thaw-induced subsidence, solifluction, and soil creep, or thawed layer detachment. The majority of the thaw-sensitive soils along the Mainline would be crossed by construction during winter.

- From MP 0–MP 180, the pipeline temperature would remain below freezing throughout the year in continuous permafrost. The natural gas in the pipeline would be cooled and maintained to below freezing temperatures to maintain the stability of thaw-sensitive soils, reducing thaw-related movement of the pipeline and impact to permafrost. For compressor stations with cooling, two types of natural gas cooling equipment are proposed: gas-to-gas exchangers and aerial coolers.
- From MP 180–MP 567, seasonal variation in natural gas temperatures would range from below freezing in the winter to above freezing in the summer. The in-line temperature in discontinuous permafrost areas was designed for a 32°F year-round average. This design maintains ground conditions under the pipe close to original conditions.
- From MP 567–MP 804, in areas of predominantly warm, non-permafrost conditions, the natural gas temperature would be allowed above freezing temperatures and maintained by using indirect fired natural gas heaters to prevent frost heaving and to meet design inlet natural gas temperature at the LNG Plant.

Winter construction in frozen soil conditions would be a primary means of mitigating adverse impacts of pipeline construction on potentially affected soils in thaw-sensitive terrain (e.g., tundra, ice-rich permafrost, muskegs, as well as other areas of permafrost and non-permafrost). Construction protocols and ROW configurations to reduce, to the extent practicable, adverse impacts on thaw-sensitive permafrost soil areas during winter construction have been developed. A detailed presentation of thaw-sensitive and thaw-stable soils by MP in the Project area is provided in Appendix C, Extended Tables for Resource Report No. 7.

The majority of the soils and terrain units within the construction footprint of the North Slope facilities (PTTL, PBTL, GTP, and associated facilities) are permafrost soils that are thaw-sensitive in terms of thaw-settlement and loss of strength on thawing. However, given the flat topography of the North Slope and the fact that pipelines would be constructed in winter from ice roads onto VSMs, and that work on the GTP would be from a granular pad, it is unlikely that solifluction, soil creep, or thawed layer detachment would be issues either during construction, reclamation, or for operations and maintenance. There could be potential for thaw-induced subsidence depending on site-specific conditions such as natural drainage patterns. The PTTL and PBTL would be placed aboveground on VSMs to reduce heat transfer to underlying soils, minimize impacts to areas of thaw-sensitive permafrost, and keep the ground frozen. The GTP facility would incorporate proven Arctic design techniques of granular pads, piles, VSMs and thermosiphons to protect the active layer and underlying permafrost. The granular material required for construction of the GTP would be obtained from the planned mine to the southwest and the dedicated water reservoir.

At compressor stations underlain by thaw-sensitive permafrost, buildings and associated infrastructure would be elevated and granular pads would be installed to mitigate heat transfer to the underlying permafrost. During construction of compressor stations, adherence with the Applicant's Plan would reduce the effects of erosion on affected soils.

Special pipeline construction methods have been developed for winter and permafrost soil conditions that address both thaw-sensitive and thaw-stable permafrost. Those methods are described in detail in the *Winter and Permafrost Construction Plan* found in Resource Report No. 1, Appendix M. This plan describes construction techniques and mitigation measures to be used during the construction of the pipelines for PTTL, PBTL, and Mainline to minimize the extent and duration of Project-related disturbance on permafrost terrain whether constructed in winter or summer. These construction techniques and mitigation measures are based on experience gained in constructing TAPS, more than 30 years of Arctic construction experience on Alaska's North Slope, as well as cold-region pipeline construction in other parts of North America. Construction methods and procedures include development of multiple ROW modes that consider the thaw sensitivity of permafrost, terrain slope conditions, MLRA, and season of construction. The *Winter and Permafrost Construction Plan* is also intended to fulfill the requirement of the Applicant's Plan.

7.6.1.2.2 Erodible Soils

During construction of Interdependent Project Facilities, clearing and grading along the ROW, pipeline excavation (trenching, backfilling, and reclamation), and general infrastructure activities could accelerate the erosion process and, without adequate mitigation, result in discharge of sediment to waterbodies and wetlands. Soil loss due to erosion could also reduce soil fertility in agricultural land and impair natural revegetation.

Approximately one-third of the soils impacted by the Mainline are considered highly water-erodible and one-quarter are considered highly wind-erodible. No soils were identified as highly water or wind erodible soils along the entire length of the PBTL and PTTL, or the GTP.

Most direct erosion-based impacts are expected to be temporary (lasting a few months after clearing and pipeline construction) to short-term (effects persisting for up to three years after clearing and pipeline construction). Persistent direct and indirect effects would result in areas that are restored to stable conditions that may not reflect preconstruction contours; however, the establishment of stable surfaces would represent the presence of an additional natural landform after the area has been stabilized, though different from preconstruction conditions.

To reduce potential impacts due to soil erosion and associated sedimentation, erosion and sedimentation control methods would be used as described in the Applicant's Plan. The Applicant's Plan includes proposed modifications to the FERC *Plan* to accommodate Alaska-specific conditions, including permafrost (via the *Winter and Permafrost Construction Plan)* and widespread silty soil deposits. The Applicant's Plan employs a toolbox approach, containing BMPs available for selection and implementation based on site-specific conditions at the time of construction.

During operations, the effectiveness of revegetation and permanent erosion control devices would be monitored by the Project. Except in actively cultivated agricultural areas, temporary erosion control devices would be maintained until the ROW would be stabilized successfully, as defined in the Applicant's Plan. Following successful stabilization of construction areas, temporary erosion control devices would be removed by the Project, where appropriate.

7.6.1.2.3 Hydric Soils

Over half of the soils crossed by the Mainline are expected to be hydric. Of these, approximately one-quarter would be crossed during winter construction. Construction during winter would be an effective mitigation measure when crossing hydric soils by allowing permafrost soils to remain stable.

The soils impacted by the PBTL and the majority of the PTTL are also expected to be hydric. Areas that may not be hydric along the PTTL include dune areas, sand blankets, and the coarse-textured terraces adjacent to rivers. Hydric soils along the PBTL and PTTL would be crossed during the winter, minimizing disturbance. In addition, the PBTL and PTTL would be placed aboveground on VSMs from ice roads, further reducing the amount of ground disturbance.

The soils impacted by the GTP are also hydric. The GTP would be constructed on a granular pad and the associated infrastructure would be built using ice pads and roads. Soils outside of the GTP pad would be subject to minimal disturbance. Similarly, the Pipeline Aboveground Facilities would be constructed on granular pads with minimal offsite disturbance anticipated for any hydric soils present.

Hydric soils are not treated differently from upland soils unless they are components of delineated wetlands. Impacts on hydric soils are expected to be minimal in areas constructed during winter. Mitigation to impacts during summer construction is identified in the Applicant's Procedures.

7.6.1.2.4 Compaction-Prone Soils

The majority of the soils crossed by the Mainline are compaction-prone, however, an estimated one-third are crossed during winter using construction methods outlined in the *Winter and Permafrost Construction Plan*. Construction during winter is anticipated to limit compaction impacts on these soils. Additionally, the

majority of the soils impacted by the PBTL and PTTL are also compaction-prone because they are poorly to very poorly drained, and they consist of relatively fine-textured eolian material overlying coarser-textured outwash and fluvial sediments; however, construction would occur in the winter using ice roads.

Approximately one-fifth of the compaction-prone soils would be crossed by summer construction where compaction of the active layer in permafrost soils may occur. Removal of the topsoil and the loose surface material in actively cultivated agricultural areas would avoid or reduce compaction typically associated with heavy machinery working over thin layers of topsoil. Seasonal freezing and thawing of Gelisols, the most common permafrost soils in Alaska, also serves as a self-mitigation for compaction to reduce the effects of compaction in non-agricultural soils.

Prior to construction, actively cultivated agricultural land would be identified (if any) and adverse impacts would be reduced with adherence to the measures outlined in the Applicant's Plan.

Because of compaction alleviation practices in the Applicant's Plan, impacts are likely to be temporary to short term in agricultural land. Similarly, impacts are expected to be negligible to short term in areas constructed during winter. In undisturbed land that is crossed by construction during summer, most direct impacts are expected to be temporary (lasting a few months after construction) to short term (effects persisting for up to three years) as freeze and thaw processes that are characteristic of the active layers in somewhat poorly drained to poorly drained soils naturally alleviate compaction. Better-drained soils that are crossed are not expected to have substantial compaction impacts.

The majority of the soils impacted by the GTP are compaction-prone. However, the GTP would be constructed on a granular pad and the associated infrastructure would be built using ice pads and roads during the winter or from granular roads. Compaction-prone soils outside of the GTP pad would be subject to minimal disturbance. Similarly, the GTP associated infrastructure would be constructed on granular pads or ice roads with minimal offsite disturbance anticipated for any compaction-prone soils present. Although the soils present exhibit compaction characteristics, there would be no compaction impacts since the soils would be covered with gravel or temporarily covered with ice.

7.6.1.2.5 Stony/Rocky Soils

Introducing stones, cobbles, or rocks to surface soil layers can reduce soil moisture-holding capacity and thus reduce soil productivity. For the buried Mainline, subsurface rocks can be expected in some areas throughout the Mainline.

During construction, adverse impacts due to the presence of stones and rocks in cultivated agricultural soils would be reduced by following mitigation protocols provided in the *Erosion Control, Revegetation, and Maintenance Plan* (Appendix D). Similarly, impacts are expected to be negligible to short term in areas constructed during winter. In undisturbed land that is impacted by construction during summer, and in areas of cross slopes and longitudinal slopes requiring cuts, most direct impacts are expected to be negligible in areas where loose surface material are placed on the surface of the reclaimed area. There may be some areas outside agricultural land where excess blast rock and subsoil rock may be spread out along the ROW; however, because these areas are not in agricultural use, the impacts of stones and rocks on reclamation are not expected to be significant. After reclamation, these nonagricultural areas may not reflect preconstruction conditions. The establishment of stable surfaces would represent an additional natural landform after the area has been stabilized.

For the PBTL and PTTL, the terrain data suggest that most of the ROW has few or no subsurface stones greater than 3 inches in size. In addition, these pipelines would be constructed aboveground on VSMs.

The terrain data suggest the Project footprint of the GTP does not have any subsurface stones greater than 3 inches in size. The presence of bedrock and large stones would not affect GTP construction because the facility would be placed on a granular pad. Similarly, the Pipeline Aboveground Facilities would be constructed on granular pads and would not be anticipated to be affected by the presence of subsurface stones.

7.6.1.2.6 Topsoil

The majority of the soils (75 percent of total) impacted by the Mainline, PTTL, and GTP have topsoils that are greater than 20 inches in thickness. This topsoil material includes loose surface material and organic-enriched surface mineral material that has been cryoturbated (churned up) within the active layer by frost action. However, all of the PBTL traverses soils with very thin topsoil and both the PBTL and the majority of the PTTL would not require trench construction.

The treatment and conservation of agricultural land, topsoil, and loose surface material is illustrated for ROW construction configurations in Resource Report No. 1. During construction, protocols would be followed for treatment of topsoil and loose surface material as indicated in the Applicant's Plan.

Persistent direct and indirect effects may result in areas where segregation of topsoil and surface soils is not practicable, or where constructed pads have been permanently placed. The establishment of stable surfaces would represent an additional man-made landform. This landform would be stabilized and reclaimed, but would be different from preconstruction conditions.

The GTP facility would be placed on a granular pad and the associated infrastructure would be built using ice pads and roads during the winter. Topsoil outside of the GTP pad would be subject to minimal disturbance. Similarly, the Pipeline Aboveground Facilities would be constructed on granular pads with minimal offsite disturbance anticipated.

7.6.1.2.7 Prime Farmland Soils

No Prime Farmlands Soils exist in Alaska; however, the Mainline would cross Soils of Local Importance. Topsoil and revegetation BMPs would be followed to reduce impacts to these soils.

7.6.1.3 Non-Jurisdictional Facilities

7.6.1.3.1 Permafrost

The PTU Expansion project and PBU MGS project footprints cross primarily thick gravelly permafrost soils that are thaw-stable. To reduce impacts, the following mitigation efforts would be implemented:

- Placing a minimum of 5 feet of granular fill;
- Elevating permanent heated buildings or structures on piles;
- Elevating off-pad pipelines containing warm (above freezing) fluids on vertical support members (VSMs);
- Minimizing or avoiding impoundments by maintaining natural drainage patterns to the extent practicable;
- Installing thermosyphons around wells to control heat transfer from wellbore fluids and protect wellbore integrity; and
- Insulating conductor piles and filling well annuli with insulating gel to minimize heat transfer to the permafrost.

No known permafrost exists along the KSH relocation project footprint.

7.6.1.3.2 Erodible Soils

The PTU Expansion and PBU MGS Project footprints are underlain by peat soils that are not susceptible to wind or water erosion. The native soil on the Kenai Spur Highway relocation project area consists primarily of silts and loams, which can have a high potential to be susceptible to wind erosion. Plans to reduce wind erosion impacts during construction, along with mitigation efforts, are discussed in Section 7.6.1.2.2.

7.6.1.3.3 Hydric Soils

All of the soils within the PBU MGS and PTU Expansion Projects are hydric. The current routing of the Kenai Spur Highway relocation project alternatives avoids hydric soils.

7.6.1.3.4 Compaction-Prone Soils

All of the soils within the PBU MGS and PTU Expansion are peat, which have a high potential for compaction. The native soil on the Kenai Spur Highway relocation project area consists primarily of well drained silts and loams, which have a low potential for compaction. Because the PTU Expansion project and the PBU MGS would be built in winter off of ice roads, or involve the use of gravel pads or gravel roads, impacts to compaction prone soils are not anticipated.

7.6.1.3.5 Topsoil

Topsoil maintenance and disposal for Non-Jurisdictional Facilities would follow the procedures discussed in Section 7.6.1.3.5, as applicable.

7.6.1.3.6 Stony Rocky Soils

There are no stony or rocky soils within the upper 72 inches of any soil that could be impacted by the Non-Jurisdictional Facilities.

7.6.1.3.7 Prime Farmland Soils

No Prime Farmland Soils exist in Alaska and no Soils of Local Importance would be impacted by the Non-Jurisdictional Facilities.

7.7 POTENTIAL OPERATIONAL IMPACTS AND MITIGATION MEASURES

Impacts to soil resources from Project operation and the potential soil-related impacts encountered would vary with the properties of the soils impacted and the nature of the operational activity. Operation activities that could impact soil properties are maintenance activities, geohazard monitoring and intervention, vegetation maintenance, maintenance of drainage control structures (e.g., interception ditches, culverts, and subdrains), and main equipment traffic.

Impacts to soil resources as a result of Project operations may include:

- Permanent conversion of soils due to installation of impervious surface (e.g., foundation paving);
- Differential thaw settlement along and across the ROW within thaw-sensitive permafrost;
- Long-term degradation of permafrost and deepening of the active layer;
- Frost bulb development and frost heave in susceptible unfrozen soils; and
- Contamination (e.g., spills);

7.7.1 Liquefaction Facility

Operations that may result in permanently altered soils or loss of soil resources include the developed site of the Liquefaction Facility, permanent roads, granular pads left in place following construction, and granular pads for aboveground facilities.

7.7.2 Interdependent Project Facilities

Stabilization and revegetation planned for the pipeline ROW would involve mitigation measures, such as re-contouring to stable contours, but not restoring original contours in all cases. In areas where removal of granular pads used for construction would be likely to create significant damage to underlying permafrost

soils, pads would be left in place following construction to naturally settle, saturate, and eventually revegetate.

In the continuous permafrost region, the pipeline temperature would be a relatively constant 30° F year-round to prevent thaw settlement of the pipeline. In discontinuous permafrost regions, in order to minimize differential settlement of the pipe relative to that of the ROW, pipeline sections would operate above freezing in the summer months and below freezing throughout the winter months. The average annual discharge temperature would be maintained at or below freezing for the majority of the line. This would ensure overall preservation of permafrost in the vicinity of the pipe.

Maintenance of granular pads and access roads following construction is not planned unless required for ongoing operations/maintenance access to specific locations in the Project area, or required by the landowner. In this case, only limited maintenance would be planned to be carried out, possibly affecting recovery of soil resources along roads and pads used for maintenance activities.

7.8 WATER RESOURCES

Alaska is divided into six hydrological regions: Arctic, Northwest, Interior, Southwest, Southcentral, and Southeast that differ in terms of physiography and climate, affecting groundwater movement and storage (USGS, 2012). The Project would cross the Southcentral, Interior, and Arctic hydrological regions.

Surface water resources within the proposed Project area were initially identified through desktop analysis using USGS Nationally Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD), best available imagery, and LiDAR (Light Detection and Ranging). Subsequent hydrology field investigations were conducted to document hydrologic characteristics and representative reaches (upstream and downstream) at select waterbodies for developing site-specific mitigation measures to avoid and minimize adverse impacts to surface water resources. Waterbodies that would be crossed by the Project pipeline facilities, including milepost, proposed crossing method and construction season, crossing width, flow regime, and fishery classification are listed in Resource Report No. 2, Appendix H.

7.8.1 Groundwater Resources Construction Impacts and Mitigation Measures

The use of groundwater resources would be relied upon to support construction activities. Without the implementation of BMPs, unregulated withdrawal of excessive water volumes from aquifers could have the potential to affect groundwater supply, while construction activities and spill events have the potential to affect groundwater quality. Groundwater would be relied upon for a wide range of Project uses (e.g., potable water, concrete preparation, hydrostatic testing, dust suppression). Anticipated groundwater use during Project construction is summarized in the Project *Water Use Plan* included in Resource Report No. 2, Appendix K.

Construction activities that could potentially impact groundwater resources (i.e. water yield and/or water quality) would include, but are not limited to, the following:

- Blasting;
- Clearing, grading, and site preparation;
- Dewatering and trenching;
- Domestic sewage and greywater disposal from construction camps;
- Facility, work pad, and helipad/airstrip construction;
- Groundwater withdrawal;
- Hydrostatic test water discharge;
- Material extraction sites and excavation dewatering;
- Potential of drilling mud release during trenchless construction;
- Potential of encountering contaminated soils or groundwater;
- Restoration or reclamation of construction areas;

- Spills or leaks of petroleum liquids or hazardous materials;
- Stormwater management and runoff;
- Underground injection; and
- Water well construction or disturbance.

Construction practices designed to minimize or mitigate potential impacts on groundwater during construction would be implemented.

7.8.1.1 Liquefaction Facility

The Liquefaction Facility would be underlain by the principal unconsolidated-deposit aquifers in the Cook Inlet Basin ecoregion. Depth to groundwater at the Liquefaction Facility site varies depending on proximity to the subsurface geologic feature (i.e., stratigraphically higher Killey Unit and the stratigraphically lower Moosehorn Unit). Water Bearing Unit 1 was found within the Killey Unit, and is unconfined with water elevation ranging between 100 feet (NAVD88) and 73 feet (NAVD88). Water Bearing 2 is present within the Moosehorn geologic unit, is semi-confined, and lies immediately beneath the Killey-Moosehorn transition zone (see Resource Report No. 2). Observed water elevations ranged from 96 feet (NAVD88) and 17 feet (NAVD88), which is reflective of upgradient and downgradient locations, respectively. No sole-source aquifers or springs would be impacted by construction of the Liquefaction Facility.

7.8.1.1.1 Clearing, Grading, and Site Development

Clearing and grading of the LNG Plant on the Liquefaction Facility site would likely cause a minor decrease in localized groundwater infiltration (i.e., absorption of rainfall into soils) and recharge (i.e., the process by which water moves downward from surface water to groundwater). Site development with the construction of roads, parking areas, laydown areas, and other areas with impermeable concrete and asphalt would also result in a minor reduction in infiltration and recharge. The impacts to groundwater recharge from clearing, grading, and site development would be long-term as the site would remain developed following construction. Natural vegetation buffers would be left intact and maintained around the LNG Plant site. Impact from dust would be mitigated by following BMPs listed in the Project *Fugitive Dust Control Plan* (Resource Report No. 9, Appendix J) and *SWPPP* (Resource Report No. 2, Appendix J).

7.8.1.1.2 Foundation Construction

Foundation construction would include installation of granular pads, pile driving for support structures, and concrete work. The foundation for the LNG Plant and associated aboveground structures would be excavated and replaced by structural fill. Depending on the depth of excavation, shallow groundwater could be encountered during foundation construction, exposing it to potential surface water runoff, dust, and spills. In addition, piles could potentially be conduits for contaminants to impact groundwater if a spill of hazardous material occurs at the pile location. Implementation of the BMPs provided in the Applicant's Plan (Resource Report No. 7, Appendix D) and the *SPCC Plan* (Resource Report No. 2, Appendix M), as well as adherence to ADEC requirements, would minimize the risk of potential impacts to groundwater. Potential spill-related impacts and mitigation measures are further discussed in the following sections. Impacts to groundwater from foundation construction would be anticipated to be short-term and minor.

The Marine Terminal would also require pile installation. The piles are not anticipated to be of sufficient depth to penetrate marine aquitard layers or influence saltwater encroachment into the groundwater table. No impacts to the groundwater table are anticipated from Marine Terminal construction.

7.8.1.1.3 Dewatering

Shallow groundwater may be encountered during foundation construction or pipe laying, and dewatering may be required. Without appropriate controls, dewatering of shallow groundwater aquifers result in a localized lowering (i.e., drawdown) of the aquifer and potential changes in groundwater quality, such as

increases in turbidity. It is anticipated that these changes would be minor and temporary. The amount of water table drawdown and the area influenced are dependent upon the hydraulic conductivity of the soil, the depth of the excavation relative to the water table, and the volume of the excavation that requires dewatering. Shallow groundwater aquifers generally recharge quickly because they are easily recharged from precipitation and surface waters.

Extracted water would likely be pumped into an onsite settling pond in accordance with an APDES General Permit AKG320000 – Statewide Oil and Gas Pipelines. The permit sets conditions on pollutants and authorizes discharges into waters of the United States and disposals to State lands resulting from construction, operation, and maintenance activities for pipelines and related facilities. This wastewater disposal general permit authorizes the following discharges from pipeline facilities:

- Drilling Fluids and Drill Cuttings;
- Domestic Wastewater;
- Gravel Pit Dewatering;
- Excavation Dewatering;
- Hydrostatic Test Water;
- Storm Water;
- Mobile Spill Response; and
- Secondary Containment.

Effluent limitations and requirements for excavation dewatering (Discharge 004) include parameters such as flow volume, pH, settleable solids (SS), turbidity oil and grease visual (no discharge), Total Aqueous Hydrocarbons (TAqH), and Total Aromatic Hydrocarbons (TAH). The Project may be required to apply for individual permits for locations where the Project wastewater discharges would be unable to comply with permit eligibility criteria.

Any discharges to the ground would be first directed through an energy-dissipating device to reduce the potential for erosion and encourage infiltration back into the soil. If dewatering requires pumping of more than 30,000 gallons per day, an ADNR Temporary Water Use Permit would be obtained. With the use of the appropriate BMPs, it is anticipated that impacts to groundwater from dewatering would be mitigated according to TWUP conditions.

Excavation and dewatering in contaminated areas can expose contaminants in groundwater or cause them to migrate to previously unaffected adjacent areas by altering the local groundwater flow regime. To reduce or eliminate the potential for such impacts, construction in known/predetermined contaminated sites would be avoided to the extent practicable. Visual monitoring for sheen and odor would also be performed daily in all locations where dewatering occurs. Site-specific plans detailing how contaminants in areas of known contamination (see Resource Report No. 8) would either be avoided or removed, and would be provided separately following consultation with ADEC and EPA. In addition, for sites located within 1,500 feet of an identified contaminated site, dewatering would be performed in accordance with the BMPs provided in the Project *Groundwater Monitoring Plan* (Appendix B). If unanticipated contamination is discovered during construction, the Project *Unanticipated Contamination Discovery Plan* (Resource Report No. 8, Appendix J) would be followed to protect groundwater resources.

7.8.1.1.4 Proposed Water Supply Wells

Groundwater would be used for site preparation, dust suppression, potable water, concrete mixing, back-up fire water supply, and hydrostatic testing. New 200- to 250-foot-deep groundwater wells would be located on the site to supply water for construction of the Liquefaction Facility. This location has been proposed because it presents high groundwater yield potential, and it is sufficiently removed from the coastal bluff to minimize the potential for saltwater intrusion into the aquifer. During peak construction activities, onsite water demand for the Liquefaction Facility would be approximately 300,000 gallons per day, or 250 gallons per minute, depending on whether hydrostatic testing of the LNG Tanks would be using freshwater or seawater from Cook Inlet. This includes water for construction uses and for potable water at

the camp. A breakdown of the proposed water use is provided in the *Water Use Plan* (Resource Report No. 2, Appendix K).

Potential impacts to groundwater from construction water use are anticipated to be short-term and minor. Construction activities may impact groundwater through impacts to existing water wells during the drilling or casing of new wells. By following permitting requirements to ensure the wells are properly built and subsurface formations are sealed off by the well casing and cement, impacts to drinking water aquifers can be avoided. The interaction between surface water and groundwater would be prevented by sealing any settling or retention ponds on-site and putting a buffer around existing wells during construction until they can be sealed and capped. The existing water wells may be used during the pioneering phase of construction as the new construction wells are installed. However, the wells would be sealed/capped during site preparation. They are not intended to be used for operations.

Construction activities could also impact water supply wells in the vicinity of the Liquefaction Facility site by altering aquifer porosity/permeability (i.e., infiltration rates) and/or the recharge area (e.g., compaction from heavy equipment operation). In addition, spills could contact shallow groundwater. Impacts would be unlikely, but if they occurred, would result in temporary and localized impacts. For water supply wells located within 150 feet and up to 500 feet of the construction footprint, routine monitoring of the groundwater quality and yield would be performed on a case-by case basis, as required by FERC regulations and ADEC APDES permits. Monitoring of wells in the vicinity of the construction footprint would depend on construction activity and potential to impact water source as detailed in the Project *Water Well Monitoring Plan* (Resource Report No. 2, Appendix C).

Water quantity and quality testing would be implemented prior to, during, and after construction completion, as needed. Water quantity parameters would be monitored, including water column height, flow rate of existing equipment, water column drawdown, and rebound time. Water would also be tested for compounds of concern including arsenic, manganese, iron, total dissolved solids, nitrates, pathogens, and radon. In addition, the BMPs listed in the Project *SWPPP* and *SPCC Plan* (Resource Report No. 2, Appendices J and Appendix M, respectively) would be followed. In the unlikely event that damage to a water supply were to occur during construction, affected parties would be provided with temporary sources of potable water and a new, comparable well or an alternative water source.

7.8.1.1.5 Hydrostatic Testing

Hydrostatic testing would occur directly after the LNG tanks and other Liquefaction Facility piping is installed to determine that they are leak-free and meet design strength criteria. Details of the required water volumes and testing procedures are provided in the Project *Water Use Plan* (Resource Report No.2, Appendix K). Hydrostatic test water would be sourced from Cook Inlet. Hydrostatic testing of the LNG tanks would occur over a 14-21 day period, with an average fill rate of 1,400 – 2,000 gallons per minute of Cook Inlet seawater. Hydrostatic testing of the 240,000 cubic meter tanks would require roughly 42,000,000 gallons of water. If groundwater is used for hydrostatic testing of plant piping, the withdrawal rate of fresh water from the onsite construction wells would be reduced to the extent practicable to reduce the potential for local groundwater drawdown. Impacts on groundwater availability could be significant but would be localized and temporary. Potential impacts from the use of Cook Inlet water for hydrostatic testing are discussed in Section 2.3.8.

Hydrostatic test water would be pumped into an onsite settling pond in accordance with an APDES Statewide Oil and Gas Pipeline. The existing APDES General Permit requirements/limits are set for discharge effluent limits of pH, settleable solids, sheen (none), TAqH, TAH, total residual chlorine, Turbidity (marine), Turbidity (fresh water), and flow. With adherence to permit requirements, it is anticipated that any impacts to groundwater from test water discharge would be localized, short-term, and minor.

7.8.1.1.6 Material Sites

As detailed in the Project *Gravel Sourcing Plan and Reclamation Measures* (Resource Report No. 6, Appendix F), onsite quarries would be developed at the Liquefaction Facility to serve the primary fill needs for construction of the Liquefaction Facility. However, the impact to any confined aquifers is unlikely since

they are well over 90 feet deep. Surficial groundwater may be present, depending on rainfall events and season of initial ground disturbance. However, this surficial groundwater would be removed through dewatering for the mining of granular material from the site.

To protect groundwater resources, the measures included in the Gravel Sourcing Plan and Reclamation Measures (see Resource Report No. 6, Appendix F) will be implemented. Impacts to groundwater from material extraction are expected to be short term and minor.

7.8.1.1.7 Blasting

Blasting is not anticipated to be required for construction of the Liquefaction Facility.

7.8.1.1.8 Domestic Wastewater

A temporary domestic wastewater treatment plant would be located east of the construction camps. Discharge from the temporary wastewater plant would be to a sediment basin on site that would ultimately discharge to Cook Inlet through an outfall in accordance with APDES permit requirements. Coverage under the newly implemented APDES Wastewater Disposal Authorization General Permit (*AKG320000 – Statewide Oil and Gas Pipelines*) for Project domestic wastewater discharges from the operation of a domestic wastewater treatment works would specify the total amount (usually in pounds) of wastewater that could be discharged from each site. APDES permit would include limits on the following pollutants: five-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform and escherichia coli bacterias, total residual chlorine, pH, and flow rate.

To reduce fecal coliform count, disinfection such as ultraviolet (UV) or chlorine would be used. In the unlikely event of a sewage spill, immediate clean-up procedures would be implemented and impacts to groundwater would be temporary and minor.

7.8.1.1.9 Fuel Use, Storage, Refueling, Lubrication, and Spill Prevention

Construction equipment would generally be refueled on the site by fuel trucks. There would be temporary fuel storage tanks placed on-site within temporary bermed secondary containment.

All fuel handling necessary for construction would be in accordance with ADEC requirements and the Project draft *SPCC Plan* (Resource Report No. 2, Appendix M) for the construction phase of the Project to minimize the potential for accidental releases and to establish proper protocol concerning minimization of, containment of, remediation of, and reporting of any releases that might occur. The proposed measures to reduce the risk of spills and minimize impacts should a release occur include, but are not limited to:

- Inspections of tanks, vehicles, equipment, and automatic shut-offs for leaks would be conducted daily;
- Secondary containment would be used for all single-walled containers, portable (e.g., skid-mounted) fuel tanks, aboveground tanks, and containers in excess of 55 gallons. Secondary containment capacity would be 110 percent of the volume of the largest container;
- Impermeable plastic lining materials would be used for temporarily stored contaminated soils and materials;
- Supervisors would oversee major fuel transfers (e.g., filling storage tanks), and other personnel would be trained on how to conduct transfers. Personnel would be trained on the components of the *SPCC Plan*;
- Sorbent, boom, and clean up materials would be available on all construction sites. All fueling vehicles would carry spill response materials such as absorbent pads, plastic bags, and shovels;
- The storage of petroleum products and refueling and lubricating activity during construction would take place at least 150 feet from water supply wells to the extent practicable. If within 150 feet, locations would be approved by the Environmental Inspector, spill response materials would be available at the site, and secondary containment structures would be used;
- Cook Inlet-specific SPCC practices would be followed; and

- If a spill were to occur in an upland area, activity associated with that spill would cease until the release was contained at the source. Small spills would be cleaned up with absorbent materials to reduce penetrations into soils, and large spills would be immediately pumped into tank trucks. Contaminated clean-up materials, excavated soil, and water would be disposed of in accordance with all applicable state, local, and federal laws and regulations.

  All petroleum, oil, and lubricant handling needed for construction would be dictated by the SPCCs. Environmental Inspectors would also oversee contractor compliance with the plan. To further protect groundwater, petroleum product storage and handling would have appropriate secondary containment to prevent spills.

  While any release has the potential for significant adverse environmental impacts, adherence to the *SPCC Plan* would greatly reduce the likelihood of such impacts, as well as minimize the resulting impacts should a spill occur.

7.8.1.1.10 Waste Management

Waste management activities would be performed in accordance with the waste management hierarchy. In order of preference, the aim would be:

1. Avoidance – Avoid the generation of waste, and particularly hazardous waste, through applicable methods, practices or materials substitution.
2. Minimization – Minimize the amount of generated waste where waste generation cannot be avoided or prevented.
3. Reuse – Reuse materials that would otherwise be relegated to a waste stream.
4. Recycle – Recycle wastes by delivering them to accessible and practicable recycling programs.
5. Recover – Recover energy from waste.
6. Disposal – Dispose of wastes responsibly at only properly licensed waste disposal facilities.

All waste generated from construction would be handled in accordance with the Project *Waste Management Plan* (Resource Report No. 8, Appendix K). This plan addresses hazardous and nonhazardous waste materials and volumes, handling, and disposal in detail. The plan would reflect compliance with all regulations for transportation, treatment, storage, and disposal. The generation and storage of hazardous wastes during construction would be minimal. Volumes and types would be determined when construction contractors are selected and construction plans finalized. At that time, each contractor would be required to develop a waste management plan that follows the guidance in the Project *Waste Management Plan* and outlines the types, volumes, and disposition of wastes anticipated during construction. With adherence to the Project *Waste Management Plan* procedures and mitigation measures, adverse impacts to groundwater due to waste management during construction of the Liquefaction Facility are not anticipated.

7.8.1.2 Interdependent Project Facilities

The various Interdependent Project Facilities, including the Mainline, PBTL, PTTL, and GTP are predominantly located in remote areas, away from other water resource users. No sole source aquifers would be impacted by construction of the Interdependent Project Facilities.

7.8.1.2.1 Mainline

No potable groundwater sources are present north of the Brooks Range. Construction of the Mainline in this area would have no impact to groundwater resources. The following discussion describes potential impacts to groundwater from construction of the Mainline south of the Brooks Range.

Extensive use of groundwater is not expected to be required for Mainline construction, with the exception of supplying the temporary construction camps as described in the Pipeline Associated Infrastructure section. However, Mainline construction activities have the potential to impact groundwater resources and are expected to be minimal, localized, and temporary. Water quantity and quality testing would be implemented prior to, during, and after construction completion, as needed.

Potential impacts of the Mainline's temporary camps water wells to community drinking water supplies would be minimized by:

- Siting water supply wells outside drinking water protection zones as required by State water use regulations;
- Monitoring camp water supply wells for groundwater quality and yielding, as required by permits and detailed in Project *Water Well Monitoring Plan* (Appendix C);
- Reducing the withdrawal rate to the extent practicable if local groundwater drawdown is determined; and
- Using alternate water supply source for camps depending on location and feasibility.

7.8.1.2.1.1 Clearing and Grading

The Mainline construction ROW consists predominantly of forested land and open space, which would be cleared and graded throughout the southern half of the route (see Resource Report No. 1). Clearing and grading would not occur north of the Brooks Range. South of the Brooks Range, clearing and grading could cause a localized decrease in both the infiltration and groundwater recharge rate. Potential impacts from clearing and grading would be reduced or eliminated with adherence to the BMPs provided in the Applicant's Plan (Resource Report No. 7, Appendix D). Following construction, the pipeline ROW would be contoured to maintain surface water flow and restored in accordance with the *Project Restoration Plan* (Resource Report No. 3, Appendix P). The vegetative cover would serve to slow water runoff, return groundwater infiltration, and recharge rates that may have been diminished during ROW clearing. Impacts to groundwater from clearing and grading of the Mainline construction ROW are anticipated to be short-term and minor.

Depending on granular material source quality and water content, particularly north of Atigun Pass, a full summer of "seasoning" may be required to allow the water from the frozen granular materials to drain sufficiently to support summer construction. In areas with groundwater, runoff or seepage from piled cut material would be controlled by silt fences, vegetative buffers, and other control measures as specified by the *SWPPP* (Resource Report No. 2, Appendix J) and the Applicant's Plan (Resource Report No. 7, Appendix D).

7.8.1.2.1.2 Trenching and Dewatering

Trenching would occur over the length of the Mainline and may extend to a depth of up to 15 feet or more below the ground surface. Aside from wetland, crossing shallow groundwater may be encountered at these depths in some areas, and dewatering may be required, depending on such variables as season, antecedent soil moisture conditions and elevation of the water table at the time of open trench in any given location. Other potential impacts from dewatering are similar to those discussed previously for the Liquefaction Facility. North of the Brooks Range in areas of continuous permafrost, pipeline trenching would occur during the winter, and no impacts to groundwater resources would be expected.

Sedimentation basins are not planned along the Mainline. South of the Brooks Range, dewatering discharge would be to the ground or nearby surface waters in accordance with ADEC requirements and

the Applicant's Procedures. Where construction occurs during the summer, and the dewatering discharge causes ponding due to permafrost, discharges may be routed to a nearby drainage path or surface water body to minimize the ponding. Local trench dewatering discharges to the ground would be directed into established vegetation cover, typically through a small dewatering structure adjacent to the pipeline ROW to reduce the potential for erosion and encourage infiltration. It is anticipated that impacts to groundwater from construction dewatering would be localized, short-term, and minor.

As noted previously, spoil piles would be contained by silt fences, where required, and other control measures as specified by the *SWPPP* (Resource report No. 2, Appendix J) and the Applicant's Plan (Resource Report No. 7, Appendix D) to prevent runoff into adjacent waterbodies.

Trenching and dewatering in unknown contaminated areas can expose contaminants in groundwater or cause them to migrate to previously unaffected areas by altering the groundwater flow regime. Constructing in known/predetermined contaminated sites without consulting ADEC would be avoided. In areas of known contamination (see Resource Report No. 8), site-specific plans detailing how contaminants at these sites would either be avoided or minimized would be provided separately. In addition, for sites located within 1,500 feet of an identified contaminated site, dewatering would be performed in accordance with the BMPs provided in the Project *Groundwater Monitoring Plan* (Appendix B). If unanticipated contamination is discovered during construction, the Project *Unanticipated Contamination Discovery Plan* (Resource Report No. 8, Appendix J) would be followed to protect groundwater resources.

7.8.1.2.1.3 Hydrostatic Testing

The proposed testing plan calls for hydrostatic testing to take place in the summer for the pipelines and would not require use of antifreeze. The use of other additives, including biocides, is not anticipated for the Mainline with the exception of Cook Inlet shore crossings and on the North Slope. As discussed previously, there is no drinking water groundwater on the Arctic Coastal Plain and groundwater would not be used for hydrostatic testing along the Mainline south of the Brooks Range. Water for hydrostatic testing would be sourced from surface water resources adjacent to the Project area and water would be discharged into the same watershed from which it was drawn. Surface discharge would be in accordance with permit requirements and released to the ground through an energy-dissipating device to reduce the potential for erosion and encourage infiltration. Water for hydrostatic testing may also be injected to approved UIC wells if they are nearby and permitted to receive hydrostatic test water.

7.8.1.2.1.4 Water Supply Wells and Springs

The construction footprint of the Mainline crosses drinking water protection areas and would be located within 150 feet of water supply wells (see Appendix A) and one spring. For the spring and water supply wells located within 150 feet, routine monitoring of groundwater quality and yield would be performed as detailed in the Project *Water Well Monitoring Plan* (Appendix C). In addition, the BMPs listed in the Project *SPCC Plan* (Appendix M) and *Blasting Plan* (Resource Report No. 6, Appendix B) would be followed to reduce potential impacts to nearby wells. In the unlikely event that damage to a water supply occurs during construction, affected parties would be provided with temporary sources of potable water and a new, comparable well or an alternative water source.

7.8.1.2.1.5 Waterbody Construction Methods

The Mainline would use bridged, elevated waterbody crossings for aerial span crossing of rivers as discussed in Section 2.3. The few number of pilings and limited extent of any foundation required to support the aerial span is unlikely to contribute to groundwater recharge rates or groundwater movement. These effects are expected to be minor and localized to the immediate areas where the pile driving occurs. Implementation of the BMPs provided in the Applicant's *Plan* (Resource Report No. 7, Appendix D) and the *SPCC Plan* (Appendix M), as well as adherence to regulatory requirements, would minimize the risk of potential impacts to groundwater in the unlikely event of a spill near a piling or foundation.

Open-cut waterbody crossings would only have minor impacts to groundwater when fine sediments and clays fill in waterbody crossing cuts and create a minor width of the low permeable nature of the streambed. However, over several seasons of spring break-up flows, this material would be carried into the watershed with the high and rapid flows experienced in the spring. Therefore, it is anticipated that any movement of surface water into groundwater, or an increased groundwater recharge rate, resulting from construction would be temporary and minor.

Where a buried trenchless method is required for waterbody crossings, the pipe would be placed well below scour depths to prevent disturbance to streambeds, based on detailed geotechnical information that would be developed during a later stage of the Project. Trenchless waterbody crossings using the HDD method would require slurry containment pits and sumps to prevent mixed-in groundwater from discharging back into the environment. Drilling mud may inadvertently discharge through previously unidentified fractures in subsurface strata ("frac-out") along the drill path due to unfavorable ground conditions. Although drilling mud consists of nontoxic materials, the release of drilling mud in large quantities could cause localized turbidity within the groundwater. Direct Micro-Tunneling would not have any risk of mud release. A Project-specific *HDD Inadvertent Release Contingency Plan,* following the outlined provided in Appendix L would minimize the risk of trenchless crossing complications and the potential for inadvertent releases of drilling fluid. It is anticipated that any impacts to groundwater from trenchless construction would be localized and minor.

7.8.1.2.1.6 Blasting

Blasting may be required where bedrock or boulders are encountered at or near the ground surface and in certain permafrost terrain conditions where mechanized fracturing and excavating are not suitable. Section 6.5 of Resource Report No. 6 discusses the locations where shallow bedrock is anticipated.

Blasting explosives and detonators commonly contain perchlorate or ammonium nitrate fuel oil, which may leave residues after blasting reach groundwater during infiltration. However, with the shallow nature of the blasting it is not anticipated that blasting residue would concentrate in quantities able to reach drinking groundwater aquifers. With adherence to the procedures detailed in the *Blasting Plan* (Resource Report No. 6, Appendix B), any potential impacts to groundwater from blasting are anticipated to be localized, short-term, and minor based on the spatial extent of the impact, the duration and frequency, and localized nature of the work.

7.8.1.2.1.7 Fuel Use, Storage, Refueling, Lubrication, and Spill Prevention

During development of the construction infrastructure, temporary fuel storage tanks would be set up at pioneer camps, civil construction spreads, pipeline construction camps, and each spread's active contractor yard. Interim storage tanks would be located at the Coldfoot and Happy Valley camps along the Dalton Highway to provide fuel for transport trucks. Tanks would be double-walled and/or include secondary spill containment in accordance with applicable regulations. Construction equipment working along the Mainline ROW would generally be refueled by fuel/maintenance trucks that visit each crew on a daily basis.

All fuel handling necessary for construction of the Mainline would be in accordance with regulatory requirements and the Project *SPCC Plan* (Resource Report No. 2, Appendix M). The Plan would be managed by the Environmental Inspectors during construction. Adherence to the protective measures outlined in the *SPCC Plan* would greatly reduce the likelihood of such impacts, as well as minimize the resulting impacts should a spill occur.

7.8.1.2.1.8 Waste Management

All waste generated from construction would be handled in accordance with the Project *Waste Management Plan* (Resource Report No. 8, Appendix K). This plan addresses hazardous and nonhazardous waste materials and volumes, handling, and disposal in detail. The plan would ensure compliance with all regulations for transportation, treatment, storage, and disposal.

The generation and storage of hazardous wastes during construction would be minimal. Volumes and types would be determined when construction contractors are selected and construction plans finalized. At that time, each contractor would be required to develop a waste management plan that follows the guidance in the Project *Waste Management Plan* and outlines the types, volumes, and disposition of wastes anticipated during construction. With adherence to the Project *Waste Management Plan* procedures and mitigation measures, adverse impacts to groundwater due to waste management during construction of the Mainline are not anticipated.

7.8.1.2.2 Prudhoe Bay Transmission Line (PBTL)

The PBTL would be constructed aboveground on VSMs and surface water would be used to hydrostatic test the pipeline. Because there are no potable groundwater resources present on the Arctic Coastal Plain, there would be no impacts to groundwater from pipeline construction.

7.8.1.2.3 Point Thomson Transmission Line (PTTL)

The PTTL would be constructed aboveground on VSMs and surface water would be used to hydrostatic test the pipeline. Because there are no potable groundwater resources present on the Arctic Coastal Plain, there would be no impacts to groundwater from pipeline construction.

7.8.1.3 Pipeline Aboveground Facilities

Because there are no potable groundwater resources present on the Arctic Coastal Plain, there would be no impact to groundwater resources from the construction of aboveground facilities. Construction practices, potential impacts and mitigation measures, waste management practices, and water use would follow existing practices used on the North Slope. The following discussions describe potential impacts to groundwater resources from construction of the Mainline Aboveground Facilities (compressor stations, meter stations, MLBVs, etc.) south of the Brooks Range.

Water for aboveground facilities would be sourced from permitted nearby surface water for use by construction personnel. All other water used during construction (e.g., construction of ice pads, water for dust control, concrete preparation, hydrostatic testing) would be taken from permitted surface water sources. Details on the anticipated water use are provided in the Project *Water Use Plan* (Resource Report No. 2, Appendix K). Impacts to groundwater would be short-term and minor with the withdrawals from surface water sources in compliance with permit conditions. Water use from wells is discussed under operations impacts.

7.8.1.3.1 Clearing, Grading, and Site Development

Potential impacts to groundwater and mitigation measures for clearing, grading, and site development for the Pipeline Aboveground Facilities would be similar to those described for the Mainline above. Granular pads and access roads installed during facility construction would remain in place. This would provide a semipermeable surface to allow for infiltration of water. Though the compacted surface would retard infiltration, however, it would not cause significant increased runoff due to the relatively small footprint of the pad surface. It is anticipated that impacts to groundwater from these ground-disturbing activities would be long-term but minor.

7.8.1.3.1.1 Foundation Construction

The Pipeline Aboveground Facilities would be constructed on granular pads or foundations built on-site. In areas south of the Brooks Range, impacts to groundwater infiltration and movement would be minor and temporary, occurring where a compacted granular pad replaces a vegetated area. Maintaining vegetative buffers and natural features at the perimeter of the pad would allow runoff to infiltrate at the perimeter. Impacts to groundwater from pad construction are anticipated to be long-term and minor based on the small footprint within the region.

Shallow groundwater could be encountered during construction of the support piles in areas south of the Brooks Range. Potential impacts to groundwater and the proposed mitigation measures would be similar to those described for the Mainline above.

7.8.1.3.1.2 Dewatering and Trenching

The amount of dewatering would vary depending on all geographic locations and seasons. If any does occur, it would be for construction and discharged in compliance with regulatory requirement.

7.8.1.3.1.3 Hydrostatic Testing

Due to the limited volumes required, approximately 80 percent of hydrostatic testing for aboveground facility modules or skids would be done at manufacturing facilities. What little hydrostatic testing is required during aboveground facility construction would be small water volumes taken from nearby surface water sources and be withdrawn and discharged according to required permits or otherwise injected or disposed at an approved facility. Impacts would be similar as those for Mainline hydrostatic testing.

7.8.1.3.1.4 Water Wells

No water supply wells have been identified within 150 feet of the aboveground facilities.

7.8.1.3.1.5 Blasting

It is not anticipated that blasting would be required for construction of most of the aboveground facilities. There is some possibility that blasting to level the sites for the Ray River, Minto, and Honolulu compressor stations may be required. This would be determined during a later stage of the Project and information provided prior to construction.

7.8.1.3.1.6 Fuel Use, Storage, Refueling, Lubrication, and Spill Prevention

All fuel handling necessary for construction of the Pipeline Aboveground Facilities would be in accordance with applicable regulatory requirements and the Project *SPCC Plan* (Resource Report No. 2, Appendix M). The *SPCC Plan* would be managed by the Environmental Inspectors during construction. Adherence to the protective measures outlined the Project *SPCC Plan* would greatly reduce the likelihood of fuel spill impacts, as well as minimize the resulting impacts should a spill occur.

7.8.1.3.1.7 Wastewater Management

All industrial wastewater generated during construction would be collected in sumps, pits, drip collection devices (e.g., built-in drip pans), or storage tanks and removed for final disposal at an approved facility in accordance with its constituent chemical properties. Domestic wastewater would be treated onsite and the treated effluent would be discharged according to required permits or into an existing permitted UIC well if present. Package wastewater systems specially designed for use in remote, Arctic environments would be used. All effluents would meet applicable regulatory standards prior to discharge or be discharged into an existing UIC well approved for sewage injection. With effective collection and treatment, impacts to groundwater resources are expected to be short-term for the period of construction and minor in effect because of the relatively small camp sizes and short durations of camp use at aboveground facilities proposed.

7.8.1.3.1.8 Waste Management

All waste generated from construction would be handled in accordance with the Project *Waste Management Plan* (Resource Report No. 8, Appendix K). This plan addresses hazardous and nonhazardous waste materials and volumes, handling, and disposal in detail. The plan would reflect compliance with all regulations for transportation, treatment, storage, and disposal.

The generation and storage of hazardous wastes during construction would be minimal. Volumes and types would be determined when construction contractors are selected and construction plans finalized. At that time, each contractor would be required to develop a waste management plan that follows the guidance in the Project *Waste Management Plan* and outlines the types, volumes, and disposition of wastes anticipated during construction. With adherence to the Project *Waste Management Plan* procedures and mitigation measures, adverse impacts to groundwater due to waste management during construction of the Pipeline Aboveground Facilities are not anticipated.

7.8.1.3.1.9 Pipeline Associated Infrastructure

The Pipeline Associated Infrastructure includes construction camps, material sites, ice roads/access roads, additional temporary workspaces (ATWS), contractor yards, pipe storage yards, rail spurs, temporary disposal sites, and material extraction sites used for construction of the pipelines. Impacts and mitigation measures described above for pipeline construction and aboveground facility construction would be similar to the impacts anticipated for the associated infrastructure facilities.

No potable groundwater sources are present north of the Brooks Range. Construction of the Pipeline Associated Infrastructure in this area would have no impact to groundwater resources. The following discussion describes potential impacts to groundwater from construction of the Pipeline-Associated Infrastructure south of the Brooks Range.

7.8.1.3.1.10 Clearing, Grading, and Site Preparation

South of the Brooks Range, potential impacts to groundwater and mitigation measures for clearing, grading, and site preparation for the Pipeline Associated Infrastructure would be similar to those described for the Mainline and Liquefaction Facility above.

If unanticipated contamination is discovered during construction, the Project *Unanticipated Contamination Discovery Plan* (Resource Report No. 8, Appendix J) would be followed to protect groundwater resources.

7.8.1.3.1.11 Access Roads

Use of properly designed culverts and siting of access roads would reduce changes to surface runoff patterns and subsequent recharge to surficial aquifers. Granular material placement and soil compaction from granular material access road construction may increase local runoff and alter normal groundwater infiltration patterns. Impacts to groundwater from road construction would be long-term and minor based on the road footprint in related to the surface area of the watersheds crossed.

7.8.1.3.1.12 Water Wells

There is no planned groundwater use from existing or new wells at aboveground facilities during construction. There is no anticipated impact to existing water wells from construction of the facilities.

7.8.1.3.1.13 Material Sites

As detailed in the Project *Gravel Sourcing Plan and Reclamation Measures* (Resource Report No. 6, Appendix F), existing mine sites would be used or new mine sites would be developed to support construction of the Mainline. Potential impacts to groundwater, where present, and mitigation measures from any required blasting and dewatering, would be the similar to those described for the Mainline above.

7.8.1.3.1.14 Domestic Wastewater

At all remote site locations, wastewater would be treated using systems designed for cold climate conditions. The systems would be designed to meet AWQS at the point of discharge. Treated Wastewater from camps and living areas would then be directed to the ground in the vicinity of the camps or living areas, in accordance with the applicable permits. Permits granted from the State of Alaska under the APDES permit would specify the total volume of wastewater that could be discharged from each site. APDES

permits limit the following parameters: BOD_5, TSS, fecal coliform and escherichia coli bacterias, total residual chlorine, dissolved oxygen (DO), pH, and flow rate.

To reduce fecal coliform count, disinfection such as UV or chlorine would be used. Where it exists, no impacts to groundwater are anticipated with treatment and disposal of domestic wastewater in accordance with regulatory requirements. In the unlikely event that a release of sewage was to occur, immediate clean-up procedures would be implemented. During winter, sewage spills would be collected and put through a snow-melter and sent to a package plant or downhole into a UIC well. During summer, soils would be removed and sewage infrastructure will be steam cleaned and the run off will be collected for treatment. Impacts to groundwater would be anticipated to be temporary and minor.

7.8.1.3.1.15 Fuel Use, Storage, Refueling, Lubrication, and Spill Prevention

All fuel handling necessary for construction of the Pipeline Associated Infrastructure would be in accordance with all regulations and the Project *SPCC Plan* (Resource report No. 2, Appendix M). The Plan would be managed by the Environmental Inspectors during construction. Adherence to the protective measures outlined in the *SPCC Plan* would greatly reduce the likelihood of fuel spill impacts, as well as minimize the resulting impacts should a spill occur.

7.8.1.3.1.16 Waste Management

All waste generated from construction would be handled in accordance with the Project *Waste Management Plan* (Resource Report No. 8, Appendix K). This plan addresses hazardous and nonhazardous waste materials and volumes, handling, and disposal in detail. The plan would reflect compliance with all regulations for transportation, treatment, storage, and disposal. The generation and storage of hazardous wastes during construction would be minimal. Volumes and types would be determined when construction contractors are selected and construction plans finalized. At that time, each contractor would be required to develop a waste management plan that follows the guidance in the Project *Waste Management Plan* and outlines the types, volumes, and disposition of wastes anticipated during construction. With adherence to the Project *Waste Management Plan* procedures and mitigation measures, adverse impacts to groundwater due to waste management during construction of the Pipeline Associated Infrastructure are not anticipated.

7.8.1.3.1.17 Gas Treatment Plant (GTP)

The GTP would be located on the Arctic Coastal Plain, which is an area of continuous permafrost. Aquifers do not exist in this area due to the extensive permafrost layer. No impacts to groundwater would occur from construction of the GTP.

7.8.1.3.1.18 GTP Associated Infrastructure

The GTP Associated Infrastructure would include a construction camp, pipelines, new DH 4 at West Dock, granular material mine, reservoir, laydown/staging areas, and access roads. The GTP Associated Infrastructure would be located on the Arctic Coastal Plain, which is an area of continuous permafrost. Aquifers do not exist in this area due to the extensive permafrost layer. Surface water sources would be used for construction of the GTP Associated Infrastructure. No impacts to groundwater would occur from construction of the GTP Associated Infrastructure.

7.8.1.4 Non-Jurisdictional Facilities

The PTU Expansion project and PBU MGS project are located close to the PBTL, PTTL, and GTP. They would both be located within the Arctic Coastal Plain, which is an area of continuous permafrost. Potable aquifers do not exist in this area, therefore no impacts to groundwater resources would occur during non-jurisdictional facility construction and operation.

The Kenai Spur Highway relocation project would result in site clearing and grading and the relocation of an impervious highway surface further inland. These activities would likely cause a minor decrease in localized groundwater infiltration and recharge. The impacts to groundwater would be long-term because

the roadway would remain following construction and add impervious surface area within the recharge zones. However, the acreage anticipated (<150 acres) would only slightly increase the footprint of the existing road being relocated.

7.8.2 Potential Operational Impacts and Mitigation Measures for Groundwater

Groundwater would be required to support operational activities at the Liquefaction Facility and some of the Pipeline Aboveground Facilities. It is not anticipated that groundwater would be used for operation of the Mainline, PBTL, PTTL, or GTP and are therefore not discussed further.

Groundwater withdrawal to support operations would have the potential to affect groundwater supply, while maintenance/repair activities, wastewater discharge, and spill events have the potential to affect groundwater quality. The discussion in the following section addresses potential impacts to both groundwater quantity and quality and provides proposed mitigation measures and BMPs to avoid and minimize potential adverse effects.

7.8.2.1 Liquefaction Facility

Site development would result in an increased amount of impermeable surface present. This would result in a long-term, minor reduction in groundwater infiltration and recharge. Natural buffers would be maintained around the Liquefaction Facility site to preserve as much recharge area as possible and all run-off and water used would be routed through on-site treatment facilities prior to discharge, reducing the likelihood of impact to groundwater resources.

7.8.2.1.1 Maintenance and Repair

Maintenance and repair activities during operation at the Liquefaction Facility are anticipated to require minimal site preparation (e.g., excavation) and hydrostatic testing. Potential impacts to groundwater from maintenance activities are anticipated to be of a lower magnitude than those described for construction due to the use of drip collection devices and collection sumps to handle lubricants and the limited fueling of vehicles to only those used by operations personnel when at the Liquefaction Facility. Impacts to groundwater from maintenance and repair are anticipated to be intermittent and minor. Essentially all maintenance and repair activities during operations would occur in confined space, on hard surfaces, and with catch-basins in place to prevent the loss of process fluids to the environment.

7.8.2.1.2 Water Wells

Project operations would use groundwater from new water wells for process water, potable water, and the firewater system. The wells would be located near the liquefaction trains. Similar to the construction wells, the operation wells would access the unconsolidated-deposit aquifers system in the Cook Inlet ecoregion and would likely be of the same depth. Normal water consumption during operations is less than 150 gallons per minute. In the unlikely event of a fire, the volume would increase to 1,000 gallons per minute for no more than 4 hours' duration.

The proposed withdrawal could represent an approximate increase of 5 percent demand on the aquifer system during normal operations and up to 30 percent for the short-term emergency use. It is anticipated that the aquifer system would be able to meet this demand, however impacts would be long-term, and the increased demand may enhance the possibility for saltwater intrusion. Hydrogeology evaluations to assess potential groundwater yield at the Liquefaction Facility site are continuing with preliminary results from the *2016 Hydrogeology Program* summarized in Appendix S.

7.8.2.1.3 Wastewater

The main discharge location of all treated wastewater containing black and gray water from Project operations would be an outfall to Cook Inlet following appropriate treatment per regulatory requirements. The outfall would be operated according to an APDES individual permit. APDES permits limit the following

pollutants: BOD_5, TSS, fecal coliform and possibly total ammonia, nitrogen (N), total recoverable copper, total recoverable zinc, whole effluent toxicity (WET), enterococci, total residual chlorine (if applicable), DO, oil and grease, pH, and flow.

One of the three onsite lined ponds would serve as the receiving area prior to discharge. No effects to groundwater are anticipated from wastewater disposal.

7.8.2.1.4 Waste Handling

Operation of the Liquefaction Facility would generate onsite waste. All waste would be handled in accordance with the Project *Waste Management Plan* (Resource Report No. 8, Appendix K). This plan addresses hazardous and nonhazardous waste materials and volumes, handling, and disposal in detail. The plan would reflect compliance with all regulations for transportation, treatment, storage, and disposal. With adherence to the Project *Waste Management Plan* procedures and mitigation measures, there would be no expected groundwater quality impacts from operation of the Liquefaction Facility.

7.8.2.1.5 Fuel Use, Storage, Refueling, Lubrication, and Spills

Spills of fuels and lubricants could occur in any area where these compounds are used or stored and have the potential to damage groundwater resources. Personnel would be trained for proper handling, storage, disposal, and timely spill response of hazardous fluids, and an *SPCC Plan* (Resource report No. 2, Appendix M) would be developed for operations. All petroleum, oil, and lubricant handling required during Project operations would be dictated by the SPCCs and managed by the Environmental Managers. Storage tanks and containers for fuels and hazardous liquids would be stored in tanks with secondary spill containment, and oil-filled operational equipment would be addressed in a manner consistent with the requirements of 40 C.F.R. 112 and ADEC requirements. Potential impacts to groundwater from fuel spills during operation of the Liquefaction Facility and mitigation measures would be similar to those described for construction.

During operations, everything containing lube oil or grease would have self-contained drip collection devices and reservoirs with overflow sumps, and all repairs would take place on concreted surfaces which feed to the closed drain and effluent treatment system. Stormwater and all surface waters collected would be checked prior to release and contaminated fluids sent to the oily water treatment system.

During operation, there is the potential for an LNG spill. However, LNG vaporizes rapidly when exposed to ambient conditions such that no effects to groundwater resources are anticipated from an LNG spill.

7.8.2.2 Interdependent Project Facilities

7.8.2.2.1 7.8.2.2.1 Mainline

Maintenance and repair activities for the Mainline are anticipated to require minimal site preparation (e.g., excavation) and hydrostatic testing. Potential impacts to groundwater in areas south of the Brooks Range from maintenance activities are anticipated to be similar but of a lower magnitude than those described for construction. Impacts to groundwater from maintenance and repair are anticipated to be long-term but intermittent and minor.

7.8.2.2.2 Point Thomson Transmission Line

No impacts to groundwater would occur during operation of the PTTL since groundwater (highly saline and nonpotable) is present at a depth greater than 1,800 feet below the permafrost layer that affects groundwater recharge.

7.8.2.2.3 Prudhoe Bay Transmission Line

No impacts to groundwater would occur during operation of the PBTL because groundwater resources do not exist on the Arctic Coastal Plain.

7.8.2.3 Pipeline Aboveground Facilities

Granular pads installed during facility construction and for access roads would remain in place. They allow for infiltration of water, but the compressed surface slows infiltration and increases surface runoff. Maintaining vegetative buffers and natural features along the perimeters of the pads would encourage infiltration of runoff. It is anticipated that impacts to groundwater, where applicable, would be long-term but minor since the footprint of the granular pads and roads is small and surface flow would not be impeded by design and placement of the granular material.

7.8.2.3.1 Maintenance and Repair

Maintenance and repair activities at the Pipeline Aboveground Facilities are anticipated to require minimal activities such as site preparation (e.g., excavation) and hydrostatic testing. Potential impacts to groundwater from maintenance and repair activities are anticipated to be similar but of a lower magnitude than those described for construction. Impacts to groundwater from maintenance and repair are anticipated to be long-term but intermittent and minor.

7.8.2.3.2 Water Wells

South of the Brooks Range, water for operations may come from a nearby surface water source, trucked and stored on site, or acquired through a water well installed at the site. Water withdrawal for the unmanned facility operation would be minimal with an estimated annual requirement of approximately 15,000 gallons in total. This would include approximately 50 to 75 gallons per day per personnel and 50 gallons per month for mechanical use by the process facilities (make-up water for the heating units). It is not anticipated that this would cause a significant drawdown of the local water table. Impacts to groundwater from use of water wells during operation of the Pipeline Aboveground Facilities are anticipated to be long-term but minor.

7.8.2.3.3 Wastewater

All industrial wastewater would be collected in sumps, pits, drip collection devices, or storage tanks and vacuum trucks for disposal at an approved wastewater treatment or disposal facility. Domestic wastewater would be treated onsite, and the effluent would be discharged to the ground per regulatory requirements. Effluent would meet ADEC regulatory standards prior to discharge. APDES permits limit the following pollutants: BOD_5, TSS, fecal coliform and possibly enterococci, total residual chlorine (if applicable), DO, oil and grease, pH, and flow. To reduce fecal coliform count, disinfection, such as UV or chlorine, would be used. No impacts to groundwater are anticipated under normal treatment and disposal of domestic wastewater.

7.8.2.3.4 Waste Handling

Operation of the Pipeline Aboveground Facilities would generate onsite waste. All waste would be handled in accordance with the Project *Waste Management Plan* (Resource Report No. 8, Appendix K). This plan addresses hazardous and nonhazardous waste materials and volumes, handling, and disposal in detail. The plan would reflect compliance with all regulations for transportation, treatment, storage, and disposal. The generation and storage of hazardous wastes during operations would be minimal. Volumes and types would be determined once operation plans are finalized. At that time, each facility operator would be required to develop a waste management plan that follows the guidance in the Project *Waste Management Plan* and outlines the types, volumes, and disposition of wastes anticipated during operation. With adherence to the Project *Waste Management Plan* procedures and mitigation measures, there would be no expected groundwater quality impacts from operation of the Pipeline Aboveground Facilities south of the Brooks Range.

7.8.2.3.5 Fuel Use, Storage, Refueling, Lubrication, and Spills

Spills of fuels and lubricants could occur where these compounds are used or stored and have the potential to impact groundwater resources if not cleaned up immediately. *SPCC Plans* would be developed for each facility prior to operation. In addition, operations would meet regulatory requirements. Potential impacts to groundwater from fuel spills and mitigation measures during operation of Pipeline Aboveground Facilities would be similar to those described for construction of these facilities.

7.8.2.3.6 Gas Treatment Plant

No impacts to groundwater would occur during operation of the GTP since groundwater (highly saline and nonpotable) is present at a depth greater than 1,800 feet below the permafrost layer that affects groundwater recharge.

7.8.2.4 Non-Jurisdictional Facilities

The PTU Expansion project and PBU MGS project are located close to the PBTL, PTTL, and GTP. Both projects would be located within the Arctic Coastal Plain, which is an area of continuous permafrost. Aquifers do not exist in these areas. No impacts to groundwater would occur from operation of either project.

The Kenai Spur Highway relocation project could result in an increased amount of impervious surface depending on the final route selected. This would likely cause a minor decrease in localized groundwater infiltration and recharge. It is anticipated that impacts to groundwater would be long-term and minor, but consistent with the current impacts of the highway.

8.0 STABILIZATION AND REVEGETATION

Project stabilization and revegetation efforts for the Mainline pipeline trench and associated right-of-way (ROW) will be performed in accordance with the Alaska LNG Applicant's Plan and Procedures and *Project Restoration Plan* (see Resource Report No. 3, Appendix P). No other impacts requiring stabilization and revegetation are anticipated for the Project; however, if they occur, a site-specific restoration plan would be developed.

The *Project Restoration Plan* is intended to provide Alaska-specific restoration practices to address impacts from pipeline construction. For some sections of the pipeline route (see Resource Report No.3, Appendix P, Section 3.0), the ROW would be largely undisturbed and thus, would not require stabilization and revegetation efforts. The performance standards for achieving successful restoration stabilization and revegetation would be developed in collaboration with the appropriate federal, state, and local regulatory agencies.

Stabilization and restoration along the ROW would generally be completed in accordance with six modes (See Appendix M of Resource Report No. 1):

- Mode 1 – Ice Work Pad Over Permafrost in Flat Terrain
- Mode 2 – Winter Frost Packed in Non-Permafrost or Thaw-Stable Permafrost in Flat Terrain
- Mode 3 – Matted Summer Wetlands
- Mode 4 – Granular Work Pad Over Thaw-Sensitive Permafrost or Thick Organic Mat
- Mode 5A – Graded
- Mode 5B – Mountain Graded Cut
- Mode 6 – Point Thomson Gas Transmission (PTTL) Aboveground Pipeline on Vertical Support Members (VSMs) – Point Thomson to the Gas Treatment Plant (GTP)

Site conditions along the ROW that would require special consideration with respect to stabilization and revegetation, regardless of construction mode (waterbody crossings and surface instability, e.g., thaw-

sensitive areas or steep longitudinal slopes), are discussed in more detail in Appendix M of Resource Report No. 1, Section 4 of Appendix P in Resource Report No.3, Applicant's Procedures in Appendix N of Resource Report No. 2, and Applicant's *Plan* in Appendix D of Resource Report No. 7.

8.1 MINERAL MATERIAL LEASES

The *Gravel Sourcing and Reclamation Measures Plan* (see Resource Report No. 6, Appendix F) provides a potential list of preferred and alternative mineral sites proposed for use by the Project. The site reclamation methods that would be implemented for extraction sites are also provided in this *Plan*. The primary goal of reclamation would be to return a site to a condition that will not pose a hazard to public health and the environment. Reclamation plans would be generated for each site and would generally include:

- Removal of all facilities.
- A grading plan that establishes stable slopes and adequate drainage.
- Self-sustaining vegetative cover.
- Monitoring of performance during and after reclamation to ensure objectives are being achieved.

The reclamation plans would include the following key elements:

- A general description and diagram of the operation and the area that shows and states the number of acres to be mined during each year covered by the plan.
- The location corners or property boundaries and their relationship to the reclamation work.
- The tailings or spoil disposal areas.
- The areas otherwise affected by the operation.
- The information furnished must be reasonably appropriate to the scale and complexity of the mine.

Reclamation plans must be approved by ADNR DMLW. This applies to state, federal, municipal, and private land and water in Alaska.

9.0 OPERATIONS AND MAINTENANCE

The integrated Project operations would employ a core team of experienced workers supplemented with experienced and newly trained staff hired locally or from out of state.

9.1 OPERATIONS

9.1.1 Liquefaction Facility

The Liquefaction Facility would be operated and maintained in accordance with applicable federal and state requirements. In particular, pursuant to the provisions of the Natural Gas Pipeline Safety Act (Public Law 112-90, 49 U.S.C 60101) amended in 2011, the facilities would be operated and maintained in accordance with 49 C.F.R. Part 193, Federal Safety Standards for Liquefied Natural Gas Facilities (and as referenced in 49 C.F.R. Part 193, the National Fire Protection Association 59A LNG Standards). The Marine Terminal would be operated and maintained in accordance with 33 C.F.R. Part 127, Waterfront Facilities handling Liquefied Natural Gas and Liquefied Hazardous Gases. Safety for the overall Liquefaction Facility would be addressed in Resource Report Nos. 11 and 13.

Operation and maintenance of the Liquefaction Facility would require approximately 310 personnel, 240 of whom would be located at the Liquefaction Facility and 70 support staff personnel would be based in Anchorage. Early staffing plans assume that the 240 operations and maintenance staff would live off site in the Nikiski and Kenai/Soldotna areas and 70 support staff would live in the Anchorage area. In addition, all personnel brought in for the turn-around maintenance at the LNG Plant would be housed in local accommodations.

The Liquefaction Facility would be designed and operated in compliance with ADEC and EPA requirements. Personnel would be trained for proper handling, storage, disposal, and spill response of hazardous fluids, and a *SPCC Plan* would be developed (Resource Report No. 2, Appendix K). Storage tanks and containers for fuels and hazardous liquids at the facility would be constructed with appropriately sized secondary containment. Oil-filled operational equipment would be addressed in a manner consistent with the requirements of 40 C.F.R. Part 112.

9.1.1.1 Water Use during LNG Operations

Raw water would be provided to the LNG Plant from new groundwater wells. It is anticipated that a flow rate of 1,000 gallons per minute would be required for boiler feed makeup water, potable water, and utilities and would be stored in onsite freshwater tanks (1,440,000 gallons net-working volume).

9.1.1.2 LNG Marine Operations

A *Follow-on Waterway Suitability Assessment* (WSA) *Report* was filed with the U.S. Coast Guard (USCG) in accordance with Navigation and Vessel Inspection Circular (NVIC) No. 01-2001, which summarizes the outcomes of a USCG-led multi-stakeholder risk assessment on the topics of safety and security to inform the USCG's decision as to the suitability of Nikiski for a Liquefaction Facility and Cook Inlet for LNGC operations. Taking into consideration the *Follow-on WSA Report*, the USCG has filed a letter of recommendation with FERC recommending Cook Inlet as a suitable waterway for this Liquefaction Facility and LNGC operations.

The LNGCs transiting to and from the proposed Liquefaction Facility would be boarded by one or more marine pilots, likely from the South West Alaska Pilots Association (SWAPA), based in Homer, Alaska. The pilot(s) would advise the vessel master and ship's bridge team on navigation and maneuvering of the LNGC. The Project representatives anticipate embarking two pilots on each inbound LNGC, and one pilot on each outbound LNGC. The pilots would embark the inbound LNGCs at a location to the west of Homer Spit using a SWAPA pilot vessel. The pilot boarding station near Homer would be used for inbound and

outbound LNGCs. Although SWAPA pilots routinely board vessels by helicopter off Nikiski for outbound transit, LNGCs may not have a helipad onboard, and it is therefore not expected that pilots would board LNGCs by helicopter. One or several pilots would also support LNGC transit to/from potential anchorage/port of refuge at the Port of Homer.

A total of five assist tugs are currently planned to support LNGC operations, with four of the tugs used to assist the LNGCs during berthing operations. The five tugs would include three 90-ton-minimum certified effective static bollard pull (i.e., the static force exerted on a fixed tow line at zero speed), Azimuth Stern Drive tugs, as well as two tugs which are slightly larger with more skeg (i.e., sternward extension of the keel), bollard pull (approximately 120 tons) and towing and ice mitigation capability. One each of the latter tug types would be stationed in Homer and Nikiski.

Tugs used to support berthing and mooring of LNGCs at the Marine Terminal would be anchored in the vicinity of Nikiski when not assisting an LNGC. Anchoring of tugs and support vessels is common in the Nikiski area. A frequently used anchoring site located to the south of the proposed PLF would be a suitable location for anchorage of tugs assisting LNGCs while performing standby duty and while off duty or on standby as a guard tug. Tug anchorage in lieu of new construction of a support vessel facility has lower environmental impact, lower maintenance and operational requirements, and lower cost.

When ice is present in Cook Inlet, an ice management system would be implemented to support safe and reliable LNGC transit and in Cook Inlet and maneuverability at the proposed Marine Terminal. The ice management system would include metocean and ice monitoring, analysis, and forecasting; ice management operations planning and management; data management and communications system; and ice-breaking tugs. Support tugs would be ice class and would assume the additional responsibilities of patrol/scouting, ice clearing, and ice breaking during winter months.

9.1.1.2.1 Cooling Water Use and Ballast Water Discharge

LNGCs calling at the Marine Terminal would be carrying ballast water (sea water) upon arrival to Cook Inlet. The ballast water would have been exchanged in international waters according to international convention. As LNG is loaded onto the LNGCs at the Marine Terminal, the LNGCs would release the ballast water, thereby replacing the sea water with LNG product as ballast to maintain stability of the LNGC in the water. Approximately 2.9–3.2 billion gallons of ballast water would be discharged per year from LNGCs during LNG loading operations at the Marine Terminal, with the range in annual discharge volume due to varying LNGC sizes and number of voyages which may call at the Marine Terminal. The water discharged would be approximately 0–25 °F warmer than ambient water temperature in Cook Inlet. Ballast water discharged in Cook Inlet would be treated according to U.S. regulations.

Approximately 1.6–2.4 billion gallons of sea water per year may be taken in and discharged by LNGCs as cooling water while at the Marine Terminal. The water would undergo minimal filtration upon intake and supports a heat exchange process to provide cool water needed for the LNGC integrated cooling systems for equipment onboard such as main engines and diesel generators. The range in intake/discharge volumes account for the varying LNGC sizes and estimates of the number of LNGC calls at the Marine Terminal. The water discharged could be approximately 5 °F warmer than ambient water temperature in Cook Inlet.

9.1.2 Interdependent Project Facilities

9.1.2.1 Pipeline Facilities

Pipeline and pipeline-related aboveground facilities would be operated and maintained to meet the requirements of the Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards (49 C.F.R. Part 192) and other applicable federal and state requirements. Any PHMSA special permits would follow 49 C.F.R. Part 190.341, Pipeline Safety Enforcement and Regulatory Procedures.

Operation and maintenance of the pipelines, meter stations, compressor stations, and the heater station are expected to require approximately 140 personnel, of which 55 would be full time O&M field staff and 85 would be support staff. Approximately 105 employees would be based in Anchorage with the remainder 35 based at a regional field office in Fairbanks. The Project representatives' safety design and systems for the pipelines are addressed in Resource Report No. 11.

9.1.3 Control Center and Telecommunications

The design includes satellite telecommunication for both construction and operation. Further investigation of the other available telecommunication services would be completed during later stages of the Project together with local service providers to determine feasibility of use of the existing telecommunication networks.

Satellite communication uses a ground-mounted antenna and earth station to communicate with a geostationary satellite orbiting the earth. The opposite end of the communication link uses similar ground-mounted antennae and electronic equipment.

Redundant telecommunication network would be used during operation. The redundant network uses two earth stations and two separate orbiting satellites for communication. If one network fails, the redundant network would continue to provide communication to an operations site.

Facilities would be monitored and operated from the control center, located in Anchorage, which would be staffed 24 hours a day. A second, fully functional backup control center (currently envisioned to be in Fairbanks) would be available in the event the primary control center becomes unavailable for any reason. Both control centers would have redundant communication to monitor pipeline status.

9.2 MONITORING AND MAINTENANCE

9.2.1 Liquefaction Facility

Natural buffer areas around the Liquefaction Facility that were not developed as part of facility construction would be retained during operations. Maintenance would be conducted of these areas in accordance with the Alaska LNG Applicant's Plan and Procedures.

During operations, routine testing of the firewater system would be conducted. As part of the routine testing, the system would be run for approximately 30 minutes; however, there would not be any discharge of water. The system design would incorporate a recycling loop for the water that is continually circulating to keep the waterlines from freezing. Water use during operations of the Liquefaction Facility is discussed in Appendix K of Resource Report No. 2.

Periodically, maintenance would be required for equipment in the plant. This maintenance can be unplanned (e.g. equipment breakdown) or may be required to meet regulatory inspection needs and/or equipment performance specifications/needs. Any required materials for support maintenance needs would be transported to the site via existing roads. Personnel brought in for the turnaround would be housed in local accommodations.

9.2.2 Right-of-Way Maintenance

After the pipeline is installed, the ROW would be maintained to facilitate the identification of surface conditions such as:

- Construction activities on or near the ROW;
- Unauthorized activities on or near the ROW;
- Urban encroachment;
- Soil defects, including backfill and thermal subsidence;
- Erosion at waterbody crossings, flooding on the ROW or sedimentation in streams;

- Damage to company property;
- Missing or moved aerial markers, pipeline markers, survey markers, or identification signs;
- Evidence of leaks; and
- Reduction of stability of soils indicated by jacking, settling and/or leaning and physical damage or defect of the VSM.

The pipeline ROW would be maintained free of obstructions. The ROW would be clearly marked for anyone performing construction or other work nearby. Third-party incidents are a leading cause of damage to transmission pipelines and often occur when excavation or other construction activity occurs near the pipeline and the pipe is accidentally struck. ROW access for maintenance and emergency response in areas subject to seasonal ground transportation limitations, such as permafrost areas on the North Slope, would use approved air transport or low pressure tire ground transportation methods. In some cases, this may include construction of temporary ice roads to access ROW areas in the winter.

If pipeline damage occurs, both the pipeline operator and emergency response personnel would need direct and immediate access to the pipeline via an adequately maintained and clear ROW. Obstructions on the ROW can prohibit emergency personnel's ability to respond.

Maintenance of the pipeline ROW would be conducted according to the measures outlined in the Alaska LNG Applicant's Plan and Procedures. Revegetation of soils disturbed by Project-related activities, or in other areas where application of thermal stabilization measures precludes revegetation (such as where a permanent mulch or other ground cover has been installed) would be carried out as outlined in the Project's *Restoration Plan* (located in Resource Report No. 3, Appendix P).

The ROW would be kept clear of trees, except over HDD or DMT crossings, because tree roots have the potential to damage the pipeline coating, which may contribute to the loss of integrity of the pipeline. In accordance with the Project *Restoration Plan*, grass and certain types of shrubs may be permitted within the ROW, provided that the plantings do not interfere with the maintenance, inspection, and operation of the pipeline and related facilities.

9.2.3 Pipeline Surveillance

According to pipeline safety regulations, transmission pipeline operators must have an inspection program to inspect and observe surface conditions on and adjacent to the pipeline ROW for indications of leaks, construction activity, and other factors affecting safety and operation.

Most inspections would be performed via aerial patrol. Other methods of inspecting pipelines, such as vehicle and foot patrols, may be used depending on ROW conditions and access. Pipe surveillance would be conducted with a minimum frequency in accordance with 49 C.F.R. Part 192.

9.2.4 Pipeline Integrity Management

Pipeline integrity regulations contained in Subpart O of 49 C.F.R. Part 192 require operators to develop and follow a written integrity management plan (IMP) containing prescribed program elements that address the risk for each covered segment of a natural gas transmission pipeline. A covered segment is defined in 49 C.F.R. Part 192 as a segment of a natural gas transmission pipeline located in an high consequence area (HCA). HCAs are identified based on class locations and/or the potential for a pipeline failure to impact buildings intended for human occupancy or a particular site.

The Project IMP would consider the following:

- Identification of all HCAs;
- Baseline Assessment Plan;
- Identification of threats to each covered segment, including by the use of data integration and risk assessment;
- Direct assessment plan, if applicable;

- Provisions for remediating conditions found during integrity assessments;
- Process for continual evaluation and assessment;
- Confirmatory direct assessment plan, if applicable;
- Process to identify and implement additional preventive and mitigation measures;
- Performance plan including the use of specific performance measures;
- Recordkeeping provisions;
- Management of change process;
- Quality assurance process;
- Communication plan;
- Procedures for providing to regulatory agencies copies of the risk analysis or IMP;
- Procedures to verify that integrity assessments are conducted to minimize environmental and safety risks; and
- Process to identify and assess newly identified HCAs.

On a preliminary basis, and for the route currently under consideration, these are the HCA identified for the Mainline at this time. HCAs were identified following the requirements of 49 C.F.R. § 192.903, with a potential impact radius that was calculated to be 1,466 feet for the Mainline and 749 feet for PTTL. The potential HCAs that have been identified for the Project Mainline and PTTL are provided in Tables 9.2.4-1 and 9.2.4-2.

TABLE 9.2.4-1

Potential HCA Takeoff Mainline Route Revision C2

Start MP	End MP	Length (mi.)	Description
236.08	237.33	1.25	Marion Creek Campground
352.21	353.35	1.14	Hotspot Cafe
529.21	530.44	1.23	RV Park and Motel
535.54	537.74	2.20	Denali Riverside RV Park, McKinley Chalet Resort, Denali Rainbow Village and RV, Denali Princess Wilderness Lodge, Denali Crows Nest Cabins, Grand Denali Lodge, Denali Bluffs Hotel
551.34	552.27	0.93	Denali Perch Resort
565.77	567.23	1.46	ADOT&PF Cantwell Station
629.75	631.35	1.60	Byers Lake Campground (73 units)
633.75	634.50	0.75	Trappers Creek Pizza Pub
797.71	799.28	1.57	Nikiski Middle/High School, Kenai Heliport, Commercial Buildings, Industrial Sites
803.39	806.05	2.66	Conoco Phillips Property and Tesoro Kenai Refinery
Total		14.79	

TABLE 9.2.4-2

Potential HCA Takeoff PTTL Route Revision C2

From MP	To MP	Length (miles)	Description
0.00	0.14	0.14	PTU
62.38	62.52	0.14	GTP
Total		0.28	

In addition to the covered segments based on the classical definition of high consequence area, there are plans to incorporate the strain based design (*SBD) Segments*[21] in its written IMP and treat the *SBD Segments* as a "covered segment" in a HCA in accordance with 49 C.F.R. Part 192, Subpart O, except for the reporting requirements contained in 49 C.F.R. § 192.945.

The pipeline segments operating under an alternative MAOP are subject to the IMP requirements of 49 C.F.R. § 192.620. The IMP would specifically address the additional requirements for baseline assessments, threat identification, and integrity assessments.

In accordance with the IMP, operations staff would periodically assess the integrity of pipeline segments operating at the alternative MAOP using assessment methodologies acceptable to the industry and PHMSA. These segments would be periodically inspected using the appropriate in-line inspection (ILI) tools. ILI tools can be used for assessments of a number of potential hazards, including metal loss from corrosion. ILI tools can also be used to inspect for deformation caused by slope movements, fault displacements, frost heave, thaw settlement, or other mechanisms. Conditions that exceed applicable acceptance criteria would be assessed and remediated to maintain the integrity of the pipeline.

The written IMP and records that demonstrate compliance with 49 C.F.R. Part 192 Subpart O would be maintained and be available for review by PHMSA and/or state regulators during inspections, as required. The pre-front end engineering design (pre-FEED) for the buried pipeline, wall thickness, and grade on the Mainline meets the requirements in 49 C.F.R. § 192.111 and 192.620 using design factors of 0.50, 0.60, 0.72, and 0.80 as per different class locations and conditions.

The wall thickness of the PTTL meets the requirements in 49 C.F.R. § 192.111 using a design factor of 0.72. The PTTL has additional wall thickness selection requirements due to considerations of ballistic and transportation of field gas that results in a wall thickness of no less than 0.500 inch (see Table 11.7.2-5).

9.2.5 Pipeline Aboveground Facilities

Planned maintenance activities at compressor stations, meter stations, and heater stations would include routine checks, calibration of equipment and instrumentation, inspection of critical components, and servicing and overhauls of equipment. Unplanned maintenance activities would include investigating problems identified by the natural gas control center and station monitoring systems and the implementation of corrective actions.

A fire buffer zone would be included for compressor stations and the heater station. This zone is a cleared strip of land that extends outward approximately 130 feet from the station fence on three sides, to provide separation between the station equipment and the surrounding vegetation. On the fourth side of the station, the fence is placed at the edge of the pipeline ROW and the buffer zone is located within the station fence. This buffer is part of the entire compressor station acreage. The fire buffer zone should reduce the potential for forest fires to spread to the station equipment. In the unlikely event of a fire within a pipeline facility, it would also reduce the potential for the fire to spread to surrounding vegetation. Vegetation in the buffer zone would be controlled by cutting and removing large trees and brush.

During operations, the Project's overall effects on visual conditions during hours of both daylight and darkness would be low. Some nighttime lighting would be required for operational safety and security at pipeline facilities. Offsite visibility and potential glare from the lighting would be minimized by using non-glare fixtures and placement of lights to illuminate only those areas where needed. However, because of other minimal manmade sources of light in these remote areas, when viewed from nearby offsite locations, the overall change in ambient lighting conditions at the Project site may be moderate to substantial.

[21] *SBD Segments* have not yet been determined for the Mainline at this phase of design. If pipeline route conditions require the use SBD to design for and manage the threat of earth movements a SP application for use of SBD would be submitted to PHMSA. The SP application for SBD would document the segments of the Mainline where SBD was identified as a design condition. These ***SBD Segments*** would constitute milepost descriptions of segments on the Mainline.

Meter stations would be provided with natural gas detection and alarm systems. Compressor and heater stations would be provided with natural gas detection to comply with existing regulations. Emergency shutdown systems would be designed to be initiated automatically or locally if an unsafe condition is detected. Over-pressure protection monitoring would prevent over-pressuring of natural gas piping and equipment.

Line break, low-pressure control devices would be installed at MLBVs. These include pressure sensing devices that would automatically close a valve if the pipeline internal pressure drops below a preestablished value, indicating a potential leak.

9.2.5.1 Water Use during Compressor and Heater Station Operations

Because the compressor and heater stations are normally unmanned, water use during operation of the facilities would not be significant. Water use at these unmanned facilities would consist of engine wash, facility cleaning, and human use/consumption for maintenance personnel onsite. Compressor and heater station facilities would include potable and black water storages, each having approximately 3,000 gallons of capacity. The potable water would be trucked in to provide adequate supply and blackwater would be pumped out as required and trucked to predesignated disposal location. General maintenance and engine wash water would be collected in designated separate drain tanks, pumped out, and trucked to a predesignated disposal location. Bottled drinking water would be trucked in as required.

9.2.6 GTP

Approximately 110 GTP-based O&M personnel would be located on site. Each shift is expected to require approximately 55 personnel. It is expected that the normal staffing requirements would result in a normal Operations Camp occupancy of approximately 125 beds. An additional 1,555 beds would be required to support the peak Operations/Maintenance workforce requirement during construction and turnarounds. Support staff of approximately 170 persons are expected to be based in Anchorage.

The GTP would be monitored and controlled from a control center located on the GTP Pad. The control room building would include a work permit area, break/lunch room, rest/change rooms, and several offices.

Additional facilities required for operations would be located at the Operations Center. This includes site office space, a lab, a warehouse, and a maintenance shop. The warehouse would include bulk, bin, shelved, and pallet storage areas and a tool room. The maintenance shop would include instrument, electrical, and mechanical shop areas and light vehicle/equipment maintenance areas.

Natural gas detection and alarm systems would be installed throughout the facility and emergency de-pressuring and/or shutdown systems would be designed to be initiated automatically, locally (at the equipment module), or remotely (in the control room). In addition, an equipment health monitoring system would be installed to collect and trend data, monitor critical rotating equipment, and manage data so that it can be accessed both locally and remotely to enable troubleshooting, optimization, and predictive maintenance planning. Additional details concerning the GTP safety systems and requirements will be addressed in Resource Report No. 11.

GTP maintenance personnel would be trained and qualified to perform most day-to-day maintenance activities. Infrequent major maintenance would be performed by qualified contractors or original equipment manufacturer service representatives, including during plant turnarounds.

Personnel would be trained for proper handling, storage, disposal, and spill response of hazardous fluids, and a *SPCC Plan* would be developed (Resource Report No. 2, Appendix K). Storage tanks and containers for fuels and hazardous liquids at the facility would be constructed with appropriately sized secondary containment. Oil-filled operational equipment would be addressed in a manner consistent with the requirements of 40 C.F.R. Part 112.

Turnaround durations and frequencies would be determined by results of the gas turbine major inspections and over-hauls. Other inspection and maintenance work would be assumed to occur within those outages. Turnarounds at the GTP would be scheduled and coordinated to coincide with scheduled Liquefaction Facility turnaround. Scheduled maintenance of the PBTL, PTTL and other GTP transfer lines would be conducted during the winter. Access for unscheduled maintenance during summer would be by foot or suitable low pressure-type vehicle. Major maintenance would require an ice road be built alongside the pipeline. Operation of the PBTL and other transfer lines would be monitored from the GTP control room.

During operations, snow removal would follow typical Alaska North Slope practices. Snow on the GTP Pad would be pushed to the west side of the pad to minimize drifting. Locations that are not practical to clear to the west would be pushed off adjacent areas of the pad and/or staged on previous construction laydown space/module movement path, maintaining minimum distance from flow lines, valves, or well houses to avoid contact, damage, or movement of lines. Snow handling procedures would minimize granular material entrainment.

Prior to breakup, reserve pits and other designated impoundments are cleared of uncontaminated snow to a level above any stored waste or residual contamination. Contaminated snow is hauled to an approved disposal facility. As much snow as practical is removed to minimize the volume of snowmelt at breakup. Snowmelt from uncontaminated snow is considered a discharge and is covered under APDES permit AKG-33-1000. The discharge locations would be inspected twice annually.

9.2.6.1 Water Use during GTP Operations

Raw water would be provided to the GTP from a water reservoir, as discussed in Section 1.3.2.2 of Resource Report No. 1 and the *Water Use Plan* (located in Resource Report No. 2, Appendix L). The raw water would flow into the plant at a rate of approximately 190 gallons per minute. This water would be split between the process water treatment system and the potable water treatment systems. It is expected that approximately 60 gallons per minute of process water would be treated for use at the GTP and approximately a peak of 130 gallons per minute of potable water would be treated for use between the GTP area and the GTP Operations Center.

9.3 ENVIRONMENTAL AND SAFETY PROCEDURES

9.3.1 Public Awareness Program

An integrated public awareness program would be developed to educate and inform excavators, contractors, emergency services, public officials, and landowners about pipeline safety associated with the Project. Information would be communicated through newspaper advertisements, social media, and Project-specific mailings to targeted audiences. The Project representatives would work with land managers to consider providing interpretive signage and/or educational kiosks.

The pipelines would be clearly marked at road crossings and other key points. Markers identifying the operator would indicate the presence of the pipelines and provide a contact number and address to be used in the event of an emergency or before any excavation in the area is started. The Project would participate in Alaska's One-Call system also called "811 Alaska Digline."

9.3.2 Waste Management

A description of the proposed waste characterization procedures, estimated waste quantities, and waste handling/disposal procedures are provided in the Project's draft *Waste Management Plan.* This plan addresses hazardous and non-hazardous waste materials in detail and is provided in Resource Report No. 8, Appendix J.

9.3.2.1 Liquefaction Facility Waste Management

Operational waste materials would be disposed of as required by federal, state, and local regulations. A description of the proposed waste characterization procedures, estimated waste quantities, and waste handling/disposal procedures is provided in the Project's draft *Waste Management Plan.* Resource Report No. 8, Appendix J.

9.3.2.1.1 Temporary Domestic Wastewater Treatment Plant

A temporary domestic wastewater treatment plant would be located east of the construction camps. Vacuum trucks and wastewater collection lines would transport wastewater from the camps. Vacuum trucks would take the material to an approved disposal facility. The temporary construction treatment plant would be sized to treat domestic wastewater at a rate of approximately 50 gallons per person per day. The plant capacity is planned for approximately 250,000 gallons per day.

Discharge from the temporary sewage plant would be to a sediment basin on site that would discharge to Cook Inlet through an outfall. The wastewater would be tested prior to discharge in accordance with APDES permit requirements.

9.3.2.1.2 Operations Wastewater Treatment System

A wastewater treatment system would be located adjacent to the liquefaction trains and potable water treatment system (see below). The main liquid effluents would be:

- Boiler blowdown;
- Reject water from the water treatment system;
- Drainage from areas outside of potential sources of contamination (e.g. processing train/facilities drainage); and
- Sanitary effluent/black water (e.g., control rooms, administration buildings, security building).

Design of the wastewater treatment system would include provisions for segregation of effluent by source, collection, routing, treatment as necessary, and monitoring to minimize liquid effluents, facilitate selective recycle, and meet ADEC regulations. The wastewater treatment area would consist of the following subsystems:

- Oily water;
- Contaminated stormwater; and
- Sanitary wastewater.

The surface runoff and oily water from collection sumps would be sent into an equalization tank for treatment. Once treated, the water would be sent to one of the three onsite ponds would serve as the receiving area prior to discharge. Treatment methods would be further defined during later stages of the Project. The main discharge location of wastewater effluent streams would be a plant outfall to Cook Inlet shoreline near the trestle. An application for an APDES discharge permit would be filed prior to operations.

Runoff outside of operational areas would drain into stormwater ponds. Overflow of water from these ponds would also be discharged in accordance with APDES requirements via outfalls into Cook Inlet.

9.3.2.2 Pipeline Waste Management

Waste material generated during construction and operation of the pipelines would be managed according to federal, state, and local regulations. Material generated during construction is primarily construction wastes from packing of material and supplies, camp wastes, sanitary waste at camps, and construction debris (vegetation, rock, ice-rich soils, etc.). Disposal sites for the construction generated wastes are provided in the *Gravel Sourcing Plan and Site Reclamation Measures*. Disposal of other construction camp wastes and contractor generated wastes would be developed during final design and would generally follow the plan outline provided for the Project's draft *Waste Management Plan.*

9.3.2.3 GTP Waste Management

Operational or construction waste materials would be disposed of as required by federal, state, and local regulations. A description of the proposed waste characterization procedures, estimated waste quantities, and waste handling/disposal procedures is proved in the Project's draft *Waste Management Plan.* This plan addresses hazardous and non-hazardous waste materials in detail and is provided in Resource Report No. 8, Appendix J.

9.4 EMERGENCY MANAGEMENT

Prior to operation of Project facilities, emergency response plans (ERPs) that meet all regulatory requirements and address the site-specific nature of the covered facilities would be prepared. A comprehensive ERP including the full scope of this Project would be developed. Ultimately, the Liquefaction Facility, pipelines, and gas treatment plant would be an integrated system and need to ensure proper and timely response to any emergency.

9.4.1 U.S. Coast Guard Emergency Response and Operations Manual

The USCG requires under 33 C.F.R. § 127.307 an Emergency Manual that must be submitted and approved by the local Captain of the Port prior to terminal operations. The manual must contain LNG release response procedures, including contacting local response organizations; emergency shutdown procedures; a description of the fire equipment and systems and their operating procedures; a description of the emergency lighting and emergency power systems and the telephone numbers of local USCG units, hospitals, fire departments, police departments, and other emergency response organizations. If the terminal handling LNG has personnel shelters, the location of and provisions in each shelter must also be provided, as well as first aid procedures and if there are first aid stations, the locations of each station. The emergency procedures for mooring and unmooring a vessel are also required.

The emergency plan and fire-prevention plan required by OSHA in 29 C.F.R. § 1910.38 may be used to comply with this section to the extent that they address the requirements specified in 33 C.F.R. § 127.307.

The USCG Emergency Manual and the Operations Manual may be combined to reduce the number of manuals and make emergency response a direct part of operating the facility.

10.0 TERMINATION

At a future time when operation of the Project is no longer commercially viable, abandonment plans would be developed in accordance with Project authorizations and legal requirements in effect at the time.

10.1 MINERAL MATERIAL LEASE SITES

Reclamation at extraction sites is discussed in Resource Report No. 8, Section 8.1.

11.0 ACRONYMS AND TERMS

ABBREVIATION	DEFINITION
Abbreviations for Units of Measurement	
°F	degrees Fahrenheit
dBA	A-weighted decibels
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
BSCF/D	billion standard cubic feet per day
BTU	British Thermal Unit
BBtu/h	billion British Thermal Units per hour
µg	microgram
MMSCF	million standard cubic feet
MMSCF/D	million standard cubic feet per day
MMTPA	million metric tons per annum
ppm	parts per million
ppmv	parts per million by volume
Psi	pounds per square inch
psig	pounds per square inch gauge
tpy	tons per year
Other Abbreviations	
AAAQS	Alaska Ambient Air Quality Standards
AAC	Alaska Administrative Code
ACRC	Alaska Climate Research Center
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
AGDC	Alaska Gasline Development Corporation
AGRU	acid gas removal unit
Applicant's Plan	Applicant's Upland Erosion Control, Revegetation, and Maintenance Plan
Applicant's Procedures	Applicant's Wetland and Waterbody Construction, and Mitigation Procedures
AOGCC	Alaska Oil and Gas Conservation Commission
APCI	Air Products and Chemicals Inc.
APDES	Alaska Pollutant Discharge Elimination System
API	American Petroleum Institute
Applicant	Alaska Gasline Development Corporation
ARRC	Alaska Railroad Corporation
AQ	air quality
AQCR	Air Quality Control Region
AQRV	Air Quality Related Value
ASME	American Society of Mechanical Engineers
ASOS	Automated Surface Observation System
ATWS	additional temporary workspace
BACT	Best Available Control Technology

ABBREVIATION	DEFINITION
BLM	Bureau of Lang Management
BMP	best management practice
CAA	Clean Air Act
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
C.F.R.	Code of Federal Regulations
CEQ	Council on Environmental Quality
CGF	Prudhoe Bay Unit Central Gas Facility
CO_2	carbon dioxide
CP	cathodic protection
CPF	Central Processing Facility
DB	Denali Borough
DF	design factor
DGGS	Alaska Department of Natural Resources Division of Geological and Geophysical Surveys
DH	dock head
DMLW	Alaska Department of Natural Resources Division of Mining, Land, & Water
DMT	direct microtunneling
DNPP	Denali National Park and Preserve
DOE	United States Department of Energy
DPOR	Alaska Department of Natural Resources Division of Parks and Outdoor Recreation
ECA	Emission Control Act
EIAPP	Engine International Air Pollution Prevention
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ERP	Emergency Response Plan
FAA	United States Department of Transportation, Federal Aviation Administration
FGL	Fuel Gas Line
FBE	fusion bonded epoxy
FERC	United States Department of Energy, Federal Energy Regulatory Commission
FERC Plan	FERC Upland Erosion Control, Revegetation, and Maintenance Plan
FERC Procedures	FERC Wetland and Waterbody Construction and Mitigation Procedures
FNSB	Fairbanks North Star Borough
FTA	Free Trade Agreement
GC1	Gathering Center #1
GHG	greenhouse gas
GTP	gas treatment plant
H_2S	hydrogen sulfide
H_2SO_4	sulfuric acid mist
HAP	hazardous air pollutant
HCA	High Consequence Area

ABBREVIATION	DEFINITION
HDD	horizontal directional drill
ILI	Inline inspection
IMO	International Maritime Organization
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPS	Initial Production System
ISO	International Standardization Organization
KPB	Kenai Peninsula Borough
Liquefaction Facility	natural gas liquefaction facility
LNG	liquefied natural gas
LNGC	liquefied natural gas carrier
MACT	maximum achievable control technology
Mainline	An approximately 800-mile-long, large-diameter gas pipeline
MARPOL	Marine Pollution Protocol
MAOP	maximum allowable operating pressure
MGS	Major Gas Sales
MLBV	Mainline block valve
MLLW	Mean Lower Low Water
MOF	material offloading facility
MOP	maximum operating pressure
MOU	Memorandum of Understanding
MP	Mainline milepost
MSB	Matanuska-Susitna Borough
N/A	Not Applicable
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NCore	National Core Network
NACE	National Association of Corrosion Engineers
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NGA	Natural Gas Act
NMFS	National Oceanographic and Atmospheric Administration, National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOPRM	Notice of Proposed Rule Making
North Slope	Alaska North Slope
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRO	Alaska Department of Natural Resources Division of Mining, Land, & Water, Northern Region Office
NSA	Noise Sensitive Area
NSB	North Slope Borough

ABBREVIATION	DEFINITION
NVIC	Navigation and Vessel Inspection Circular
O_2	oxygen
O_3	ozone
O&M	Operations and Maintenance
Off-ROW	Work areas located off the construction right-of-way
OSHA	Occupational Safety and Health Administration
PBTL	Prudhoe Bay Gas Transmission Line
PBU	Prudhoe Bay Unit
$PM_{2.5}$	particulate matter having an aerodynamic diameter of 2.5 microns or less
PM_{10}	particulate matter having an aerodynamic diameter of 10 microns or less
PHMSA	United States Department of Transportation, Pipeline and Hazardous Materials Safety Administration
PLF	product loading facility
POD	Plan of Development
Project	Alaska LNG Project
PSY	Pipe Storage Yard
PTEP	Point Thomson Expansion Project
PTTL	Point Thomson Gas Transmission Line
PTU	Point Thomson Unit
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
Ro-Ro	Roll-on/Roll-Off
ROW	right-of-way
SAWL	longitudinally submerged arc-welded pipe
SCRO	Alaska Department of Natural Resources Division of Mining, Land, & Water, Southcentral Region Office
SHPO	Office of History and Archaeology, State Historic Preservation Office
SimOps	Simultaneous Operations
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations
SMYS	Specified Minimum Yield Strength
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasure
SPCS	State Pipeline Coordinator's Section
SPMT	self-propelled module transporter
STP	Seawater Treatment Plant
SWAPA	Southwest Alaska Pilots Association
SWPPP	Stormwater Pollution Prevention Plan
TAPS	Trans-Alaska Pipeline System
TBD	To be determined
TQ	Threshold quantities
UIC	Underground Injection Control

ABBREVIATION	DEFINITION
UL	Underwriters Laboratories
U.S.	United States
U.S.C.	United States Code
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOI	United States Department of the Interior
USDOT	United States Department of Transportation
USFWS	United States Department of the Interior, United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile organic compound
VSM	vertical support member
WDAP	Wastewater Discharge Authorization Program
WHRU	waste heat recovery unit
WSA	Waterway Suitability Assessment

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ATTACHMENT A:

ESTIMATED EXTENT OF TRAVEL LANES AND BYPASS LANES

Attachment A

Estimated Extent of Travel Lanes and Bypass Lanes

Spread	Section	From MP	To MP	Total Limited Access (miles)	Travel Lane (miles)	Bypass Lane (miles)	Access Road on Travel Lane (miles)
1	A	0.00	56.63	56.63	56.63	56.63	0.00
	B	56.63	63.33	6.70	6.70	0.00	0.00
	B	94.31	109.65	15.34	15.34	0.00	0.00
	C	129.58	136.52	6.94	6.94	0.00	0.00
2	A	223.47	224.27	0.80	0.80	0.00	0.00
	A	227.71	228.09	0.38	0.38	0.00	0.00
	L	389.00	393.95	4.95	4.95	0.00	0.00
3	A	401.20	408.10	6.90	6.90	6.90	6.90
	B	408.10	421.51	13.41	0.00	0.00	13.41
	C	430.48	464.36	33.88	33.88	33.88	0.00
	C	464.36	470.70	6.34	0.00	6.34	0.00
	E	473.78	489.38	15.60	15.60	15.60	0.00
	F	489.38	498.58	9.20	9.20	0.00	0.00
	K	538.87	543.08	4.21	4.21	0.00	0.00
4	A	642.28	648.28	6.00	6.00	0.00	0.00
	B	674.05	693.94	19.89	0.00	0.00	19.89
	B	693.94	703.80	9.86	0.00	0.00	9.86
	C	703.80	721.23	17.43	17.43	0.00	0.00
	C	721.23	745.00	23.77	23.77	0.00	0.00
			Totals	258.23	208.73	119.35	50.06

ATTACHMENT B:

ANTICIPATED HELIPADS ASSOCIATED WITH THE MAINLINE

Attachment B

Anticipated Helipads Associated with the Mainline

Helipad Location (MLBVNo./Camp Name/Town Name)	Approximate Milepost[a]	Permanent or Temporary[b]
NORTH SLOPE		
Prudhoe Bay Camp	0.61	Temporary
MLBV 2	36.68	Permanent
Franklin Bluffs Camp	43.65	Temporary
Sagwon Compressor Station	75.97	Permanent
Happy Valley Camp	85.77	Temporary
MLBV 4	111.98	Permanent
Galbraith Lake Camp	142.49	Temporary
Galbraith Lake Compressor Station	148.51	Permanent
YUKON-KOYUKUK		
MLBV 6	194.03	Permanent
Dietrich Camp	205.85	Temporary
Coldfoot Compressor Station	240.10	Permanent
Coldfoot Camp	241.11	Temporary
Prospect Camp	278.92	Temporary
MLBV 8	285.99	Permanent
Old Man Camp	305.68	Temporary
Ray River Compressor Station	332.64	Permanent
Five Mile Camp	353.68	Temporary
MLBV 10	377.89	Permanent
Livengood Camp	400.96	Temporary
Minto Compressor Station	421.56	Permanent
MLBV 12	444.88	Permanent
Dunbar Camp	456.06	Temporary
MLBV 13	467.03	Permanent
DENALI		
MLBV 14	492.94	Permanent
Rex Camp	498.58	Temporary
Healy Compressor Station	517.62	Permanent
Healy Camp	528.86	Temporary
MLBV 16	534.77	Permanent
MLBV 17	538.76	Permanent
MLBV 18	546.44	Permanent
Cantwell Camp	567.51	Temporary

Attachment B

Anticipated Helipads Associated with the Mainline

Helipad Location (MLBVNo./Camp Name/Town Name)	Approximate Milepost[a]	Permanent or Temporary[b]
MLBV 19	572.21	Permanent
MATANUSKA-SUSITNA		
Honolulu Creek Compressor Station	597.36	Permanent
Hurricane Camp	606.64	Temporary
MLBV 21	625.81	Permanent
Chulitna Camp	647.78	Temporary
MLBV 22	648.10	Permanent
Rabideux Creek Compressor Station	675.23	Permanent
Susitna Camp	693.72	Temporary
MLBV 23	703.61	Permanent
MLBV 25	725.91	Permanent
Sleeping Lady Camp	744.88	Temporary
Theodore River Heater Station	749.12	Permanent
KENAI PENINSULA		
Beluga Marine Camp	765.83	Temporary
MLBV 27	765.99	Permanent
MLBV 28	793.32	Permanent
MLBV 29	799.83	Permanent
Kenai Camp	803.52	Temporary

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Notes:

[a] Mainline MP 0.0 starts at the GTP.

[b] Temporary indicates needed during construction; permanent indicates needed during construction and operation.