APPENDIX 5D – TECHNICAL MEMORANDUM - MODEL ASSUMPTIONS AND REASONABLY FORESEEABLE FUTURE ACTIONS

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ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

ADNR	Alaska Department of Natural Resources
ANS	Alaska North Slope
APP	Alaska Pipeline Project
bod	barrels of oil per day
Btu	British thermal unit
CBR	Constitutional Budget Reserve
CNG	compressed natural gas
Donlin Gold	Donlin Gold Mine
EIA	Energy Information Administration
FNG	Fairbanks Natural Gas
FSRU	floating storage and re-gasification unit
GTL	Gas-to-Liquids
GVEA	Golden Valley Electric Association
LNG	Liquefied Natural Gas
NPR-A	National Petroleum Reserve-Alaska
OCS	Outer Continental Shelf
PF	Permanent Fund
PFD	Permanent Fund dividend
REMI	Regional Economic Models, Inc.
RFFA	reasonably foreseeable future action
TAPS	Trans-Alaska Pipeline System
TNP	Trans-national petroleum reserve-alaska Pipeline
U.S.	United States

D1.0 INTRODUCTION

This document summarizes the Reasonably Foreseeable Future Actions (RFFAs) which will form the basis for the analyses of socioeconomic impacts under the **"With APP"** or the **Action Alternative**, and the **"Without APP"** or **No Action Alternative** scenarios. In general, the RFFAs create a qualitative framework within which the quantitative economic impact models and analyses will be developed. The descriptions of future actions provided in this document are general in nature, without specific amounts or terms provided except for a few of the key components of the assumptions such as those related to the pipeline project, oil and gas development projects, mining and in-state gas use issues.

D2.0 SOURCES OF RFFAs

The RFFAs are the result of an information collection process aimed at deriving a consensus for a possible economic future for Alaska. The RFFAs reflect the combined information from published reports, project proponents, statements from industry and government representatives, and opinions from stakeholders. In addition to a thorough review of published reports (listed in the selected bibliography in Attachment A), the study team interviewed more than 30 Alaskan stakeholders with experience and expertise in the state's leading industries and policy areas. These interviews took place from January 28 to March 8, 2011, and their collective responses played a significant role in shaping many of the RFFAs. The list of persons interviewed, and the businesses and organizations that they represent are listed in Attachment B. Ultimately, Northern Economics, Inc. is responsible for assessing the likelihood of the future outcomes identified by these sources and compiling the information into the assumptions presented in this document.

D3.0 ORGANIZATION OF RFFAs

There are 31 RFFAs organized into different categories. The categories start at the national level (RFFAs 1 – 4), then move on to describe Alaska oil and gas production (RFFAs 5-9). From there the RFFAs describe state tax and fiscal assumptions (RFFAs 10-15), and assumptions on large transportation (road and port) projects (RFFAs 16-18). Next, the document describes assumptions on other resource-based and basic industries that bring wealth into the state (RFFAs 19-23). The last two groups of RFFAs deal with in-state energy supply and demand (RFFAs 24-27) and statewide population, labor availability, and rural issues (RFFAs 28-31).

The categories are organized in a flow-through concept – categories that are discussed earlier in the document flow through and affect the assumptions in later categories. For example, RFFA 4, Federal Spending and Permitting Activities in Alaska, affects assumptions made in RFFA 5, Alaska OCS Oil Production, which in turn affects assumptions for RFFA 9, the Trans-Alaska Pipeline System (TAPS) Pipeline. In this example, it is assumed that federal permitting policies that are generally in effect today continue throughout the study period, including the assumption that oil and gas activities in critical habitat for polar bear are permitted. This assumption flows through and leads to the assumption that Outer Continental Shelf (OCS) oil production in the Beaufort and Chukchi Seas will be permitted and that oil production begins in 2024 in the Beaufort Sea and 2028 for the Chukchi Sea. The prospect and later the reality of large volumes of oil from the OCS, combined with assumptions in RFFA 6, Alaska Onshore Oil Production, are sufficient to spur investments to keep TAPS operating through several years of relatively low throughput from 2011-2024.

The complete list of RFFAs is as follows.

RFFA	Title
1	U.S. Economy
2	U.S. Oil Prices
3	U.S. Natural Gas Prices
4	Federal Spending and Permitting Activities in Alaska
5	Alaska OCS Oil Production
6	Alaska Onshore Oil Production
7	North Slope/Arctic OCS Natural Gas Production
8	Cook Inlet Natural Gas Production
9	TAPS Pipeline
10	Spending by the State of Alaska
11	Permanent Fund and Permanent Fund Dividends
12	State Taxes on Oil
13	State Taxes on Natural Gas
14	State Taxes on Mining Revenues
15	State Income and Sales Taxes
16	Railroad Projects
17	State Funded Road Projects
18	Port Projects
19	Alaska In-state Oil Refining and Imports of Petroleum Fuel
20	Mining
21	Fisheries
22	Tourism
23	Air Transportation
24	Economic Diversification
25	Electrical Generation Infrastructure
26	Supply of Gas to In-state Users
27	Prices for Users of Natural Gas in Alaska
28	Statewide Population growth
29	Rural and Urban Changes
30	Resident vs. Non-Resident Labor
31	Subsistence

D3.1 U.S. ECONOMY

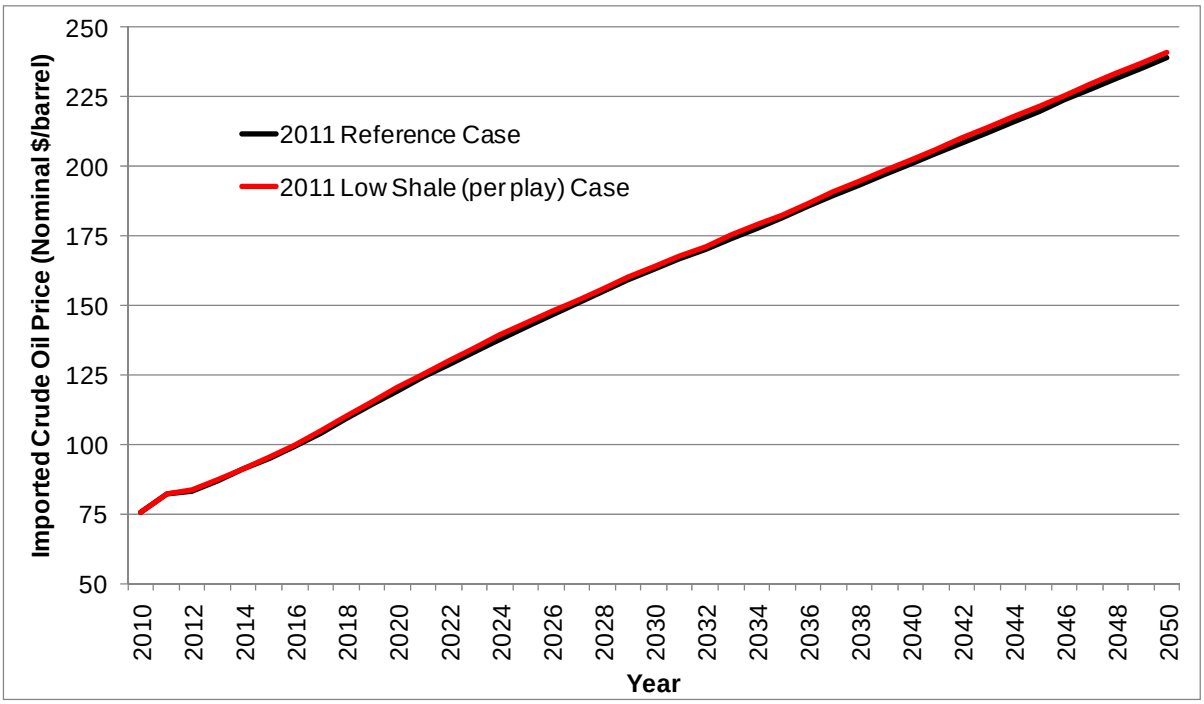
No Action / Without APP
Growth in the U.S. economy is a Regional Economic Models, Inc. (REMI) model output rather than an assumption. The REMI model is used to forecast the U.S. economy for the project timeline.
With APP
Growth in the U.S. economy is a model output rather than an assumption. The REMI model is used to forecast the U.S. economy. This set of assumptions will include additional economic activity from construction and operation of the Alaska Pipeline Project (APP) and additional oil and gas activity in Alaska.

D3.2 U.S. OIL PRICES

No Action / Without APP

The U.S. Energy Information Administration (EIA) forecasts for oil prices out to 2035 are taken from the 2011 Annual Energy Outlook Low Shale Recovery Case. The EIA assumes increased prices as the world economy recovers from the recent recession. From 2036 to 2050, the study uses the trend of EIA prices from 2026-2035. The figure shows the prices used (in nominal terms) through 2050, as well as prices from the EIA Reference Case. By 2021, the nominal price of oil is forecast at $125 per barrel. The Low Shale Recovery Case was chosen for oil in order to be consistent with assumptions made for U.S. natural gas prices as discussed in the next RFFA.

EIA Forecasts of U.S. Crude Prices



With APP

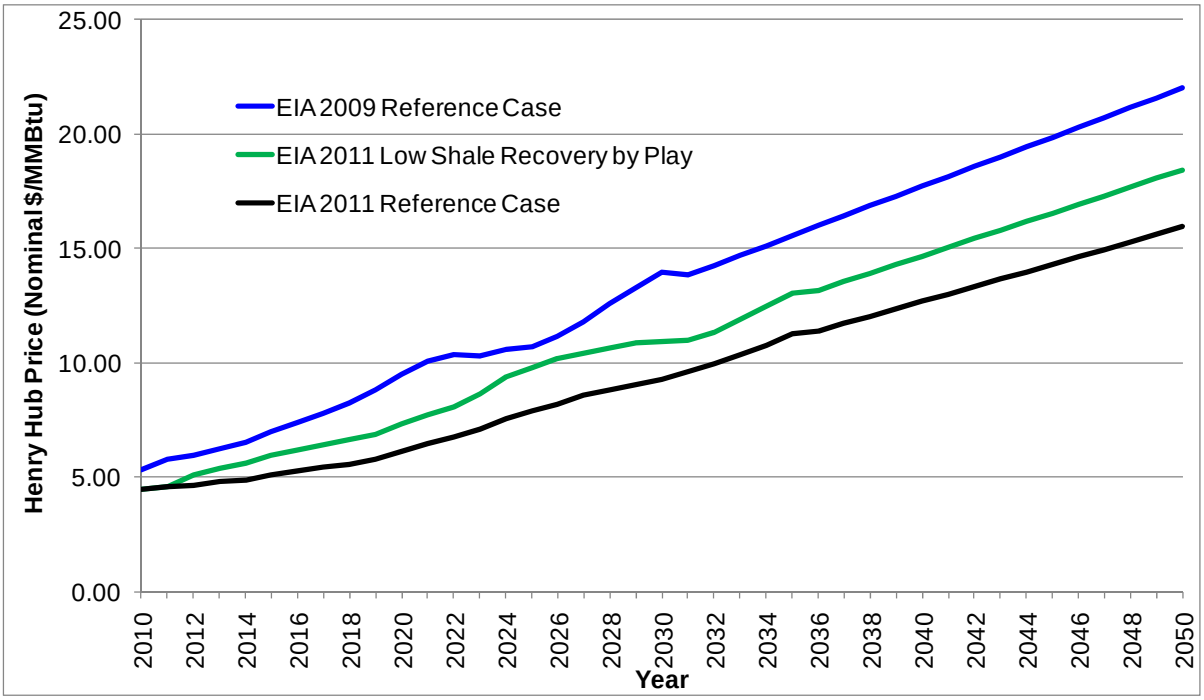
The study will use the same assumptions as in the Without APP Scenario.

D3.3 U.S. NATURAL GAS PRICES

No Action / Without APP

U.S. natural gas prices out to 2035 will be taken from price forecasts developed by the EIA. As shown in the figure below, there is significant variation in the EIA forecasts. The figure shows the 2009 and 2011 reference cases as well as one of the many alternative scenarios included in the EIA 2011 forecasts. The EIA considered alternative scenarios for technically recoverable shale gas resources, and the scenario chosen for the model – the "Low Shale Recovery by Play" scenario – represents a mid-level forecast. For years 2036-2050, the study uses the trend calculated from the 2011 EIA reference forecast for the years 2026-2035.

EIA Forecasts of U.S. Natural Gas Prices



For Alaska, the Without APP Scenario assumes liquefied natural gas (LNG) is imported to Southcentral Alaska to supplement declining Cook Inlet production. Traditionally, the price of LNG has been closely linked with the price of crude oil, but early in the last decade some LNG contracts were negotiated with much lower sensitivity to crude oil prices. The traditional linkage to oil results in the highest LNG prices, while certain contracts signed early in the last decade have much lower pricing. The Cook Inlet price is estimated using published global average costs of capital and operating costs for liquefying, shipping, and regasifying LNG plus the cost of natural gas at Henry Hub to project the price of LNG delivered in Cook Inlet.

With APP

The study assumes the same prices for natural gas as used in the Without APP scenario.

D3.4 FEDERAL SPENDING AND PERMITTING ACTIVITIES IN ALASKA

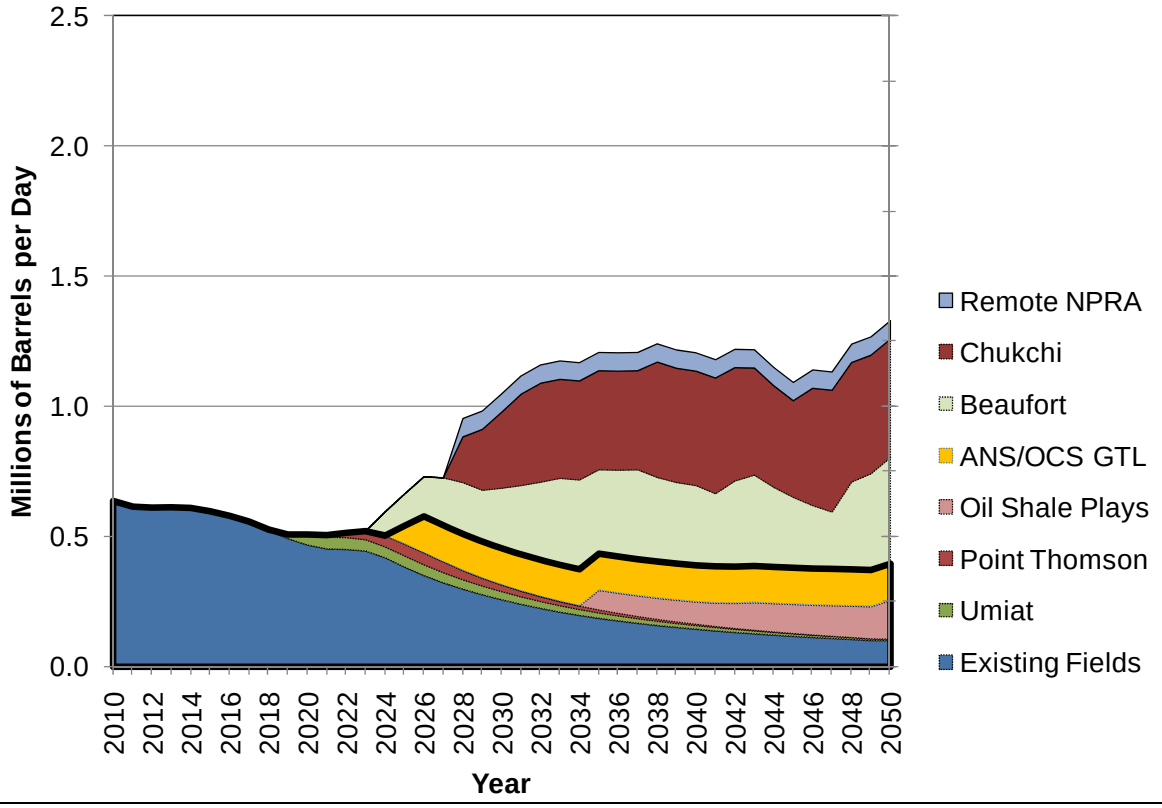
No Action / Without APP
Federal military and civilian spending in Alaska have been declining on a per-capita basis with the exception of transfer payments to individuals (Social Security, Medicare, etc.), which follow national trends. By 2009, federal spending was back to the inflation-adjusted average per-capita levels experienced from 1985-1995. Federal per-capita spending increases at the rate of inflation through the remainder of the study period. It is also assumed that permitting policies remain generally constant with those in place today: Oil and gas activities in polar bear critical habitat will continue to be allowed with appropriate consultations; permanent infrastructures (roads, buildings, platforms, etc.) on declared wilderness areas, national parks, national monuments and national sanctuaries will not be permitted. National wildlands will be declared, but these designations will not preclude limited development activities.
With APP
The study uses the same assumptions as in the Without APP Scenario.

D3.5 ALASKA OUTER CONTINENTAL SHELF OIL PRODUCTION

No Action / Without APP

OCS oil production from the Beaufort Sea will begin in 2024 and in the Chukchi Sea in 2028. Oil produced in the Beaufort Sea will be transported through TAPS. Oil produced in the Chukchi Sea will be transported through an onshore pipeline across the National Petroleum Reserve-Alaska (NPR-A) (hereafter referred to as the Trans-NPR-A Pipeline or TNP) to TAPS. Two winter construction seasons are assumed to build the TNP with 1,000 workers each season. There are no changes from the current rules for federal OCS royalties; the State of Alaska will not receive any portion of the royalties from OCS activity that are paid to the federal government. The figure below shows oil throughput for TAPS. Assumed production from the Beaufort and Chukchi Seas is presented in the two top areas in the figure. (Additional assumptions regarding onshore production and TAPS throughput are described in more detail in RFFAs 3.6 and 3.9 below). In the figure, all production above the heavy black line is related to OCS production. The remote NPR-A oil production is assumed to come online at about the same time as the Chukchi production because the presence of the pipeline infrastructure makes marginal oil fields in the NPR-A achieve profitability. The figure also shows the additional TAPS throughput from a gas-to-liquids (GTL) plant that is assumed to be built on the North Slope in 2024 to monetize the natural gas supplies — see RFFA 3.7 below for more details.

TAPS Throughput under the No Action Alternative



With APP
OCS oil production under the With APP scenario is identical to the OCS production in the Without APP scenario. Other changes in onshore production and TAPS throughput are discussed in RFFA 3.6 and 3.9.

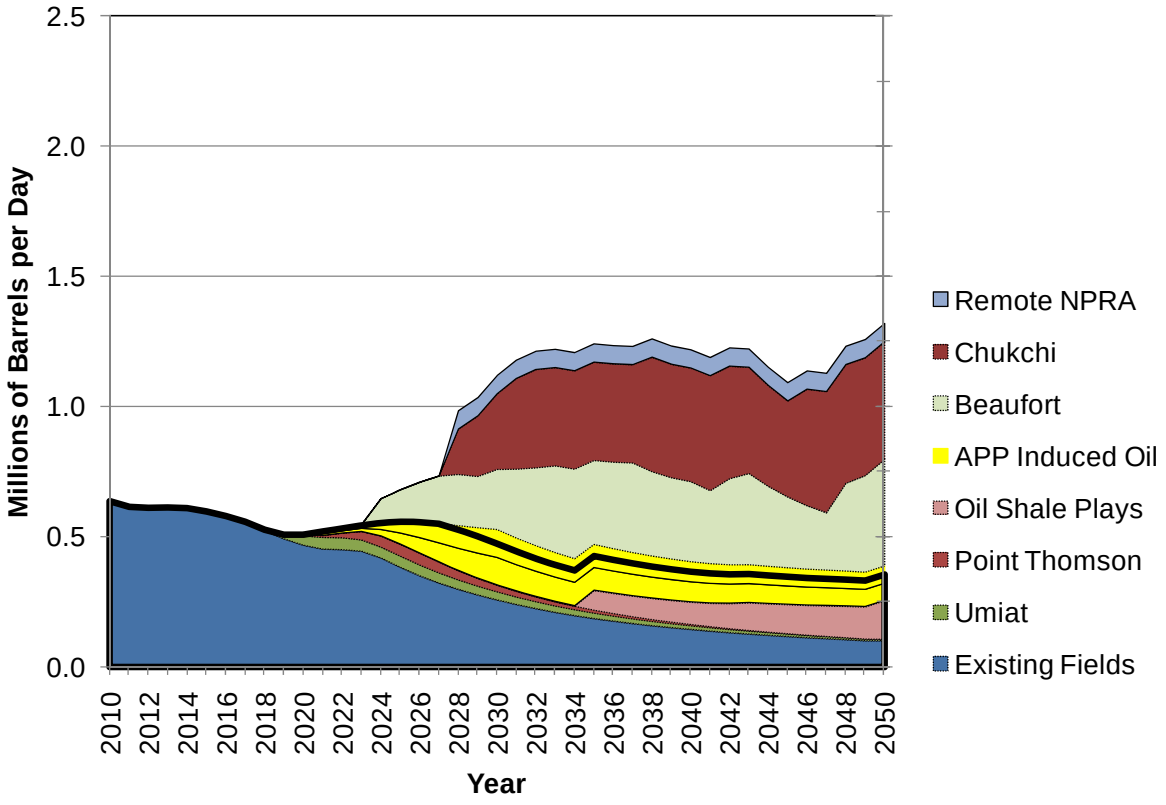
D3.6 ALASKA ON-SHORE OIL PRODUCTION

No Action / Without APP
As shown in the chart above, oil production from currently producing onshore fields continues to decline and will follow the forecasts of the Alaska Department of Natural Resources (ADNR) annual production through 2050 (the endpoint of ADNR's forecasts). By 2021, these existing fields will be producing 417,000 barrels of oil per day (bod). Development in the Alaska National Wildlife Refuge will not be permitted during the study period, and little onshore exploration occurs because of the likelihood that gas rather than oil will be found, and there are sufficient known reserves of gas to meet gas demand under this alternative. Some new onshore and near-shore development does take place, including: 1. Liberty comes online in 2011 and ramps up to peak production of 33,000 bod in 2014. By 2021 production is down to 11,000 bod. 2. Point Thomson condensates production will commence in 2014. By 2021 production grows to 17,000 bod, but peaks in 2026 at 97,000 bod. Natural gas will be re-injected until 2040 (See RFFA 7 *North Slope/Arctic OCS Natural Gas Production*). 3. Permitting delays push first production in the NPR-A to 2013. Production by 2021 reaches 27,000 bod, with peak production occurring in 2023. 4. The development of the TNP to move oil from the Chukchi to TAPS will spur additional development of previously marginal fields in the NPR-A. These marginal fields will contribute an average of 70,000 bod from 2026-2050. 5. North Slope shale oil fields will be developed beginning in 2035, and will add an average of 150,000 bod over a 40-year period. These activities listed above keep oil and gas employment in onshore fields relatively constant, which implicitly assumes that more labor is required per barrel of oil produced each year.

With APP

The ability to transport any gas discoveries via APP will lead to increased exploration and development activities on the North Slope, and will preclude development of the GTL plant described in the Without APP scenario. Beginning in 2019, APP will induce oil exploration and development with new production beginning in 2021. Combined daily production from existing fields and APP-induced fields (but excluding the Point Thomson Unit, Umiat and Remote NPR-A) remains constant at 2020 levels (e.g., 470,000 bod). Combined throughput remains at that level through 2030. Beginning in 2031, combined throughput declines following the profile of existing fields from 2031-2050. Total APP-induced production is 1.52 billion barrels of crude oil (bbls) through 2050. The figure below shows TAPS throughput under the With APP scenario – the yellow area in the figure shows APP-induced oil. The portion of the yellow area above the heavy black line reflects production from remote NRP-A fields that rely on the TNP. Point Thomson condensates production will commence in 2014 with the natural gas re-injected until 2021, after which Point Thomson gas will be shipped via APP. All other production assumptions described in the Without APP scenario will also occur in the With APP scenario – these include production from fields in the NPR-A and the oil shale plays.

Trans-Alaska Pipeline System Throughput Under the Action Alternative



D3.7 NORTH SLOPE/ARCTIC OCS NATURAL GAS PRODUCTION

No Action / Without APP
Natural gas will be produced in sufficient quantities to meet localized demand in the North Slope Borough and for field consumption. Long-term purchase agreements with Fairbanks-based organizations results in the installation of a containerized LNG plant on the North Slope in 2014. The plant remains in operation through the end of the study period. Note: The current assumption is based on demand from Fairbanks Natural Gas (FNG) (commercial and residential) and Golden Valley Electric Association (GVEA) based on earlier announcements. More recent announcements indicate that GVEA and Flint Hills will jointly pursue development of an LNG plant on the North Slope and FNG has announced that it is moving ahead with its own project. In our opinion, only one LNG plant will be built since even FNG's proposed plant can supply all of the LNG requirements for the Fairbanks and North Pole areas. Future revisions of the RFFAs will increase the volume of LNG requirements to satisfy the demand for all three organizations once that information is available. The economics of OCS gas production in the Chukchi are challenging, and leaseholders find it more prudent to develop oil resources rather than gas resources. Development of gas resources in the Chukchi are assumed to occur only after the timeframe of the study period. At Prudhoe Bay, a GTL plant for onshore gas reserves is constructed by 2025 and generates 140,000 barrels per day of GTL distillate products (kerosene, jet fuel, etc.) that feeds directly into TAPS. In 2040, Point Thomson gas production begins to provide feedstock to the GTL plant. The employment for the GTL plant is scaled from employment estimates for the Gas Treatment Plant.
With APP
Alaska North Slope (ANS) gas is shipped to North American markets via APP at the rate of approximately 4.5 billion cubic feet per day through 2050. First gas flows through APP beginning in 2020, and ramps up to full capacity by mid-2021. A Gas Treatment Plant with capacity of approximately 5 bcfd of raw gas is also built in Prudhoe Bay and comes online in 2020. Prudhoe Bay and Point Thomson will be primary gas sources for APP during the early years of operation. A gas pipeline with the capacity to carry 1 billion cubic feet per day is built from Point Thomson to Prudhoe Bay with first gas flowing in 2020. In later years, gas production from other fields will begin to meet APP needs, primarily from the NPR-A and the Foothills of the Brooks Range. Gas production from the Beaufort Sea OCS will begin in 2029 and will be transported to markets via APP. No expansion of APP is assumed for this scenario. The containerized LNG plant to supply needs in Fairbanks is built in 2014 as described in the Without APP scenario. With APP, the plant is closed in 2023 after a 10-year contract expires because the price of natural gas supplied by APP in Fairbanks is lower than the cost of gas from the LNG plant. In addition to natural gas for APP, natural gas for localized demand in the North Slope Borough will continue to be supplied throughout the study period.

D3.8 COOK INLET NATURAL GAS PRODUCTION

No Action / Without APP
Natural gas production in Cook Inlet continues to decline and is insufficient to meet growing Southcentral demands, although a natural gas storage facility in Kenai comes online in 2012 and eases winter peak demand issues. Gas production from Cook Inlet continues at modest levels throughout the study period as local utilities continue to seek diversity in their natural gas supplies, including imported LNG. Other sources of gas supplies for in-state use are described under RFFA D3.20, *Mining* and RFFA D3.26, *Supply of Gas to In-state Users*.
With APP
The study uses the same assumptions as in the Without APP Scenario.

D3.9 TAPS PIPELINE

No Action / Without APP
In spite of falling production from onshore fields, production is sufficient to keep oil flowing through TAPS. Throughput is lowest in 2021 at approximately 509,000 bod. Because of the development of large OCS oil fields in the Beaufort and Chukchi seas, the owners of TAPS make the necessary investments (i.e., a new pump station in 2027-2028) to keep the pipeline open and flowing. With throughput from the OCS expected to continue through the study period, and with the development of the shale oil plays, TAPS is reauthorized to operate for another 30 years in 2033. The figure shown in RFFA 3.5 depicts TAPS throughput during the study period under the Without APP scenario.
With APP
The study will use the same primary assumptions as in the Without APP Scenario. Oil volumes moving through TAPS are higher than under the Without APP scenario due to additional induced oil production as described in RFFA 3.6*, Alaska Onshore Oil Production*. The figure shown in RFFA 3.6 depicts TAPS throughput during the study period under the With APP scenario.

D3.10 SPENDING BY THE STATE OF ALASKA

No Action / Without APP

Unless constrained by budget deficits, the state operating budget plus the capital budget and receipts from the federal government is set to equal state revenues less dedicated contributions to the Permanent Fund, the Constitutional Budget Reserve (CBR), Education Fund, and other accounts. Future capital projects with potential state support include:

- Port MacKenzie railroad extension is constructed in the 2022-2025 period ($160 million);
- Low Watana (Susitna) Hydroelectric project is constructed from 2016-2021 ($4.5 billion);
- Umiat Road is completed and opens in 2015 ($277 million);
- Port of Anchorage expansion is scaled back but completed in 2015 ($461 million); and
- Port of Skagway expansion completed by 2017 ($103 million).

The operating budget is permitted to increase in years when the CBR is needed to balance the budget. Once the CBR is depleted, the state will need to find new sources of revenue – these new, but unspecified sources are assumed to allow state spending to be maintained, but not increased, at the then current level. Model runs indicate that, even though TAPS throughput continues at relatively high levels, declining revenue from onshore oil and gas production means the CBR will be depleted by 2040.

With APP

The study will use similar assumptions as in the Without APP Scenario with the following changes.

- Knik Arm Crossing is completed in 2017 ($750 million);
- Natural gas pipeline spur from Delta Junction to Cook Inlet is built by the state in 2022 ($1.8 billion)—it is assumed that a third party will take ownership of the spur line after it is built;
- Highway reconstruction projects from 2021-2030 (1,738 miles @ 0.75 per mile; note that this reconstruction would be required over time, but APP shortens the time period between required reconstruction intervals); and
- Port MacKenzie rail extension is completed prior to major APP construction activities rather than later in the study period.

While some of the projects listed above in both the With APP and Without APP scenarios may be useful to APP if they are completed prior to construction, none of them are necessary for APP to proceed. The larger revenues to state government under the With APP Scenario will result in higher spending with the assumptions noted above. Fiscal model runs indicate that under the With APP scenario through 2050, the CBR does not need to be used to balance state spending and revenue.

D3.11 PERMANENT FUND AND PERMANENT FUND DIVIDENDS

No Action / Without APP
As mandated by the Alaska Constitution, 25 percent of state oil and gas royalties continue to be paid into the Permanent Fund (PF) and the principal balance of the PF continues to grow. Earnings from the PF would continue to be paid as dividends (PFDs) even if the CBR is fully depleted and other taxes are implemented.
With APP
The study uses the same assumptions as in the Without APP Scenario. The additional onshore oil and gas production, and additional oil and gas royalties, under the With APP Scenario, would contribute more to the PF and the PFD than the Without APP Scenario.

D3.12 STATE TAXES ON OIL

No Action / Without APP
The current tax structure, Alaska's Clear and Equitable Share (ACES) continues. While there are attempts by the state to negotiate revenue-sharing arrangements with the federal government on OCS oil production, no agreements are reached that generate direct revenues to the state from OCS leases in the Chukchi and Beaufort Seas. If the CBR becomes fully depleted in the future, new forms of taxes may be considered. The fiscal model determines overall state revenues from all sources, and related state spending. State spending then becomes an input into the REMI model, which provides population and other information for input into the fiscal model in an iterative fashion until convergence is established.
With APP
The study uses the same assumptions as in the Without APP Scenario.

D3.13 STATE TAXES ON NATURAL GAS

No Action / Without APP
The existing tax structure continues. If the CBR becomes fully depleted in the future, new forms of taxes may be considered.
With APP
The study makes no specific assumption regarding fiscal certainty, but assumes that the APP is built and that producers are willing to develop long-term shipping contracts with APP. All other assumptions in the Without APP Scenario are used.

D3.14 STATE TAXES ON MINING REVENUES

No Action / Without APP
Increases in mining taxes are considered but never approved. Current mining taxes are minimal and even future mining tax revenues would be minor given current rates. The effect of the additional mining activity and jobs is modeled in the REMI model and provides input for the fiscal model to develop mining tax revenues.
With APP
The study uses the same assumptions as in the Without APP Scenario.

D3.15 STATE INCOME AND SALES TAXES OR OTHER FUTURE TAXES

No Action / Without APP
If the CBR is depleted, the state legislature approves new taxes that are sufficient to keep revenues and spending constant at that particular time. The form of any new taxes is not specified, but could potentially include broad-based income or sales taxes, or other taxes on resource extraction industries. Model runs indicate that some form of new taxes will be required by 2040.
With APP
The study will use the same assumptions as in the Without APP scenario. The imposition of new taxes is not required based on model runs specific to the With APP Scenario.

D3.16 RAILROAD PROJECTS

No Action / Without APP
The railroad spur between Port MacKenzie and the Parks Highway is delayed, but eventually opened in 2025. Federal budget issues mean that the proposed railroad spur line between Fairbanks and Delta Junction is not developed.
With APP
The study uses the same assumptions as in the Without APP Scenario except that the railroad spur from the Parks Highway to Port MacKenzie will be built prior to 2017 and will be used to transport pipe segments.

D3.17 STATE FUNDED ROAD PROJECTS

No Action / Without APP
Because of the recognition that the state government needs to spend within its means, only those road projects that appear to generate positive economic development will be built. In general, the state will require these road projects to be funded through private/public partnerships and local improvement programs. The following roads will be built with the years shown indicating the beginning of the construction period: The road to Umiat in 2014; upgrades of the road from Iniskin Bay to Pebble in 2026; several high-profile roads and bridges are not built, including the roads to Nome and Ambler and the Knik Arm and Gravina bridges.
With APP
All road projects assumed under the Without APP Scenario will be built. In addition, portions of the Parks Highway, Dalton Highway, Richardson Highway, Glenn Highway, Tok Cutoff, Haines Cutoff, and Klondike Highway will be refurbished after 2020 to repair APP and spurline construction-related effects. In addition, the Knik Arm Bridge is funded given that APP is moving forward and is built in 2016-2017.

D3.18 PORT PROJECTS

No Action / Without APP
The Port of Anchorage expansion is scaled back but is completed in 2015. Port of Seward improvements will be done to support coal exports and increasing utilization by fishing vessels. The Port MacKenzie rail spur is completed by 2025. Upgrades to the Port of Skagway are finished in 2016. The port in Iniskin Bay will be built to support development of the Pebble Mine in 2025. Dock facilities at Prudhoe Bay will be developed with significant dredging to support OCS development. A port on the Chukchi Sea coastline will be developed in 2026 to support OCS and TNP development.
With APP
The study uses the same assumptions as in the Without APP Scenario.

D3.19 ALASKA IN-STATE OIL REFINING AND IMPORTS OF PETROLEUM FUELS

No Action / Without APP
The recent recession, and a series of regulatory rulings have changed the baseline economic conditions for in-state refinery operations. These conditions allowed importers of jet fuel to gain a significant market share beginning in 2009, and these imports of jet fuel are expected to continue throughout the study period. Due to its reduced market share and the supply foothold gained by importers, the Flint Hills refinery in North Pole will only operate at capacity during warmer months (June-September). The availability of LNG from the North Slope enables Flint Hills to maintain profitability but does not increase its market share. All other refineries in Alaska continue to operate throughout the study period with average output holding steady at levels equal to averages from pre-recession levels (2000-2007).
With APP
Low-cost natural gas from APP results in higher profit margins for refineries in North Pole, and Flint Hills returns to year-round operations at full capacity in 2024. However, the threat of competition from imports for other petroleum products means there is no noticeable change to in-state gasoline or diesel prices relative to the Without APP scenario.

D3.20 MINING

No Action / Without APP
Mining activity expands with development of several large prospects and expanded resource utilization at existing operations. In general, mine developers determine that they cannot afford to wait for the state to develop energy infrastructure, and therefore provide their own infrastructure in a way that allows future flexibility if new energy sources become available. The major new mining projects are described separately below, but other smaller mining operations also come online during the study period. 1. The Donlin Gold Mine (Donlin Gold) begins production in 2017. Natural gas is used to generate the mine's 120+ megawatt energy demand. The gas is transported to Donlin Gold via a newly constructed gas pipeline from Cook Inlet. Given the declining production of Cook Inlet natural gas (see RFFA 3.8) and the inability to access ANS gas, the mine utilizes imported LNG as the primary supply source. The LNG could be re-gasified at the existing LNG plant if it were converted to a re-gasification facility, or using a floating storage and re-gasification unit (FSRU). We have assumed an FSRU, positioned on the west side of Upper Cook Inlet. The mine operates from 2017-2036 and produces a total of 30 million ounces of gold. 2. Pebble begins production in 2030, after permitting delays. The mine has a smaller footprint than currently envisioned, but is still able to access known mineral resources. The mine utilizes imported LNG as its primary energy source. The LNG is re-gasified using an FSRU which is positioned in Iniskin Bay and the gas is transported to the mine via a 90-mile pipeline. The mine operates throughout the remainder of the study period. The copper and gold are exported via the port facility in Iniskin Bay. 3. Livengood mine comes online in 2020 and utilizes LNG, which is supplied by truck transported from the North Slope LNG plant. The mine would produce 16 million ounces of gold during through 2040. 4. Chuitna Coal comes online in 2025 after further litigation and delays, and continues to operate through 2045. Chuitna Coal is exported via a mine-funded vessel-loading facility at the mine site. Power needs for the coal mine are supplied from the natural gas-fired Beluga power plant. 5. Red Dog Mine expands operations to adjacent resource deposits and operates through 2045. 6. Coal exports increase from the Usibelli Mine through the Port of Seward. 7. Smaller unspecified mines with road/port access and access to energy will generate an additional 10 mining jobs each year from 2011-2050. These new jobs replace older mines that are closing down due to resource depletion so that baseline mining employment remains constant over time.

With APP
In general, all of the assumptions with respect to mining operations described above will occur. The existence of a large in-state supply of natural gas in the Interior and a spur line to Southcentral changes the energy infrastructure utilized by Donlin, Pebble, and Livengood. The availability of lower cost energy also results in development of a new mining district around Tok. The differences from the Without APP scenario are described below: 1. Donlin Gold opens in 2017 with the same gas pipeline from Cook Inlet. The mine switches from LNG to ANS gas after the spur line to Southcentral is completed and their FSRU contracts expire. Low-cost energy from APP means the mine continues to operating until 2046. 2. Pebble mine opens in 2030 — 10 years after the opening of APP. The mine's energy needs are met with ANS gas via a subsea pipeline from the Kenai Peninsula to Iniskin Bay where it enters a 90-mile onshore pipeline to the mine site. Lower energy costs allow the mine to operate for several more years than under the Without APP scenario, but these effects occur after the study timeframe. 3. The Livengood mine will use ANS gas accessed through a nearby APP off-take point and because of reduced energy costs will continue to operate until 2050. 4. Chuitna Coal comes online in 2025 and with the availability of lower cost natural gas from the North Slope continues to operate through 2050. 5. A gas off-take point will be located at Tok and low-cost ANS gas will spur development of mines in the region. A large anchor mine builds the initial pipeline for its use and then other mines buy into the pipeline project as they are developed. Mines in the Tok area and other smaller mines with access to ANS gas generate 200-300 additional mining jobs from 2020-2050.

D3.21 FISHERIES

No Action / Without APP
Harvest volumes of most species are expected to stay within the ranges of the last 10 years. Revenues from seafood are expected to increase as demand in Asia continues to grow and wild-caught seafood attains a premium over farm-raised seafood in the marketplace. Trends associated with global climate change continue with some northward movement of fish stocks and densities. The industry is able to adapt to the gradual changes, as stocks that were formerly found in more southerly waters are now more abundant in Alaska waters. Commercial fish harvests in the Chukchi and Beaufort Seas continue to be prohibited. Due to a variety of issues it is unlikely that Pollock quotas after 2025 will remain at current levels, and instead will range between levels seen in 2008 and 2009. Salmon populations will remain strong throughout the study period. Community Development Quota groups begin to homeport some of their vessels at Alaska ports by 2015, but state budget constraints limit the number of vessels that move from Puget Sound ports. Fisheries are not explicitly modeled in the REMI model or the fiscal model.
With APP
Community Development Quota groups begin to homeport some of their vessels at Alaska ports by 2015, and facilities are available to move all of their vessels after construction of APP is completed. Other assumptions are the same as the Without APP Scenario.

D3.22 TOURISM

No Action / Without APP
Growth in Alaska's tourism industry continues, but at a lower rate than in the past decade due to competition from other global tourist destinations, and a limited number of communities that can meet the needs of the cruise ship industry. The growth rate in the tourism sectors is constrained to two-thirds of the prior decade's growth rates.
With APP
The study uses the same assumption as in the Without APP Scenario.

D3.23 AIR TRANSPORTATION

No Action / Without APP
Air cargo support in Alaska will continue to grow, but at lower rates than in prior decades. Tourism accounts for a substantial portion of air transportation activity and future growth rates are constrained to two-thirds of the prior decade's growth rates.
With APP
The study uses the same assumptions as in the Without APP Scenario.

D3.24 ECONOMIC DIVERSIFICATION

No Action / Without APP
Other than specific projects that have already been identified, no new industries are added to the Alaska economy.
With APP
Similar to the assumption under the Without APP Scenario, no new industries are added other than specific projects identified for the With APP Scenario.

D3.25 ELECTRICAL GENERATION INFRASTRUCTURE

No Action / Without APP
The Low Watana version of the Susitna hydroelectric project comes online in 2022 with a generating capacity of 600 megawatts and a capital cost of $4.5 billion. The natural gas-fired Municipal Light and Power and Chugach Electric Association power plant project is brought online in 2014 to replace older gas-fired plants with minimal effect on the state's economy but lower fuel consumption. Alternative energy use increases, but rural Alaska continues to rely on diesel.
With APP
Additional gas power generators will be installed in the Railbelt region as electric power demand increases over time. Parts of rural Alaska will use propane rather than diesel for electrical generation as described in the In-State Gas Demand study. Mines around Tok access ANS gas for their operations. Other assumptions are the same as the Without APP Scenario, including development of the Susitna hydro project.

D3.26 SUPPLY OF GAS TO IN-STATE USERS

No Action / Without APP
LNG is imported into Cook Inlet beginning in 2014 and re-gasified at either the existing Nikiski LNG facility, which is converted to process the imported LNG, or via chartered FSRUs. The model assumes FSRUs are used, that they remain in place through 2050, are sufficient to meet demands for gas in Southcentral and for mining operations at Pebble and Donlin Gold. The use of FSRUs and construction of the Watana Dam on the Susitna River preclude a bullet line from the North Slope to Southcentral. An LNG production plant is built on the North Slope in 2014 to supply LNG via truck to Fairbanks. The plant supplies a majority of GVEA electrical generation demand and is used by refineries in North Pole. The capacity of the LNG plant is also sufficient to meet other residential and commercial gas needs. Storage capacity is developed in Fairbanks for both LNG and re-qasified methane that is sufficient to cover potential weather delays during winter in mountain passes on the Dalton Highway. In order to justify construction of the LNG plant, a 10-year contract is negotiated initially, with contract extensions continuing through the end of the study period.

With APP
Gas off-take points along APP and a spur line provide a reliable and steady supply of natural gas to Fairbanks, North Pole, and communities in the ENSTAR service area by 2022. However, the capital costs of pressure regulation and delivery systems mean that off-take points are developed only where there are sufficient industrial uses or large numbers of consumers. Off-take points are developed at the following locations: 1. Livengood: A methane only off-take point is developed by the mine. 2. Fairbanks/North Pole: Because of acute energy shortfalls in the near term, an LNG production plant is built on the North Slope in 2014 to supply LNG to users in the Fairbanks area via truck. The LNG supplies all of the residential and commercial demand and a majority of the electrical generation and industrial demand. Storage capacity is developed in Fairbanks for both LNG and re-gasified methane that is sufficient to cover potential weather delays during winter in mountain passes on the Dalton Highway. In order to justify construction of the LNG plant, a 10-year contract to purchase LNG is negotiated. In 2020, with the availability of ANS gas, GVEA converts all of its generating capacity to natural gas with the remaining diesel units placed in backup status. After 2023, when the 10-year contract expires, the LNG plant on the North Slope is closed, and Fairbanks users switch to ANS gas supplied by APP. While an off-take could be built at both Fairbanks and North Pole, economies of scale indicate that a single off-take point in the Fairbanks region with capacity to supply gas for the entire Fairbanks area is developed. The location is not specified at this time. CNG or propane could also be supplied to communities located along the Yukon River, Parks Highway, the Elliot Highway, and the Alaska Highway beginning in 2020. 3. Delta Junction: This is the starting point of the spur line to Southcentral and a large-scale facility to extract propane for insertion into the spur line and local consumption is built at this off-take point. Some of the propane extracted from the APP gas stream is used in Delta Junction, Fort Greeley, and communities as far away and Tok and Glennallen. The density of development at Delta Junction and Fort Greeley are not sufficient to support methane gas distribution systems at this time. 4. At the terminus of the spur line, a propane extraction facility is built to pull propane from the gas stream before it enters the ENSTAR distribution system. This gas supply is transported via pipelines to Donlin and Pebble (See RFFA 20, *Mining*). CNG or propane handling systems are developed to barge or ship these energy sources to rural Alaska communities. 5. Tok: Methane gas is supplied via pipeline to newly developed mines in the district, but cost considerations mean that CNG/propane must be shipped from the Delta Junction off-take point. (See RFFA 20, *Mining*.)

D3.27 PRICES FOR USERS OF NATURAL GAS IN ALASKA

No Action / Without APP
Natural gas prices for consumers in Alaska will be higher than Lower 48 prices in order to generate adequate returns to local gas producers that operate in a high-cost environment in Alaska. Prices paid by consumers for natural gas will not be subsidized by the state. It is presumed that throughout the study period, the price of imported LNG to Southcentral will change with Asian LNG prices (recent spot market prices were approximately $12 per million British thermal units [Btu]), but with less direct linkages to the price of crude oil. Natural gas prices in Southcentral for gas derived from imported LNG are likely to remain higher than the Henry Hub prices and higher than prices that would be charged for natural gas from Cook Inlet production. Consumption of natural gas in the Cook Inlet region will be a mix of imported LNG and continued Cook Inlet production. According to FNG project documents, natural gas prices in Fairbanks are expected to be relatively stable ranging between $10 and $12 per million Btu for the end user. This stability is a result of long term contracts with ANS suppliers, and the fact that ANS supplies are otherwise stranded.
With APP
Alaska natural gas prices will be linked to national prices with APP. Tariffs will be set at levels necessary to support the infrastructure used to transport the gas. Prior to completion of the spur line, gas prices in Southcentral Alaska will be linked to Asian LNG prices and are likely to be higher than elsewhere in the nation; after 2022, the gas price will reflect the ANS wellhead value plus transportation charges. Gas from Cook Inlet may be priced higher than ANS gas delivered via the APP and the spurline to account for higher production costs, so the Southcentral end consumer could see a blended rate for gas. Natural gas prices for Fairbanks users will be a blend of the cost noted above for LNG trucked to Fairbanks and ANS gas delivered by APP to Fairbanks, plus distribution costs. After 2023, Fairbanks users will see prices based on ANS gas delivered by APP plus distribution costs, if applicable.

D3.28 STATEWIDE POPULATION GROWTH

No Action / Without APP
Statewide population is an output of the REMI model. We are not making specific assumptions regarding population.
With APP
The study will uses the same assumptions as in the Without APP Scenario. Population is an output of the REMI model and is determined independently in the With APP Scenario.

D3.29 RURAL AND URBAN CHANGES

No Action / Without APP
Population for modeled boroughs and census areas will be an output of the REMI model. Borough and census area totals from the model will be allocated down to the community level using a gravity model supplemented with consideration of existing trends, and modified by any of the RFFAs that are specific to individual communities (e.g., Livengood). Community population estimates will be an input into the Fiscal Model. Other assumptions that affect community populations are listed below: 1) The state will continue to fund schools in communities as long as 10 students remain; 2) Revenue sharing formulas that are currently in place will remain unchanged; and 3) Bypass mail subsidies continue.
With APP
The study uses the same assumptions as in the Without APP Scenario with the exception that the mines at Tok are developed under the With APP scenario and will thus affect local populations.

D3.30 RESIDENT VERSUS NON-RESIDENT LABOR

No Action / Without APP
The trend of resident versus non-resident labor from 2006-2009 will continue through the study period. According to Alaska Department of Labor and Workforce Development, non-residents as a percent of total number of workers have declined steadily from a high in 2006 of 19.6 percent, to 19.1 percent in 2009. Non-resident hire varies widely by industry — in the oil and gas sector non-resident workers declined both in total numbers and as a percent of total, while in the construction industry the number of non-resident workers increased while the number of resident workers decreased.
With APP
Specific preliminary assumptions regarding resident and non-resident workforce for construction and operation of APP, in-migration and similar topics have been developed in concert with Alaska Department of Labor and Workforce Development. For all other projects and industries, the study will use the same assumptions as in the Without APP Scenario.

D3.31 SUBSISTENCE

No Action / Without APP
The study assumes there are no changes in the per-capita use of subsistence resources. Subsistence activities are not addressed in the REMI or the fiscal model.
With APP
The study uses the same assumptions as in the Without APP Scenario. Subsistence activities are not addressed in the REMI or the fiscal model.

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ATTACHMENT B PERSONS INTERVIEWED

Person Interviewed	Company or Organization	Title
Mr. Jim Balsiger	National Marine Fisheries Service	Assistant Administrator
Mr. Thomas Barrett	Alyeska Pipeline Service Company	President
Mr. Joe Beedle	Northrim Bank	President
Ms. Susan Bell	Alaska Department of Commerce, Community & Economic Development	Commissioner
Ms. Renata Benett	Totem Ocean Trailer Express	Manager of Market Research
Mr. Steve Borell	Alaska Miners Association	Executive Director
Mr. Jerry Brian	U.S Bureau of Ocean Energy Management	Economist
Mr. Michael Catsi	Alaska Industrial Development and Export Authority	Business Development Officer
Mr. Harold Curran (for Mayor Edward Itta)	North Slope Borough	Chief Administrative Officer
Mr. Mark Davis	Alaska Industrial Development and Export Authority	Economic Development Officer
Mr. Dan Dickinson	Dan Dickinson, CPA	CPA
Ms. Kathryn Dodge (for Mr. Luke Hopkins)	Fairbanks Northstar Borough	Economic Development Specialist
Mr. Jim Dodson	Fairbanks Economic Development Corporation	Executive Director
Mr. Ron Dunton (for Mr. Bud Cribley)	U.S Bureau of Land Management	Gas Pipeline Manager
Ms. Michelle Egan	Alyeska Pipeline Service Company	Corporate Communications Director
Mr. Craig Fleener	Alaska Department of Fish and Game	Deputy Commissioner
Mr. Neal Fried	Alaska Department of Labor & Workforce Development	Economist
Mr. Scott Goldsmith	University of Alaska, Institute of Social and Economic Research	Economist
Mr. Rod Hoffman	Alaska Pipeline Project	Regulatory Advisor
Ms. Doreen Lampe	Inupiat Community of the Arctic Slope	President
Ms. Rebecca Logan	Railbelt Utility Task Force	Chair
Mr. John Mackinnon	Associated General Contractors of Alaska	Executive Director

Person Interviewed	Company or Organization	Title
Ms. Kara Moriarty (for Ms. Marilyn Crockett)	Alaska Oil and Gas Association	Deputy Director
Mr. Phil Mundy	National Marine Fisheries Service	Director of Auke Bay Lab
Mr. Joel Neimeyer	Denali Commission	Federal Co-Chair
Ms. Cherie Nienhuis	Alaska Department of Revenue	Acting Chief Economist
Mr. Jeff Ottesen	Alaska Department of Transportation and Public Facilities	Chief of Planning
Mr. Ron Peck	Alaska Travel Industry Association	Executive Director
Mr. Norman Phillips Jr.	Doyon Ltd.	President and CEO
Mr. Bill Popp	Anchorage Economic Development Corporation	Executive Director
Mr. Frank Richards	Office of Federal Coordinator for ANGP	Deputy Federal Coordinator
Mr. Tim Towarak	Federal Subsistence Board	Chair