APPENDIX L CUMULATIVE IMPACTS

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1.0 INTRODUCTION

The purpose of this assessment is to describe the cumulative impacts to the environment associated with the Alaska LNG Project (Project). Cumulative effects are those that result "from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 C.F.R. Part 1508, Sec. 7). This analysis will follow the procedures outlined in the Council on Environmental Quality (CEQ) 1997 guidance manual, Considering Cumulative Effects under the National Environmental Policy Act. The analysis is based upon information found in the public record and, as such, is limited in the level of information available for projects currently undergoing permitting or regulatory review.

1.1 SCOPE OF CUMULATIVE IMPACT ASSESSMENT

Cumulative impacts may result when the environmental effects associated with both the temporary and permanent activities of a proposed project are added to impacts associated with other past, present, or reasonably foreseeable future projects. Although the individual impact of each separate project might not be significant, the additive or synergistic effects of multiple projects could be significant. This cumulative analysis focuses on potential impacts from the proposed Project on resource areas or issues where their incremental contribution would be potentially significant when added to the potential impacts of other actions. Therefore, actions meeting the criteria below were included in this cumulative analysis:

- Affect a resource potentially affected by the proposed Project;
- Cause this impact within all, or part of, the geographic Project area; and
- Cause this impact within all, or part of, the timespan for the potential impact from the proposed Project.

For the purposes of this analysis, the temporal extent of other projects would start in the recent past and extend out for the expected duration of the impacts caused by the Project. Recent past, current, and future actions were identified through communications with federal cooperating agencies and local boroughs. "Reasonably foreseeable actions" are proposed projects or developments that have applied for a permit from local, state, or federal authorities or which are publicly known.

The geographic extent of the area considered in the cumulative effects analysis varies by the project and by resource. The cumulative impact analysis area for a resource may be substantially greater than the corresponding project-specific area of impact in order to consider an area large enough to encompass likely effects from other projects on the same resource. The CEQ recommends setting the geographic scope based on the natural boundaries of the resource affected, rather than jurisdictional boundaries. For example, they suggest that the watershed is likely the appropriate geographic boundary for analyzing water quality and the airshed for analyzing air quality.

Cumulative impacts from future third-party pipelines and associated infrastructure to transport natural gas from the gas interconnection points to markets in Alaska are considered in this analysis. As described in Section 1.3.2.1 of Resource Report No. 1, to date, the State of Alaska has identified the following three locations for planned delivery of gas to in-state customers:

- Fairbanks/North Star Off-take Facilities – near MP 441 for delivery to a treatment facility and pipeline to serve Fairbanks;

- Anchorage/Matanuska-Susitna Off-take Facilities – near MP 763 for delivery to a treatment facility and pipeline to serve Anchorage/Matanuska-Susitna; and
- Kenai Peninsula Off-take Facilities – near MP 804 to connect to the existing ENSTAR pipeline system.

Impacts from certain non-jurisdictional facilities (see Resource Report No. 1, Section 1.3.9 for a description of non-jurisdictional facilities) connected to the Project are addressed in the Resource Reports along with Project impacts. These include:

- Modifications/new facilities at the PTU;
- Modifications/new facilities at the PBU; and
- Relocation of the Kenai Spur Highway.

The sections below outline the criteria used to identify reasonably foreseeable future actions and the methodology used to assess their effects in combination with those of the Project.

1.1.1 Area of Interest

The Area of Interest (AOI) for this cumulative impacts analysis focuses on simultaneous or overlapping construction of the Project and other projects in the area. Potential overlap encompasses both the direct and indirect footprint of the Project as well as the use of existing infrastructure potentially shared by this Project and other projects. This includes approximately direct footprint and the extent of indirect impacts for each resource (this varies by resource; visual impacts can extend for miles, sound less than a mile). Also included are projects completed or planned for the roads, railroads, and waterways that would be used as infrastructure for the Project and the ports, airports, and mineral sites that would be used by the Project.

In addition, in accordance with recent FERC Data Requests for other LNG projects, there is an assessment of potential cumulative impacts during Project operations, including relevant existing facilities. This includes any operations activities along the Trans-Alaska Pipeline (TAPS), and at the existing industrial facilities near the Liquefaction facility in Nikiski, the PBU, and the PTU.

1.1.2 Project Selection Criteria and Methodology

The AOI was assessed to determine other projects occurring or planned to occur that may result in cumulative impacts on resources. The timeframe being considered for this analysis includes projects taking place from 2019 to 2026 (essentially from the start of construction of the Project to full production of the Project). The Project will continue to identify all projects that are either publicly announced, are currently within permitting review, or have already been permitted and are anticipated to be constructed within this time frame. Known or proposed projects that would also be operated within the timeframe of Project operations (30 years) are also included to the extent information is available for those projects.

Using the AOI described in Section 1.1.1, and the timeframe identified above, the Project has researched existing agency databases and publicly available project announcements. The Project will hold discussions with regulatory agencies to identify additional potential projects that will be considered for the cumulative impacts discussion prior to filing the final application.

For each project identified, publicly available information has been used to describe the project, timeframe for construction and operation, location, footprint, and potential resource impacts that would need to be considered in conjunction with Project resource impacts. For instance, although the Donlin gold mine is a considerable distance from the Project, it has been included in the analysis since it will:

- Likely occur during a similar timeframe based upon its anticipated construction start date;
- Involve a natural gas pipeline that crosses the Mainline; and
- Involve the use of a barge unloading facility on the western shore of Cook Inlet for the movement of equipment and material.

Overlapping resource impacts would be considered for species impacts from barge traffic in Cook Inlet, water quality impacts from any dock unloading facility construction in Cook Inlet, air impacts from the mine site, and impacts from the transportation of equipment and material during construction and operations. Using this approach, the Project identified other projects indicated in the Section 2.0, Table 1.

2.0 IDENTIFIED PROJECTS

A list of the identified, reasonably foreseeable future projects within the AOI is provided in Table 1 and their locations are shown in Figures 1 through 6. Table 2 includes a brief description of each project with the drivers for possible cumulative effects: footprint, proximity, and timeframe. Table 3 is a list of infrastructure improvement projects with potential cumulative impacts with the Project. Sections 3.0 through 12.0 of this appendix address the potential cumulative impacts by resource. Of note, the analysis is limited to the extent information is available for each project in the public record. The Alaska Standalone Pipeline Project (ASAP) is not included in the list of projects analyzed for cumulative impacts because ASAP would not be required if the Project proceeds.

TABLE 1

Summary Matrix of Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

	Water Use & Quality	Fish, Wildlife, & Vegetation	Threatened & Endangered Species	Cultural Resources	Socioeconomics	Transportation & Traffic	Geologic Resources	Soils	Land Use, Recreation, & Aesthetics	Air Quality	Noise		Past	Present	Reasonably Foreseeable
In-State Off-takes from Alaska LNG interconnection points	X	X	X	X	X	X	X	X	X	X					X
Accumulate Energy	X	X			X	X	X	X	X	X	X			X	X
Agrium	X				X					X	X		X		X

TABLE 1

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	Water Use & Quality	Fish, Wildlife, & Vegetation	Threatened & Endangered Species	Cultural Resources	Socioeconomics	Transportation & Traffic	Geologic Resources	Soils	Land Use, Recreation, & Aesthetics	Air Quality	Noise		Past	Present	Reasonably Foreseeable
Alaska Deep-Draft Arctic Port System	X	X	X		X	X	X		X		X				X
Beaufort Sea area oil and gas development	X	X	X		X	X	X	X	X	X	X		X	X	X
Brooks Range Petroleum Development	X	X		X	X	X	X	X	X	X	X				X
Cook Inlet area oil and gas development	X	X	X		X	X	X	X	X	X	X		X	X	X
Eva Creek Wind Project expansion and maintenance	X	X			X		X	X	X	X					X
F-35 Beddown	X	X			X					X					X
Golden Valley Electric Plant and Transmission Line	X	X		X	X		X	X	X	X	X				X
GMT-1 & GMT-2	X	X	X	X	X	X	X	X	X	X	X				X
Great Bear Shale Oil Development	X	X		X	X	X	X	X	X	X	X				X
Homer CIP	X	X			X	X		X	X	X					X
Liberty Development	X	X	X		X		X	X	X	X	X				X
Knik Arm Bridge	X	X	X		X	X	X	X	X						X
Nenana Basin area oil and gas development	X	X		X	X		X	X	X	X	X				X
Nikiski Conoco Phillips LNG plant					X					X			X	X	X
Nuna Development – Caelus Energy LLC	X	X		X	X		X	X	X	X	X				X
Port of Anchorage Expansion	X	X			X	X			X						X
Port Mackenzie Rail Extension	X	X	X	X	X	X	X		X	X	X			X	X
Seward Marine Terminal Expansion	X		X		X	X	X			X	X				X
South Denali Visitor Center		X		X					X	X					X
TAPS maintenance and upgrades planned		X				X	X	X							X
Ted Stevens Airport Expansion	X				X	X	X		X	X	X				X
Tesoro Kenai Refinery	X									X			X	X	X
Umiat Development	X	X			X	X	X	X	X	X	X			X	X

TABLE 1

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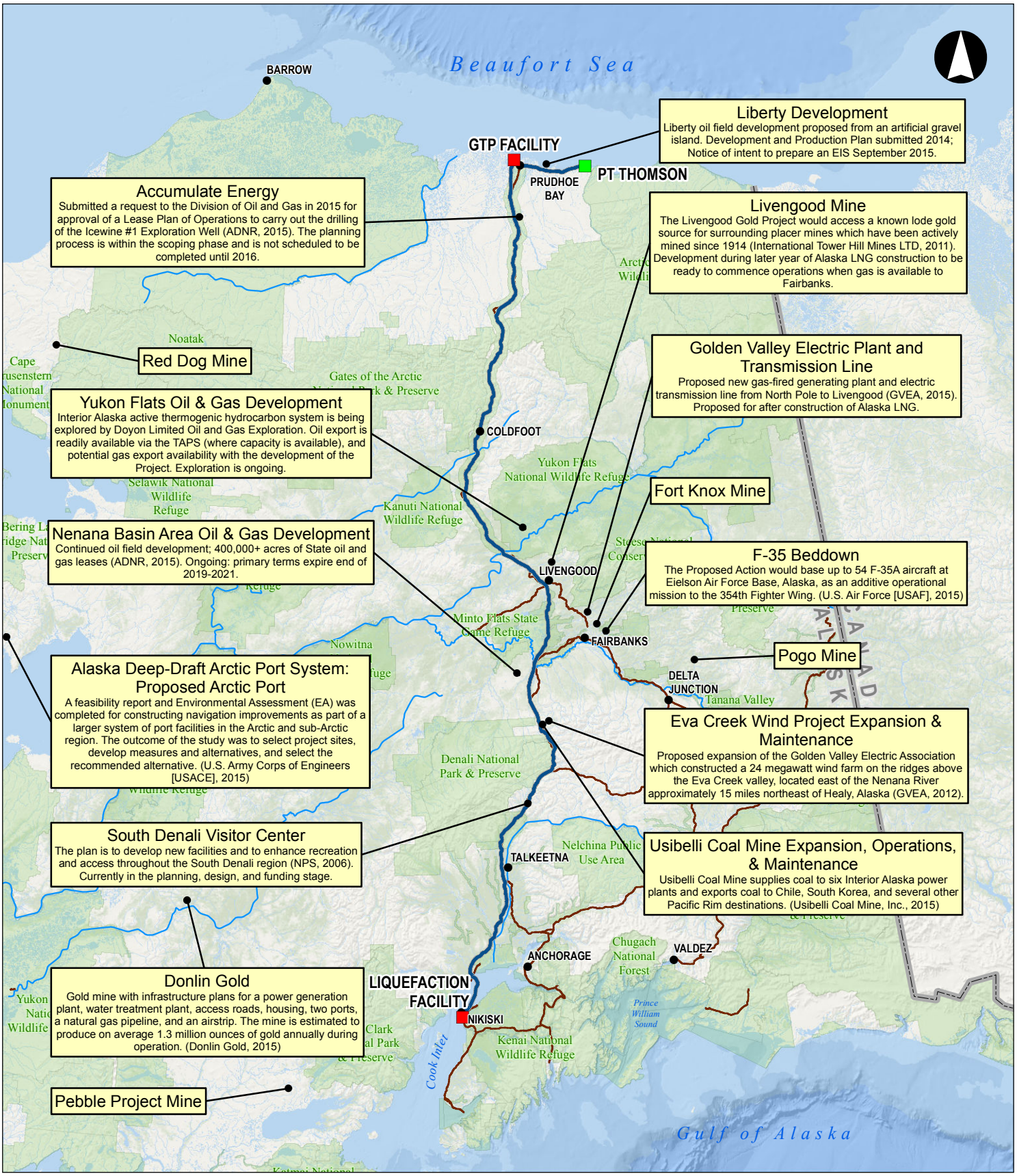
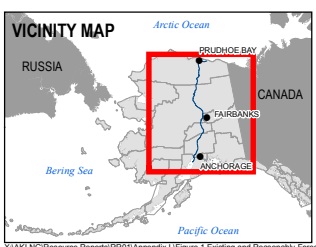
Usibelli Coal Mine expansion, operations, and maintenance	X	X		X	X		X	X	X	X	X		X	X	X
Yukon Flats area oil and gas development	X	X		X	X	X	X	X	X	X	X				X
Oil and Gas Activity Identified by Alaska Department of Natural Resources, Division of Oil and Gas															
Ahtna Corporation	X	X	X		X					X	X			X	X
AIDEA - Interior Energy Project	X	X	X		X					X	X			X	X
Bluecrest Energy	X	X	X		X					X	X			X	X
BP Exploration - North Prudhoe Bay	X	X	X		X					X	X			X	X
CINGSA - Cannery Loop Field	X	X	X		X					X	X			X	X
ConocoPhillips - Colville River Unit (Alpine)	X	X	X		X					X	X			X	X
ConocoPhillips - Kuparuk River	X	X	X		X					X	X			X	X
Cook Inlet Energy - North Fork Unit	X	X	X		X	X				X	X			X	X
Cook Inlet Energy - Otter Unit	X	X	X		X	X				X	X			X	X
Cook Inlet Energy - Redoubt Unit	X	X	X		X	X				X	X			X	X
Cook Inlet Energy - West McArthur Unit	X	X	X		X	X				X	X			X	X
Furie Operating Alasak - Kitchen Lights Unit	X	X	X		X					X	X			X	X
Global Geophysical Services - Kadleroshilik River	X	X	X		X					X	X			X	X
Hillcorp - Ivan River, Lewis River and Pretty Creek Units.	X	X	X		X					X	X			X	X
Hillcorp - Ninilchik	X	X	X		X				X	X	X			X	X
Hillcorp - Northstar Unit	X	X	X		X					X	X			X	X
Hillcorp - South Granite Point Unit	X	X	X		X					X	X			X	X
SAExploration	X	X	X		X					X	X			X	X
Savant Alaska LLC - Badami	X	X	X		X					X	X			X	X

TABLE 1

Summary Matrix of Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

	Water Use & Quality	Fish, Wildlife, & Vegetation	Threatened & Endangered Species	Cultural Resources	Socioeconomics	Transportation & Traffic	Geologic Resources	Soils	Land Use, Recreation, & Aesthetics	Air Quality	Noise		Past	Present	Reasonably Foreseeable
Large Mine Permitting Identified by Alaska Department of Natural Resources, Division of Mining, Land & Water															
Chuitna Coal Mine	X	X		X	X		X	X	X	X	X				X
Donlin Gold Mine	X	X		X	X	X	X		X	X	X				X
Fort Knox	X	X	X		X		X			X	X		X	X	
Graphite Creek	X	X	X		X		X			X	X		X	X	
Livengood Mine	X	X		X	X	X	X	X	X	X	X				X
Pebble Project	X	X	X		X		X			X	X				X
Pogo Mine	X	X	X		X		X			X	X		X	X	
Red Dog	X	X	X		X		X			X	X		X	X	





LEGEND

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

0 40 80 160 Miles

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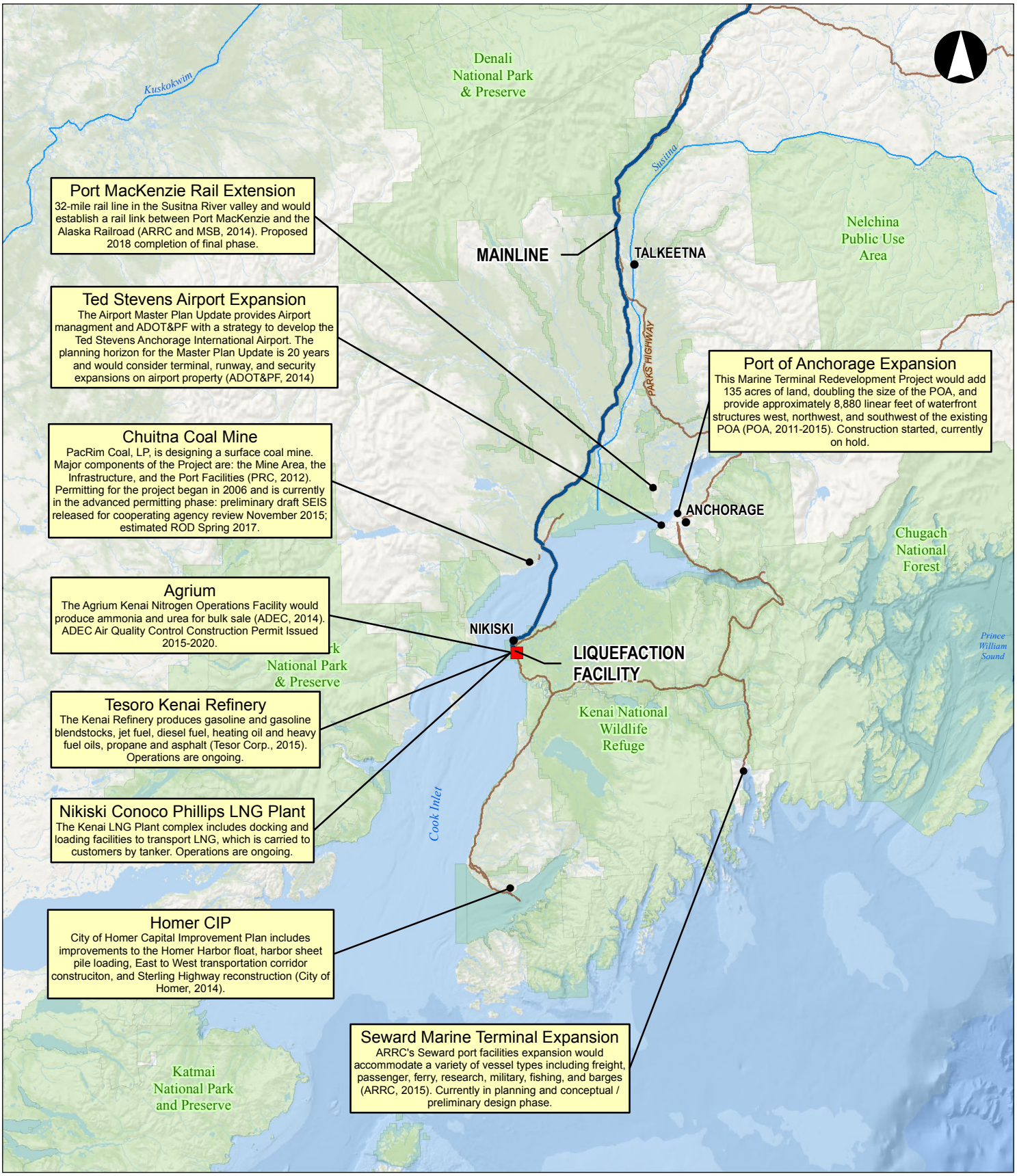
PREPARED BY:	AGDC		
SCALE:	1:6,500,000		
DATE:	2017-03-23	SHEET:	1 of 1

EXISTING AND REASONABLY FORESEEABLE PROJECTS (NORTH SLOPE & INTERIOR)

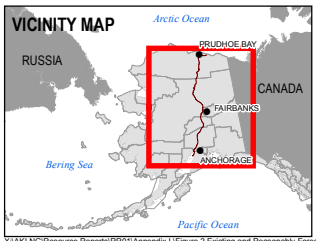
FIGURE 1

ALASKA LNG

X:\AKLNG\Resource Reports\RR01\Appendix L\Figure 1 Existing and Reasonably Foreseeable NS and Interior.mxd



VICINITY MAP



LEGEND

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

0 15 30 60 Miles

X:\AKLNG\Resource Reports\RR01\Appendix L\Figure 2 Existing and Reasonably Foreseeable SC and ICook Inlet.mxd

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SCALE:	1:2,500,000		
DATE:	2017-03-23	SHEET:	1 of 1

EXISTING AND REASONABLY FORESEEABLE PROJECTS (SOUTHCENTRAL & COOK INLET)

FIGURE 2

ALASKA LNG

North Slope Oil and Gas Activity

State of Alaska, Department of Natural Resources, Division of Oil and Gas, as of May 2016

Caelus Energy
Drilled CT-1 and CT-2 in state waters to evaluate Brookian Torok Fm and deeper horizons. Wells reached 6,943 and 9,030 feet TVD, respectively.

Armstrong-Repsol
US Army Corps of Engineers opened up EIS scoping for Nanushuk development, which involves three drillsites and four pads. Operator estimates peak production of 120,000 BOPD.

Caelus Energy
Suspending drilling at Oooguruk oil field.

Hilcorp Alaska LLC
Drilled four new wells at Milne Point Unit, constructing new facilities, planning to drill ten additional wells and workovers, and seeking to expand unit.

Hilcorp Alaska LLC
Multiple well workovers and major facilities projects in 2015-16.

Division of Oil and Gas
Requesting substantial new information regarding Beaufort Sea, North Slope, and North Slope Foothills Areawide oil and gas lease sales that has become available over the past year. Substantial new information must be submitted by May 13, 2016.

Bureau of Ocean Energy Management
Proposing OCS lease sales; Beaufort Sea in 2020 and Chukchi Sea in 2022. Public comment period for EIS statement ends May 2, 2016.

ASRC Exploration LLC
Drilled and suspended Placer 3 exploratory well.

BP Exploration Alaska
Released three of five rigs effective early Q2 2016.

Hilcorp Alaska LLC
Filed Development and Production Plan with BOEM for Liberty project. Planned two-year construction phase for man-made island.

ConocoPhillips
Brought CD-5 online in October 2015. Planning 18 additional wells beyond initial 15-well development plan. Expect to reach 16,000 BOPD target in 2016.

ExxonMobil
Achieved initial condensate production on April 22 via 2-well gas cycling system. Third well to be brought on line this summer.

ConocoPhillips Alaska, Inc.
Drilled Tinmiaq 2 and 6. GMT-1 development sanctioned November 2015, expected to produce 30,000 BOPD at peak. Currently permitting GMT-2, which will have 19 potential wells.

SAExploration
Conducting 2015-2016 Aklaq 3D seismic survey.

Brooks Range Petroleum Corp.
Received extension of Southern Miluveach Unit term until December 31, 2017.

ConocoPhillips-Kuparuk River
First production at Drill Site 2S October 2015. Funding approved for 8,000 BOPD 1H NEWS project expected to start up in late 2017.

Planning to expand southwestern part of unit to support development and production. Building 16.5 acre gravel pad and access road.

Applied to AOGCC for pool rules for Torok Fm Moraine oil pool in NW part of unit.

Bureau of Land Management
Issued a call for nominations and comments for tracts in 2016 NPRA oil and gas lease sale.

Geokinetics USA Inc.
Conducting Great Bear 2016 3D seismic survey.

Geokinetics USA Inc.
Planning 2016 Itkillik 3D seismic survey.

Accumulate Energy Alaska
Drilled Icewine 1 at Franklin Bluffs pad and conducting seismic survey on its acreage. Planning to drill Icewine 2H horizontal in Q1 2017.

Geokinetics USA Inc.
Permitted 2016 Icewine 3D seismic survey.

SAExploration Inc.
Conducting 2016 Toolik/Kuparuk 2D seismic survey. Survey will provide data to aid in planning Icewine 2 well.

Division of Oil and Gas
North Slope Areawide lease sale held November 2015 received 134 bids on 131 tracts. Winning bids totaled ~$9.5 million.

Bureau of Land Management
Offered 143 tracts of land at November 2015 NPRA lease sale. Six tracts received bids with the sum of bids totaling $788,680.

Department of Natural Resources
Received legislative approval for sales of 20-25,000 BOPD of North Slope royalty-in-kind oil to Tesoro starting August 2016 until July 2021.

Smith Bay
Teshekpuk Lake
Alaska Seaward Boundary
Beaufort Sea
Pikka
Nikaitchuq
Oooguruk
Ougruk
Milne Point
Northstar
Dewline
Beechey Point
Bear Tooth
Colville River
Kuparuk River
Prudhoe Bay
Duck Island
Liberty
Point Thomson
Badami
Greater Mooses Tooth
S. Miluveach
Tofkat
Kuparuk River
Trans-Alaska Pipeline
Dalton Hwy
Deadhorse
Prudhoe Bay
Arctic National Wildlife Refuge
National Petroleum Reserve - Alaska
Umiat

CT-1 & CT-2
QUGRUK 9
QUGRUK 7
QUGRUK 5 & 5A
QUGRUK 301
PLACER 3
QUGRUK 8
TUTTU 1
TINMIAQ 6
TINMIAQ 2
FLAT TOP1
RENDEZVOUS 3
ALKAID 1
ICEWINE 1
UMIAT 23H

Exploratory Wells Spud

- 2016
- 2015
- 2014

Oil & Gas Unit Boundary

0 5 10 15 20 25 Miles

Map Location

The accuracy of this map is subject to pending decisions currently on appeal and other administrative actions. Please visit www.dog.dnr.alaska.gov/GIS/ActivityMaps.htm to see our most current maps.

Figure 3

Cook Inlet Oil and Gas Activity

State of Alaska, Department of Natural Resources, Division of Oil and Gas, as of May 2016

Division of Oil and Gas
Bid openings for Alaska Peninsula and Cook Inlet Areawide 2016 competitive oil and gas lease sales are scheduled to be held May 4, 2016.

Visit http://dog.dnr.alaska.gov/Leasing/Documents/E-mail_Subscription_FAQs.pdf to subscribe to leasing announcements.

Nenana Basin, Doyon, Ltd
Toghotthele 1 exploration well to be drilled Summer 2016 with potential follow-up well during same drilling season. Conducting 2016 Nenana Basin 2D seismic survey.

Cook Inlet Energy
Relinquishing Susitna V exploration license.

Copper River Basin, Ahtna
Ahtna company Tolsona Oil and Gas Exploration LLC constructing road and pad near Glenallen for Tolsona 1 gas exploration well. Drilling scheduled for April with well testing in May.

Alaska Energy Authority
Alaska Industrial Development and Export Authority
Alaska Housing Finance Corporation
Governor Walker signed administrative order 281 to consolidate the above corporations and improve efficiency.

Division of Oil and Gas
Released seismic data and information for the Moquawkie 2D seismic survey through Geologic Materials Center .

Aurora Exploration LLC
Lease plan of operations approved for natural gas exploration wells, Theodore River 2 and Chedatna Lake 1.

ConocoPhillips Alaska Inc.
Completed purchase and sale agreement with Municipal Light and Power and Chugach Electric for Beluga River Unit. Approved by Regulatory Commission of Alaska.

Furie Operating Alaska
Filed new plan of operations for Kitchen Lights Unit, including ten exploratory wells over the next five years. Randolf Yost jack-up rig arrived early March. Planning to drill two development wells this year.

SAExploration
Conducting Shadura 2D and 3D seismic survey.

Apache Alaska Corporation
Suspending seismic acquistion and exploration activities in Alaska.

Regulatory Commission of Alaska
Allowing CINGSA to sell 2 BCF of found native gas.

11 development wells drilled in six fields during 2015:
Kenai (3), Cannery Loop (2), Ninilchik (2), Swanson River (2), Deep Creek (1), and North Fork (1).

Hilcorp Alaska LLC
Relinquishing Kasilof Unit by May 31, 2016.

BlueCrest Energy
Production from Cosmopolitan Unit began April 2016. Arrival of new land-based drill rig for oil development planned for sometime 2016. Plan to drill offshore delineation well in 2016 or 2017.

Hilcorp Alaska LLC
Asking state to defer contraction of leases at Deep Creek and Ninilchik Units until May 31, 2017.

Hilcorp Alaska LLC
Permitting Greystone pad for exploration project between Deep Creek and Nikolaevsk Units.

Bureau of Ocean Energy Management
Proposing Cook Inlet lease sale in 2021. Public comment period for EIS statement ends May 2, 2016.

Global Geophysical Services
Conducting 2016 South Kenai 2D seismic survey.

Susitna V
Susitna
Lewis River
Susitna Flats State Game Refuge
Otter
Pretty Creek
Stump Lake
Ivan River
OLSEN CREEK 2
Beluga River
Lone Creek
Tyonek
Moquawkie
North Cook Inlet
Trading Bay State Game Refuge
Nicolai Creek
Granite Point
Kitchen Lights
KITCHEN LIGHTS 5
Trading Bay
West McArthur River
Birch Hill
Redoubt Bay Critical Habitat Area
Swanson River
Tiger Eye
South Middle Ground Shoal
Redoubt
Beaver Creek
Nikiski
Salamatof
Kenai
Chugach National Forest
Cannery Loop
Sterling
Cooper Landing
Soldotna
Kenai
Kasilof
Kasilof
Cook Inlet
Clam Gulch
Tustumena Lake
Kenai National Wildlife Refuge
Alaska Seaward Boundary
Ninilchik
Deep Creek
Cosmopolitan
Nikolaevsk
Nikolaevsk
WEST EAGLE 1
Anchor Point
North Fork
Homer
Kachemak

Exploratory Wells Spud

- 2016, 2015 No Activity
- 2014
- Existing Wells Approved for Gas Storage
- Field
- Oil & Gas Units
- Exploration License

0 5 10 15 Miles

Map Location

The accuracy of this map is subject to pending decisions currently on appeal and other administrative actions. Please visit www.dog.dnr.alaska.gov/GIS/ActivityMaps.htm to see our most current maps.

Figure 4

TABLE 2

Project Information: Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Driver for Cumulative Effect	Timeline
Project Gas Interconnection Point: Fairbanks/North Star Gas Interconnection Point Facilities	Near Mainline MP 441 for delivery to a pipeline to serve Fairbanks (See Figure 5)	Installation of a tee with an isolation valve(s) would occur at several points along the Mainline to allow for the opportunity for future in-state deliveries. Off-take facilities serve as the intermediary between the connection to the Mainline and the lateral that conveys the gas up to the transfer point to utility and industrial users. In general, these facilities step down the pressure, odorize the gas, and then meter it before entering the pipeline to the local distribution company (LDC). Common equipment consists of: • A High-integrity Pressure Protection System (HIPPS); • Strainers; • Process heaters; • Pressure reduction control valves; • Measurement equipment; and • Odorization equipment (optional, not required for the three aforementioned connections). An overview of the facility layouts and process flow is provided in Attachment 1.	Overlapping footprint with the Mainline and predicted to be in the same general timeframe.	Construction: 2019-2026
Project Gas Interconnection Point: Anchorage/Matanuska-Susitna Gas Interconnection Point Facilities	Near Mainline MP 764for delivery to a treatment facility and pipeline to serve Anchorage/Matanuska-Susitna Borough (See Figure 6)			
Project Gas Interconnection Point: Kenai Peninsula Gas Interconnection Point Facilities	Near Mainline MP 804 to connect to the existing Enstar pipeline system.			
Accumulate Energy	Franklin Bluffs, North Slope Borough	In 2015, Accumulate Energy Alaska, Inc, submitted a request to the Division of Oil and Gas for approval of a Lease Plan of Operations to carry out the drilling of the Icewine #1 Exploration Well. The Icewine #1 Exploration Well is currently being drilled and is approximately 30 miles south of Deadhorse adjacent to the Dalton Highway on the Franklin Bluffs gravel pad. (Alaska Department of Natural Resources [ADNR], 2015)	Potentially within the same timeframe, and in proximity to the Mainline.	The planning process is within the scoping phase and is not scheduled to be completed until 2016.
Agrium	Nikiski, AK; Kenai Peninsula Borough	The Agrium Kenai Nitrogen Operations Facility is located at Mile 21 of the Kenai Spur Highway, near Kenai Alaska. It is classified as a nitrogenous fertilizer manufacturing facility under Standard Industrial Classification code 2873 and under North American Industrial Classification code 325311. The facility will produce ammonia and urea for bulk sale. (Alaska Department of Environmental Conservation [ADEC], 2014)	Potentially within the same timeframe and in proximity to the Liquefaction Facility.	ADEC Air Quality Control Construction Permit Issued 2015-2020

TABLE 2

Project Information: Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Driver for Cumulative Effect	Timeline
Alaska Deep-Draft Arctic Port System: Proposed Arctic Port	Nome, AK; Nome Census Area	A feasibility report and Environmental Assessment (EA) was completed for constructing navigation improvements as part of a larger system of port facilities in the Arctic and sub-Arctic region. The outcome of the study was to select project sites, develop measures and alternatives, and select the recommended alternative. (U.S. Army Corps of Engineers [USACE], 2015)	Potentially within the same timeframe.	Unknown
Beaufort Sea and Chukchi Sea area oil and gas development	Northern parts of the Yukon and Northwest Territories of Canada; and Northwest Alaska Arctic	Oil and gas development with target area focus on the northern Yukon Territory, Banks Island, Victoria Island, and Beaufort Sea (Lin Callow, LTLC Consulting, 2013). No known exploration plans in the Chukchi Sea.	Potentially within the same timeframe for construction of and in proximity to the GTP. Use of the same marine transportation corridors as Project construction.	Beaufort Sea: Ongoing Chukchi Sea: Unknown (new Arctic lease sales potential in 2020 (BOEM))
Brooks Range Petroleum Development	North Slope Borough	Brooks Range Petroleum will be conducting exploration for onshore oil and gas on Alaska's North Slope.(Brooks Range Petroleum, 2011)	Potentially within the same timeframe and in proximity to the GTP and Mainline.	Ongoing
Chuitna Coal Mine	In the Chuitna River Watershed approximately 12 miles northwest of the Native Village of Tyonek and 45 miles west of Anchorage; Kenai Peninsula Borough	The Chuitna Coal Project is being designed by PacRim Coal, LP, as a surface coal mine with contemporaneous reclamation to recover an estimated 300 million tons of sub-bituminous ultra-low sulfur coal. Permitting for the project began in 2006 and is currently in the advanced permitting phase. Production is expected to average 12 million metric tons per year which will depend on market demand. Major components of the Project are: the Mine Area, the Infrastructure and the Port Facilities. (PacRim Coal, 2012)	Potentially within the same timeframe and in proximity to the Mainline and LNG Plant.	Preliminary Draft Supplemental Environmental Impact Statement (SEIS) Released for Cooperating Agency Review: November 2015 Estimated Record of Decision (ROD) Spring 2017
Cook Inlet area oil and gas development	Cook Inlet, AK	Cook Inlet is a mature, petroleum producing basin which has seen extensive exploration and development over the past 40 years. (ADNR, 2013)	Within the same timeframe and in proximity to the Mainline and	Ongoing

TABLE 2

Project Information: Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Driver for Cumulative Effect	Timeline
			Liquefaction Facility. Use of the same marine, air, and highway transportation corridors as Project construction.	
Donlin Gold Mine	10 miles from Crooked Creek, AK; Bethel Census Area	Gold mine with infrastructure plans for a power generation plant, water treatment plant, access roads, housing, two ports, a natural gas pipeline, and an airstrip. The mine is estimated to produce on average 1.3 million ounces of gold annually during operation. (Donlin Gold, 2015)	Potentially within the same timeframe and in proximity to the Mainline. Use of the same marine, air, and highway transportation corridors as Project construction.	Draft Environmental Impact Statement (DEIS) published in FR 11/27/2015; ROD estimated Spring 2017
Eva Creek Wind Project expansion and maintenance	Healy, AK; Denali Borough.	Golden Valley Electric Association (GVEA) constructed a 24 megawatt (MW) wind farm on the ridges above the Eva Creek valley, located east of the Nenana River approximately 15 miles northeast of Healy, Alaska. The public and charitable lease to GVEA for the purpose of constructing and operating the above-described wind farm is for 25 years, subject to standard and special lease terms. (GVEA, 2012)	Within the same timeframe and in proximity to the Mainline.	Completed 2013. Operations and Maintenance ongoing. Expansion to be determined.
F-35 Beddown	Eielson Air Force Base, AK; North Star Borough	The Proposed Action would base up to 54 F-35A aircraft at Eielson Air Force Base, Alaska, as an additive operational mission to the 354th Fighter Wing. (U.S. Air Force [USAF], 2015)	Potentially within the same timeframe and in proximity to the Mainline.	The first aircraft would be delivered in 2019, with the final aircraft arriving by late 2020, allowing full operational capabilities for both squadrons by 2021.
Golden Valley Electric Plant and Transmission Line	North Pole, AK; Fairbanks North Star Borough to Livengood, AK; Yukon-Koyukuk Census Area	Proposed new gas-fired generating plant and electric transmission line from North Pole to Livengood. (GVEA, 2015)	Within the same footprint as the Mainline.	Unknown - after Project construction

TABLE 2

Project Information: Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Driver for Cumulative Effect	Timeline
GMT-1 & GMT-2	Nuiqsut, AK; North Slope Borough	ConocoPhillips Alaska, Inc. (CPAI) has been approved for placement of 72.5 acres of fill material to construct the Greater Mooses Tooth 1 (GMT-1) and has filed an application for Greater Mooses Tooth 2 (GMT-2). GMT1 will include construction of a drill site, an access road, pipeline valve pads, pipelines, bridge abutments, communication equipment, and power lines for oil and gas production. Oil, gas, and water produced from the reservoir would be carried via pipeline for processing. Sales quality crude would be transported via the Alpine Oil Pipeline and Kuparuk Pipeline to the TAPS. Lean gas and Kuparuk-supplied seawater would be delivered to the drill sites via pipelines for injection into the reservoirs. The proposed drill site would be operated and maintained by Alpine staff and supported using existing infrastructure. (Bureau of Land Management [BLM], 2014)	Potentially within the same timeframe and in proximity to the GTP and Mainline.	GMT1 facility construction activities are on a two-year schedule to take place between Winter 2015 and Winter of 2017. First production aimed for Winter 2017.
Great Bear Shale Oil Development	Dalton Highway; North Slope Borough	There is currently a single project proposed to develop a source-reservoir resource. Great Bear Petroleum is currently seeking permits for exploration and evaluation wells along the Dalton Highway. Their success in the last two Central North Slope lease sales has secured leases that straddle an approximately twenty-mile section of the highway, approximately thirty miles south of Prudhoe Bay. (ADNR, 2011)	Within the same timeframe and in proximity to the GTP and Mainline.	Ongoing
Homer Capital Improvement Plan (CIP)	Homer, AK; Kenai Peninsula Borough	City of Homer CIP includes improvements to the Homer Harbor float, harbor sheet pile loading, East to West transportation corridor construction, and Sterling Highway reconstruction (City of Homer, 2014).	Use of the same marine and highway transportation corridors as Project.	2015-2019
Liberty Development	To be constructed on the Federal Outer Continental Shelf in Foggy Island Bay. Inside the barrier islands, about 5 miles off the coast nearly midway between Point Brower to the west and Tigvariak Island to the east; between the McClure	The original plan proposed to develop the Liberty oil field from an artificial gravel island. The overall project includes the following: • An artificial offshore gravel island; • Stand-alone processing facilities and associated infrastructure on the island; • Approximately 6.1 miles of offshore buried oil pipeline;	Potentially within the same timeframe and in proximity to the GTP.	Unknown

TABLE 2

Project Information: Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Driver for Cumulative Effect	Timeline
	Islands and the coast; North Slope Borough	• Approximately 1.5 miles of onshore elevated pipeline connecting the island facilities to the Badami pipeline; • An onshore gravel mine site at the Kadleroshilik River used during construction and then rehabilitated; and • Onshore and offshore ice roads. (Bureau of Ocean Energy Management [BOEM], 2015)		
Livengood Mine	70 miles northwest of Fairbanks, AK; Yukon-Koyukuk Census Area	The Livengood Gold Project is located in the Tolovana mining district within the Tintina Gold Belt. The project area is centered on a local topographic high point named Money Knob. This feature and the adjoining ridge lines have been considered by many to be the lode gold source for placer gold deposits which lie in the adjacent valleys and which have been actively mined since 1914, with the production of more than 500,000 ounces of gold. (International Tower Hill Mines LTD, 2011)	In proximity to the Mainline.	Development during later years of Alaska LNG construction to be ready to commence operations when gas is available to Fairbanks.
Nenana Basin area oil and gas development	Nenana, AK; Yukon-Koyukuk Census Area	Continued oil field development: 400,000 acres+ of State oil and gas leases. (ADNR, 2015)	Within the same timeframe and in proximity to the Mainline.	Ongoing; primary terms expire end of 2019-2021
Nikiski Conoco Phillips LNG plant	Nikiski, AK; Kenai Peninsula Borough	The Kenai LNG Plant complex includes docking and loading facilities to transport LNG, which is carried to customers by tanker. Owned by Conoco Phillips, the plant is currently the only commercial exporter of LNG from the United States and has shipped the product primarily to Japan – more than 1,300 loads – safely for the past four-plus decades. (Alaska Natural Gas Transportation Projects, 2014)	Within the same timeframe and in close proximity to the Liquefaction Facility.	Ongoing
Nuna Development – Caelus Energy LLC	Northwest of the Kuparuk River field; North Slope Borough	Nuna development is an onshore pad designed to develop the southern part of the Torok reservoir which cannot be reached from Oooguruk Drill Site (ODS). Nuna, like ODS, would pay to use Kuparuk facilities to process its oil. (ADNR, 2014)	Potentially within the same timeframe and in proximity to the GTP.	Estimated production to begin 2017
Port of Anchorage Expansion	Anchorage, AK	The U.S, Department of Transportation, Maritime Administration (MARAD) in cooperation with the Port of Anchorage (POA) originally proposed to expand, reorganize, and improve the POA. This Marine Terminal Redevelopment	Potentially within the same timeframe and in proximity to the	On hold

TABLE 2

Project Information: Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Driver for Cumulative Effect	Timeline
		Project would add 135 acres of land, doubling the size of the POA, and provide approximately 8,880 linear feet of waterfront structures west, northwest and southwest of the existing POA. (POA, 2011-2015)	Mainline. Use of the same marine, air, highway, and rail transportation corridors as Project construction.	
Port Mackenzie Rail Extension	Susitna River Valley; Matanuska-Susitna Borough	The Port MacKenzie Rail Extension is a 32-mile rail line in the Susitna River valley. The rail line travels north from the port facility and connects to the existing rail system near Houston, AK. The new rail line is an extension of the Alaska Railroad Corporation (ARRC) system, which currently connects ports in Seward, Whittier, and Anchorage with Interior Alaska, including Denali National Park, Fairbanks, and North Pole. The Matanuska Susitna Borough is the operator of Port MacKenzie, project sponsor, and co-manager of the project. The purpose of the Port MacKenzie rail extension project is to establish a rail link between Port MacKenzie and the Alaska Railroad, providing Port MacKenzie customers/shippers efficient rail transportation between the Port and Interior Alaska. The rail line would travel north from the port facility and connect to the existing rail system at a point near Houston. (ARRC and Matanuska-Susitna Borough, 2014)	In close proximity to the Mainline.	Proposed 2018 completion when funded.
Seward Marine Terminal Expansion	Seward, AK; Kenai Peninsula Borough	The Seward Marine Terminal Expansion Planning project would provide a comprehensive master planning effort, inclusive of all relevant transportation and engineering disciplines, and result in a Seward Marine Terminal Expansion Master Plan for ARRC's Seward port facilities and Conceptual/Preliminary Designs of the port and upland support facilities. A completed expansion effort would accommodate a variety of vessel types including freight, passenger, ferry, research, military, fishing, and barges. It would also improve Port of Seward safety and efficiency, preserve and enhance the intermodal operations of 40+ existing freight and passenger vessel docking customers, accommodate demonstrated and projected increases in traffic volumes and types, promote economic growth,	Potentially within the same timeframe. Use of the same marine, air, highway, and rail transportation corridors as Project construction.	Currently in planning and conceptual/ preliminary design phase.

TABLE 2

Project Information: Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Driver for Cumulative Effect	Timeline
		employment, and sustainability, and ensure the long term utility of Seward facilities. (ARRC, 2015)		
South Denali Visitor Center	Denali State Park; Denali Borough	The purpose of the plan is to enhance recreation and access throughout the South Denali region: designing expanded visitor facilities and recreational opportunities in the South Denali region, while protecting the cultural and natural resource values of the area, and preserving quality of life for residents in nearby communities. The plan is to develop new facilities and enhancements and project partners are exploring cooperative efforts for implementation and maintenance through public and private sector support. (NPS, 2006)	Potentially within the same timeframe and in proximity to the Mainline.	Development of the proposed visitor center is still in the planning, design and funding stages.
TAPS maintenance and upgrades planned	Prudhoe Bay to Port Valdez	The operation and maintenance of the existing 800-mile-long, 48-inch-diameter hot oil pipeline. (BLM, 2002)	Within the same timeframe and footprint as the Mainline.	Ongoing
Ted Stevens Airport Expansion	Anchorage, AK	Airport management and ADOT&PF plan to expand the Ted Stevens Anchorage International Airport to strategically position the airport for the future by maximizing operational efficiency and business effectiveness, as well as by maximizing property availability for aeronautical development through efficient planning. The planning horizon for the Master Plan Update is 20 years and would consider terminal, runway, and security expansions on airport property. (ADOT&PF, 2014)	Within the same timeframe.	2015 out 20 years
Tesoro Kenai Refinery	Nikiski, AK; Kenai Peninsula Borough	The Kenai Refinery can process up to 72,000 barrels per day (bpd). The refinery produces gasoline and gasoline blendstocks, jet fuel, diesel fuel, heating oil and heavy fuel oils, propane and asphalt. Crude oil is delivered by double-hulled tankers through Cook Inlet and by pipeline from the Kenai Peninsula and Cook Inlet. A 68-mile, 42,000 bpd common-carrier products pipeline transports jet fuel, gasoline and diesel fuel to the Port of Anchorage and the Anchorage International Airport. Wholesale delivery occurs through terminals in Kenai, Anchorage, and Tesoro's Nikiski dock. (Tesoro Corp., 2015)	Within the same timeframe and in close proximity to the Liquefaction Facility.	Ongoing

TABLE 2

Project Information: Proposed, Under Construction, and Planned Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Driver for Cumulative Effect	Timeline
Umiat Development	Umiat, AK; North Slope Borough	Continued oil field development in the Alaskan National Petroleum Reserve Area. (Linc Energy, 2014)	Potentially within the same timeframe and in proximity to the Mainline and GTP.	Ongoing
Usibelli Coal Mine expansion, operations, and maintenance	Wishbone Hill, Healy, AK; Matanuska-Susitna Borough	Usibelli Coal Mine (UCM) currently has a work force of approximately 130 employees, and operates year-round. Mine production has grown from 10,000 tons in 1943 to an average above 2 million tons of coal per year. UCM supplies coal to six Interior Alaska power plants and exports coal to Chile, South Korea and several other Pacific Rim destinations.(Usibelli Coal Mine, Inc., 2015)	Potentially within the same timeframe and in proximity to the Mainline.	Operations and maintenance are ongoing; expansion timeline is unknown.
Yukon Flats area oil and gas development	Near the Yukon River, some 150 miles/240 km north of Fairbanks; Yukon-Koyukuk Census Area	The Yukon Flats Basin is an underexplored part of Interior Alaska. The Cretaceous-Tertiary continental rift basin comprises multiple sub-basins formed along the north margin of the right-lateral Tintina Fault. Well-defined on gravity and magnetic data, the Basin covers ~12,000 miles^2/3,100 km^2, with up to 21,000 ft/6,400 m of sedimentary fill. Surface hydrocarbons in soils, along with oil and gas in lake bed sediment cores, indicate the presence of an active thermogenic hydrocarbon system. Oil export is readily available via the TAPS (where capacity is available), and potential gas export availability with the development of the Project. (Doyon Limited Oil and Gas Exploration, 2015)	Potentially within the same timeframe and in proximity to the Mainline.	Ongoing

TABLE 3

Project Information: Infrastructure Improvement Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Borough or Municipality	Nearest Milepost	Distance to Centerline	Driver for Cumulative Effect	Timeline
Port of Anchorage	Anchorage, AK; Cook	Add riprap to bank to reduce the current, rapid erosion of key staging	Anchorage Municipality	734.8	29	In close proximity, in the same timeframe, and/or use of the	2017-2020

TABLE 3

Project Information: Infrastructure Improvement Projects with Potential Cumulative Impacts with the Project

Project	Location	Description	Borough or Municipality	Nearest Milepost	Distance to Centerline	Driver for Cumulative Effect	Timeline
Shoreline Improvement	Inlet	areas at the Port of Anchorage.				same marine, air, highway, and rail transportation corridors as Project construction.	
Anchorage Staging/Laydown Yards	Anchorage, AK	Increase staging and laydown yard acreage in Anchorage near ARRC site.	Anchorage Municipality	724.6	35.2		2017-2020
Fairbanks Intermodal Yard	Fairbanks, AK	Increase staging and laydown yard acreage in Fairbanks near ARRC site.		446	27.9		2017-2020
Deadhorse Airport Expansion	Deadhorse, AK	Increase capacity at the Deadhorse Airport including an additional transit passenger facility with the intention of handling the increase in rotational workforce passenger traffic.	North Slope Borough	10	4.6		2017-2020

VICINITY MAP

X:\AKLNG\Resource Reports\RR01\Appendix L\Figure 5 Fairbanks North Star Off-take Facilities.mxd

LEGEND

- AKLNG Milepost
- Alaska LNG Rev C2 Route
- Fairbanks Gas Interconnection Pipeline
- Multi-lane Road
- Single lane Road

0 1 2 4 Miles

DISCLAIMER

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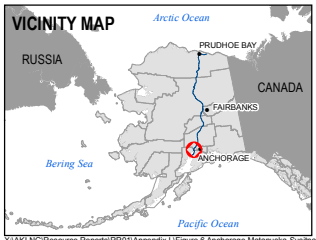
PREPARED BY:	AGDC		
SCALE:	1:225,000		
DATE:	2017-03-23	SHEET:	1 of 1

FAIRBANKS/NORTH STAR OFF-TAKE FACILITIES

FIGURE 5

ALASKA LNG

VICINITY MAP



LEGEND

- Mile Post
- Alaska LNG Rev C2 Route
- Anchorage/Mat-Su Proposed Gas Interconnection Pipeline
- Multi-lane Road
- Single lane Road

0 0.2 0.4 0.8 Miles

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PREPARED BY:	AGDC		
SCALE:	1:30,000		
DATE:	2017-03-23	SHEET:	1 of 1

ANCHORAGE / MATANUSKA-SUSITNA OFF-TAKE FACILITIES

FIGURE 6

ALASKA LNG

X:\AKLNG\Resource Reports\RR01\Appendix L\Figure 6 Anchorage Matanuska-Susitna Off-take Facilities.mxd

3.0 POTENTIAL RESOURCE IMPACTS OF EXISTING AND REASONABLY FORESEEABLE PROJECTS

Table 4 summarizes potential resource impacts for the Project and for other projects that have been identified as reasonably foreseeable. The information within this table represents the Project's best efforts to collect a comprehensive listing of projects that might be categorized as "reasonably foreseeable" in the context of the Project's schedule and proposed footprint. Also included are projects completed or planned for the roads, railroads, and waterways that would be used as infrastructure for the Project and the ports, airports, and material sites that would be used by the Project. Information provided in this table is information found in the public record, such as permit applications, agency websites, and project websites. The Applicant has not drawn any conclusions on the validity of the information found in the public record and have provided the information "as is."

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
Alaska LNG Off-take: Fairbanks/ North Star Off-take Facilities	Minor impacts from the use of surface water for construction activity.	111.5 acres of estimated potential wetland impact.	No impacts.	Impacts from vegetation clearing expected to be moderate and limited to the footprint of the facilities and pipeline ROW.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue, as well as short-term housing shortages. Alaska LNG would utilize worker camps to avoid impacting existing rental housing. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas	Some gravel use is expected, but it is anticipated that Alaska Gasline Development Corporation (AGDC) would utilize existing state sources.	BMPs are expected to be used by AGDC to minimize impacts on soils within the footprint of their facilities.	Minor impacts on visual resources anticipated.	Unknown, facility locations with respect to NSAs not defined.
Alaska LNG Off-take: Anchorage/Matanuska-Susitna Off-take Facilities	Minor impacts from the use of surface water for construction activity.	1.5 acres of estimated potential wetland impact.	No impacts.	Impacts from vegetation clearing expected to be moderate and limited to the footprint of the facilities and pipeline ROW.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue, as well as short-term housing shortages. Alaska LNG would utilize worker camps to avoid impacting existing rental housing. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Some gravel use is expected, but it is anticipated that AGDC would utilize existing state sources.	BMPs are expected to be used by AGDC to minimize impacts on soils in within the footprint of their facilities.	Minor impacts on visual resources anticipated.	Unknown, facility locations with respect to NSAs not defined.
Alaska LNG Off-take: Kenai Peninsula Off-take Facilities	Minor impacts from the use of surface water for construction activity.	Unknown.	No impacts.	Impacts from vegetation clearing expected to be moderate and limited to the facilities, no pipeline has been identified to date.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue, as well as short-term housing shortages. Alaska LNG would utilize worker camps to avoid impacting existing rental housing. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Some gravel use is expected, but it is anticipated that AGDC would utilize existing state sources.	BMPs are expected to be used by AGDC to minimize impacts on soils in within the footprint of their facilities.	Minor impacts on visual resources anticipated.	Unknown, facility locations with respect to NSAs not defined.
Accumulate Energy	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.
Agrium (ADEC 2014, 2015)	Surface water discharges from operations.	No impacts.	No impacts.	No impacts.	No impacts on known cultural resources.	Estimated 340 direct, indirect, and induced jobs. Estimated $30 million total payroll.	No impacts.	No impacts.	No new visual resource impacts.	Negligible noise impacts from operations.
Alaska Deep-Draft Arctic Port System: Proposed Arctic Port (USACE 2015)	Would require the deposition of quarry rock to extend the causeway.	No impacts.	Minor turbidity impacts expected from rock placement.	The affected excavated area includes 120.7 total acres for Nome. This proposed dredging would be beyond the natural sediment movement along the shoreline.	No impacts on known cultural resources.	Unknown.	Use of quarry rock to extend causeway.	No impacts.	Would be visible from the shoreline and would mainly involve views of barge-mounted cranes and material barges.	Potential impacts from construction and operations. Unknown severity and duration.

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
Alaska Roads to Resources - proposed new road construction	Minor impacts from sedimentation and use of surface water for construction activity.	Potential impacts on wetlands for new road construction.	Impacts to near surface groundwater from new construction would be negligible.	Impacts from vegetation clearing expected to be moderate and limited to the road footprint.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Impacts limited to the use of material for construction.	Potential effects on soils include erosion and compaction from new construction.	Moderate impacts on visual resources anticipated.	Unknown.
Beaufort Sea area oil and gas development	Potential impacts on waterbodies from the deposition of materials during the process of construction, exploration, and drilling activities. For offshore activities – minor turbidity associated with drilling offshore. Potential for fuel spills or well blowout addressed with BMPs instituted by permitting agencies.	Potential effects include potential impacts on wetland composition and plant communities. Possible impacts on wetlands from oil spills depend on location and response abilities, therefore, cannot be measured.	No impacts on groundwater due to offshore activities.	Potential effects on wildlife include possible noise disturbances, injury/mortality from ship strikes, and habitat changes/degradation that are expected to be temporary and insignificant.	No impacts on known cultural resources.	Noise from construction activities could result in effects on subsistence resources such as marine mammals, fish, and waterfowl from traditional hunting and harvesting areas. Potential increase in jobs and revenue.	Potential effects could include deposition of material during construction and operation activities. Potential impacts include erosion during dredging, pipe laying and/or backfilling of trenches.	No impacts.	Unknown.	Potential impacts from exploration, construction, and operations. Unknown severity and duration.
Brooks Range Petroleum Development (BRP 2011)	Potential impacts on waterbodies from the deposition of materials during the process of construction, exploration, and drilling activities.	Potential effects include potential impacts on wetland composition and plant communities. Possible impacts on wetlands from oil spills depend on location and response abilities, therefore, cannot be measured.	Potential effects on groundwater include withdrawal of groundwater and/or disposal of minerals; not expected to be significant.	Potential effects on wildlife include possible noise disturbances and habitat changes/degradation that are expected to be temporary and insignificant.	Effects related to soil disturbance from exploration and construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts include erosion during construction and operation of exploration, transportation, and drilling.	Potential effects on soils include erosion and compaction. Effects may differ based on topography of the land, but are expected to have only minor effects.	Unknown	Potential impacts from exploration, construction, and operations. Unknown severity and duration.
Chuitna Coal Mine (PacRim 2015)	Potential impacts from construction and operations. Unknown severity and duration.	Estimated potential wetland footprint of 29 acres.	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Moderate impacts on visual resources anticipated.	Potential impacts from construction and operations. Unknown severity and duration.

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
Cook Inlet area oil and gas development	Potential impacts on waterbodies from the deposition of materials during the process of construction, exploration, and drilling activities.	No impacts.	No impacts due to offshore activities.	Potential effects on wildlife include possible noise disturbances, injury/mortality from ship strikes, and habitat changes/degradation that are expected to be temporary and insignificant.	No impacts on known cultural resources.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts include erosion during construction and operation of exploration, transportation, and drilling.	Potential effects on soils include erosion and compaction. Effects may differ based on topography of the land, but are expected to be minor.	Unknown	Potential impacts from exploration, construction, and operations. Unknown severity and duration.
Donlin Gold Mine (Donlin 2015)	Increased sedimentation due to alteration of existing topography in the watersheds; discharge of treated water from the pit dewatering wells.	Estimated potential wetland footprint of 6,758 acres.	Increases from approx. 1,700 USgpm (386 m^3/h) during construction to approximately 2,600 USgpm (591 m^3/h) in the Year 11. After Year 19, the total average annual dewatering rate is predicted to generally decrease to approximately 1,500 USgpm (341 m^3/h).	A total of 16,303.2 acres would be impacted by the footprints of the project components. Needle leaf forest communities account for more than half (52.4 percent) of this vegetation. Shrub communities are the next most impacted type, accounting for 25.3 percent of the total impacted vegetation.	Archaeologists identified a total of 37 cultural resources: 26 newly discovered sites and 11 previously known.	Would provide up to 3,000 jobs during construction, which is estimated to take three to four years. Between 800 and 1,400 jobs are projected throughout the estimated 27+ year operational phase. Estimated $5.2 million to $8.7 million in income in the region during project operations.	Proposed 204.6 acre gravel mine. Opening of the mine pit would expose the site geology, and removal of materials would create the potential for down-slope movement of both established soils and bedrock. Potential failures include instantaneous slope failures; soil and slope creep; earth-flows; and/or debris flows, solifluction, and other mass wasting. These ground movements have the potential to impact site geology by removing or physically altering soils, regolith, and/or bedrock geology at the mine site.	Proposed 204.6 acre gravel mine. Opening of the mine pit would expose the site geology, and removal of materials would create the potential for down-slope movement of both established soils and bedrock. Potential failures include instantaneous slope failures; soil and slope creep; earth-flows; and/or debris flows, solifluction, and other mass wasting. These ground movements have the potential to impact site geology by removing or physically altering soils, regolith, and/or bedrock geology at the mine site.	Potential effects from modification of land uses.	Potential impacts from construction and operations. Unknown severity and duration.
Eva Creek Wind Project expansion and maintenance (Golden Valley 2012)	Minor impacts from construction.	Minor impacts from construction.	No impacts.	Minor impacts from construction.	No impacts on known cultural resources.	Negligible increase to jobs and revenue.	Minor impacts from construction.	Minor impacts from construction.	Minor changes from expansion.	Potential impacts from construction and operations. Unknown severity and duration.

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
F-35 Beddown (USAF 2015)	Would include an additional 21 acres of impervious surfaces. Localized increases in stormwater run-off could potentially occur in these areas; however, any possible increases would not exceed the current capacities of stormwater systems at Eielson AFB.	Would include an estimated 4 acres developed within the 100-year floodplains.	No impacts.	May impact a wide variety of migratory bird species listed under the MBTA that occur within the northern Joint Pacific Alaska Range Complex (JPARC) airspace, including bald and golden eagles, which are also protected under the Bald and Golden Eagle Protection Act, as well as trumpeter swans.	No impacts on known cultural resources.	The F-35A Beddown estimates an increase in population of 2.6 percent. Construction activities are anticipated to occur from FY16 to FY20 and would inject an estimated $453 million into the economy.	No impacts.	No impacts.	No impacts.	Localized impacts.
Golden Valley Electric Plant and Transmission Line (Golden Valley 2012)	Unknown.	Unknown.	Unknown.	Unknown.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Unknown.	Unknown.	Moderate impacts on visual resources anticipated.	Localized impacts.
GMT-1 & GMT-2 (BLM 2014)	Use of fresh water for construction camps, ice roads, ice pads, and drilling. Potential impacts from increased bank erosion and sedimentation; dust fallout on ice and snow or direct fallout on water bodies in summer, resulting in increasing turbidity; and dewatering of lakes. Impacts temporary and minor through mitigations and based on amount of water available in the area.	Estimated potential wetland footprint of 72.7-87.3 acres and total gravel fill of 628,050-845,600 cu yds.	Potential for underground disposal of non-hazardous waste: contamination of groundwater; and change(s) to groundwater flow patterns.	During operations, there would be indirect impacts to vegetation and wetlands adjacent to gravel roads, pads, and airstrips resulting from dust deposition and gravel spray, altered snow distribution, hydrologic impoundments, and thermokarst. Potential impacts to sensitive plant species are expected to be negligible. Reduced water levels would still be a concern, particularly as it relates to connecting a lake to other lakes or streams.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Proposes a gravel mine site. Mining activities are planned to occur in two phases and would occur on about 31.5 acres. A reserve area, covering approx. 22.5 acres, would be used if additional gravel were needed. Would use about 990,000 cubic yards of gravel.	Impacts to soils directly related to the construction materials needed for production of oil from the GMT1 and the conceptual GMT2 sites. Mine site development may result in changes to hydrologic flows, resulting in surface soil erosion. Through mitigations, these impacts are expected to be minor and long-term.	Moderate impacts on visual resource anticipated.	Potential impacts from construction and operations.

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
Great Bear Shale Oil Development	Potential impacts on waterbodies from the deposition of materials during the process of construction, exploration, and drilling activities.	Potential effects include potential impacts on wetland composition and plant communities. Possible impacts on wetlands from oil spills depend on location and response abilities, therefore, cannot be measured.	Potential effects on groundwater include withdrawal of groundwater and/or disposal of minerals; not expected to be significant.	Potential effects on wildlife include possible noise disturbances and habitat changes/degradation that are expected to be temporary and insignificant.	Effects related to soil disturbance from exploration and construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts include erosion during construction and operation of exploration, transportation, and drilling.	Potential effects on soils include erosion and compaction. Effects may differ based on topography of the land, but are expected to be minor.	Unknown	Potential impacts from exploration, construction, and operations. Unknown severity and duration.
Homer Capital Improvements Plan	Minor impacts as a result of construction activities and deposition of material.	No Impacts.	No Impacts.	Minor impacts on marine vegetation and habitats from construction activity in subtidal and intertidal areas.	No impacts on known cultural resources.	Would result in beneficial impacts on regional and state economies.	No impacts.	Potential effects on soils: erosion and compaction.	Minor and limited impacts; primary improvements exist in developed industrial areas.	Unknown.
Liberty Development (BOEM 2015)	Would release particulate matter and attendant turbidity in the water that may come from remnant fill from the pipeline trench, particulate leaching from the island, and final island preparation (reshaping). When refilling pipeline trenches, the excess fill not deposited back into the trench would be placed on the ice parallel to the pipeline and would filter into the Beaufort Sea as breakup progresses. Chronic discharges of contaminants would occur during every breakup from contaminants entrained in the ice roads.	Approximately 24 acres of wetlands would be lost or disturbed by gravel mining activities. A reserve area, including 17 acres of wetland, would be used if additional gravel were needed.	No impacts.	Would impact threatened and endangered species. Some bowhead whales temporarily may avoid noise-producing activities or change their breathing, surfacing, or calling rates. Contact with spilled oil could cause temporary, nonlethal effects, and a few could die from prolonged exposure to freshly spilled oil.	No impacts on known cultural resources.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas. Indirect impacts on marine mammals in vicinity are unknown.	Proposes a gravel mine site. Mining activities are planned to occur in two phases and would occur on about 31.5 acres. A reserve area, covering approx. 22.5 acres, would be used if additional gravel were needed. Would use about 990,000 cubic yards of gravel.	Potential minor impacts on areas used as material sites for construction.	Moderate to major change limited to a specific site and for the operational life of the field.	Potential impacts from construction and operations. Unknown severity and duration.
Livengood Mine (International Tower Hill Mines 2011)	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Moderate impacts on visual resources anticipated.	Potential impacts from construction and operations. Unknown severity and duration.

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
Nenana Basin area oil and gas development (ADNR 2015)	Potential impacts on waterbodies from the deposition of materials during the process of construction, exploration, and drilling activities.	Potential effects include potential impacts on wetland composition and plant communities. Possible impacts on wetlands from oil spills depend on location and response abilities, therefore cannot be measured.	Potential effects on groundwater include withdrawal of groundwater and/or disposal of minerals; not expected to be significant.	Potential effects on wildlife include possible noise disturbances, and habitat changes/ degradation that are expected to be temporary and insignificant.	Effects related to soil disturbance from exploration and construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts include erosion during construction and operation of exploration, transportation, and drilling.	Potential effects on soils include erosion and compaction. Effects may differ based on topography of the land, but are expected to be minor.	Unknown.	Potential impacts from exploration, construction and operations. Unknown severity and duration.
Nikiski Conoco Phillips LNG plant	No impacts.	No impacts.	No impacts.	No impacts.	No impacts on known cultural resources.	No impacts.	No impacts.	No impacts.	No impacts.	Unknown.
Nuna Development – Caelus Energy LLC (ADNR 2014)	Potential impacts on waterbodies from the deposition of materials during the process of construction, exploration, and drilling activities.	Potential effects include potential impacts on wetland composition and plant communities. Possible impacts on wetlands from oil spills depend on location and response abilities, therefore, cannot be measured.	Potential effects on groundwater include withdrawal of groundwater and/or disposal of minerals; not expected to be significant.	Potential effects on wildlife include possible noise disturbances and habitat changes/degradation that are expected to be temporary and insignificant.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts include erosion during construction and operation of exploration, transportation, and drilling.	Potential effects on soils include erosion and compaction. Effects may differ based on topography of the land, but are expected to be minor.	Moderate impacts on visual resource anticipated.	Potential impacts from construction and operations. Unknown severity and duration.
Port of Anchorage Expansion (MOA 2015)	Potential for less sedimentation than existing conditions around the port, thus less maintenance dredging required. Changes in tidal currents generally less than four inches per second, except at Berth 1 and 2 and former Summit Barge and Transfer Facility stations, where changes up to eight inches per second are predicted. Construction could lead to short-term increases in sediment discharges to surface waters. Operations increases result in potential for increased pollutant discharge to stormwater runoff.	No impacts.	Unknown.	Would result in impacts on marine vegetation and habitats from filling 135 acres of subtidal and intertidal areas. There are plans to mitigate loss of intertidal and subtidal areas to include restoration efforts on Ship Creek. The expansion would result in impacts on 135 acres of EFH, but no long-term significant adverse impacts on federally-managed fish species.	No impacts on known cultural resources.	Would result in beneficial impacts on regional and state economies: potential construction expenditures over seven years would generate in excess of $530 million in total economic output, 6,700 jobs, $230 million in income, and $350 million in gross state product (GSP); and, by 2025, estimated economic benefits of port operations would approach $920 million in output, 8,400 jobs, $270 million in income, and $515 million in GSP.	No impacts.	No impacts.	Minor and limited impacts; located in an existing developed industrial area. Benefits to Ship Creek from planned restoration activities.	Unknown

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
Port Mackenzie Rail Extension (ARRC 2014)	Construction and the unpaved access road could have resulted in potential adverse impacts on water quality in areas were the rail line and access road were near, adjacent to, or spanned waterbodies.	Impacted an estimated 188 acres of wetlands, (comprising 15 percent of the ROW) and up to 478 acres of wetlands, or 45 percent of the alignment. Many wetlands along this alternative consist of bog wetlands that have diverse vegetation communities and are considered high-functioning wetlands.	Effects were limited to the footprint of the proposed rail line, facilities, access road, and staging areas, which represent a small fraction of the total area where water enters the ground and infiltrates to the water table.	May result in the maximum clearing of 1,272 acres and a minimum of 930 acres of vegetation from the 200-foot ROW. This is less than one percent of the 435,895 acres of available habitat in the area.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Could reroute subsistence user access across project area lands into areas west of the Susitna River. Would result in a temporary stimulus to the Borough's economy and labor market. ARRC estimates it would employ 66 to 100 workers in the various phases of the construction period; however, the positive impact to employment would be temporary because it would be limited to the construction period.	Construction activities affected soils unsuitable for rail line construction. These soils were removed and replaced with imported, well-draining soils. In some locations, the railroad was constructed on soils considered locally important for agricultural purposes, though these soils were not in use for agricultural purposes.	Construction activities affected soils unsuitable for rail line construction, and these soils were removed and replaced with imported, well-draining soils. In some locations, the railroad was constructed on soils considered locally important for agricultural purposes, though these soils were not in use for agricultural purposes.	Moderate impacts on visual resources anticipated.	Localized impacts.
Seward Marine Terminal Expansion (ADOT&PF 2011)	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	Unknown.	No impacts.	Unknown.
South Denali Visitor Center	Unknown.	Unknown.	Unknown.	Unknown.	Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Unknown.	Unknown.	Unknown.	Minor impacts on visual resources. Increased conservation in surrounding area expected.	Impacts but expected to be localized.
TAPS maintenance and upgrades planned (BLM 2002)	No impacts.	No impacts.	No impacts.	Destruction of vegetation cover, erosion, and siltation would be localized and would not increase over levels seen historically during TAPS operations. Impacts generally are anticipated to be local, affect only individual animals, and have no adverse impacts on wildlife populations. Population level impacts are considered very unlikely.	No impacts on known cultural resources.	No impacts.	<100,000 cubic yards/year of sand, gravel, and quarry stone would be extracted.	Geologic processes associated with TAPS are expected to be confined to localized areas near TAPS. An increase in oil through put could expand thaw bulbs and result in ground settlement near TAPS. A reduction in through put could result in frost heaves.	No impacts.	Localized impacts.
Ted Stevens Airport Expansion (2014)	Unknown.	Unknown.	Unknown.	Unknown.	No impacts on known cultural resources.	Potential increase in jobs and revenue.	Unknown.	Unknown.	No impacts.	Localized impacts.
Tesoro Kenai Refinery (Tesoro Corporation 2015)	No impacts.	No impacts.	No impacts.	No impacts.	No impacts on known cultural resources.	No impacts.	No impacts.	No impacts.	No impacts.	Negligible noise impacts from operations.

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
Umiat Development (Linc Energy 2014)	Potential impacts on waterbodies from the deposition of materials during the process of construction, exploration, and drilling activities.	Potential effects include potential impacts on wetland composition and plant communities. Possible impacts on wetlands from oil spills depend on location and response abilities, therefore, cannot be measured.	Potential effects on groundwater include withdrawal of groundwater and/or disposal of minerals; not expected to be significant.	Potential effects on wildlife include possible noise disturbances and habitat changes/degradation that are expected to be temporary and insignificant.	Unknown.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas	Potential impacts include erosion during construction and operation of exploration, transportation. and drilling.	Potential effects on soils include erosion and compaction. Effects may differ based on topography of the land, but are expected to be minor.	Unknown.	Unknown.
Usibelli Coal Mine expansion, operations, and maintenance (Usibelli 2015)	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Effects related to soil disturbance from construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are not expected to be significant and are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts from construction and operations. Unknown severity and duration.	Potential impacts from construction and operations. Unknown severity and duration.	Minor impacts on visual resources anticipated.	Potential impacts from exploration, construction and operations. Unknown severity and duration.
Yukon Flats area oil and gas development	Potential impacts on waterbodies from the deposition of materials during the process of construction, exploration, and drilling activities.	Potential effects include potential impacts on wetland composition and plant communities. Possible impacts on wetlands from oil spills depend on location and response abilities, therefore, cannot be measured.	Potential effects on groundwater include withdrawal of groundwater and/or disposal of minerals; expected to be negligible.	Potential effects on wildlife include possible noise disturbances and habitat changes/degradation that are expected to be temporary and insignificant.	Effects related to soil disturbance from exploration and construction. Mitigation measures in place to identify and evaluate cultural resources and address inadvertent discoveries.	Potential increase in jobs and revenue. Impacts to subsistence resources are are primarily in the form of reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas.	Potential impacts include erosion during construction and operation of exploration, transportation. and drilling.	Potential effects on soils include erosion and compaction. Effects may differ based on topography of the land, but are expected to be minor.	Unknown.	Potential impacts from exploration, construction, and operations. Unknown severity and duration.
Infrastructure Improvement Projects										
Port of Anchorage Shoreline Improvement	Unknown.	Unknown.	Unknown.	Unknown.	No impacts on known cultural resources. Expansion of existing facilities on developed land.	Minor or negligible impacts anticipated to jobs, revenue, and subsistence use.	Unknown.	Negligible. Assume standard BMPs/mitigations would be employed to control erosion and runoff.	Negligible impacts to visual resources. No impacts to land use and recreation. Expansion of existing facilities on developed land.	Negligible. These improvements are in a developed area. No aboveground facilities are anticipated. Estimated increase of 100-200 additional trips per day

TABLE 4

Potential Resource Impacts of Existing and Reasonably Foreseeable Projects

Project	Fresh Waterbodies	Wetlands	Groundwater	Fish, Wildlife, and Vegetation	Cultural Resources	Socioeconomics	Geological Resources	Soils	Land Use, Recreation, and Aesthetics	Air and Noise Quality
Anchorage Staging/Laydown Yards	Unknown.	Unknown.	Unknown.	Unknown.	No impacts on known cultural resources. Expansion of existing facilities on developed land.	Minor or negligible impacts anticipated to jobs, revenue, and subsistence use.	Unknown.	Negligible. Assume standard BMPs/mitigations would be employed to control erosion and runoff.	Negligible impacts to visual resources. No impacts to land use and recreation. Expansion of existing facilities on developed land.	Negligible. These improvements are in a developed area. No aboveground facilities are anticipated. Estimated increase of 100-200 additional trips per day
Fairbanks Intermodal Yard	Unknown.	Unknown.	Unknown.	Unknown.	No impacts on known cultural resources. Expansion of existing facilities on developed land.	Minor or negligible impacts anticipated to jobs, revenue, and subsistence use. Increased traffic.	Unknown.	Negligible. Assume standard BMPs/mitigations would be employed to control erosion and runoff. This includes stormwater design to accommodate additional impervious surface.	Minor impacts to visual resources. No impacts to land use and recreation.	Negligible. These improvements are in a developed area. No aboveground facilities are anticipated. The expansion would be similar to existing operations.
Deadhorse Airport Expansion	Unknown.	Unknown.	Unknown.	Unknown.	No impacts on known cultural resources. Expansion of existing facilities on developed land.	Minor or negligible impacts anticipated to jobs, revenue, and subsistence use. Increased traffic.	Unknown.	Negligible. Assume standard BMPs/mitigations would be employed to control erosion and runoff. This includes stormwater design to accommodate additional impervious surface.	Negligible impacts to visual resources. No impacts to land use and recreation. Expansion of existing facilities on developed land.	Negligible. These improvements are in a developed area. The expansion would be similar to existing operations.

4.0 CUMULATIVE IMPACTS SUMMARY

Existing and reasonably foreseeable projects in combination with the Project that have potential for cumulative impacts are shown in Table 1.

4.1 WATER RESOURCE IMPACTS

Impacts to groundwater resources that may occur as a result of the Project in combination with existing and reasonably foreseeable projects include:

- Spread of contamination associated with dewatering contaminated groundwater in the vicinity of known hazardous waste sites;
- Potential impairment of groundwater quality from construction and operation activities from spills or sediment introduction; and,
- Reduction in aquifer yields by certain construction activities.

No cumulative impacts to groundwater from existing and reasonably foreseeable projects are anticipated in combination with groundwater impacts from the construction and operation of the Liquefaction Facility. Cumulative impacts to groundwater from GTP, PTTL, and PBTL construction and operations are also not anticipated due to it being located on the Arctic Coastal Plain, which is an area of continuous permafrost. Cumulative impacts to groundwater from other projects and construction and operation of the Mainline are anticipated in areas of development where there's potential for impact overlap. However, the various Interdependent Project Facilities, including the Mainline, are predominantly located in remote areas, away from other water resource users. No sole source aquifers would be impacted by construction of the Project facilities.

Fresh waterbody impacts that may occur as a result of the Project in combination with existing and reasonably foreseeable projects include the following:

- Changes in surface water flows from withdrawals or discharges;
- Physical disturbance or alteration of waterbodies from construction activities;
- Releases of sediment and increases in turbidity (e.g., from dredging, construction, material sites);
- Temperature change (e.g., from cooling water);
- Changes in BOD5, fecal coliform bacteria count, pH, TSS (e.g., from domestic sewage discharges);
- Inadvertent spills of hazardous compounds including fuels, lubricants, and solvents; and
- Contamination of runoff during concrete batching, causing increased pH, TSS, and TDS levels.

Wetland impacts that may occur as a result of the Project in combination with existing and reasonably foreseeable projects include the following:

- Alterations of recharge areas;
- Introduction of invasive species;
- Erosion;
- Fugitive dust;
- Permafrost thaw;

- Thermokarst;
- Changes to hydrology; and
- Permanent conversion to industrial or open land.

Cumulative impacts to wetlands occur from existing and reasonably foreseeable projects within the same watershed, including Chuitna Coal, Livengood Mine, Usibelli Coal, Umiat, and oil and gas development in Nenana and Yukon Flats.

Impacts to waterbodies and wetlands from construction of the Project and existing and reasonably foreseeable projects are managed by the USACE and the implementation of the associated plans and procedures.

4.2 FISH, WILDLIFE, AND VEGETATION RESOURCES IMPACTS

Existing and reasonably foreseeable projects that have the potential for cumulative impacts on fish, wildlife, and vegetation include: oil and gas development projects on the North Slope, in the Beaufort and Chukchi Sea, and in Cook Inlet (shown in Figures 3 and 4); and the Donlin Gold project, Port of Anchorage expansion, and Chuitna Coal (shown in Figures 1 and 2).

Impacts to fish and wildlife that may occur as a result of the Project in combination with existing and reasonably foreseeable projects include the following:

- Increased noise levels;
- Increased vessel traffic and potential for vessel strikes;
- Temporary habitat and migrations disturbance; and
- Inadvertent spills of hazardous compounds including fuels, lubricants, and solvents.

The use of the Port of Anchorage by the Project in combination with the Port of Anchorage expansion would result in cumulative impacts on marine habitat; the expansion will have resulted in filling 135 acres of subtidal and intertidal areas of EFH (MOA 2015). Increased vessel traffic in the Cook Inlet as a result of the Project in combination with the Port of Anchorage expansion, oil and gas development, and the Chuitna Coal project may result in cumulative impacts to fish and marine mammals.

The Donlin Gold project estimates that over 75% of its 16,303 acres would be cleared of vegetation during construction (Donlin 2015). This includes additional clearing necessary to cross the Mainline, however, the vegetation clearing at the crossing is a very small percentage of total impacts and a minor impact when considering total vegetation in that area.

4.3 CULTURAL RESOURCES IMPACTS

There is a potential for an increase of inadvertent discoveries of cultural resources during construction of the Project in combination with existing and reasonably foreseeable projects. However, inadvertent discoveries are handled on a case-by-case basis by the State Historic Preservation Office (SHPO) and are not therefore considered cumulative impacts. The Project has provided an Unanticipated Cultural Resources Discovery Plan for review that would be implemented during construction. There are also SHPO

approved mitigations that the Project and other reasonably foreseeable projects would implement that are meant to identify, evaluate, and avoid cultural resources and address any discoveries.

4.4 SOCIOECONOMIC IMPACTS

Impacts to socioeconomics that may occur as a result of the Project in combination with existing and reasonably foreseeable projects include the increase in jobs and revenue, short-term housing shortages during construction, and impacts to subsistence resources in the form of reduced availability and reduced access to subsistence use areas. The Agrium Nitrogen Plant estimates 340 direct, indirect, and induced jobs (ADEC 2014). To reduce impacts to housing the Project would use worker camps during construction to avoid impacting existing rental housing. Another reasonably foreseeable project, Umiat development, in combination with the construction of the Mainline may temporarily reduce access to subsistence resources on the North Slope.

Impacts from increased traffic from existing and reasonably foreseeable projects that use the same marine, air, and highway transportation corridors as those for Project construction include oil and gas development projects on the North Slope, in the Beaufort and Chukchi Seas, and in the Cook Inlet, the Chuitna Coal project, Donlin Gold, the Port of Anchorage expansion, the Seward Marine Terminal expansion, and the Port MacKenzie Rail Extension. It is likely in some cases, such as port and marine terminal expansion projects, that work would be completed in order to reduce adverse impacts associated with increased traffic and increased use during Project construction and operations (e.g. the Port of Anchorage expansion would impact traffic during the expansion of the port, however, if completed in anticipation of, would improve management of increased traffic as a result of the Project and other reasonably foreseeable projects).

4.5 GEOLOGICAL RESOURCE IMPACTS

Impacts to geological resources that may occur as a result of the Project in combination with existing and reasonably foreseeable projects include the removal of materials for construction as well as site-specific down-slope movement of established bedrock. These ground movements have the potential to impact site geology by removing or physically altering soils, regolith, and/or bedrock geology. Existing and reasonably foreseeable projects that would impact geological resources include oil and gas development projects on the North Slope, the Port of Anchorage expansion, and other projects that impact the same road transportation corridors that would require road maintenance and upgrades (i.e. the Seward Marine Terminal expansion, Chuitna Coal, Livengood Mine, and the Port MacKenzie Rail Extension). Competition for resources on the North Slope would be managed by the ADNR. Construction and mining activities of geological resources by the Project and existing and reasonably foreseeable projects would also be managed by the State to reduce adverse impacts.

4.6 SOILS RESOURCE IMPACTS

Impacts to soils that may occur as a result of the Project in combination with existing and reasonably foreseeable projects include the site-specific down-slope movement of established soils. Potential failures include instantaneous slope failures; soil and slope creep; earth-flows; and/or debris flows, solifluction, and other mass wasting. These ground movements have the potential to impact site geology by removing or physically altering soils, regolith, and/or bedrock geology. Existing and reasonably foreseeable projects that would impact soils in combination with the Project include only those projects in the same project

vicinity, including the Donlin Gold project, the Port of Anchorage expansion, Chuitna Coal, the Port MacKenzie Rail Extension.

4.7 LAND USE, RECREATION, AND VISUAL RESOURCES IMPACTS

Impacts to land use, recreation, and visual resources that may occur as a result of the Project in combination with existing and reasonably foreseeable projects include temporary and permanent changes to current land use, limited access to recreation and special use areas, and changes to sensitive visual resources.

Existing and reasonably foreseeable projects in close proximity to the Liquefaction Facility and the GTP occur mostly in areas that are developed and impacts to land use and visual resources are minor. Existing and reasonably foreseeable projects that may cumulatively impact access to recreation and special use areas if construction occurs in the same timeframe include: Chuitna Coal, Donlin Gold, and oil and gas development projects in Nenana and Yukon Flats. Site-specific Public Land Use and Recreational Use Coordination Plans (an outline is provided in appendix I of Resource Report No. 8) would be developed in consultation with managing agencies to reduce impacts to recreation and special use land.

4.8 AIR AND NOISE IMPACTS

Impacts to air that may occur as a result of the Project in combination with existing and reasonably foreseeable projects are provided below (the full air quality modeling results are included as Appendices D and F in Resource Report No. 9).

Analysis at the Liquefaction Facility addressed the cumulative ambient air quality impacts from Project and nearby offsite sources. The following lists the offsite sources included in the analysis:

- Tesoro Refinery
- Existing ConocoPhillips Company (COP) Kenai LNG Facility (including ships)
- Tesoro Kenai Pipe Line (KPL) Marine Loading Terminal (including ships)
- Homer Electric Association (HEA) Bernice Lake Power Plant
- Agrium Kenai Nitrogen Plant and Loading Terminal (including ships) (Agrium)
- Homer Electric Association (HEA) Nikiski Generation Plant

Analysis for far-field area (Class I and Sensitive Class II) in the range of 31 miles to 186 miles (50 km to 300 km) of the Liquefaction Facility included:

- Lake Clark National Park & Preserve – Sensitive Class II Area (50 km)
- Chugach National Forest – Sensitive Class II Area (74 km)
- Tuxedni National Wildlife Refuge – Class I Area (86 km)
- Kenai Fjords National Park – Sensitive Class II Area (92 km)
- Denali National Park – Class I Area (183 km)
- Kodiak National Wildlife Refuge – Sensitive Class II Area (256 km)

For cumulative impact analyses, the far-field modeling included existing sources and reasonably foreseeable development not close enough to the Liquefaction Facility to cause a significant concentration gradient. A total of 23 other facilities were included in the far-field modeling to account for these impacts.

The NAAQS, AAAQS, and increment modeling results for the six Class I and Sensitive Class II areas listed above are all well below the applicable standards. The most sensitive of these are the Class I increment analyses at Tuxedni NWR and Denali NP. The Liquefaction Facility would not cause or contribute to a violation of the increments at Alaska Class I areas.

For the GTP cumulative air quality impact analysis, the following offsite sources were considered:

- BPXA's Central Compression Plant (CCP), and
- BPXA's Central Gas Facility (CGF).

Emissions from the CCP and CGF sources generally consist of gas-fired compressor turbines, gas-fired heaters, and emergency equipment. For conservatism in this modeling demonstration, these offsite sources were modeled at PTE.

There are no Class I areas within 186 miles (300 km) of the GTP. Sensitive Class II areas in the range of 31 miles to 186 miles (50 km to 300 km) of the GTP are:

- Arctic National Wildlife Refuge – Sensitive Class II Area (93 km); and
- Gates of the Arctic National Park and Preserve – Sensitive Class II Area (214 km).

For cumulative impact analyses, the far-field modeling included existing sources and reasonably foreseeable development not close enough to the GTP to cause a significant concentration gradient. A total of 19 other facilities were included in the far-field modeling to account for these impacts (see Appendix F of Resource Report No. 9).

The NAAQS, AAAQS, and increment modeling results for ANWR and Gates of the Arctic NPP are all well below the applicable standards. The most sensitive of these are the Class II increment analyses at these two areas. The GTP would not cause or contribute to a violation of the increments at Alaska Sensitive Class II areas.

Noise impacts that may occur as a result of the Project in combination with existing and reasonably foreseeable projects exist primarily for projects in close proximity and in the same timeframe. Most impacts to Noise Sensitive Areas would occur only during construction. Reasonably foreseeable projects that may result in cumulative noise impacts include construction during oil and gas development on the North Slope, the Port of Anchorage Expansion, and Chuitna Coal.

Noise impacts from operations have been considered and are in areas that are primarily developed (e.g. noise from operations of the Liquefaction Facility and Marine Terminal is in an industrial area with fewer Noise Sensitive Areas).

5.0 LIST OF ACRONYMS

Acronym	Definition
AAAQS	Alaska Ambient Air Quality Standards
ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
AGDC	Alaska Gasline Development Corporation
AOI	Area of Interest
ARRC	Alaska Railroad Corporation
BLM	Bureau of Land Management
BMP	Best Management Practice
BOEM	Bureau of Ocean Energy Management
bpd	barrels per day
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
CO	Carbon monoxide
CPAI	ConocoPhillips Alaska, Inc.
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EFH	Essential fish habitat
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
GMT1	Greater Mooses Tooth 1
GSP	Gross State Product
GTP	Gas Treatment Plant
GVEA	Golden Valley Electric Association
HIPPS	High-Integrity Pressure Protection System
LDC	Local Distribution Company
MARAD	United States Department of Transportation, Maritime Administration
MBTA	Migratory Bird Treaty Act
MP	milepost
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NGA	Natural Gas Act
NHPA	National Historic Preservation Act
NPS	National Park Service
ODS	Oooguruk Drill Site
ORPC	Ocean Renewable Power Company
PBTL	Prudhoe Bay Transmission Line
PBU	Prudhoe Bay Unit
POA	Port of Anchorage
PTTL	Point Thomson Transmission Line

Acronym	Definition
PTU	Point Thomson Unit
ROD	Record of Decision
ROW	right-of-way
SEIS	Supplementary Environmental Impact Statement
SHPO	State Historic Preservation Office
TAPS	Trans-Alaska Pipeline System
U.S.	United States
UCM	Usibelli Coal Mine
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USgpm	United States gallons per minute

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