Alaska
Natural Gas Development Authority

Beluga to Fairbanks

Natural Gas Pipeline System

Project Description

Submitted to:

U.S. Army Corps of Engineers, Alaska District
POA-2007-1676

Bureau of Land Management, Alaska State Office

December 2009

Table of Contents

Appendices

Attachments

List of Acronyms and Abbreviations

ADNR	Alaska Department of Natural Resources
ADOT/PF	Alaska Department of Transportation and Public Facilities
AGIA	Alaska Gasline Inducement Act
ANGDA	Alaska Natural Gas Development Authority
ANS	Alaska North Slope
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
B2F	Beluga to Fairbanks
bbl	one barrel
BCF	billion cubic feet
bscf	billion standard cubic feet
Btu	British thermal units
CEA	Chugach Electric Association
CFR	Code of Federal Regulations
CO_2	carbon dioxide
CVEA	Copper Valley Electric Association
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
F	Fahrenheit
FCAW	flux core arc welding
FTE	full-time-equivalents
GMAW	gas metal arc welding
GVEA	Golden Valley Electric Association
HDPE	High-Density-Polyethylene
I.D.	Pipe Inside Diameter (Inches)
ksi	kips per square inch
lb/cf	pounds per cubic foot
LNG	Liquefied Natural Gas
MAOP	maximum allowable operating pressure
the military bases	Fort Wainwright, Fort Greely, Eielson Air Force Base, or the Missile Defense Facility
mmBTU	million British Thermal Units
MMcf/d	million cubic feet per day
MM/mo	million per month
Mmscf	million standard cubic feet
P	Internal Pressure (psig)
psig	pounds per square inch
RFP	Request for proposal
ROW	Right-of-Way
SAW	submerged arc welding
SMAW	shielded metal arc welding

SMYS	specified minimum yield strength
TAPS	Trans-Alaska Pipeline System
TEG	thermoelectric generators
USDOT/PHMSA	U.S. Department of Transportation/Pipeline and Hazardous Materials Safety Administration

1.0 Introduction

Alaska In-State Natural Gas Supply

Alaska's economy has been heavily dependent on oil and gas production since the discovery of large commercial oil and gas reserves in Alaska's Cook Inlet in the 1950's and the start-up of the Prudhoe Bay oilfield in 1977. Getting Alaska's North Slope (ANS) natural gas to market has been an elusive goal since oil production started in the late 1970's. Plans to build a major natural gas pipeline to deliver ANS natural gas to markets have come and gone over the years. Two competing projects to deliver approximately 4 Bcf/d of North Slope natural gas are currently being evaluated that could achieve this goal as early as 10 years from today. Although Alaska holds some of the largest natural gas reserves in North America, geography, proximity to markets, worldwide supply, and economies of scale have contributed to the challenges of realizing a large-scale project to monetize ANS natural gas reserves. In the meantime, Southcentral Alaska struggles to establish a stable and reliable natural gas supply to meet customers' demand, and Interior and Rural Alaska struggle with long time reliance upon oil-based fuels.

The only proven large reserves of natural gas in the state are on the North Slope and in Cook Inlet. The difference between the two fields is that the Cook Inlet field is "dry gas", over 99% methane, and the North Slope fields are "wet gas", rich in multiple commercial gas components such as propane and ethane. Gas exploration is currently underway in the Nenana and Copper River basins.

The Alaska Natural Gas Development Authority (ANGDA) requested the Army Corps of Engineers to coordinate an Environmental Impact Statement (EIS) for the construction of a 24-inch diameter steel gas pipeline system extending from the Cook Inlet to Delta Junction and a 12-inch steel pipeline from Delta Junction to Fairbanks, Alaska (B2F Pipeline) for the purpose of delivering natural gas from Cook Inlet to the Copper Valley, Glennallen, Delta Junction and Fairbanks. ANGDA requested a Bureau of Land Management (BLM) right-of-way grant for approximately 104 miles where the pipeline will be within federal lands that are managed by the military and the BLM.

Another purpose of the B2F Pipeline will be to serve as storage for gas in times of excessive deliverability demands which generally occur during the 10-14 coldest days of the winter. The final purpose of the B2F Pipeline will be to serve as a spur pipeline that could connect to a major ANS gas pipeline when one is ultimately built.

There are sufficient additional natural gas reserves in the Cook Inlet region for development and delivery to Fairbanks and the Copper Valley via the B2F Pipeline. Therefore the supply of gas to existing consumers of Cook Inlet natural gas would not be adversely impacted.

The B2F pipeline will pass in close proximity to the exploratory drilling activity in the Copper River basin, providing this area with market access should there be commercial gas discoveries. Gas from the Cook Inlet will be transported through the B2F Pipeline through negotiated contracts between the pipeline company and producers and marketers.

The B2F Pipeline system will be within existing rights-of-way (ROW) (pipelines, utilities, roads, highways) and RS-2477 trails from Beluga to Fairbanks. The B2F Pipeline system will be approximately 364 miles from Beluga to Delta Junction and 73 miles from Delta Junction to Fairbanks. The B2F Pipeline system route is presented in Appendix A2. Supporting information for the B2F project is available in Appendices A, B and C and at: http://www.angdab2feis.com.

2.0 Project Purpose

Initially the B2F pipeline will deliver gas from Cook Inlet to the Copper Valley, Glennallen, Delta Junction and Fairbanks, and will provide gas storage for Southcentral use. The final purpose of the pipeline will be to serve as a spur pipeline to a major ANS gas pipeline, when one is built, to move ANS gas into Southcentral Alaska markets, with a connection at either Delta Junction or Glennallen.

3.0 Project Need

Southcentral Alaska has relied on and benefited from the natural gas supplies of Cook Inlet for power generation and heat for over 40 years. Cook Inlet's ability to produce economic quantities of natural gas has for years been supported by the base load of industrial activity in the region consisting of the Agrium fertilizer plant and ConocoPhillips-Marathon Liquefied Natural Gas (LNG) export facility. With the closure of the Agrium plant, the uncertainty around extension of the current LNG export license which will expire in 2011, and the limited nature of the gas consumer market in Southcentral Alaska, interest in exploration for additional natural gas reserves in Cook Inlet has diminished in recent years. Expected consumer and industrial gas demand in Southcentral Alaska alone will not likely incentivize the exploration and production investments necessary to add significant Cook Inlet natural gas supplies. A larger market is needed.

The Copper Valley and Interior Alaska also need a dependable and long-term supply of natural gas for electric power generation. Interior Alaska residents are threatened with volatile and high energy costs and need reliable and affordable gas in the shortest time possible.

Natural gas is needed for electric generation in Copper Valley, Glennallen, Delta Junction and Fairbanks. The B2F Pipeline will deliver gas from Cook Inlet to the Golden Valley Electric Association (GVEA) power plant in Fairbanks for Interior Alaska and to Copper Valley Electric Association (CVEA) for Glennallen and other Copper Valley consumers. While the amount of gas needed to meet GVEA and CVEA current requirements is relatively small, it is significant to their customers, and other major customers of the gas will likely include: Pogo Mine, Fort Wainwright, Eielson Air Force Base, and Fort Greely Missile Defense System, all of which stand to benefit significantly from more affordable, clean-burning natural gas that will be provided by the B2F Pipeline. It is anticipated that the demand will increase and distribution systems will be expanded as this affordable and reliable gas supply becomes available.

The B2F Pipeline will also provide another important need for Southcentral gas consumers. In addition to transportation of gas, a near-term benefit of the B2F pipeline will be gas storage for peak season demand in Southcentral Alaska. During the winter months, the demand for gas for heating and electricity generation has outstripped the supply available during the 10-14 coldest days of the winter. Currently peak demand has to be met through a reduction in the Nikiski LNG Export Facility operations. However, there is no assurance that the Nikiski LNG Plant will be operational after 2011. Even with it operational, near-catastrophic failures in Southcentral natural gas deliverability in 2009 have been well documented. The B2F pipeline will provide gas storage to ensure gas deliverability during these limited peak demand periods and greatly improve energy security during peak gas use.

Gas is projected to move north from Cook Inlet to interior Alaska unless and until a major ANS Gas Pipeline project is completed. Upon construction and commissioning of an ANS Gas Pipeline, North Slope gas will move through Canada to the Continental U.S., or will be exported as LNG out of Valdez. At that time, ANS gas could be transported through the pipeline into Southcentral Alaska markets. It is estimated that the earliest that an ANS gas pipeline could be operational is 2019. Thus ANS gas would be able to supplement the gas needs of Southcentral in the 2020 time frame.

With or without an ANS Gas Pipeline, the minimum anticipated life of the B2F pipeline system is approximately 50 years.

4.0 Benefits

Residents in the Interior are experiencing unstable and escalating energy costs. The B2F pipeline will provide dependable, stable and long-term gas supply to Alaska's interior including the Copper Valley, Glennallen, Delta Junction and Fairbanks.

In addition, by enhancing the marketability of Cook Inlet Gas, the B2F pipeline will improve the economics of expanded Cook Inlet gas development, thereby improving the reliability and security of natural gas supply in both the Interior and Southcentral regions of Alaska.

Environmental Protection Agency (EPA) standards for air quality are not being met in the Interior. The air quality in Interior Alaska is compromised through use of crude oil, coal and wood for heating. Emission calculations demonstrate large reductions in potential pollutant emissions when natural gas is burned as opposed to coal and liquid fuels (*Alaska Natural Gas Development Authority Potential Air Pollutant Emission Reductions,* A. Trbovich, Hoefler Consulting Group, August, 2009). The pipeline will deliver natural gas from Cook Inlet for electric power generation for the Copper Valley and Interior Alaska. With natural gas available in Fairbanks and along the route, distribution systems can be expanded to include additional domestic and commercial customers. The expansion of use of gas from Cook Inlet will be a significant aid in improving winter air quality in Interior Alaska.

Gas storage will benefit Copper Valley and the Interior and Southcentral areas during periods of high demand or supply interruption. Southcentral Alaska is threatened with potential failure of the gas and electric generation systems for 10 to 14 of the coldest days each winter due to gas deliverability shortfalls. Currently, the shortfalls are made up through reductions in the LNG export operations in

Nikiski. However, should the Nikiski facility shut down after the 2011 expiration of its current export license, this safety net will no longer exist. If demand exceeds deliverability, the impact to residences, businesses, governments and institutions in Southcentral will be significant. There are over 348,800 natural gas users in Southcentral Alaska (ENSTAR, 2007). The B2F pipeline with a diameter of 24 inches for the southern half and 12 inches for the northern half can store approximately one billion standard cubic feet of natural gas at 2,500 pounds per square inch (psig). As seasonal peak demand approaches, the line will be operated in a “pressure-up” mode to store excess gas which can be drawn down during peak periods in the Anchorage area to increase their overall system deliverability. Delivery of gas to Fairbanks and other interior locations will not be interrupted. Thus, the efficient operation of B2F will allow gas to be available year-round in Fairbanks while also being able to help Southcentral Alaska during periods of peak demand.

The project will benefit local governments and the State through increased royalties, production taxes and property taxes, and will result in increased revenue to local economies through economic development made possible by stable energy supplies. The project will also stimulate economic growth and provide stability and local employment while providing an alternative to diesel, wood, and coal burning for heat and power production.

Future use of the B2F Pipeline will provide important benefits to Alaskans. The B2F Pipeline will be in place and operational and will be available to accelerate construction and testing of the ANS pipeline and compressors between Delta Junction and the North Slope, thus contributing to lower tariff costs that will increase long-term state tax and royalty revenues. In ten to fifteen years when gas reserves in Cook Inlet are waning, ANS gas will be available through the pipeline (functioning as a spur line) to supplement Southcentral gas supplies.

5.0 Project Alternatives

ANGDA Progression of Projects

Since its inception in 2003, ANGDA has pursued its goal of getting Alaska’s North Slope gas to market and delivering a long-term stable and reliable supply of gas to consumers throughout Alaska. ANGDA’s initial focus was to deliver ANS natural gas to tidewater, which at the time was envisioned to be the Port of Valdez. In the same timeframe, ANS producers and others began assessing the option of constructing a pipeline from Prudhoe Bay to Valdez for LNG export. While this project remains a possible option, it is not likely to be realized within the next 10 years and does not address the immediate energy needs of the Copper Valley, Glennallen, Delta Junction, Fairbanks, and the military bases of Fort Wainwright, Fort Greely, Eielson Air Force Base, or the Missile Defense Facility (the military bases).

With the prospect of a major ANS Gas Pipeline project from Prudhoe Bay to Valdez, ANGDA developed the concept of a “Spur Line” from Glennallen to Palmer to provide natural gas to Southcentral Alaska. ANGDA filed for and was issued a conditional right-of-way (ROW) lease by the

State of Alaska in 2006. As other project developers evaluated a major gas pipeline from the North Slope to U.S. markets through Canada, ANGDA also assessed the Spur Line extending from Delta Junction to Palmer, with the section of pipeline between Delta Junction and Glennallen closely paralleling or sharing the existing Trans-Alaska Pipeline System (TAPS) ROW corridor. Thus, ANGDA evaluated both options for a Spur Line; first, from Glennallen to Palmer if a large diameter pipeline is built to Valdez, and second from Delta Junction to Palmer if a large diameter pipeline is built to Canada. Both options remain viable until such time as an initial Open Season on the 48-inch pipeline defines and confirms the route and delivery points. The initial "Open Season" of a gas pipeline is the process during which the pipeline owner and the pipeline's potential customers negotiate the material terms of shipment of the customer's gas on the pipeline in anticipation of the construction of the gas pipeline.

In the summer of 2008 record high oil prices caused fuel prices to soar, with a significant economic impact on Fairbanks, Interior Alaska and the surrounding rural areas due to their dependency on oil-based fuels for heat and power generation. ANGDA was tasked by the Governor to look for ways to help Interior consumers. Having already studied the feasibility of building a spur pipeline that would connect to possible ANS gas pipeline projects, it made sense to supplement ANGDA's prior work to solve the immediate energy needs of Interior and rural Alaska pending construction of an ANS gas pipeline. ANGDA developed the B2F pipeline system project to provide natural gas from Cook Inlet to Interior and Rural Alaska and to address Cook Inlet gas deliverability issues by providing gas storage. The gas stored in the B2F pipeline could be drawn upon during periods of winter peak demand. "Stand-alone" positive economics give the pipeline system "independent utility" status, and retains its potential function as a spur line to an ANS gas pipeline. No significant changes to the B2F Pipeline design or construction will be required for use as a spur line. The final pipeline system design is expected after the 2010 ANS Gas Pipeline project Open Season.

Other proposed ANS natural gas pipelines are being considered:

1. Alaska Stand Alone Natural Gas Pipeline - The proposed pipeline project will deliver North Slope gas south to tie in to the ENSTAR Natural Gas Distribution System in the Wasilla area.

2. TransCanada/ExxonMobil Alaska Pipeline Project – The proposed pipeline project will deliver gas from the North Slope through Delta Junction along the existing TAPS ROW and then through Canada to the continental U.S. An alternate under consideration by this project is to deliver gas to the Port of Valdez for LNG export with a pipeline extending from Delta Junction through Glennallen to Valdez.

3. Denali – The Alaska Gas Pipeline – The proposed pipeline project by ConocoPhillips and BP Exploration Alaska is very similar to the TransCanada/Exxon project to deliver gas through Canada to the continental U.S. This project does not offer the option of Valdez LNG exports.

4. Alaska Gasline Port Authority Pipeline – The proposed pipeline project will deliver natural gas from the North Slope or regions near the Brooks Range for conversion to LNG for export from Valdez.

None of these alternatives are considered to be viable for this project since none meet the stated purpose of delivering gas from Cook Inlet to Copper Valley, Glennallen, Delta Junction and Fairbanks.

Appendix C includes an index of reports, available in the ANGDA Library, relating to the history of studies and alternatives considered by ANGDA and others in recent years.

Alternatives Considered

ANGDA considered various project alternatives to provide gas to the Copper Valley, Glennallen, Delta Junction, Fairbanks and the military bases. With huge natural gas reserves existing on the North Slope, an obvious alternative is to construct a pipeline from Prudhoe Bay to these locations. Although total pipeline miles to Fairbanks from either Prudhoe Bay or Cook Inlet are comparable, significant other differences quickly rule out the North Slope to Fairbanks and North Slope to Southcentral Alaska options.

- North Slope natural gas requires a costly conditioning plant to remove carbon dioxide (CO_2), water, oil, and sulfur. Gas from Cook Inlet does not require a conditioning plant. Both the TransCanada and the Denali Gas Pipeline projects will require construction of a North Slope Gas Conditioning Plant. However these plants will not be constructed in time to address the Interior's near-term supply and Southcentral deliverability problems.

- The pipeline corridor between Prudhoe Bay and Fairbanks requires expensive arctic construction through large regions of continuous permafrost, with construction costs on the order of 2 to 3 times those along the corridor south of Fairbanks.

- Delivering ANS gas to Delta Junction and Glennallen requires an additional 100 to 250 miles of pipeline adding significant cost to the project to meet the goal of serving these communities, military bases and the missile defense facility.

- The Alaska Stand Alone Gas Pipeline (also referred to as the "bullet line") along the Parks Highway does not serve Delta Junction, Glennallen, Copper Valley or the military bases or missile defense facility. ANGDA considers permitting challenges and hurdles to permit a pipeline ROW through or in proximity to Denali National Park would create significant project schedule and cost risk and potentially jeopardize this route entirely.

ANGDA considered meeting project objectives by trucking LNG from Cook Inlet to the Copper Valley, Glennallen, Delta Junction, and Fairbanks. This option was considered and dismissed due to economic inefficiencies and negative socioeconomic and environmental impacts associated with delivery of the volumes needed by the utilities in Interior Alaska, industry and military consumers. Much smaller volumes of LNG are currently trucked from Point MacKenzie to Fairbanks. A significant scale-up of this effort is impractical in terms of cost inefficiency and socioeconomic/environmental impacts. Similarly, the use of LNG railcars would require large capital investments in LNG infrastructure (facility, additional railways, railcars, receiving and re-gasification facilities, etc.) and cannot practically serve all of the Copper Valley, Glennallen, Fairbanks, and Delta Junction areas. Unlike the B2F pipeline system, with asset value expected to increase should an ANS Gas Pipeline be constructed, both truck and railcar LNG capital investments will devalue or become obsolete upon pipeline commissioning.

Alternative Routes

ANGDA contracted for studies that are the basis for alternative routes initially considered for the pipeline route. The first alternative considered was a pipeline within the Parks Highway Corridor. This alternative considered using the Alaska Railroad easement along the Parks Highway. Appendix A2 shows the preferred and alternate project routes. ANGDA's comparative studies that assessed the Parks Highway route are listed in Appendix C and are available in the ANGDA Library.

The Department of Energy contracted for another comparative study called "The Conceptual Engineering and Socioeconomic Impact Study – Alaska Spur Pipeline, (DOE-NETL, 2007)". This study also compared the Parks and Richardson Highway corridors. The Parks Highway historical route alignment is presented in Appendix A3.

The Parks Highway route and ANGDA's preferred route are similar in length and environmental consequences. The technical difficulty of constructing the pipeline is comparable for both alignments. Both route alternatives could be used for current and future mining operations and other commercial uses.

Neither the Parks Highway route nor the Alaska Railroad alternative route would meet the B2F purpose of delivering gas for electric generation in populated Interior Alaska areas including the Copper Valley, Glennallen, Delta Junction, and Fairbanks areas. Both the Parks Highway route and the Railroad route bypass the growing population along the Richardson Highway. The Parks Highway is geographically constricted by public lands, and legislative restrictions that limit future populations and commercial growth opportunities.

6.0 Economics

ANGDA is a public corporation created in 2002 by a ballot measure and has the statutory authority to bond, subject to State Legislative approval of the bond amounts. ANGDA will decide the type of debt to be issued as funds are required for pipeline design and construction. Security for the debt will be the gas sales contracts to publicly owned electric utilities in the Interior and Southcentral regions of Alaska. ANGDA does not propose to be the pipeline owner, constructor or operator. ANGDA proposes to solicit private sector owner(s) or partner(s) to contract for and manage pipeline design, construction engineering studies, additional fieldwork operations and management. There is an opportunity for the State to finance this pipeline project. There is also the opportunity for ANGDA to issue a Request for Proposals (RFP) for the B2F pipeline system project with a subsidy similar to the Alaska Gasline Inducement Act (AGIA) process.

The existing natural gas market supply and demand study is presented in the *Final ANGDA Energy Scenarios Study,* Ecology and Environment, Inc., March 7, 2008. The study included projected production and consumer expenditures, and current and projected gas and electric demand and costs to the year 2025. The study concluded that demand for and cost of gas and electricity will continue to escalate.

The B2F pipeline is an economically viable project without consideration of the economics associated with its second phase of usage as a line to an ANS gas pipeline. The B2F is neither technically nor economically dependent on a future ANS pipeline that will transport gas outside of Alaska.

Simplified economic models demonstrate that for project costs of $1.25 billion the “break-even tariff” at 50 million cubic feet per day (MMcf/d) is $4.70/MMcf. Using current Cook Inlet gas prices of approximately $8/MMcf, delivered costs to Fairbanks will be $12.70/MMcf, or approximately 35% less than Fairbanks heating fuel and approximately 15% less than naphtha being used by GVEA on a British thermal unit (Btu) equivalent basis at $70 per barrel (bbl) crude price. If crude prices rise again to $100/bbl, the savings increase to approximately 40% and 50% when compared to naphtha and heating fuel, respectively. Appendix A8 contains the State of Alaska’s Official Oil Price Forecast, released December 10, 2009. Figure 2-6 forecasts ANS well head prices in 2011 will be $70.36 and in 2012 will be $77.78.

Project economics were modeled within the following range of assumptions:

1. Capital construction costs are estimated at $1.25 billion. Economic cases were run with costs ranging from $1.25 billion to $1.75 billion.

2. Project financing will be available with ANGDA-issued bonds reflecting interest rates in the range of 4-6%. As a State-owned corporation with bonding authority, debt service is assumed to require interest only payments without initial principal recovery or profit components.

3. Annual operating expenses range between $10 to 15 million.

4. With expected deliveries in the range of 50 MMcf/d, the B2F pipeline will be able to deliver gas year-round, including peak demand winter months when the pipeline can be used as peak supply “storage”. As a demand-limited case, economics assume deliveries for only 10 to 11 months per year from Cook Inlet to Fairbanks. During the other 1 to 2 months, the pipeline will serve as a pressure vessel providing gas storage capacity for high demand seasonal peaks for Southcentral Alaska. Uninterrupted gas flow during these months would continue into Fairbanks and Copper Valley. Revenues generated for peak gas storage deliveries are estimated at $1 to 3 million per month. This is a very conservative assumption in that gas deliveries can still be made to Fairbanks in this mode of operation.

5. Gas deliveries to Fairbanks range from a low of 20 MMcf/d to a “target” of 50 MMcf/d and a “high case” of 65 MMcf/d. Current markets for natural gas are estimated to be in the range of 50 MMcf/d, with future demand to increase as natural gas becomes available and more affordable in Fairbanks.

A graph of tariff cost versus throughput for a range of flow rates and capital cost is shown in Appendix A7.

Using ranges of assumptions, a “break-even” tariff was calculated for delivery to Fairbanks. For all cases modeled, with deliveries in excess of 20 MMcf/d and Cook Inlet gas prices in the current range of $8/Mcf, delivered cost to Fairbanks is less than heating fuel cost of approximately $20/MMbtu when crude oil prices are in the range of $70/bbl. These economic assumptions are presented to represent that under all expected and reasonable cases, significant financial margins are available to provide investment and operating cost recovery adequate to attract commercial market capital.

Sensitivities:

1. With mid-point operating costs and monthly storage revenues, varying project costs from $1.25 billion to $1.75 billion impacts break-even tariffs across the range of flow rates by 35%, or $4.18/Mcf at 20 MMcf/d and $1.67/Mcf at 50 MMcf/d.

2. With mid-point project costs of $1.5 billion, mid-point operating costs and monthly storage revenues, varying bond interest rates from 4-6% impacts break-even tariffs across the range of flow rates by 44%, from $5.00/Mcf at 20 MMcf/d to $2.00/Mcf at 50 MMcf/d.

3. With mid-point project costs of $1.5billion, mid-point operating costs and 5% interest rate, varying monthly storage revenues from 0 to $3 MM/mo impacts break-even tariffs across the range of flows by -7% (increased storage revenues decreases tariffs), from $1.00/Mcf at 20 MMcf/d and $0.40/Mcf at 50 MMcf/d.

4. Varying the number of months that gas is shipped to Fairbanks (between 9 and 11 months) with other variables at mid-point impacts break-even tariffs by 14%.

7.0 Preferred Route

The preferred pipeline route alignment selection considered the following factors:

1. Able to meet the stated project purpose
2. Minimize potential environmental impacts
3. Benefit the greatest number of Alaskan consumers
4. Maximize use of existing infrastructure, transportation corridors, and right-of-ways
5. Require no additional federal or state legislation

The proposed B2F pipeline route extends from Beluga in the Cook Inlet Basin to North Pole, Alaska. The route crosses a diverse landscape including mountain ranges, expanses of permafrost-laden tundra, rivers and creeks, through almost entirely unpopulated areas within mostly existing rights-of-way. The B2F Pipeline route is described in 4 segments. Beginning in the north, the route between Delta Junction and Beluga is 374 miles, and is described in three segments: Segment 1 between Delta Junction and Glennallen, Segment 2 between Glennallen and Wasilla, and Segment 3 between Wasilla and Beluga. The 73 mile pipeline route between Delta Junction to North Pole is called Segment F. ANGDA’s *“Delineation of Wetlands and Waters Report for B2F Natural Gas Pipeline”* Shaw, April, 2009 is available in the ANGDA library.

ANGDA incorporates by reference the large body of environmental, socio-economic and other information for the proposed mainline routes that parallel the Trans-Alaska Pipeline System (TAPS) from Prudhoe Bay to Delta Junction and then east to the Canadian border and from Prudhoe Bay to Valdez. The Alaska Department of Natural Resources (ADNR) considered access to, along and across the Alaska Natural Gas Transportation System (ANGTS) and described physical and biological resources, public safety, subsistence, cultural resources, mining and pipeline termination (Commissioner's Analysis and Proposed Decision and Action, ADL 403427, ADNR, Anchorage Alaska, 2004). Many design approvals and major authorizations, such as wetlands permits under Section 404 of the Clean Water Act, were issued for the project. The Section 404 permits and other permits were extended and maintained. The project was approved in accordance with the Alaska Natural Gas Transportation Act.

ANGDA incorporates by reference the works and studies used as the basis for the EIS and state and federal authorizations for the TAPS lease renewal and environmental assessment for the TAPS reconfiguration as well as the Yukon Pacific (YPC) Trans-Alaska Gas System (TAGS) conditional right-of-way that generally follows the TAPS route from Prudhoe Bay to Valdez.

The referenced projects included the required NEPA public process that provided opportunities to comment and ask questions. Potential affects to humans, subsistence, wildlife, subsistence resources, commercial fisheries, recreation and tourism, public safety, socio-economics, cumulative impacts were considered during the NEPA process.

Alternative Pipeline Route Segments

ANGDA contracted for studies to determine the optimal pipeline route. Each of the following alternative route segments were studied and rejected for a variety of factors including opportunities for shared synergies within existing corridors, costs savings, maximized pipeline safety through known soils types and minimized human disturbances including avoidance of private property and impacts to traffic. Each of the segments received archaeological and cultural clearances and wetlands delineation. The B2F pipeline system alternate route segments are shown in Appendix A2.

7.1.1 Alternative Route Segment 1: Chugach Electric Association Easement

The Chugach Electric Association (CEA) alternative route segment follows the electric utility easement from the Beluga power plant, crosses the Susitna River, passes Port MacKenzie and continues north to the road system southwest of Wasilla. The CEA route segment does not parallel the existing gas pipeline, and synergies such as shared surveillance and maintenance through known soils would be lost. Furthermore, the CEA route segment crossing the Susitna River is closer to navigable waters than the existing ENSTAR natural gas pipeline system and preferred gas pipeline route.

7.1.2 Alternative Route Segment 2: Glenn Highway – Sutton to Eureka

ANGDA's contractor evaluations of the Glenn Highway alternative route segment documented conditions that would preclude burying the pipeline along the highway and under the Matanuska

River. The conditions include major physical geologic restrictions or “pinch points” along the highway. Construction problems include steep side hill slopes, unstable soils that are susceptible to landslides, extremely limited construction areas, and developed areas near or adjacent to the highway with increased potential for pipeline corrosion.

Pipeline construction crossing rivers in deep canyons would cause major interruption of normal highway operations service during winter and summer. There are no viable alternative routes to minimize pipeline construction impacts on the highway traffic. Construction within those areas may compromise public safety, pipeline integrity and create logistics problems with concurrent highway and pipeline construction and maintenance activities.

The Alaska Department of Transportation and Public Facilities (ADOT/PF) annualized traffic counts from Sutton to Eureka for 2008 are 1,393/day and Eureka Lodge 753/day.

7.1.3 Alternative Route Segment 3: Golden Valley Electric Association Easement

A portion of the GVEA alternative route segment between the southern end of Eielson AFB and the GVEA North Pole facility is within an active floodplain that could lead to accelerated corrosion, washouts, and potential unintended gas releases with resultant public safety concerns.

7.1.4 Alternative Route Segment 4: Glennallen Bypass

This route alternative segment would encroach on privately owned property and would make unachievable one of ANGDA’s primary purposes – to bring natural gas to the Glennallen area while avoiding private property to the extent possible. The Glennallen bypass route selection is not based on sound engineering principles for buried steel pipeline but was the result of an early route assessment to map the shortest route possible to Cook Inlet. This alternative segment has undesirable conditions that include unstable soils through warm permafrost and undisturbed wetlands areas. The warm permafrost, (+30 degrees Fahrenheit (F)), is extremely sensitive to thaw and freezing. The thermally disturbed surface cannot immediately reestablish soil conditions for several years even with timely revegetation. Wetlands damage could occur as a result of the freeze/thaw sensitivity in the area.

Tyonek Industrial Park Consideration

ANGDA was asked to determine whether Tyonek would be a suitable location to receive and process pipe and equipment/supplies during project scoping. In this scenario, pipe would be delivered by barge to Tyonek, unloaded, processed, and reloaded onto trucks for delivery to another project location.

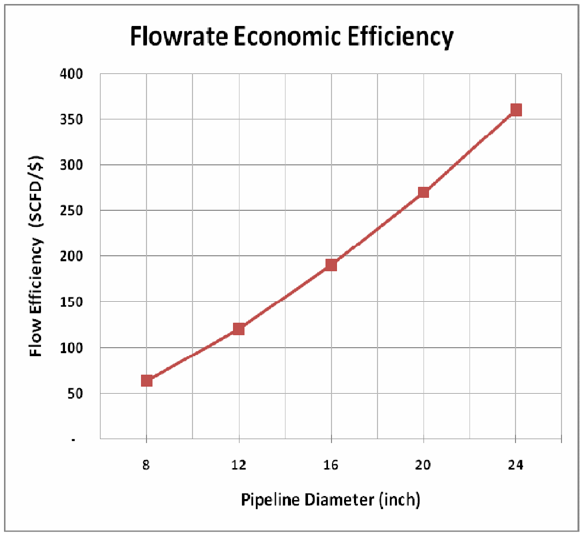
ANGDA determined that the Tyonek industrial park alternative is not a feasible receiving port. The location would be inefficient and would add significant costs to pipeline construction. The dock is in water that is too shallow for barged pipe deliveries and would require significant dredging and dock extension to receive the pipe.

Pipeline Design and Sizing Considerations

Pipeline system design involves an analysis of factors and trade-offs that must be considered including:

- distance to be traveled
- volumes to be received
- receipt points
- volumes to be delivered
- delivery points
- composition of gas
- forecast volume growth

These factors dictate the diameter and composition of the pipe, compression requirements and other surface facilities. Final design will determine the optimum pipe size(s) as well as the optimum tie-in location in Palmer or Beluga. Based on preliminary pipeline hydraulic modeling, a 20- to 24-inch diameter steel pipeline will provide the optimum balance between installed cost, expected and maximum operating flow rates, the number of compressor stations and required compressor horsepower. Economics demonstrate size preference for potential maximum flow rates to allow for potential future compressor stations, as opposed to being hydraulically limited by pipe diameter. Pipeline sizing must consider the efficiency of the design basis when comparing the construction costs of a larger diameter line across a range of potential flow rates and pressure drops against the cost of additional compressor capacity. For example, using a simple factor like flowrate economic efficiency, which is a comparative factor representing the volume of gas that can be moved per dollar of capital investment [Max Flowrate/Construction Cost], one can see a roughly a three-fold improvement in this factor when comparing a 12-inch diameter pipe to a 24-inch diameter pipe. This is due to the fact that although some cost elements increase with larger pipe (e.g. cost of pipe, welding time, coating costs, transportation, etc.) many other cost factors remain relatively the same (e.g. overhead, access roads, pads, support equipment, engineering, etc.). Put another way, even as some variable costs, like pipe costs, rise linearly, maximum flowrates increase exponentially as pipe diameter increases (see chart below). Larger diameter pipe equates to less pressure drop than smaller diameter pipe over the same distance. Larger diameter pipe also allows for lower capital investment in compressor stations and subsequent operating costs for fuel. All of these factors are taken into consideration when finalizing the design of a pipeline to maximize investment return and operating efficiency. This analysis is true regardless of whether the gas flow direction is north or south. Therefore, the efficiency of the larger diameter pipe is maintained during phase one when gas is flowing from north south Cook Inlet to Fairbanks, and in phase two when gas would flow from Delta Junction to Beluga.



While the optimum operation of the B2F Pipeline would utilize a 24-inch diameter line, final determination of the pipeline diameter(s) will be based on actual requirements and forecasts determined by the B2F Open Season process. A successful B2F Open Season process will yield firm, contractual commitments to ship gas such that a pipeline developer can be confident in making multi-billion dollar financial commitments to ultimately construct the pipeline. These commitments provide details for the final B2F Pipeline system design to proceed, confirming such specifications as pipeline diameter, delivery and take-off points, at which time the design and cost estimates can be confirmed. Prior to the B2F Open Season commitments, ANGDA cannot compare and evaluate the value and cost engineering factors needed to determine pipeline diameter. Although the most significant information required to determine pipe size is gained through the B2F Open Season process, a project developer must also forecast future possible throughput, delivery, and off-take locations to avoid potentially undersizing the pipeline for the markets.

Other than the obvious impacts on some variable construction costs, the construction techniques, equipment requirements, logistics and indirect support facilities and staff remain the same for any conceivable pipe size in the range of 12 to 24 inches. Direct and indirect construction impacts on humans and the environment are also assumed to be the same for this project, regardless of pipe diameter ultimately selected.

During initial evaluations of the B2F pipeline, ANGDA considered the use of high-density-polyethylene (HDPE) pipe between Delta Junction and Fairbanks. It was believed this section of pipeline might have a short economic life if an ANS Gas Pipeline was constructed and gas flow was available for delivery to Southcentral. Upon further consideration, this option was dismissed based on design and code challenges.

The B2F pipeline system design was refined to include industry standard buried steel pipeline from Beluga to Fairbanks. With expected gas deliveries in Glennallen and Delta Junction, current expectation is that a 12-inch diameter pipeline segment will be adequate between Delta Junction and Fairbanks to North Pole. Pipe size will be established during final design after the B2F Open Season. Should the pipeline segment between Fairbanks and North Pole, and Delta Junction or Glennallen be shut-in due to the availability of ANS gas, the length of pipeline will be either cleaned, capped and abandoned in place, or removed and impacted areas remediated as required by permit and regulation as determined at the time.

Gas Storage Capacity

The B2F pipeline system provides substantial gas storage capacity for use during the winter months when Southcentral Alaska natural gas demand approaches (and in the next few years is expected to exceed) Cook Inlet deliverability limits. Depending on the final design diameter of pipeline selected, gas storage capacity in B2F will be between 500 MMcf and 1 billion cubic feet (Bcf) when operating at 2,500 psig. The gas storage capacity will supplement maximum gas delivery from Cook Inlet field production. At the 24-inch diameter, the B2F gas storage could provide enough stored gas capacity to deliver an additional 10 to 20% above existing production capacity for 1 to 3 weeks depending on ambient conditions and demand at the time. For example, when Southcentral Alaska daily natural gas demand peaks near 330 MMscf as it has on extremely cold winter days, and Fairbanks is taking deliveries of, for example, 50 MMscf/d, B2F has the capacity to flow gas from its line-pack (gas volume stored at 2,500 psig) back into the Southcentral Alaska natural gas distribution system. No other project alternative considered provides this potential to address the problem of Cook Inlet deliverability that threatens gas curtailment or rolling power outages in Southcentral Alaska during the coldest winter days (See Appendix A, “Cook Inlet Peak Day Comparison” table). The B2F pipeline will serve as a “pressure vessel” for storing volumes of gas that can be drawn down in any direction including peak load periods when gas from Cook Inlet cannot keep up with heat and power generation demand. Other studies are underway to ascertain the viability of using existing or depleted reservoirs for these peak loads. Neither the B2F Pipeline nor any other means of gas storage currently under consideration will provide a complete solution to the currently forecasted declining gas supplies from Cook Inlet. The B2F Pipeline will, however, address some of the near-term problems of short-term peak demand deliverability. Ultimately, the long term solution for gas deliverability will be an expanded Cook Inlet drilling program to produce increased quantities of additional gas.

Within the likely expected range of pipeline diameter (20- to 24-inch), construction methods do not materially differ. Therefore, human and environmental impacts are assumed to be the same for all expected pipe sizes. For the purpose of the EIS evaluation, it should be assumed that the Beluga to Delta Junction pipeline is 24-inch diameter, and the Delta Junction to Fairbanks is 12-inch diameter. In both cases, these are envisioned to be the largest pipe sizes under expected flow conditions.

Gas storage in the B2F Pipeline, while an ancillary benefit, is potentially an important one for Southcentral Alaska. Storage capacity will be impacted by pipeline diameter selection. A range of potential gas storage volumes are possible based on the ultimate size of the pipeline and the diameter will be determined taking into account the short term benefit of storage capacity. ANGDA has not evaluated the installation of additional gas storage tanks to be used in conjunction with pipeline storage.

The following equation was used to calculate how much gas is contained in a given line section:

(I.D.)^2 x P x 0.372 = scf / 1000 feet of pipe, where I.D. = Pipe Inside Diameter (inches) and P = Internal pressure (psig)

Using this equation, the segment of pipeline between Beluga and Delta Junction (364 miles, 24”) will contain 1.07 billion standard cubic feet (Bscf) at 2,500 psig and the segment of line between Delta Junction and Fairbanks (73 miles, 12-inch) will contain 56 MMscf. Assuming pressure can be drawn down to approximately 900 psig, the amount of potentially available stored gas in the B2F pipeline is approximately 725 MMscf. Since the pipeline will be capable of operating at pressures up to 2,500 psig, simultaneous off-take at multiple locations is possible. This means the pipeline can deliver both north and south simultaneously. Although economics for the B2F considered the possibility of only delivering gas to the interior 10 to 11 months per year, with the pipeline operating in the high pressure storage mode, it will be possible to make gas deliveries to Interior Alaska 12 months per year while also supplying gas to Southcentral Alaska.

8.0 Typical Design and Construction

Pipeline Specifications

Pipeline Specifications Assumptions:

Length	Beluga to Delta Junction	364 miles
	Delta Junction to North Pole	73 miles
MAOP	Pipeline	2,500 psig
Flanges and Fittings	ANSI Class 1500	3,600 psi
Material	SMYS	70 ksi
	Specification	API 5L
	Pipe Class	Electric Resistance Welded
Diameter	Beluga to Delta Junction	20- to 24-inch
	Delta Junction to North Pole	8- to 12-inch

Key:
ANSI = American National Standards Institute.
API = American Petroleum institute.
ksi = kips per square inch.
MAOP = maximum allowable operating pressure.
psi = pounds per square inch.
psig = pounds per square inch gauge.
SMYS = specified minimum yield strength.

Appendix B represents simplified diagrams of ditch/trench modes, pipeline crossings and cathodic protection systems.

Depth of Cover and Underground Clearance

The pipeline will be buried with a depth of cover of 30-inches in Class 1 locations and 36-inches in Class 2 and 3 locations. These depths are in accordance with the requirements of 49 Code of Federal Regulations (CFR) 192.327. The CFR also allows for reduced depth of cover requirements when in areas of consolidated bedrock (18 inches for Class 1, 24 inches for Class 2, and 36 inches for Class 3).

Pipe clearance requirements (49 CFR 192.325) mandate a minimum clearance of 12 inches between the pipeline and other underground structures not associated with the pipeline.

49 CFR 192.5 defines Location Classes: Class 1 – Ten (10) or fewer buildings intended for human occupancy, Class 2 - more than 10 but fewer than 46 buildings intended for human occupancy and Class 3 - more than 46 buildings intended for human occupancy. The Project involves only gaseous hydrocarbons that would dissipate into the atmosphere if released.

Ditch Modes

Several ditch modes will be used to accommodate soil and terrain conditions encountered along the proposed alignment. Ditch modes are designed to ensure long-term integrity of the pipeline and to protect nearby foreign structures and the environment. Additional ditch modes may be developed as more detailed terrain analyses, seismic characterizations, permafrost characterizations and soils analyses are completed.

Right-of-Way, Construction Easements, Temporary Work Space

The pipeline will be located in a 50-foot minimum permanent ROW. Additional permanent ROWs will be required in specific areas such as locations for compressor stations, block valves, and meter stations; side hill cuts and fills; river crossings; and where permanent gravel workpad/maintenance roads are required. Temporary construction corridors will be required on both sides of the permanent ROW to facilitate construction. Typically the total width of the corridor (including the permanent ROW area) is 300 feet. River Crossings may require up to 1,500 feet of temporary construction corridor width.

Buoyancy Control

For pipe wall thicknesses corresponding to Location Classes 1 and 2 the pipeline will be buoyant in high water table areas, at water crossings, and at directionally drilled crossings. For pipe wall thicknesses corresponding to Location Class 3, the pipeline will not be buoyant.

Assuming a concrete coating unit weight of 140 pounds per cubic foot (lb/cf) between 1.0 and 2.5 inches of concrete will be required to provide buoyancy control for pipe in Location Classes 1 and 2 respectively. However, it may not be practical to apply or handle coatings as thin as one inch. An equivalent number of saddle weights can also be applied. If saddle weights are used, appropriate measures will be taken to ensure coating integrity.

Welding

The pipeline will be welded using a combination of mechanized gas metal arc welding (GMAW), submerged arc welding (SAW) and shielded metal arc welding (SMAW) methods, or other qualified methods. The pipeline will be welded according to the requirements of API 1104 – "Welding of Pipelines and Related Facilities" and project-specific requirements. Tie-ins and repair welds will use a combination of SMAW and semi-automatic flux core arc welding (FCAW).

Crossings

Several types of terrain features will be crossed by the B2F Pipeline including transportation alignments (trails, driveways, roads, highways, and railroads); waterbodies (streams, rivers, and wetlands); and above ground and below ground foreign pipelines, utilities, and faults.

There are several construction methods for underground crossings including open cut, horizontal bore, and horizontal directional drilling. Open cut is typically used for smaller crossings where traffic or flow can be diverted while completing the crossing. Horizontal bores are typically used on arterial roads, collector roads and railroad crossings where public access cannot be interrupted for long periods. Horizontal directional drilling is typically used on long crossings of waterbodies and occasionally long crossings of transportation infrastructure.

Communications and Safety

The pipeline will be controlled remotely by a Supervisory Control and Data Acquisition (SCADA) system. The compressor stations and mainline block valves will be shut down remotely in the event of an emergency.

Hydrotesting

All piping systems shall be tested after construction to the requirements of 49 CFR 192 Subpart J – Test Requirements and American Society of Mechanical Engineers (ASME) B31.8-2003 – 841.3 Testing After Construction.

Corrosion Control (Cathodic Protection and Coatings)

Buried portions of the pipeline not exposed to high abrasion soils or high soil stress will be fusion-bonded epoxy-coated. Two methods of cathodic protection will be used, as required, to protect the pipeline: (1) sacrificial anodes, and (2) an impressed current system.

For this project, the primary source of cathodic protection will be a galvanic magnesium ribbon anode system, supplemented by impressed current systems (when readily available) primarily located (where necessary) at block valve locations. Thermoelectric generators (TEG), fueled by natural gas from the B2F pipeline will provide the current to the anodes.

Compressor Stations

Compressor stations will be installed near the intersection of the Glenn and Parks Highways and in Glennallen. Manifold pipeline will be installed in the vicinity of Jack Warren and Phillips Road, and the TAPS corridor. The pipeline size will be decreased at this point from 20-24 inch to 8-12 inch pipe. A pig launcher and receiver will be installed at this location on a small gravel pad.

Block Valves

In accordance with the United States Department of Transportation-Pipeline and Hazardous Materials Safety Administration (USDOT/PHMSA) code requirements, inline block valves will be located along the alignment. Generally for Class 1 locations the maximum allowed valve spacing is 20 miles.

Inline Inspection

The pipeline will be designed and constructed to allow the use of inline inspection pigs.

Metering

Gas will be metered at the inlet and outlet ends of the pipeline and at any potential future off-take delivery point.

Construction

The pipeline will be constructed during summer and winter seasons dependent on specific conditions within each route segment. The construction season is determined by the presence of continuous and discontinuous permafrost and other factors such as logistics requirements, workers needed in varied locations, and seasonal constraints. Typical seasonal constraints include nesting, wildlife migration, spawning, lambing and calving.

The permafrost in some segments along the pipeline corridor is very warm, about +30 degrees Fahrenheit or warmer and is subject to large ground temperature variations. Soil characteristics change dramatically throughout the area and care must be taken to appropriately address and match thaw stability, potential frost jacking and / or freeze stability of the soils. Surfacial soil disturbance, outside of the work area, will be held to a minimum especially where thaw unstable soils are encountered.

Fresh water will be required to construct (ice road/pads construction, maintenance, drilling operations, and camp use) during winter season(s). Water will be acquired from commercial sources and lakes and rivers. Ice may be harvested if needed from permitted lakes and transported by trucks. Lakes will be accessed via snow trail or ice road spurs from the main winter trail using the most direct route possible. Ice roads and water locations requirements are shown in the following table.

ICE ROAD LOCATION	ICE ROAD LENGTH (MILES)	ICE ROAD WIDTH (FT)
Beluga: Near power plant, east of Susitna River	50	40
Settlers Bay vicinity to Parks Highway – Trunk Road Intersection	20	40
East of Chitna Pass to near Sourdough	70	40
Shaw Creek Flats	10	40

Approximately 237,000,000 gallons of water will be required for 150 miles of ice road/pad construction and maintenance.

Gravel, sand and rock will be acquired by contractors from commercial sources and the Alaska Department of Natural Resources (ADNR). Gravel related activities are subject to ANGDA's Quality Control and Quality Assurance Plan. Transporting gravel on the highway will be minimized as most of the gravel material sites are on the pipeline side of the highway and short distances from the pipeline ROW.

Gravel work pad site locations will be chosen by the pipeline owner. Foam insulation overlain by suitable gravel cover, not permeable to water, will be used to maintain a thermally and structurally stable workpad where gravel may be unavailable or limited. Gravel requirements are shown in the following table.

GRAVEL PURPOSE	PAD SIZE (ACRES)	QUANTITY
Staging Area	40	8
Lay Down Area	20	15
Compressor Station	1 to 1 ½ acres	2

Workforce

Pipeline construction and operation requires a wide range of skilled and unskilled laborers and professionals working in a variety of disciplines including:

- accountants

- building tradespersons
- camp and site security
- catering and accommodations
- construction/project engineers
- electrical/mechanical tradespersons
- electricians
- engineers
- equipment operators
- expeditors
- fencers / painters
- supervisors
- general technicians
- geotechnical specialists
- heavy equipment supply and maintenance tradesmen
- helicopter and charter air services personnel
- information systems specialists
- instrumentation specialists
- laborers
- mechanics
- modular assembly manufacturers
- operational maintenance workers
- pipeline engineers
- process and field operations
- project managers
- ROW clearing, re-vegetation and restoration workers
- surveyors
- traditional knowledge specialists
- transportation tradespersons
- welders
- wildlife specialists

While some of these skills are industry specific, others are not. The more general trades, particularly construction and maintenance, are oftentimes in short supply during times of rapid expansion of the oil and gas industry, but more readily available during times of contraction in the industry. Limited labor supply can lead to escalating costs and delays in construction. Construction of an ANS gas pipeline could create thousands of jobs that could cause a serious shortage of workers in Alaska, although the B2F project will require the same skilled workers in much fewer numbers. Most, if not all workers required for construction and operation of B2F are expected to come from the existing Alaskan workforce, many of them local to the communities through which the pipeline will pass. Although it is difficult to predict, ANGDA targets a 70 to 90% Alaskan workforce throughout construction and a 100% Alaska workforce during operations of the B2F pipeline.

Employment estimates for pipeline construction are 500 full-time-equivalents (FTE) per pipeline spread. Pipeline operations and maintenance will require an estimated maximum 32 FTE (21 field, 3 shop, and 8 headquarters). Pipeline termination will require an estimated maximum 40 intermittent FTE for a year of activities such as reseeding, restoration, and solid waste removal, pipeline purging, welding/cutting to satisfy termination stipulations and permit criteria.

Alaska Fabrication Sites

ANGDA envisions the project management and execution plan will rely on the use of competitively bid contracts to procure equipment and materials, as well as the labor force to construct the pipeline. Several scenarios are possible relating to in-state laydown, storage, coating and fabrication operations. Steel line pipe will be sourced from overseas manufacturers and delivered in large loads through port facilities in Anchorage, Seward, Whittier, or Valdez depending on the final transportation and logistics plan. For the purpose of this Project Description, a likely scenario is described below.

Steel line pipe will be delivered to existing port facilities using existing and readily available equipment in Anchorage, Point MacKenzie, Seward, Whittier, and Valdez based on the contractors proposal/bid documents. Depending on the competitive bid process, line pipe may be delivered to Alaska with external coating applied. The Project Specifications will define the external coating system material and application requirements, but will allow the bidders to propose to apply the coating at any location deemed competitive and able to meet specifications. ANGDA will not require specific locations to be used for coating or fabrication facilities. Line pipe will be transported via highway trucks to staging/laydown, prefabrication facilities (such as pipe coating, bending, double-joint welding, and valve and fitting welding) at locations along the pipeline route. Likely locations for this preparation work are Anchorage, Palmer/Wasilla, Glennallen, Delta Junction and Fairbanks. Rail transportation may be used to transport line pipe from Seward, Whittier, or Anchorage to Fairbanks. Sites that will be selected are envisioned to be existing laydown and work areas, except possibly in the Glennallen area where Ahtna, Inc., is considering construction of a Glennallen Industrial Site. If the Glennallen Industrial Site is developed it would likely be leased for use during construction. Other locations will not require construction of new sites for pipeline-related activities. Contractors will be responsible for determining the most efficient transportation, handling, loading and off-loading, staging and fabrication facilities, and operations. The report titled “Glennallen Industrial Park Site Selection” by Ahtna Inc. 2009, is presented in Attachment 1.

9.0 Project Schedule

The B2F Project is scheduled to conduct an Open Season in early 2010 with field preparation work commencing in late 2010 and start-up by January 2014 (see Appendix B1).

Bibliography

ADEC, 2008. Alaska Department of Environmental Conservation *Alaska's 2009 Air Monitoring Network Plan, Chapter 2 – Monitoring Plan.* http://www.dec.state.ak.us/AIR/am/09_monplan_ch2.pdf

ADF&G, 2004. *Special Area Permit FG-04-II-0022, Ice Road Construction, Beluga Natural Gas Transmission Pipeline-Susitna Flats State Game Refuge.*

ADF&G, 2008. Alaska Department of Fish & Game http://www.adfg.state.ak.us/

ADNR, 1986. *Management Unit 27: Gulkana River – Richardson Highway.* http://www.dnr.state.ak.us/mlw/planning/areaplans/copper/pdf/ch3_27.pdf

ADNR, 2006. Alaska Department of Natural Resources. Conditional Right of Way Lease for the Glennallen to Palmer Pipeline by and Between The State of Alaska and The Natural Gas Development Authority, ADL 229297. July.

ANGDA, 2005a*. Final Report, Glennallen to Palmer Gas Spurline Archaeological Studies*, Redacted Version. Prepared by Shaw Alaska, Inc. November.

ANGDA, 2005b. *Alaska Natural Gas Development Authority Environmental Permitting Plan Glennallen/Palmer Natural Gas Pipeline*. Prepared by Hoefler Consulting Group. October.

ANGDA, 2005c. *Alaska Natural Gas Development Authority Glennallen to Palmer Spur Line Native Landowner Right of Way Report*. Prepared by Natural Resource Group, Inc. October.

ANGDA, 2005d. *Recreational Use Research Report Glennallen to Anchorage Natural Gas Spur Line*. Prepared by Bristol Environmental Engineering Services, Inc. October.

ANGDA, 2005e. *Glennallen to Palmer Spur Line Soil Studies, Main Report Vol. 1 and Vol. 2*. Prepared by R&M Consultants, Inc. October.

ANGDA, 2005f. Final Report, Delta Junction to Glennallen Natural Gas Pipeline Engineering Feasibility and Cost Assessment. Prepared by URS Corporation. September.

ANGDA, 2005g. *Environmental Report, ANGDA Glennallen to Palmer Spur Gas Pipeline*. Prepared by ASRC Energy Services, Lynx Enterprises, Inc. April 12.

ANGDA, 2005h. *Glennallen to Palmer Spur Line-Alignment Land Deliverable Report*. Prepared by ENSTAR Natural Gas Company. April 8.

ANGDA, 2005i. Alaska State Right-of-Way Lease Application for the Glennallen to Palmer Spur Line. April 4.

ANGDA, 2005j. *Glennallen to Palmer Spur Line Engineering Report*. Prepared by Michael Baker, Jr., Inc. March 31.

ANGDA, 2005k. *Engineering/Fault Zone Crossing Design Glennallen to Palmer Spur Line, Final Report.* Prepared by URS. October

ANGDA, 2006a Alaska Natural Gas Development Authority. *Spurline Terminal Conceptual Design*. Prepared by Shaw Stone & Webster and Shaw Alaska, Inc. July.

ANGDA, 2006b. (Alignment Sheets) Natural Gas Pipeline Land Use and Ownership, Glennallen to Palmer Spurline. Prepared by Michael Baker, Jr., Inc. June 13.

ANGDA, 2006c. *Cook Inlet Supply Alternative Study, Final Report*. Prepared by Dunmire Consulting Team. April 14.

- ANGDA, 2006 PMP 84-94 Field Reconnaissance Proposed Realignment, Glennallen to Palmer Gas Spurline, Final Report, Environmental Field Studies, Shaw Alaska. November.

ANGDA, 2008a. *Proposed Beluga to Fairbanks Natural Gas Pipeline with General Land Status.* November.

ANGDA, 2008b. *Wetlands Delineation and Project Management (Draft).* Prepared by Shaw Environmental, Inc. December.

ANGDA, 2008c. *Beluga to Fairbanks/North Pole – Environmental Baseline Data Research and Data Gap Analysis (Draft)*. Prepared by Dowl HKM. December.

ANGDA, 2008d. Moose Creek Crossing Profile, Alaska Gas Spurline. Prepared by Shaw Alaska, January.

ANGDA, 2008e. Alaska Natural Gas Development Authority Potential Issues Associated with the Joint Use of the Trans-Alaska Pipeline Rights-of-Way. (Discussion Draft). Prepared by URS. April 21.

ANGDA 2008f Beluga to Fairbanks Wetlands Delineation Report. Prepared by Shaw Group, November

ANGDA 2009a Beluga to Fairbanks AIR QUALITY, Al Trbovich--- Hoefler, 2009

ANGDA 2009b AHTNA, Inc. Cultural Report, November.

ANGDA 2009c Glennallen Industrial Park Site Selection for Beluga to Fairbanks Natural Gas Pipeline, AHTNA, Incorporated, 2009

ANGDA 2009d Cultural Resources Survey. Beluga to North Pole. ADNR/SHPO. December.

ANGDA 2009e B2F Pipeline System. Preferred Route & Alternative Routes. Dowl HKM. November.

BLM, 1983. *River Management Plan for the Delta National Wild and Scenic River.*

BLM, 2002. *TAPS Renewal Final EIS.*

BLM, 2004. TAPS Reconfiguration EA.

BLM, 2006. *River Management Plan Revised for the Gulkana National Wild River.*

BLM 2009 Ruby Pipeline Project Description, October.

DOA 2003, USACE: Project Description for the King Cove Access Project, 6th Revision, Oasis Environmental, Inc.

DOI, U.S. Department of the Interior. 1974. Water Resources Along The Taps Route, Alaska 1970-1974, DOI 78-137 (Water sources information was acquired along the Trans-Alaska Pipeline System [TAPS] by the U.S. Department of the Interior, Geological Survey with a final report published in 1974).

DOI U.S. Department of the Interior 2008. Possible Native Allotments Affected by Proposed ANGDA Pipeline, Paul C. Roehl, Supervisory Realty Specialist

DOI, 2002a. U.S. Department of the Interior, Bureau of Land Management. *Final Environmental Impact Statement, Renewal of the Federal Grant for the Trans-Alaska Pipeline System Right-of-Way.* http://tapseis.anl.gov/

DOI, 2002b. U.S. Department of the Interior, Bureau of Land Management. Final Environmental Impact Statement, Renewal of the Federal Grant for the Trans-Alaska Pipeline System Right-of-Way.

DOI, 2003. U.S. Department of the Interior, Bureau of Land Management. Renewal of Federal Right-Of-Way for the Trans-Alaska Pipeline and Related Facilities, Record of Decision.

Elden R. Johnson, Michael C. Metz and David A. Hackney, *Assessment of the Below-Ground Trans-Alaska Pipeline Following The Magnitude 7.9 Denali Fault Earthquake.* Presented at the Sixth U.S. Conference and Workshop on Lifeline Earthquake Engineering, ASCE Technical Council on Lifeline Earthquake Engineering, Long Beach, CA, August 2003, and publication in the Conference Proceedings.E3, 2008. E3 Expansion. *Typical Pipeline Construction Sequence.* http://www.e3expansion.com/thee3project/e3pipeline/

FNG 2008. Fairbanks Natural Gas, LLC. http://www.fngas.com/about.html

Gallant, 1995. Gallant et al., 1995. Ecoregions of Alaska. U.S. Geological Survey Professional Paper 1567. Prepared in cooperation with Colorado State University and the Environmental Protection Agency.

HLA, Harding Lawson Associates, 1988. *Trans-Alaska Gas System Final Environmental Impact Statement*. Prepared for the U.S. Department of Interior, Bureau of Land Management, and the U.S. Army Corps of Engineers, Alaska District. June.

Lahr and others, 1986. Lahr, J.C., Page, R.A., Stephens, C.D., and Fogleman, K.A., 1986, Sutton, Alaska, Earthquake of 1984: Evidence for activity on the Talkeetna segment of the Castle Mountain fault system, Bulletin of the Seismological Society of America, v. 76, p. 967-983.

NRCS, 1998. U.S. Department of Agriculture, Natural Resource Conservation Service. Soil Survey of Matanuska- Susitna Valley Area, Alaska.

NRCS, 2001. U.S. Department of Agriculture, Natural Resource Conservation Service. Soil Survey of Anchorage Area, Alaska.

NRCS, 2005. U.S. Department of Agriculture, Natural Resource Conservation Service. Soil Survey of Fort Greely and Donnelly Training Area, Alaska.

TAPS Owners, 2001. *Environmental Report for TAPS- Right of Way Renewal Volume 1 of 2.*

TAPS, 1980. Trans Alaska Pipeline System Prudhoe Bay to Valdez, Alaska Construction Record Drawings 48" Oil Pipeline Sheet 0 thru Sheet 143, Alyeska Pipeline Service Company, 1980

USDOE, 2007. U.S. Department of Energy National Energy Technology Laboratory. *Conceptual Engineering/Socioeconomic Impact Study – Alaska Spur Pipeline, February 2007.* http://www.jpo.doi.gov/SPCO/DOE%20Spurline%20Documents/Spur%20Line%20Final%20Report.pdf

USDOT, 2004. U.S. Department of Transportation. *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*. Code of Federal Regulations, Title 49, Part 192. October 1.

USEIO, 2008a. U.S. Department of Energy Information Administration. Natural Gas Monthly, October 2008. Document DOE/EIA-0130(2008/10). http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/natural_gas_monthly/current/pdf/ngm_all.pdf

USFWS, 2007. U.S. Fish and Wildlife Service. *National Bald Eagle Management Guidelines.*

USGAO, 2006. U.S. Government Accounting Office. *Natural Gas Pipeline Safety: Integrity Management Benefits Public Safety, but Consistency of Performance Measures Should Be Improved*. Report to Congressional Committees. Document GAO-06-946 www.gao.gov/cgi-bin/getrpt?GAO-06-946.

USGS, 2002. *Location of Castle Mountain fault in south central Alaska.* http://pubs.usgs.gov/of/ 2001/ of01-504/

USGS, 2005. *Rupture in South-Central Alaska – The Denali Fault Earthquake of 2002. Fact Sheet 014-03.* http://pubs.usgs.gov/fs/2003/fs014-03/

USGS, 2006. U.S. Geological Survey. *Ground Water in the Anchorage Area, Alaska: Meeting the Challenges of Ground-Water Sustainability.* http://pubs.usgs.gov/fs/2006/3148/pdf/fs20063148.pdf

Visser, 2007. *The Tanana Basin Alluvial Aquifer.* http://academic.emporia.edu/schulmem/hydro/TERM%20PROJECTS/2007/Visser/code.htm

WRCC, 2008. Western Regional Climate Center. http://www.wrcc.dri.edu/

Youcha, 2002. Youcha, E.K., Lilly, M.R., Hinzman, L.D, 2002. Geohydrologic Properties of Fractured Bedrock Aquifer Systems: A Review and Application to Ester Dome, Alaska. http://www.awra.org/state/alaska/proceedings/2002abstracts/youcher