

APPENDIX V

Part I: Applicant Proposed Design Features, Mitigation Measures and Best Management Practices

Part II: Rationale ASAP Pipeline Route Refinement

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ALASKA STAND ALONE PIPELINE - MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
	SOILS & GEOLOGY
1	GCF Module Transport to Construction Site - All SPMTs would be accompanied by a field crew to guide and aid in spill response, as well as by mechanics, where necessary, on the road for safe transport. Causeway and land roads would be surveyed for damage, erosion, and appropriate width before module movement. All maintenance would occur after snowmelt is complete.
2	Layout of Material Sites - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, material site boundaries would be shaped in such a manner as to blend with surrounding natural land patterns. Regardless of the layout of material sites, primary emphasis would be placed on prevention of soil erosion and damage to vegetation.
3	Mitigation for Frost Heave or Thaw Settlement - Frost heave could be mitigated by replacing frost susceptible soil with non-frost susceptible borrow material, by controlling the operational pipe temperature, by applying insulation to control ground freezing, and possibly by providing drainage measures to control moisture migration. Thaw settlement could be mitigated by replacing thaw unstable soils with compact structural fill, by installing thermosyphons or applying insulation to control ground thawing in localized areas, or by controlling the operational pipe temperature.
4	<p>Monitoring would be conducted by air, ground, and on foot surveys, through ILI surveys' and through SCADA. Monitoring and maintenance surveys would be conducted during the dormant period and operational phase.</p> <ul style="list-style-type: none"> • Implement a programmatic maintenance cycle standard of "Monitor, Detect, Correct" to ensure prompt attention and correction for soil erosion and water management issues identified after construction and during operations. • Monitoring Curvature Along the proposed pipeline through ILI surveys - The use of a high resolution inertial navigation system (INS) based geometry tool would result in the highest level of survey accuracy. An initial/baseline geometry survey of the proposed pipeline would occur as soon as practicable after construction. Survey-to-survey curvature changes could be used as a basis for estimating the rate of curvature accumulation at any areas of concern. • Integrating Security - Effectively integrating security into SCADA requires defining and executing a comprehensive program that addresses all aspects of security, ranging from identifying objectives to day-to-day operation and ongoing auditing for compliance and improvement. Elements of this program are defined in NIST SP 800-82 as: <ul style="list-style-type: none"> ○ Obtain senior management buy-in. ○ Build and train a cross-functional team. ○ Define charter and scope. ○ Define specific SCADA and control system policies and procedures. ○ Define and inventory SCADA and control system assets. ○ Perform a risk and vulnerability assessment. ○ Define the mitigation controls. ○ The mitigation controls include business continuity planning, disaster recovery planning, configuration management, malicious code detection, intrusion detection system (IDS), and change management. These documented controls would be developed during design and integrated into the SCADA and automation systems. ○ Provide training and raise security awareness for SCADA and control system staff.
6	Permafrost Impact Mitigation - Minimize impacts to continuous permafrost through the following methods for winter construction: use of ice roads, ice pads, and snow packing; trench depth for the pipeline to at least 6ft in permafrost; keep dormant period to two years or less during construction and testing; operate an ambient temperature pipeline, which is below-freezing and protects permafrost between MP 0 and MP 175; maintain areas with excessive ponded water in or near the filled trench; employ prompt maintenance staff, as needed. Increase efforts for maintenance during first several years after construction; stabilize permafrost through revegetation over the settled crown - includes mixtures of annuals and native seed; implement stabilization through revegetation promptly after construction in sensitive areas; allow native plant recruitment to increase over time. In non-sensitive areas, scarification outside the permanent ROW would occur, which would help to facilitate natural recolonization. After 3 years, if the reclamation standard of 30% basal cover isn't met, additional measures, such as re-seeding and fertilization, would occur. For sensitive areas vulnerable to erosion (sloped areas and Arctic Coastal Plain), re-seeding would occur immediately using the prescribed seed mix in the Revegetation Plan (Appendix H).

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7	<p>Segregation of the Organic Layer in Agricultural Areas - The proposed project would entail segregating the organic layer from subsoils and replacing it as the last layer of backfill in the trench within designated agricultural lands. In most locations along the pipeline trench, the organic layer would not be segregated from subsoils and a subsoil-organic layer mixture would be used as general back-fill.</p>
8	<p>Restoration and Revegetation - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, revegetation of disturbed areas on state/federal land would be conducted as soon as practicable and, if necessary, would be repeated until revegetation is successful, unless otherwise approved by SPCS/BLM.</p> <ul style="list-style-type: none"> • Surface materials taken from disturbed areas would be stockpiled and utilized during restoration unless otherwise approved by SPCS/BLM. • Stabilization practices, as determined by the needs for specific sites, would include but shall not be limited to the placement of mat binders, soil binders, rock, or gravel blankets or structures. • All disturbed areas of state / federal land would be left in such stabilized condition that erosion in excess of natural rates would be minimized until the practicable restoration and revegetation of the leasehold could be accomplished in a manner that is reasonably satisfactory to SPCS/BLM. • Areas on state / federal land disturbed by AGDC would be restored by AGDC to the reasonable satisfaction of SPCS/BLM, as stated in writing. • Vegetation, overburden, and other materials removed during clearing operations would be disposed of by AGDC. Upon completion of the restoration on state / federal land, AGDC would remove all equipment and supplies from the site.
9	<p>Stabilization of Soils and the Buried Pipe - Use of thaw-stable material where possible. Re-seed, re-vegetate, and, as appropriate, fertilize in areas of continuous and discontinuous permafrost. Use of in-line inspection devices (smart pigs) to regularly detect longitudinal strain, primarily in continuous and discontinuous permafrost potentially related to slumping or heaving to facilitate prompt maintenance response.</p>
10	<p>Surveillance and Monitoring - In areas where a lease is required from SPCS or federal grant of ROW is required from BLM, a surveillance and monitoring program for the proposed pipeline would be approved by SPCS/BLM prior to start-up of the proposed pipeline. The program shall be designed at a minimum to prevent and mitigate erosion, maintain pipeline integrity, and monitor any pipeline movement that may affect integrity. BLM/SPCS lease stipulations would be used to develop similar policies for other landowners.</p>
11	<p>Trench Restoration for Buried Pipeline Mile 0 - 60 - Special techniques may be needed to reduce impacts to the ice-rich permafrost. These may include using additional backfill to account for excess settling if wet permafrost thaws after pipe installation, installing ditch plugs (blocks of tundra or other native sod, bentonite, or other appropriate material), or revegetating to aid in achieving thermal stability of the soil in the trench. In drier areas, the trench backfill may remain above the surrounding grade even after settling. In this case, the backfill may be seeded with upland species.</p>
12	<p>Water Management - Implement adequate water management during construction and maintenance phases:</p> <ul style="list-style-type: none"> • Install ditch plugs where appropriate, as determined by environmental engineers. • Crown the ditch to allow settlement near to ground level to avoid having the filled trench slump and catch water or avoid runoff erosion. • Contour terrain, as needed, to direct water. • Maintain natural water flowpaths through the centerline. • Utilize culverts, bridges or other infrastructure as determined by civil engineers. • Implement a maintenance program to manage waterflow and ensure prompt maintenance after conditions are reported.
169	<p>Establish a Stabilization and Revegetation Plan (Appendix H) with Alaska Department of Natural Resources (ADNR) Plant Materials Center; revegetate promptly after construction. Where required, re-grade construction disturbances to a condition that blends with the surrounding terrain and surface drainage patterns. Rely upon wind dispersal of seeds from plant species in the area to naturally recolonize the site. Upon completion of seedbed preparation, construction areas would be left unseeded to allow for natural revegetation/recolonization of the site. For areas that do not meet the revegetation criteria (cover and density standard) within the time standard (usually 3 years), seeds would be planted or some form of adaptive management considered.</p>

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170	<p>Plans for construction, operation, maintenance, and termination: In areas where a lease is required from the State Pipeline Coordinator's Section (SPCS) or a federal grant of ROW is required from BLM, AGDC would submit to the SPCS /BLM for approval the following plans, each of which would cover construction, operation, maintenance, and termination activities:</p> <ul style="list-style-type: none"> • Pipeline trench backfill methods. • Disposal of overburden, and excess and excavated material. • At the completion of operations, aboveground facilities would be removed and stabilized/revegetated to the satisfaction of the landowner. Buried pipeline would be left in the ground, which would have the least harmful impacts to the land.
171	<p>Excavated material - In areas where a lease is required from the SPCS or a federal grant of ROW is required from BLM, excess excavated material would be disposed of in accordance with approved construction plans during construction and as approved by the SPCS/BLM during operation, maintenance, and termination of the pipeline. Excavated materials would not be stockpiled in rivers, streams, floodplains, or wetlands unless approved by the SPCS/BLM regulatory agencies and designated as an appropriate storage or disposal location by the terms of the lease.</p>
WATER	
14	<p>Pipeline Temperature - To maintain the existing thermal regime and protect the stability of water resources, the proposed pipeline would remain at or near the ambient soil temperature and would not be chilled or heated for transport.</p>
15	<p>Stream Flow Regimes & Profiles - Stream characteristics and riparian areas would be restored to preconstruction conditions to the maximum practicable extent. Maintain, to the maximum extent practicable, existing surface water hydrology at waterbody crossings:</p> <ul style="list-style-type: none"> • Prevent discharges that have the potential to adversely affect waterbodies. • Stabilize cut slopes immediately when design grade is obtained. • Initiate reclamation of disturbed areas as soon as is practicable. • Ensure water withdrawals meet federal and state standards and guidelines. • Keep construction activities within the pipeline ROW and project footprint. • Perform water crossings in a manner that minimizes effects to water quality, including use of materials that do not introduce sediment or other harmful substances into waters when using isolated open cut.
16	<p>General Pipeline Stream Crossing BMPs - Attachment 12, the Pipeline Stream Crossing Construction Mode Determination, describes 32 BMPs for pipeline stream crossings and include:</p> <ul style="list-style-type: none"> • Locate extra work areas (<i>e.g.</i>, fabrication and staging areas) at least 50 feet from water's edge when practical, and no less than 30 feet from the water's edge when approved. • Locate fueling and fuel storage at least 100 feet from streams and waterbodies. When conditions require refueling within 100 feet of waterbodies, the Contractor must implement a preapproved spill prevention and cleanup plan. • Limit extra work area sizes to that needed to construct the stream crossing. • Ensure all established erosion and sediment control measures are implemented across the work area. • Store as much instream spoil on the banks as is practical (additional temporary workspace may be required). When placing spoils in the active channel, deposit spoils in long piles oriented parallel to flow to minimize erosion, avoiding areas of highest water velocity. • Construct berms or other sediment barriers to prevent saturated spoils on banks from flowing back into the waterbody. If working at a dry crossing, berms would not likely be required unless groundwater and saturated spoils are encountered. • Retain a 30-foot buffer from the stream bank of undisturbed vegetation during initial clearing, except where needed, for equipment crossing. Sediment control measures would be in place prior to construction within the 30-foot vegetation buffer. • Limit clearing of vegetation between the waterbody edge and extra work areas to the project right of way (ROW).

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
17	<p>General Pipeline Stream Crossing BMPs - (Attachment 12 Continued):</p> <ul style="list-style-type: none"> • Salvage and store vegetation layer to aid in bank reclamation following construction. • Grading of stream banks for trenching equipment would be limited to the trench line. • Grading of work areas would be directed away from the waterbody to minimize runoff entering the waterbody. • Temporary or permanent vehicle crossings may be constructed, as required. • Maintain natural stream flow rates at all times. • Retain undisturbed native soils (hard plugs) between the stream and overbank trench. These would remain in place during instream excavation to prevent diversion into the open trench. Trench plugs would be removed immediately prior to pipe placement and backfilled once the pipe is in place. • Install trench breaker (soft plug) adjacent to waterbody where consolidated soils or organic materials are prone to washing out. • If necessary, install soft plugs and dewater trench in a manner that does not cause erosion and inhibits silt-laden water from entering the waterbody. • When performing instream blasting, implement blasting methods that minimize overall shockwave, deploy air bubble curtains to dampen shockwave, limit blasting to times of least environmental/biological impact, displace fish from blast area using approved methods, use confined explosives, and avoid using ammonium nitrate based explosives. • Install approved instream sediment controls, such as sediment mats or geotextile blankets, as necessary. • Complete fabrication (welding, coating, weighting) and testing of instream pipe string well in advance of completing instream trenching activities. • Utilize “push-pull” or “float” techniques to place pipe in trench whenever conditions allow. • Place pipe in trench and backfill immediately. Restore stream channel to approximate preconstruction profile using clean gravel or native materials for the upper 1 foot of backfill. • In areas where a lease is required from SPCS or federal grant of ROW from BLM, no blasting would be done underwater or within one-quarter mile of streams or lakes with identified sensitive wildlife habitat without approval.
18	<ul style="list-style-type: none"> • Backfilling generally consists of replacing the excavated material, however, clean gravel may be used as backfill when excavated materials increase potential downstream sedimentation, increase scour potential, or do not provide sufficient groundwater flow around the pipe. Where surface material has been segregated, in the case of an armor layer overlying fine grain materials, subsurface material would be replaced in the stratified order it was removed. • Prior to backfilling, the trench would be dewatered as necessary. The pump intake shall be suspended above the trench bottom and water discharged over a well vegetated upland area with appropriate energy dissipation; splash pup, splash plate, plastic liner, non-woven sediment filter bag, or straw bale dewatering structure. Dewatering activities would be performed such that no silt-laden water is discharged to the stream. • Backfill from the center of the stream towards the bank to direct silt-laden water toward the plugs where it could be pumped and discharged. Lower bucket into water before releasing backfill. • It is the Contractor’s responsibility to meet the necessary water quality standards and requirements set forth by regulatory agencies. • No backfill crown would be placed in the waterway. Ensure that the channel profile and gradient are returned to preconstruction conditions. • Ensure backfill is well compacted on approach slopes and stream banks. • Stabilize banks and install temporary sediment barriers within 24 hours of completing instream construction. For isolated trenching, restore channel geometry and stabilize banks prior to returning flow to the watercourse. Grade banks back to preconstruction contours when practical, or to an approved stable angle of repose. • All instream work would comply with construction timing windows and conditions permitted by the appropriate regulatory agencies and applicable permits. Ideally, all instream work would be completed within 24 hours on minor streams and 48 hours on intermediate and major waterways when conditions allow. • Vegetative stabilization techniques are preferred where feasible. If soil and/or flow conditions dictate use of riprap or non-native materials (e.g. geogrids) for bank stabilization their placement must comply with authorizing agencies. • Install permanent erosion and sedimentation control measures, including revegetation of riparian areas. • Clean-up water crossing work areas immediately following backfill and erosion control installation. When winter clean-up is impacted by frozen spoils complete rough clean-up prior to breakup and final clean-up after breakup.

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19	<p>Restoring Stream Characteristics and Riparian Area - Following construction, stream characteristics and riparian areas would be restored to preconstruction conditions to the maximum practicable extent as described below by:</p> <ul style="list-style-type: none"> • Salvaging and storing the vegetation layer to aid in bank reclamation following construction. • Stabilizing cut slopes immediately when design grade is obtained and installing temporary sediment barriers within 24 hours of completing instream construction. • Ensuring backfill is well compacted on approach slopes and stream banks. • Using vegetative stabilization technique where feasible unless soil and/or flow conditions dictate use of riprap or non-native materials (e.g. geogrids) for bank stabilization • Immediately restoring stream channel to approximate preconstruction profile using clean gravel or native materials for the upper one foot of backfill
20	<p>Minimize the number of river and stream crossings</p> <ul style="list-style-type: none"> • Use existing bridges where feasible. • Use horizontal directional drilling (HDD) or other trenchless technology to minimize disturbance to water bodies. • Perform water crossings in a manner that minimizes effects on water quality. • Use materials for dam construction that do not introduce sediment or other harmful substances into waters when using the open-cut isolation method. • Use materials for the flume pipe system that do not introduce sediment or other harmful substances into waters when using the open-cut isolation method. • Position flume pipe system discharges to prevent erosion or scouring. • Use temporary bridges for transportation as practicable.
21	<p>Sediment Control Measures - At waterbody crossings, AGDC would install sediment control measures prior to and during construction and maintain the exiting surface water hydrology and bank stability to the maximum extent practicable at waterbody crossings.</p>
22	<p>Waterbody Crossings: Since the publication of the 2012 FEIS (USACE, 2012a), alignment changes have been made resulting in a reduction in the total number of waterbody crossings from 515 to 430.</p>
23	<p>Chemicals - In areas where a lease is required from SPCS or where a federal grant of ROW is required from BLM, AGDC would use only non-persistent and immobile types of pesticides, herbicides, preservatives, and other chemicals. Each chemical to be used and its application constraint would be approved by SPCS or the Authorized Officer (BLM) prior to use.</p>
24	<p>Disturbance of Natural Waters - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, all activities of AGDC in connection with the proposed pipeline that may create new lakes, drain existing lakes, significantly divert natural drainage and surface runoff, permanently alter stream or groundwater hydrology, or disturb significant areas of streambeds are prohibited unless such activities and necessary mitigation measures are approved by SPCS / BLM. The temperature of natural surface water or groundwater would not be significantly changed by the proposed pipeline or by any construction, maintenance, operation, or termination related activities so as to adversely affect the natural surface water or groundwater, unless approved by SPCS / BLM.</p>
25	<p>Erosion and Sedimentation - In areas where a grant is required from SPCS/BLM, erosion control measures would be maintained to limit induced and accelerated erosion, limit sediment production and transport, and lessen the possibility of forming new drainage channels during construction, operation, maintenance, and termination of the proposed pipeline.</p>
26	<p>Pollution Control -</p> <ul style="list-style-type: none"> • In areas where a grant is required from SPCS/BLM, in the construction, operation, maintenance, and termination of the proposed pipeline, AGDC would perform its activities in accordance with applicable air and water quality standards and related facility siting standards and plans. Mobile ground equipment would not be operated in or on lakes, streams, or rivers on state / federal land unless approved by SPCS/BLM Authorized Officer. Refueling of excavation equipment would take place at least 100 feet from any surface waterbody as a mitigation measure. • Implement a preapproved Spill Prevention, Control, and Countermeasure (SPCC) Plan, as required by 40 CFR 112 to prevent discharges of oil to waters of the U.S. • AGDC has committed to avoiding the known contaminated site areas described in Chapter 3 and any newly discovered contamination would be reported to the ADEC in accordance with their reporting requirements and handled in a manner to avoid transport of contaminated materials.
27	<p>Purchase of Materials - In areas where a grant is required from SPCS/BLM, gravel and other construction materials would not be taken from streambeds, riverbeds, lakeshores, or outlet of lakes, unless the taking is approved by SPCS Authorized Officer.</p>

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154	<p>Monitoring and Maintenance -</p> <ul style="list-style-type: none"> • The gas volume, flow, and pipe integrity would be monitored using an ILI program, block valves, and maintenance and response bases. • Water quality monitoring would be conducted, as required by the state water quality standards. Water quality and turbidity monitoring would be conducted, as required by the Alaska Pollutant Discharge Elimination System (APDES) permit.
	VEGETATION
28	<p>Removal of some aboveground facilities - Various compressor stations, the Straddle and Offtake Facility, and the NGLP were omitted from the Project, eliminating vegetation and wildlife impacts from those project elements.</p>
29	<p>Management of Invasive Plants - AGDC would develop a framework for preventing spatial dispersal of invasive plants, which could result from access road construction and use. Considerations would include seed sources, preventative measures, and monitoring and eradication procedures. Before any construction activities, any equipment brought in from outside of Alaska would be thoroughly decontaminated upon entering Alaska; any equipment stored in Alaska would be likewise decontaminated before any construction activities.</p>
30	<p>Revegetation Management - AGDC would consult with US BLM and follow Alaska Department of Natural Resources' Plant Materials Center Revegetation Manual for Alaska. The Revegetation Plan stipulates seed mixes for different geographic areas, seed application methods, and application rates (if any) for fertilizers.</p>
33	<p>Crowning - The slope over the crown is critical to stabilizing soils and directing ponding, thereby mitigating some erosion and drainage impacts. The remaining spoil material not used for backfilling and crowning would be feathered and blended across the construction corridor, creating a roughened surface to capture precipitation, decrease erosion, and provide safe sites for plant establishment.</p>
35	<p>Ditch Excavation - Construction scheduling is the most appropriate way of limiting thaw of open-ditch segments. To the extent possible, thaw-unstable soils would be excavated during winter seasons. In all cases, durations of open-ditch construction activities would be minimized. After trenching, pipe lowering in, and backfilling any compacted areas would be tracked to mitigate the compaction effects of the excavator and associated traffic, graded to facilitate drainage, covered with any available growth media (organic layer and topsoil material), and scarified to allow natural revegetation by native plants. Fertilization and/or seeding would occur in sensitive and erosive areas immediately, other areas would be allowed to revegetate naturally. If the reclamation standard of 30% cover over a 3-year period does not occur, then additional revegetation efforts would commence, per the Revegetation Plan (Appendix H).</p>
36	<p>Dust suppression - The Project would perform dust suppression using water, if necessary. The exact locations and timing of this activity is not known.</p>
37	<p>Earthwork/Re-contouring - Re-contouring would be done in a way to emphasize the use of existing drainage patterns and landform types to blend with and be compatible with the surrounding landscape to the extent practicable. Re-contouring disturbed areas would be done with site complexity in mind. Generally, revegetation of disturbed areas is planned for long-term stabilization.</p>
40	<p>Site De-Compaction - In areas that have been compacted as a result of summer construction activities and require de-compaction to facilitate revegetation, the areas would be ripped to mitigate the compaction effects of the traffic, equipment use, storage, or from other construction-related activities and other use. Site de-compaction is not intended for use in areas that would be constructed during the winter (<i>i.e.</i>, on the Arctic Coastal Plain). Identified areas would be ripped to a minimum depth of 8 to 20 inches (20 to 50 cm) prior to surface soil replacement. The equipment used to rip the soil should be operated along the contours to minimize soil erosion and facilitate soil-water retention to aid revegetation. For sloped sites, ripping along the contour would intercept runoff as it flows downslope. Revegetation actions would be performed as soon as practicable after site compaction has been alleviated. Fertilization and/or seeding would occur in sensitive and erosive areas immediately, other areas would be allowed to revegetate naturally. If the reclamation standard of 30% cover over a 3-year period does not occur, then additional revegetation efforts would commence, per the Revegetation Plan.</p>
41	<p>Workpad Construction - Granular workpads would be utilized for areas scheduled for summer construction. In wetlands overlaying thaw-unstable permafrost, the organic layer under the workpad would not be removed, as it would be detrimental to the thermal stability of the underlying permafrost. The workpad would be left in place after construction. For workpads not required for O&M, any compacted areas of the workpad would be ripped to mitigate the compaction effects of traffic, graded to facilitate drainage, covered with any available growth media (organic layer and topsoil material) and scarified to allow natural revegetation by native plants. Fertilization and/or seeding would occur in sensitive and erosive areas immediately, other areas would be allowed to revegetate naturally. If the reclamation standard of 30% cover over a 3-year period does not occur, then additional revegetation efforts would commence, per the Revegetation Plan.</p>

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42	<p>Timber Clearing, Salvage, and Utilization - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, prior to initiation of clearing operations on state / federal land, AGDC would provide SPCS/BLM with an estimate of the amount of merchantable timber, if any, which would be cut, remobilized, or destroyed in the construction and maintenance of the proposed pipeline, and would pay in advance of construction or maintenance activity, and would pay in advance the sum of money SPCS/BLM determines to be the full stumpage value of the timber to be cut, removed, or destroyed. AGDC would provide an opportunity for residents and local communities to utilize the salvaged timber. All debris resulting from clearing operations and construction that may block stream flow, delay fish passage, contribute to flood damage, or result in a streambed scour or erosion would be removed. Logs would not be skidded or yarded across any watercourse without approval. No log storage would be located within three hundred feet of any watercourse on state / federal land except with approval from SPCS/BLM.</p>
43	<p>Vegetation Clearing - For riparian vegetation clearing, vegetation would be cut off at ground level to leave the existing root systems in place to provide streambank stability. In riparian areas, the pulling of tree stumps and rooting for grading activities would be limited to the area directly over the trench line. Where conditions allow, riparian vegetation would be restored with native plant species.</p>
172	<p>Implementation of the Revegetation Plan (Appendix H), which was developed using the following resources:</p> <ul style="list-style-type: none"> • The Alaska Coastal Revegetation and Erosion Control Guide (Wright and Czaplá, 2010); • Interior Alaska Revegetation & Erosion Control Guide (Czaplá and Wright, 2012); • Strategic Plan for Invasive Weed and Agricultural Pest Management and Prevention In Alaska (ADNR, 2011); • Native Plant Revegetation Manual for Denali National Park and Preserve (Densmore <i>et al.</i>, 2000); and • NPS Invasive Plant Management Plan.
173	<p>Site-specific rehabilitation and revegetation measures determined in the plan:</p> <ul style="list-style-type: none"> • Soil de-compaction methods; • Erosion control and slope stabilization methods; • Seed species composition and application rates; • Seed application methods (hydroseeding, aerial distribution, or hand methods) • Fertilizer and/or mulch requirements, composition, and application rates; • Long-term vegetation maintenance and monitoring requirements; and • Identification of additional site treatment options if initial revegetation efforts are unsuccessful.
WETLANDS	
46	<p>Removal of some aboveground facilities - Various compressor stations, the Straddle and Offtake Facility, and the NGLP were omitted from the Project, eliminating vegetation and wildlife impacts from those project elements.</p>
48	<p>Alignment Shifts to Manage Wetland Impacts -</p> <ul style="list-style-type: none"> • A portion of the alignment was moved from Minto Flats to the upland Summer Ridge area to avoid and minimize impacts to wetlands and reduce impacts to a state game refuge. • The Fairbanks Lateral segment has shifted into rural forested ridges, away from the railroad corridor. • The alignment along the Susitna River has shifted to the west and is now closer to the floodplain than the disturbed transportation corridor. This change was made to avoid encroaching on a steep bluff and results in a slight increase in wetland impacts; • South of the Nenana River, the alignment has moved to the west of the Nenana River into undeveloped forest and away from the disturbed transportation corridor. This change was made to straighten the alignment and move onto drier terrain. The route moved onto steeper slopes but improves the crossings of streams and reduces bog crossings; and • In the Northern Ecoregion, the alignment has moved west, away from the Sagavanirktok River and the Dalton Highway transportation corridor. This change avoids several lakes, avoids higher value wetlands, and improves stream crossings.

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161	Wetland Permitting Regulations - Regulations regarding dredging and deposition of fill material would be followed; 40 CFR 230 Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material. The Section 404 of the CWA establishes protocols and policy for the discharge of fill into aquatic resources. Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences of negative impacts on the nation's water resources. Pursuant to these requirements, the district engineer would issue an individual Section 404 permit only upon a determination that the proposed discharge complies with applicable provisions of 40 CFR Part 230, including those which require the permit applicant to take all appropriate and practicable steps to avoid and minimize adverse impacts to waters of the U.S. Practicable means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall proposed Project purposes. Compensatory mitigation for unavoidable impacts may be required to ensure that an activity requiring a Section 404 permit complies with the Section 404(b)(1) Guidelines. In accordance with 33 CFR 332 Compensatory Mitigation for Losses of Aquatic Resources, compensatory mitigation must be commensurate with the amount and type of impact that is associated with a particular Department of the Army permit.
52	Minimizing Ground Disturbance - Proposed pipeline construction across wetlands would be scheduled during the winter to the maximum extent practicable and existing bridges or HDD / other trenchless technology would be used, as appropriate.
53	Avoid and minimize ground-disturbing activity in wetlands - Limit grading wetlands to the maximum extent practicable. Use mats or other types of mitigation during non-winter construction to prevent rutting. When possible, locate permanent facilities outside of wetlands. Maintain existing hydrologic systems. Use existing bridges or HDD / other trenchless technology where practicable.
56	Wetland Hydrology and Trenching - To avoid a "French-drain effect" in wetlands that are trenched for the proposed pipeline, trench breakers would be installed in the trench to stop water from flowing along the trench. In discontinuous permafrost areas, the trench breakers would be installed just outside the wetland area to keep wetland water from moving outside of the wetland. In continuous permafrost areas, the trench breakers stay in place because the bottom of the trench stays frozen, as noted in AGDC's geothermal modeling reports. The trench breakers would be water resistant and stable through the use of material designed to resist water movement (sand bags, bentonite, non-toxic spray foam, etc.) so they would not be able to be penetrated by water, eroded or moved. AGDC's thermal modeling also shows that areas near the bottom of the trench would be frozen year round, adding additional stability.
160	Over excavate and replace thaw unstable material - this technique may be a viable method in some locations; the material would be excavated and removed, and foreign material imported, requiring the mining and importation of additional select fill material to backfill the removed material. This technique could be employed in areas where very high displacement strains in near surface soils are evident, such as massive ice in a near surface strata but below the active layer.
159	Ditch Plugs and Thermosiphons: AGDC intends to institute a comprehensive monitoring program and would employ several mitigative measures to offset and minimize indirect impacts to wetlands, including a revegetation program that allows for the recolonization of the ROW by native species in non-sensitive areas and the immediate revegetation of the ROW through re-seeding in sensitive areas (AGDC, 2016e). The program would employ continual detection and field maintenance activities (AGDC, 2016b,e) and the use of thermosiphons or ditch plugs (AGDC, 2016b and AGDC, 2016c). Ditch plugs made from blocks of native sod, bentonite, or other appropriate material would be used south of MP 175 during construction. Thermosiphons would be used in select areas of discontinuous permafrost where greater permafrost stability near the surface is required; field monitoring crews observing issues such as slumping or reports of suspected thaw by in-line inspection may lead to thermosiphon placement. Thermosiphons are passive heat pipes designed for installation in select locations along the edge of the ROW to provide a thermal curtain and limit impact (AGDC 2016b,c). Thermosiphons have been used historically for areas along the TAPS ROW and for other projects, such as the Alpine horizontal directionally drilled (HDD) crossing of the Colville River. Additional ditch plugs could be used where newly identified water management efforts are required. In rare instances, where thaw or slumping are identified around permanent facilities that cannot be moved (e.g., block valves) and where a power supply is available, a stationary active refrigeration unit may be employed.
158	Re-routing within the ROW: In some cases, the field conditions encountered might be very site specific and limited. In this case, potential reroute of the ROW pad within the lateral limits of the construction ROW, could limit expected disturbance.
157	Localized active refrigeration and insulation- this measure would be considered in "extraordinary and specific conditions," such as a mechanically driven equipment that would refrigerate sections of the ground around permanent facilities where a power supply is available (e.g., use of a design similar to TAPS Pump 1 brine system). Workpad insulation would also be considered.

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
174	Surface-leveling is one possible form of intervention/mitigation that can be employed should the ROW need to be elevated from a settlement condition during operations. New backfill material is placed in the area to be re-leveled. Care must be employed, however, to ensure that the surface characteristics are not adversely affected to further advance thaw progression. Additional revegetation measures would occur on the newly disturbed areas.
	WILDLIFE
57	Removal of some aboveground facilities - Various compressor stations, the Straddle and Offtake Facility, and the NGLP were omitted from the Project, eliminating vegetation and wildlife impacts from those project elements.
58	Food and Waste Storage Mitigation Measure - Store food waste and other associated waste in containers until transferred for disposal at an approved disposal site. Strictly prohibit employees from directly feeding animals, throwing food to animals, or improperly disposing of food wastes. Transfer sanitary waste from bathrooms, sewage sludge, and kitchen associated garbage on a regular basis to ensure control of attractants. Identify kitchen grease for treatment as spoilsable waste.
59	Eagle and Migratory Bird Protection - Bald and golden eagles and their nests are protected under the Bald and Golden Eagle Protection Act. AGDC would work with federal and state agencies to employ appropriate mitigation measures to avoid or minimize impacts to eagles and comply with existing regulations. Clearing and grubbing would occur during the fall, winter, or spring and would avoid disturbance or destruction of migratory bird nests. Consult with USFWS and clear area of raptor nests prior to vegetation removal. If nest found, regardless of season, consultation is required with USFWS. A permit is required if tree removal is needed. Bald and golden eagles and their nests are protected under the Bald and Golden Eagle Protection Act. AGDC would work with federal and state agencies to employ appropriate mitigation measures to avoid or minimize impacts to eagles and comply with existing regulations.
61	<p>General Wildlife Habitat - Avoid locating pipeline facilities in sensitive wildlife habitats to the maximum extent practicable by:</p> <ul style="list-style-type: none"> • In areas where a lease is required from SPCS/or federal grant of ROW from BLM, the proposed pipeline would be maintained to avoid significant alteration of big-game movement patterns. SPCS/BLM may require additional measures to mitigate impacts to big-game movement. AGDC would coordinate with USFWS regarding any activity that has the potential to disturb polar bears. Prior to starting proposed pipeline activities, AGDC would obtain the locations of known brown bear dens from ADF&G to avoid both human/bear interactions and disturbance of bear dens. • Develop systems or mechanisms to facilitate escape of wildlife from the pipeline trench in the event wildlife becomes trapped (<i>e.g.</i>, escape ramps). • Construction activities would be scheduled to avoid effects during sensitive periods in the life cycle of wildlife to the extent practicable, including scheduling excavation activities during times of the year when major movements across the ROW occur (<i>i.e.</i>, migrations). Construction and operational activities would be avoided or minimized to the extent practicable during sensitive periods in life cycles such as moose and caribou calving, lambing season, bear denning, raptor nesting, and nesting migratory birds.
62	Human and Wildlife Interactions - Ensure construction camp operations and pipeline facility construction activities comply with measures that avoid attracting wildlife. Adopt motor vehicle and aircraft procedures that minimize disturbances to wildlife. Identify and then avoid or minimize situations where wildlife may be killed in defense of life or property.
63	Material Sites - Avoid placement of source material sites near raptor cliff nesting habitat, or remove source material outside the breeding season when adults are not in the area. The location of material sites would be in the vicinity of existing transportation routes or utility corridors. Material sites would be permitted by the federal, state, and local government agencies, and require wildlife mitigation measures.
64	Non-native Species - Barges entering the project area as part of the sealift would be cleaned according to federal and state protocols in order to mitigate against the potential spread of non-native species.
68	Zones of Restricted Activity - In areas requiring a lease from SPCS and federal grant of ROW from BLM , during periods of wildlife breeding, nesting, lambing, or calving activity, and during major migrations of wildlife, AGDC's activities on state / federal land may be restricted by SPCS/BLM with written notice. From time to time, SPCS/BLM would furnish AGDC with a list of areas where such actions may be required, together with anticipated dates of restriction. During periods of fish spawning, rearing, and migration, AGDC's activities on state / federal land may be restricted by SPCS / BLM with written notice, and the coordinator would furnish AGDC with a list of areas where such actions may be required, together with anticipated dates of restriction.
175	Revegetate and reclaim all areas of ground disturbance as soon as possible after disturbance is complete to minimize impacts to wildlife habitat. The Revegetation Plan (Appendix H) would guide the revegetation of all areas of ground disturbance.
176	Minimize vehicle and aircraft traffic to minimize disturbances to wildlife, where possible.

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
177	The buried pipeline would be designed to minimize changes to the thermal stability of the surrounding soil and water, and any associated waterbodies, which would in turn protect important bird habitat.
	FISH
70	Title 16 Permits - Temporary or permanent culverts in fish streams would require when permanent access roads cross fish-bearing streams. Title 16 permits from ADF&G would be in place and are required to maintain fish passage. Ice road construction across fish-bearing rivers and streams would also require an Title 16 Permit. These permits generally require mitigation measures and the use of Best Management Practices to minimize impacts to fishery resources.
71	Blasting - ADF&G would apply Blasting Standards to both anadromous and resident fish stream crossings, where appropriate.
73	Fisheries Contaminant Prevention - No freeze depressants would be discharged into any streams. To the maximum extent practicable, material storage, refueling activities, fueling, and related liquid storage areas would be located at least 100 feet from the bank of a fish stream.
74	Waterbody Crossing Methods - Open-cut isolation methods using flumes would only be used in waterbodies with flows that would not exceed the capacity of the flume. Open-cut isolation crossings using pumps would only be used for stream crossings where pumps could adequately transfer streamflow volumes around the work area and there are no concerns about sensitive species passage. For open-cut isolation methods, appropriate fish screening to minimize entrapment of fishes would be used. Stream simulation culverts, at least as wide as the crossing site, would be used at all road crossings too small to feasibly construct a bridge, in accordance with ADF&G consultation.
75	Fishway Required and Protection of Fish and Game Statues - The Applicant would comply with the requirements of Alaska Statutes (AS§16.05.841, Fishway Required, and AS §16.05.871, Protection of Fish and Game) regarding project-related winter ice-bridge crossings and summer ford crossings of all anadromous and resident fish streams. If necessary for winter ice-bridge crossings, natural ice thickness could be augmented (through snow removal and water application to increase ice thickness, or other techniques) if site-specific conditions, including water depth, are suitable for a crossing that would protect fish habitat and maintain fish passage. Maintain, to the maximum extent practicable, existing temperature and stream hydrologic regimes at fish stream crossings.
76	HDD Drilling - Stream crossings using HDD would have the entry and exit workspaces set back at least 50 feet from the waterbody to reduce the risk of drilling mud entering the stream. HDD drilling mud and slurry would be stored away from the waterbody in tanks, behind earthen berms, or by other methods that would prevent it from flowing off the work area. HDD activities would be continually monitored to immediately detect if any inadvertent release of drilling mud has occurred. After installation of the proposed pipeline, the HDD drilling mud would be disposed of according to applicable regulations
77	Docking and Ballasting Barges at Dock Head 3 - To stabilize the barges during offload at DH3, barges would be ballasted to the seafloor. This would require internal barge compartments to be filled with seawater by using portable pumps and hoses inserted into utility holes on the barge decks. Stability would be verified before the modules are offloaded.
78	Dredge Disposal - Winter disposal would coincide with winter dredging activity. Winter activities would eliminate potential impacts to or conflicts with migratory animals (birds and marine mammals), subsistence activities, and migratory fish routes. AGDC would seek and adhere to appropriate mitigation measures for polar bear and ice seals and would acquire needed permits and authorizations directed by the jurisdictional agencies.
79	Dredging and Screeding - Comply with any USACE requirements for sediment testing and disposal. Ensure that disposal sites are properly managed (<i>e.g.</i> , disposal site marking buoys, inspectors, the use of sediment capping and dredge sequencing) and monitored (<i>e.g.</i> , chemical and toxicity testing, benthic recovery) to minimize impacts associated with dredge material. Dredge the marine area through the ice during the winter to minimize sedimentation effects on water quality.
80	Erosion Control - To minimize erosion after the design grade is obtained, cut slopes would be stabilized immediately, and stream banks would be returned to as close to pre-construction conditions as possible. AGDC would collaborate with ADF&G to apply appropriate in-stream bank erosion structures to provide post-construction bank stability and minimize erosion. Bank and bed scour protection would be installed after the proposed pipeline is installed, as part of the trench backfilling. To protect stream banks and beds from scour erosion, site specific BMPs would be implemented based on scour and erosion potential at each site. Routine inspections would be used to identify areas of erosion, exposed pipeline, and nearby construction activities, to allow for early identification of bank stability problems and minimization of the potential for continuing environmental effects during pipeline operation.

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
81	Fish Passage - In areas where a lease is required from SPCS or federal grant of ROW from BLM, all proposed pipeline activities would be conducted as to assure free passage and movement of fish in streams designated by SPCS/BLM, in consultation with ADF&G. Temporary blockages of fish necessitated by in stream activities would be approved by ADF&G. Pump intakes would be screened to prevent harm to fish and screening specifications approved by SPCS/BLM. When abandoned, water diversion structures would be removed or plugged and stabilized unless otherwise approved by SPCS/BLM. If material sites are approved adjacent to or in certain lakes, rivers, or streams, SPCS/BLM may require AGDC to construct levees, berms, or other suitable means to protect fish and fish passage and to prevent siltation of streams or lakes.
82	Fish Spawning Beds, Rearing Areas, and Overwintering Areas - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, AGDC would protect fish spawning beds, rearing areas, and overwintering areas from sediment where soil material is expected to be suspended in water as a result of proposed pipeline activities. Settling basins or other sediment control structures would be constructed and maintained to intercept sediment before it reaches rivers, streams, or lakes. AGDC would comply with site-specific terms and conditions imposed by SPCS/BLM to protect fish spawning beds, rearing areas, and overwintering areas, and overwintering areas from the effects of proposed pipeline activities. Damage caused by AGDC's proposed pipeline activities would be repaired to the reasonable satisfaction of SPCS/BLM. AGDC would avoid disturbance to fish spawning beds, rearing areas, and overwintering areas designated by SPCS/BLM. However, where disturbances could not be avoided, proposed modifications and appropriate mitigation measures would be designed by AGDC and approved by SPCS/BLM.
83	GCF Module Offload - A rotational three-barge offload would be implemented to minimize the total offload time and reduce environmental impacts: as one barge is preparing to dock and offload, another would be offloading, while a third would have completed offloading and would be demobilizing to make room for the next inbound barge. Before the SPMTs are put into operation, all components would be checked for leaks and pressure-tested to the maximum operating pressure. Hoses would be wrapped in absorbent material, and drip trays would be placed under the power packs. Extra absorbent material and absorbent booms would be available for each SPMT unit used while in transit.
85	Material Extraction - One material site location was requested by ADF&G to provide a launch location for a boat ramp. Acute temporary impacts to hydrology and fish habitat would be mitigated by scalping rather than digging deep holes, unless otherwise authorized by ADF&G.
86	Material Mining - Outside of the North Slope, material sites would not be developed in riparian areas and floodplains providing habitat for EFH species, where possible. On the North Slope, the Sagavanirktok River floodplain is the only riverine material site being considered by the proposed Project. AGDC has worked with ADF&G on the possibility of developing sites on the Sagavanirktok River. There is existing access to these sites where material has been previously impacted. If allowed, development here would only occur under the strict guidance of ADF&G and ADNR; if permitted, the proposed Project would follow all mitigative measures required by these overseeing agencies to protect riparian areas and fish habitat. Material sites located in floodplains should not result in fish access habitats where entrapment and desiccation would likely occur. All floodplain material sites would be sloped and day-lighted to allow fish to leave the site. Any material removal and gravel mining from dewatered gravel bars of large river systems should avoid mining in flowing waters, active channels and hyporheic zones of these rivers. All gravel mining below the ordinary high water level of any fish bearing rivers would be coordinated with ADF&G and would comply with all ADF&G permit conditions and stipulations to protect EFH. Monitor turbidity for in water activities during critical fish life history stages and cease operations if turbidity exceeds predetermined threshold levels. Restore natural contours and use native vegetation to stabilize and restore habitat function to the extent practicable. Monitor the site for an appropriate time to evaluate performance and implement corrective measures if necessary. Minimize the aerial extent of ground disturbance (<i>e.g.</i> , through phasing of operations) and stabilize disturbed lands to reduce erosion.
87	Pile Installation Impact Mitigation - Vibratory pile driving would occur at West Dock. Should impact pile driving occur at other facilities, the following would be conducted to reduce impacts: <ul style="list-style-type: none"> o Install pilings through the ice in the winter to minimize potential effects on water quality o Install hollow steel piles with an impact hammer at a time of year when larval and juvenile stages of fish species with designated EFH are not present. Use a vibratory hammer when driving hollow steel piles o When impact hammers are required due to seismic stability or substrate type, drive the pile as deep as possible with a vibratory hammer before using the impact hammer
89	Pile-driving at DH3 & Causeway - To mitigate against potential noise impacts to fish and marine mammals, vibratory pile-driving technology would be used in the installation of sheet piling and mooring dolphins rather than impact pile driving (Blackwell <i>et al.</i> , 2004; Blackwell, 2005). AGDC would further adhere to guidance from the services on permits, authorizations and mitigation for all winter activities including pile driving, dredging and transport of heavy equipment or dredge spoils over sea ice.
90	Pipeline Alignment - The pipeline alignment changes and new streams and wetlands studies have resulted in the elimination of several anadromous fish stream crossings for the revised alignment.

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
92	<p>Stream Bank Protection - During construction, every effort should be made to minimize impacts to the active floodplain and channel, thereby reducing the level of site reclamation.</p> <ul style="list-style-type: none"> • To mitigate potential impacts to the proposed pipeline and restore local hydraulic conditions and habitat, bank restoration and protection would be required for trenching modes. • All stream banks should be restored to as near pre-construction conditions as possible. The stream bank elevation should be re-established to tie into existing grade. If practicable, stream banks would be stabilized and temporary sediment barriers installed within 24 hours of completing the pipeline crossing. • Ensure that erosion and sediment control measures are implemented and functional until long-term bank stabilization has been established. In thaw unstable soils where permafrost and ice lenses persist, incorporate thermal barriers as quickly as possible to inhibit thermal erosion and seepage into the proposed pipeline ROW. • Stream crossing design would not rely on bank armoring or river training works to maintain proposed pipeline integrity without substantive reasoning, such as impractical overbank construction, presence of adjacent facilities, or environmental concerns. • If conditions dictate (<i>e.g.</i>, excessively steep, unstable banks or excessive flow velocities), engineered bank protection may be required. All engineered bank protection should be designed by the Project Engineer in consultation with a qualified fluvial geomorphologist and/or qualified fish biologist.. • Natural materials, with a preference toward bio-engineered techniques would be implemented in engineered structures wherever feasible for stream bank stabilization following a stream cut.
94	<p>Construction Mitigation to Fisheries Impacts</p> <ul style="list-style-type: none"> • Each water crossing would be individually permitted and all in-stream pipeline crossing construction methods would avoid the anadromous and resident fish migration and spawning time periods for in-stream work. • In-stream pipeline construction would be completed in one-to-three days from initiation. • Necessary in-water activities would be scheduled when the fewest species/least-vulnerable life stages of federally managed species would be present.
95	<p>Vessel Operations</p> <ul style="list-style-type: none"> • Minimize contamination from ship bilge waters, antifouling paints, shipboard accidents, shipyard work, maintenance dredging and disposal, and nonpoint source contaminants from upland facilities related to vessel operations and navigation. • Maintain the barge-bridge system in place the minimum time period needed to offload the modules each open water season.
96	<p>Wastewater Discharge - Wastewater discharge locations would be planned at locations that avoid waterbodies and during periods that minimize potential impacts to fishery resources. Hydrostatic testing would occur in a manner that eliminates the potential for freeze depressants to be inadvertently discharged into a fish-bearing waterbody, as none would be used.</p>
97	<p>Waterbody Crossing - Waterbody crossings would be accomplished using several different crossing techniques including bridges, culverts, HDD, and open trenching. For all fish bearing waterbodies, ADF&G would require a Fish Habitat Permit approving the crossing type. The permit would include stipulations specific to each individual crossing.</p>
100	<p>Winter Water Withdrawal - Screens would be used on withdrawal intakes to minimize fish uptake; appropriate federal and state guidelines would be followed to determine screen sizes.</p>
102	<p>Management of Fishery Impacts</p> <ul style="list-style-type: none"> • Activity schedules would be coordinated with ADF&G to minimize impacts to fisheries resources. • A Fish Habitat Permit from ADF&G would be required for any blasting operations that occur either in or near the banks of a fish-bearing waterbody. • To minimize potential effects on fishery resources, construction activities would comply with all ADEC water quality regulations. • ADF&G and fisheries scientists would be consulted on installation of access road culverts and bridges, West Dock impacts, and proposed pipeline stream crossings.
178	<p>Logging near streams: Remove all debris that may block stream flow, delay fish passage, contribute to flood damage, or result in a streambed scour or erosion. Logs would not be skidded across any watercourse without approval. No log storage within 300 feet of any watercourse except with approval from the SPCS.</p>
179	<p>Minimize the effects of sedimentation on fish habitat. Use methods such as the construction of settling ponds and curtains to control sediment transport.</p>
180	<p>Avoid constructing crossings where redds (nests of fish eggs) are present; implement standard BMPs to ensure protection of any downstream crossings.</p>
181	<p>Timing, location and mode of stream crossings would be selected, to the degree practicable, as determined by AGDC, to minimize impacts to fish and fish habitat.</p>

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
194	Site material sites with input from ADF&G, where appropriate; duration of disruption of surface water flows would be minimized
MARINE MAMMALS	
103	Whale Mitigation Measures - Avoid concentrations of groups of whales by all vessels. Avoid multiple changes in direction and speed when within 300 yards (274 m) of whales. Vessels may not be operated in such a way as to separate members of a group of marine mammals from other members of the group. In addition, operators should check the waters immediately adjacent to a vessel to ensure that no whales would be injured. Maintain the maximum practicable distance from concentrations of marine mammals. Vessels would reduce speed to below 10 knots when within 300 yards (274 m) of whales, and those vessels capable of steering around such groups would do so. Vessels would reduce speed when weather conditions require, such as when visibility drops, to avoid the likelihood of injury to marine mammals. Vessels would avoid multiple changes in direction and speed when within 300 yards (274 m) of whales. In addition, operators should check the waters immediately adjacent to a vessel to ensure that no whales would be injured.
104	Marine Mammal Subsistence - Consult with potentially affected communities and appropriate subsistence user organizations to discuss potential conflicts with subsistence marine mammal hunting caused by the location, timing, and methods of proposed operations and support activities.
106	Marine Mammal Observer - Designate a qualified individual or individuals to observe, record, and report on the effects of project activities on polar bears and Pacific walrus and other marine mammals. Report the results of specified monitoring activities to USFWS and NMFS.
107	Marine Mammal Reporting - AGDC would consult with NMFS and USFWS regarding the need for an authorization for incidental harassment (i.e., either an Incidental Harassment Authorization [IHA] or LOA under the Marine Mammal Protection Act [MMPA], depending on the duration and type of activities covered). An IHA or LOA would include additional mitigation measures to reduce the potential for impacts to marine mammals due to incidental harassment, as defined under the MMPA.
108	Hazardous Waste Mitigation - Transport hazardous wastes off vessel for disposal at an approved facility.
111	Vessel Operations - Prior to any winter work in Prudhoe Bay, clear the area for ringed seal lairs and polar bear dens.
THREATENED AND ENDANGERED SPECIES	
113	<p>The proposed Project would include implementation of the following measures to reduce and eliminate interaction with Project personnel and Pacific walrus and polar bears:</p> <ul style="list-style-type: none"> • Proposed Project activities would not approach Pacific walrus or polar bears on ice or land closer than 805 m (0.5 mi). • Reduce/eliminate polar bear attractants. • Choose the harassment method that would have the least effect on the polar bear and increase the intensity of the method or use additional methods of harassment only, if necessary. • Ensure polar bear has escape route(s) prior to conducting harassment activity. • Monitor polar bear movement after harassment. • Implement a 24-hour monitoring plan to record and observe polar bears in the area to minimize polar bear and human interactions, thereby reducing the potential for take. • Train operation and construction crews regarding polar bear awareness. • Train operation and construction crews regarding polar bear awareness. • Shout at the polar bear as a method of harassment before using a projectile. • Report all observations of polar bears during any industry operation to the assigned USFWS biologist (or other applicable authority designated by USFWS).
114	<p>Polar Bear Denning Mitigation Measure - Prior to any winter route clearing or maintenance, clear the area for polar bear dens:</p> <ul style="list-style-type: none"> • Make efforts to locate occupied polar bear dens within and near proposed areas of operation, utilizing appropriate tools, such as, forward looking infrared (FLIR) imagery and/or polar bear scent-trained dogs and report polar bear dens to USFWS prior to the initiation of activities. • Cease work in the immediate area of previously unknown occupied polar bear dens and contact USFWS for guidance. • Observe a 1-mile operational exclusion zone around all known polar bear dens during the denning season (November-April) or until the female and cubs naturally leave the areas. • Use a 500m setback for winter vibratory hammering to protect polar bear. • Project activities would be timed to limit disturbance around polar bear dens.

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
155	Lighting - During final design stages of the project, AGDC would coordinate with USFWS with regards to birds and lighting, while taking into account the lighting safety requirements for operators.
182	Construction gravel infrastructure on the ACP and at West Dock would take place during the winter, and therefore, would not occur during bird nesting season (e.g., Steller's eider [<i>Somateria fischeri</i>] or spectacled eider [<i>Polysticta stelleri</i>]). Migratory birds would not be present during the construction on the ACP or at West Dock, as work would occur during the winter. Additionally, migrating whales are not in the area during the winter, reducing potential conflicts with whaling activities. Winter sea ice also mitigates the potential of an excavation turbidity plume.
LAND USE	
122	Land Ownership - A highway use agreement would be in place prior to construction, and would be an agreement between AGDC and ADOT&PF for how impact to infrastructure caused by construction would be mitigated.
123	Maintenance Access - In areas where a lease is required from SPCS or federal grant of ROW is required from BLM, AGDC would provide and maintain access roads and airstrips, the number and location of which shall be approved by SPCS/BLM, to ensure that AGDC's maintenance crews and representatives would have continued access.
124	Off Right-of-Way Traffic - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, AGDC would not operate mobile ground equipment off of the leased area, access roads, highways, or authorized areas, unless approved by SPCS/BLM or when necessary to prevent harm to any person.
125	Public Access - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, AGDC would regulate or temporarily prohibit public access and vehicular traffic on roads on public land, which are not managed or owned by the Alaska Department of Transportation and Public Facilities, as required for activities in the immediate vicinity of the proposed pipeline and related facilities. AGDC would provide appropriate warnings, flagging, barricades, and other safety measures when AGDC is regulating public areas. AGDC would make provisions for suitable permanent crossings for the public where the ROW crosses existing roads, foot trails, winter trails, easements, or other right of way, unless otherwise authorized by SPCS/BLM.
126	Public Improvements - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, AGDC would protect existing telephone and other transmission lines, roads, trails, fences, ditches, and like improvements during construction, operation, maintenance, and termination of the proposed pipeline. Any damages caused by AGDC to public utilities and/or improvements would be promptly repaired by AGDC to a condition which is reasonably satisfactory to SPCS/BLM.
127	Reduce Unintended Public Access - Where requested by the landowner, limit public access to the ROW for recreation or hunting by blocking entry areas with large boulders, berms, or fencing.
128	Surveillance and Monitoring - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, a surveillance and monitoring program for the proposed pipeline would be approved by SPCS/BLM prior to start-up of the proposed pipeline. The program shall be designed at a minimum to protect public and private property.
129	Waste Management - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, All waste generated in construction, operation, maintenance, and termination of the proposed pipeline would be removed or otherwise disposed of according to all local, state, and federal laws, and in a manner reasonably acceptable to SPCS/BLM.
130	ADEC Contaminated Sites - AGDC has committed to avoiding the known contaminated site areas described in Chapter 3 and any newly discovered contamination would be reported to the ADEC in accordance with their reporting requirements and handled in a manner to avoid transport of contaminated materials.
183	Prior to construction, AGDC would enter into a comprehensive agreement with ADOT&PF for the use of highways and other facilities under the jurisdiction of ADOT&PF.
184	Where a lease is required from SPCS or a federal grant of ROW is required from BLM, the creation of any permanent obstruction to the passage of small craft in streams is prohibited, unless otherwise approved by the SPCS/BLM.
185	After construction is complete, with the concurrence of AGDC, the SPCS/BLM may designate areas of the Leasehold to which the public shall have free and unrestricted access.
195	For road crossings where the proposed pipeline cannot be installed by HDD, a trench would be excavated. In such cases, a temporary bypass or bridge would be built to minimize the effects to traffic flow.
RECREATION	
132	Impacts on Recreation and Tourism - These measures may be related to restricting access, avoiding high-use periods and areas, and coordinating between the public and the recreation and tourism industry.

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
133	Reduce Unintended Public Access - Where requested by the landowner, limit public accessing to ROW for recreation or hunting by blocking entry areas with large boulders, berms, or fencing.
135	<p>Recreation Impact Mitigations - AGDC would implement the following mitigation measures that address the effects on tourism and recreations use areas:</p> <ul style="list-style-type: none"> • Retain existing public access routes and uses • Minimize activities in areas with tourist-related facilities during high use periods to the extent practicable • Minimize activities in areas with public recreation facilities during high use periods to the extent practical • Minimize creating new public vehicular access to remote areas • Minimize impacts to the existing natural landscape to the extent practicable • Schedule preconstruction work to minimize activity during peak periods of tourism and recreation • Conduct early and continuing consultation with the public, tourism, and recreation businesses • Collocate with existing and planned transportation and utility system where practicable
186	Cross the Yukon River via HDD, and evaluate crossing the Putuligayuk River, Susitna River, Montana Creek, and the Nenana River via existing or new bridge structures
VISUAL	
136	Visual Impacts to Property and Environmental Sites - Mitigation measures include; providing minimum offsets, and possibly fencing of significant environmental resources, limit or minimize the permanent ROW, but ensure adequate size to accommodate operations, maintenance, and future expansion, limit the construction ROW, application of trenchless construction methods in certain areas.
137	<p>Visual Impact Mitigations - These measures would include:</p> <ul style="list-style-type: none"> • Minimize the Construction of new permanent access roads by using snow-ice roads during construction • Restore the construction zone in a manner that facilitates reestablishment of the adjacent natural vegetation • Use root balls, salvaged native plant materials, and topsoil removed from the construction footprint for redistribution on disturbed areas where feasible. The organic layer however would not be segregated from subsoils in most location. • Maintain a screening of existing natural vegetation when the proposed pipeline is offset from a highway • Use existing disturbed areas to the maximum extent practicable for temporary construction activities such as construction camps, material stockpiling, pipe jointing, and pipe bending • Minimize locating pipeline facilities, new material sites, and construction material stockpiling in places with special visual resource values that would be visible to the public • Blend the pipeline system into the natural setting to the extent practicable when crossing places with high visual resource value • Use revegetation species that are appropriate for the general area • Re-grade construction disturbances to a condition that blends with the surrounding terrain and surface drainage patterns • Monitor reclaimed, disturbed construction areas and take remedial action where expected revegetation success is not achieved
162	For temporary and permanent facilities, use the minimum lighting intensity necessary to ensure safety, use localized task lighting, and incorporate measures (such as diffusers, lenses, and shielding) to reduce nighttime glare, light radiation, and backscatter into the sky.
163	For permanent aboveground facilities, select paint colors that blend into the background, including different shades of green, brown, or grey.
SOCIOECONOMICS	
138	<p>Socioeconomic Impact Mitigations - AGDC proposes to implement the following mitigation measures to address the effects on socioeconomics:</p> <ul style="list-style-type: none"> • Time construction activities to minimize impacts to high-use tourist and local recreation seasons (<i>e.g.</i>, wildlife viewing, hunting, snow machining, and dogsledding) • Time construction activities to minimize impacts to local business (<i>i.e.</i>, avoid summer and fall construction in recreational and tourist areas) • Develop and implement traffic control plans to minimize negative impacts to local businesses by blocking access during construction • Identify and promote work opportunities for local residents • Develop training programs for local residents so that they could be employed during construction and O&M
164	Avoid locating construction support facilities (<i>e.g.</i> , construction camps) in places with special visual resource values that would be observable to the general public, which would reduce the visual impact of these facilities and any associated impacts on private property value (UASCE, 2012a).

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
	SUBSISTENCE
140	Subsistence Whaling - AGDC would coordinate with whaling groups and agencies to employ appropriate mitigation measures to avoid and minimize disturbance of noise and vessel traffic to subsistence species and activities. AGDC would work with communities to discuss additional mitigation for barge traffic during subsistence timeframes.
142	Hunting, Fishing, Trapping, and Camping - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, with respect to AGDC's agent, employees, contractors, and the contractors' employees, AGDC would prohibit hunting, trapping, shooting, and camping within the leased area. The agents, employees, contractors of AGDC would not use project equipment, including transportation to and from the job site, for the purpose of hunting, fishing, shooting, and trapping.
143	Subsistence Activity Impact Mitigations - These include: <ul style="list-style-type: none"> • Identify locations and times when subsistence activities occur, and minimize work during these times and in these areas to the maximum extent practicable • Schedule work (e.g., blasting) to avoid conflict with subsistence activities when possible • Notify workers that subsistence activities are ongoing in the area and direct them to avoid activities that may affect the activities (e.g., not removing trap line markers)
144	Construction Mitigation to Subsistence Impacts- Time construction activities to minimize impacts to subsistence activities where possible. AGDC would work with communities to discuss additional mitigation for barge traffic during subsistence timeframes.
187	Biological Assessment Mitigation Measure: AGDC would consult with PACs and appropriate subsistence user organizations to discuss potential conflicts with subsistence marine mammal hunting caused by the location, timing, and methods of proposed operations and support activities (AGDC, 2017b). Additionally, the ASAP Biological Assessment is provided as Appendix X.
	PUBLIC HEALTH
145	Surveillance and Monitoring - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, a surveillance and monitoring program for the proposed pipeline would be approved by SPCS/BLM prior to start-up of the proposed pipeline. The program shall be designed at a minimum to provide for and protect public health and safety. In areas where a lease is required from SPCS or federal grant of ROW is required from BLM, AGDC would take all measures necessary to protect the health and safety of all persons affected by its activities performed in connection with the construction, operation, maintenance, or termination of the proposed pipeline, and shall immediately abate any health or safety hazards. AGDC would immediately notify SPCS/BLM of all serious accidents which occur in connection with such activities.
165	In areas where a lease is required from the SPCS or a federal grant of ROW is required from BLM, AGDC would use only non-persistent and immobile types of pesticides, herbicides, preservatives, and other chemicals. Each chemical to be used and its application constraint would be approved by the SPCS/BLM prior to use. Avoid or minimize construction and operational activities during sensitive periods in life cycles such as calving, denning, nesting, and migration.
166	In areas where a lease is required from the SPCS or a federal grant of ROW is required by BLM, AGDC would regulate or temporarily prohibit public access and vehicular traffic on roads on state land, which are not managed or owned by the ADOT&PF, as required for activities in the immediate vicinity of the pipeline and related facilities. AGDC would provide appropriate warnings, flagging, barricades, and other safety measures when AGDC is regulating public areas. AGDC would make provisions for suitable permanent crossings for the public, where the leasehold or access roads cross existing roads, foot trails, winter trails, easements, or other ROW, unless otherwise authorized by the SPCS/BLM. Pipeline activities shall not interfere with the public's free and unrestricted access to and upon the Leasehold, except that, with the SPCS/BLM approval, regulate or prohibit access, including vehicular traffic, to and upon the Leasehold to the extent necessary to facilitate pipeline activities, maintain pipeline integrity, or to protect the public and wildlife from hazards associated with pipeline activities. After construction is complete, with the concurrence of AGDC, the SPCS/BLM may designate areas of the Leasehold to which the public shall have free and unrestricted access.
167	Off-ROW Traffic: In areas where a lease is required from the SPCS or a federal grant of ROW is required by BLM, AGDC would not operate mobile ground equipment off of the leased area, access roads, state highways, or authorized areas, unless approved by the SPCS/BLM or when necessary to prevent harm to any person.

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
168	In areas where a lease is required from the SPCS or a federal grant of ROW is required by BLM, AGDC would promptly notify the SPCS of any fires on, or which may threaten any portion of the pipeline and shall take all measures necessary for the prevention and suppression of fires in accordance with applicable law. Use of open fires in connection with the pipeline activities is prohibited on state land unless approved by the SPCS/BLM and performed in accordance with state law.
AIR QUALITY, CLIMATE CHANGE, AND GHGs	
146	<p>Management of Air Quality Impacts - include the following:</p> <ul style="list-style-type: none"> • Implement BMPs during construction activities to mitigate fugitive dust and reduce particulate matter emissions • Use best available control technology (BACT) for combustion equipment to mitigate NOx and CO emissions • Use ultra-low sulfur diesel fuel for construction equipment and non-natural gas combustion equipment (to mitigate SO2 emissions), particulate matter emissions and volatile organic compound (VOC) emissions • Operate all combustion equipment in accordance with manufacturer’s specifications to mitigate NOx, CO, VOC, and particulate emissions resulting from incomplete combustion • Maintain emissions control equipment in accordance with manufacturer’s specifications to mitigate emissions and maintain emission control efficiency
Implement the use of Tier 4 EPA-certified engines within the FNSB PM2.5 Nonattainment Area	
188	At locations where a ROW lease from SPCS or a federal grant of ROW from BLM applies, AGDC would operate all facilities and devices used in connection with the proposed pipeline so as to avoid or minimize air pollution and ice fog. Facilities and devices that cannot be prevented from producing ice fog would be located so as not to interfere with airfields, communities, or roads.
NAVIGATION	
154	<p>Navigation</p> <ul style="list-style-type: none"> • HDD proposed at major river crossings such as the Yukon River (Alternative 1 only); • Use of existing vessel shipping lanes and transit routes; • Use of existing bridges for crossing the Nenana and Susitna rivers; • Consultation with federal and state regulatory agencies would occur prior to taking gravel from new material sites located along the Sagavanirktok River; • Approval from USACE and other federal and state regulatory agencies prior to any work in rivers or streams, as required under Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) and Section 404 of the CWA; and • Barges entering the project area as part of the sealift would be cleaned according to federal and state protocols in order to mitigate against the potential spread of non-native and invasive species.
RELIABILITY & SAFETY	
148	Monitoring Potential Frost Heave - During design the frost heave potential along the alignment would be evaluated using the available route alignment data combined with the line pipe capacities and advanced engineering simulation methodology to explore the potential interaction between the soil subsurface and the pipe during its operational life. To address the differential values along the route, soil displacements and resistance values would be estimated using the landform characteristics along the route derived from the project geo-database. Periodic monitoring would identify locations that are of concern with respect to the pipe structural integrity.

Mitigation Measure ID	Applicant-Proposed Mitigation Measure
149	<p>Pipeline design mitigation measures - For the pipeline route segments where the estimated heave potential may exceed the ability of the pipe to withstand the imposed displacement, a number of mitigation options could be employed to reduce the potential for deleterious movement including:</p> <ul style="list-style-type: none"> • Reroute within the alignment corridor to a non-frost-susceptible terrain unit, if available and investigate the subsurface of the suspect terrain segment more closely so as to reduce the conservatism inherent in the station to station approach. • Insulate the pipe ditch to reduce the heat flux through the frost-susceptible soil and increase the pipe wall thickness to increase the resistance of the pipe to ditch displacements, as well as increasing the ability of the pipe to withstand higher displacements. • Over-excavate the frost-susceptible soil beneath the buried pipeline and replace with non-frost-susceptible soils. • Excavate soils with high uplift resistance above the pipe springline and replace with soils with low uplift resistance. • Elevate the pipeline aboveground, placing it in an embankment. Elevating the pipe would reduce or eliminate the heat extracted from the ground and elevate the pipeline aboveground, placing it on overhead supports. Elevating the pipe would eliminate the heat extracted from the ground and uncouple the pipe from the soil resistance. • Heat trace the soil underneath the pipe to counteract frost penetration and emplace stand-alone heat pipes to freeze the soil quickly, reducing the ability of the frost-susceptible soil to cause large soil volume changes.
151	<p>Fire Prevention and Suppression - In areas where a lease is required from SPCS or a federal grant of ROW is required from BLM, AGDC would promptly notify SPCS/BLM of any fires on, or which may threaten any portion of the proposed pipeline and shall take all measures necessary to appropriate for the prevention and suppression of fires in accordance with applicable law. Use of open fires in connection with pipeline activities is prohibited on public lands unless approved by SPCS / BLM and performed in accordance with state or federal law.</p>
NOISE	
189	<p>Schedule pipeline construction within the Denali NPP Route Variation during the winter, where possible, when there is little commercial and recreational activity to minimize noise impact on recreational visitors and travelers along the Parks Highway. Work along the highway and through the commercial area would not start until after Labor Day and would occur through late November to avoid the majority of the tourist season around the commercial area and the DNP. Summer work would take place from the Nenana crossing at Moody to the Yanert Fork crossing on the east side of the Nenana River, and on the mountainside due to avalanche danger in the winter.</p>
190	<p>Maintain all construction equipment in accordance with manufacturer's specifications.</p>
191	<p>Implement mitigation measures to minimize construction impacts on recreation and tourism. These measures include:</p> <ul style="list-style-type: none"> o Restrict access (e.g., AGDC would prohibit hunting, trapping, shooting, and camping in areas where a lease is required from the SPCS); o Minimize activities in areas with tourist-related facilities during high-use periods; o Minimize activities in areas with public recreation facilities during high-use periods; o Minimize creating new public vehicular access to remote areas; o Schedule preconstruction work to minimize activity during peak periods of tourism and recreation; and o Conduct early and continuing consultation with the public, tourism, and recreation businesses.
192	<p>Where requested by the landowner, limit public access to ROW for recreation or hunting by blocking entry areas with large boulders, berms, or fencing.</p>
BENTHIC	
193	<p>Dredged materials would be placed on top of the ice in the nearshore areas and enter the water column intermittently as nearshore ice melts in the summer.</p>
196	<p>Minimize contamination from ship bilge waters, antifouling paints, shipboard accidents, shipyard work, maintenance dredging and disposal, and nonpoint source contaminants from upland facilities related to vessel operations and navigation.</p>
197	<p>Use dredged materials for the beneficial use of West Dock beach replenishment and construction where appropriate.</p>
ALL RESOURCES	
153	<p>SPCS ROW Lease Stipulations / BLM Grant of ROW Stipulations (Draft) - Stipulations are applicable to locations where the project area crosses state-owned or federally-owned land (Note: the State ROW lease applies to State lands, except Mental Health Trust, University and Railroad land; the federal grant applies to federal land except Denali NPP land (not proposed) and trust land (allotments). AGDC has worked with BLM to develop the federal grant of ROW with similar draft stipulations as the SPCS ROW lease. AGDC would use these stipulations as the basis for operations processes and procedures which would be used throughout the project area.</p>

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
1	0.00 - 2.03	Reroute improves the routing out of the GCF and improves crossings of utility corridors	Starting at MP 0, the reroute leaves the Gas Conditioning Facility (GCF) heading south. It then turns 90 degrees to the west and parallels a pipeline and associated access road for 2,500 feet. The reroute then turns south and crosses under pipelines and access road. It then turns southwest for 4,600 feet, where it crosses under a set of power lines. The reroute then heads south for about 1,000 feet where it goes between a snow fence and a well pad. The reroute then turns southwest for 1,200 feet and rejoins ASAP v6 at MP 2.03.
2	2.99 - 4.48	Reroute reduces potential impacts to fish habitat and avoids an actively eroding right bank of the Putuligayuk River.	At MP 2.99 the reroute heads southwest across the Putuligayuk River in a favorable crossing location approximately 400 feet further upstream than ASAP v6. The reroute then heads south-southwest where it crosses an aboveground pipe rack, the Spine Road and a smaller local North Slope pipeline access road before rejoining ASAP v6 at MP 4.48.
3	6.32 - 11.01	Reroute avoids the lake near MP 7.3.	The reroute departs ASAP V6 at MP 6.32 and goes in a south-southwest direction for approximately 8,800 feet bypassing several lakes that are crossed by the ASAP v6 alignment. The reroute then turns south for 3.25 miles rejoining ASAP v6 at MP 11.01.
4	26.34 - 48.68	Reroute shortens alignment and improves construction access.	The reroute moves closer to the Dalton Highway. This reroute begins at MP 26.34 and rejoins ASAP v6 at MP 48.68.
5	68.43 - 71.06	Reroute shortens alignment and improves construction access.	The reroute moves closer to the Dalton Highway. This reroute begins at MP 68.43 and rejoins ASAP v6 at MP 71.06.
6	71.94 - 78.09	Reroute moves the alignment onto the fall line and away from existing drainage near MP 72. Between MP 72 and MP 78.09 the AKLNG route was selected because the two routes were closely aligned.	This reroute moves the alignment, near MP 72, to the north by approximately 75 feet to avoid drainage issues. The reroute then follows the AKLNG route through the Sag. River floodplain. The reroute begins at MP 71.94 rejoins ASAP v6 at MP 78.09.
7	82.05 - 83.76	Reroute avoids stream crossing at meander bends, beaded pools and reduces crossing of wet areas. The reroute also improves routing down the fall line and along a ridge.	This reroute improves stream crossings and routing across hilly terrain. The reroute begins at MP 82.05 and rejoins ASAP v6 at MP 83.76.
8	84.28 - 85.52	Reroute reduces and improves stream crossings and avoids higher value wetlands. Reroute also reduces sidehill work.	The reroute is proposed to avoid higher value wetlands, remove cross-slopes and improve constructability. The reroute begins at MP 84.28 and rejoins ASAP v6 at MP 85.52.
9	87.08 - 88.75	Reroute improves stream crossing and removes some sidehill work.	The reroute crosses the stream at a location with better stream bank stability. South of the stream crossing the route is moved east to avoid sidehill. The reroute begins at MP 87.08 and rejoins ASAP v6 at MP 88.75.
10	90.94 - 93.93	Reroute avoids larger and deeper beds of stream and improves constructability by crossing lower banks.	This reroute crosses further downstream than the ASAP v6. The reroute provides better bank stability. The reroute begins at MP 90.94 and rejoins ASAP v6 at MP 93.93.

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
11	96.24 - 114.92	Reroute moves the alignment off of some sidehill. Portions of the AKLNG route were adopted because the two routes are closely aligned.	The reroute runs parallel to the ASAP v6 alignment where it moves to the alignment to the top of a ridge at MP 101. The reroute begins at MP 96.24 and rejoins ASAP v6 at MP 114.92.
12	120.58 - 122.52	Reroute shortens the alignment and improves the crossing location of the Dalton Highway.	The reroute takes a straighter approach across an unnamed stream at MP 121.75. This shortens the length and improves the Dalton Highway crossing location. This reroute begins at MP 120.58 and rejoins ASAP v6 at MP 122.52.
13	124.19 - 138.34	Reroute straightens and shortens the alignment by over two miles.	The reroute shortens the alignment by leaving V6 near MP 129 running southwest where it crosses TAPS and the Dalton Highway at a new location near MP 138.3. This reroute begins at MP 124.19 and rejoins ASAP v6 at MP 138.34.
14	146.39 - 147.25	Reroute reduces potential fish habitat impacts along ASAP v6 and improves construction access.	This reroute moves the Atigun River crossing to the west side of TAPS to reduce fish habitat impact, avoids a high bank on the north side of the river and improves construction access. The reroute begins at MP 146.39 and rejoins ASAP v6 at MP 147.25.
15	149.41 - 163.85	Reroute eliminates two Dalton Highway crossings. Portions of the AKLNG route were adopted because the two routes are closely aligned.	The reroute was selected to avoid two Dalton highway crossings. The reroute begins at MP 149.41 and rejoins ASAP v6 at MP 163.85.
16	164.54 - 164.84	Reroute moves away from unstable soils.	This reroute moves the alignment to the east to avoid an area of suspected slope instability at MP 164.68. The reroute begins at MP 164.54 and rejoins ASAP v6 at MP 164.84.
17	169.47 - 170.70	Reroute moves stream crossing to a wider area that has less scour potential and improves constructability. Portions of the AKLNG route were adopted because the two routes are closely aligned.	The reroute moves a stream crossing to a wider area with less scour potential. The reroute also improves the Dalton highway crossing location. The reroute begins at MP 169.47 and rejoins ASAP v6 at MP 170.70.
18	171.43 - 173.37	Reroute improves constructability at the summit and the Dalton Highway crossing. Portions of the AKLNG route were adopted because the two routes are closely aligned.	The reroute moves further from the Dalton Highway at the summit. The reroute also adjusts the angle of the Dalton Highway crossing at MP 173.37. The reroute begins at MP 171.43 and rejoins ASAP v6 at MP 173.37.
19	175.46 - 176.13	Reroute moves away from suspected palsa located near MP 175.6.	This reroute moves the alignment to the east to avoid a suspected palsa. The reroute begins at MP 175.46 and rejoins ASAP v6 at MP 176.13.
20	176.38 - 176.62	Reroute moves the alignment away from the DOT/PF graded area.	This reroute moves the alignment further upslope behind the DOT/PF facility at Chandalar to avoid a graded area. The reroute begins at MP 176.38 and rejoins ASAP v6 at MP 176.62.
21	178.28 - 178.87	Reroute avoids sidehill slopes and straightens out the approach above Chandalar Shelf.	This reroute realigns the pipeline at the top of Chandalar Shelf. The reroute begins at MP 178.28 and rejoins ASAP v6 at MP 178.87.

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
22	181.27 - 183.95	Reroute shortens floodplain crossings of the creek at MP 182.2 and the Dietrich River and improves the location of the TAPS crossing. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute moves the creek crossing at MP 182.2 upstream. It then crosses the Dietrich River at a better location to shorten the floodplain width. In addition, the reroute also moves the TAPS crossings. This reroute begins at MP 181.27 and rejoins at MP 183.95.
23	185.13 - 196.30	Reroute moves the alignment further upslope away from Dalton Highway, improves the approach to Nutirwik Creek and improves the Dalton Highway crossing. Portions of the AKLNG route were adopted because the two routes are closely aligned.	Starting at MP 185.13, this reroute moves the alignment further to the east (uphill) of the Dalton Highway on generally drier terrain. The reroute improves the approach to Nutirwik Creek at MP 189 and shortens the length of the Dalton Highway crossing at MP 194.85. The reroute begins at MP 185.13 and rejoins ASAP v6 at MP 196.30.
24	204.04 - 206.10	Reroute moves the PI to near MP 204, north out of drainage and on to flatter ground. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute moves a PI bend to an area with less sidehill. This reroute begins at MP 204.04 and rejoins ASAP v6 at MP 206.1.
25	208.00 - 208.12	Reroute improves the Dalton Highway crossing.	The reroute changes the angle of a Dalton Highway crossing. This reroute begins at MP 208.00 and rejoins ASAP v6 at MP 208.12.
26	208.48 - 209.47	Reroute eliminates encroachment into the TAPS encroachment corridor.	The reroute moves the alignment away from the TAPS encroachment corridor at 208.65. The reroute begins at MP 208.48 and rejoins ASAP v6 at MP 209.47.
27	213.10 - 214.80	Reroute avoids palsas at the base of Sukakpak Mountain and improves the stream crossing near MP 214.8.	This reroute moves the alignment 200 feet east to avoid thaw sensitive soils at the base of Sukakpak Mountain. The ASAP v6 alignment crosses multiple frost blisters (palsas) which may have massive ice beneath the ground surface. The stream crossing at MP 214.8 is also improved. The reroute begins at MP 213.10 and rejoins ASAP v6 at MP 214.80
28	220.71 - 229.58	Reroute avoids Native Allotment, high frost heave potential soils, gravel pit, three major river crossings and river training structures.	This reroute moves the alignment away from a Native Allotment and gravel pit near MP 222. It also avoids three major river crossings, Middle Fork Koyukuk (2) and Hammond River. The reroute also avoids a pinch point between the Dalton Highway and TAPS between MP 228.25 -MP 229. Within this same milepost range river training structures are avoided. The reroute begins at MP 220.71 and rejoins ASAP v6 at MP 229.58.
29	230.36 - 231.97	Reroute improves the crossing of Minnie Creek, reduces the number of PI's and length.	This reroute improves the Minnie Creek crossing and straightens the alignment. The reroute begins at MP 230.36 and rejoins ASAP V6 at MP 231.97.
30	N/A	vacant	vacant

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
31	240.80 - 251.30	Reroute avoids steep terrain south of Clara Creek, avoids braided channels on Slate Creek, runs the ridge between MP 243 and MP 245, improves the crossing of Rosie Creek and improves the routing around the base of Cathedral Mountain. Portions of the AKLNG route were adopted because the two routes are closely aligned.	The reroute moves the Clara Creek crossing downstream closer to the Dalton Highway, which also avoids steep terrain. It also moves the Slate Creek crossing downstream to avoid crossing multiple channels in its floodplain. South of Slate Creek the reroute follows a ridge approximately two miles to avoid wet terrain. The Rosie Creek crossing is moved upstream to avoid steep banks. A minor reroute around Cathedral Mountain helps to avoid wet terrain adjacent to the Dalton Highway. This reroute begins at MP 240.80 and rejoins ASAP v6 at MP 251.30.
32	252.69 - 253.41	Reroute avoids a small lake.	This reroute avoids a small lake. The reroute begins at MP 252.69 and rejoins ASAP v6 at MP 253.41.
33	255.54 - 256.07	Reroute reduces the stream crossing impact.	This reroute reduces the impact to Chapman Creek and potential bank restoration efforts. The reroute begins at MP 255.54 and rejoins ASAP v6 at MP 256.07.
34	257.26 - 258.61	Reroute avoids a pinch point between the highway, small lake and gully.	This reroute moves the alignment to the west to avoid a pinch point between the highway, small lake and gully near MP 258.
35	259.47 - 260.75	Reroute avoids suspected subsurface flow.	This reroute proposed to avoid suspected subsurface flow. The reroute begins at MP 259.47 and rejoins ASAP v6 at MP 260.75.
36	262.07 - 274.66	Reroute shortens the alignment, avoids a pinch point between TAPS and the Dalton Highway, avoids a fiber optic line and removes two Dalton Highway crossings.	The reroute begins at MP 262 and stays east of the Dalton Highway and Grayling Lake. It avoids two highway crossings and a pinch point with TAPS, Dalton Highway and a fiber optic line on the west side of the lake. The Jim River crossing was also adjusted. This reroute begins at MP 262.07 and rejoins ASAP v6 at MP 274.66.
37	282.26 - 282.77	Reroute improves the Prospect Creek stream crossing.	This reroute provides a wider, flatter crossing with less scour potential and less impact to fish habitat of Prospect Creek. The reroute begins at MP 282.26 and rejoins ASAP v6 at MP 282.77.
38	283.01 - 292.05	Reroute moves alignment onto fall line, avoids wetter terrain and oxbow lakes. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute starts south of Prospect Creek and includes minor adjustments for terrain, avoids oxbow lakes and adjusts the Bonanza Creek crossing. This reroute begins at MP 283.01 and rejoins ASAP v6 at MP 292.05.
39	297.46 - 298.72	Reroute aligns with fall line.	This reroute moves the alignment onto the fall line on either side of Fish Creek. This reroute begins at MP 297.46 and rejoins ASAP v6 at MP 298.72.
40	305.82 - 313.40	Reroute avoids Old Man Camp, avoids private property, moves TAPS crossing to an aboveground location and moves the Dalton Highway crossing. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute avoids Old Man Camp at MP 306.5. It also avoids private property near MP 311. The buried TAPS crossing near MP 313.1 was relocated to near MP 311.5 where TAPS is aboveground. The Dalton Highway crossing is also moved to approximately 311.5. This reroute begins at MP 305.82 and rejoins ASAP v6 at MP 313.4.

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
41	335.31 - 338.39	Reroute minimizes impact to wetlands and avoids a rock outcrop.	This reroute moves the alignment further to the west to avoid a large area of wet, boggy marsh. The reroute also avoids a rock outcrop located at MP 337.8. The reroute begins at MP 335.31 and rejoins ASAP v6 at MP 338.39.
42	340.29 - 341.24	Reroute removes an unnecessary PI.	This reroute removes an unnecessary PI resulting in a slight adjustment. The reroute begins at MP 340.29 and rejoins ASAP v6 at MP 341.24.
43	342.25 - 342.36	Reroute improves the Dalton Highway crossing.	This realignment adjusts the crossing angle of the Dalton Highway. The reroute begins at MP 342.25 and rejoins ASAP v6 at MP 342.36.
44	348.16 - 356.65	Reroute moves the Dalton Highway crossing to a better location, avoids Native Allotments, avoids a wastewater treatment facility and moves the alignment out of highly incised stream channel. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute starts near MP 348 and moves the nearby Dalton Highway crossing further south. The reroute avoids a Native Allotment located near the Hot Spot Cafe at MP 353.5. South of MP 356, the alignment has been moved to the east to avoid a Native Allotment. The reroute begins at MP 348.16 and rejoins ASAP v6 at MP 356.65.
45	356.86 - 357.53	Reroute moves the Yukon River HDD exit point onto flatter terrain on the south bank.	This is a reroute of the Yukon River crossing due to detailed design completed for the Special Design Area (SDA). The reroute begins at MP 356.86 and rejoins ASAP v6 at MP 357.53.
46	358.30 - 358.59	This is a reroute of the Yukon River crossing due to detailed design completed for the Special Design Area (SDA). The reroute begins at MP 356.86 and rejoins ASAP v6 at MP 357.53.	This reroute provides a perpendicular crossing with TAPS so that the alignment fits between the VSMs. The reroute begins at MP 358.30 and rejoins ASAP v6 at MP 358.59.
47	370.39 - 372.69	Reroute improves construction access to TAPS crossing. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute relocates the TAPS crossing to an open area where it is not pinched against the Dalton Highway to the south. This reroute begins at MP 370.39 and rejoins ASAP v6 at MP 372.69.
48	373.02 - 373.66	Reroute reduces sidehill slopes and encroachment onto TAPS encroachment corridor.	This reroute moves the alignment from a sidehill onto flatter terrain for ease of construction and moves further from TAPS. The reroute begins at MP 373.02 and rejoins ASAP v6 at MP 373.66.
49	388.27 - 388.65	Reroute improves stream crossing and avoids probable high quality fish habitat.	This reroute avoids a meandering section of stream channel and narrow working area between meander and pipeline. Reroute also avoids probable high quality fish habitat. The reroute begins at MP 388.27 and rejoins ASAP v6 at MP 388.65.
50	401.00 - 408.44	Reroute improves the Tolovana River crossing and moves the alignment east to drier terrain. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute starts near MP 401 and moves west further from TAPS, then to an improved Tolovana River crossing. From there it moves upslope to reduce wet terrain. The reroute begins at MP 401.00 and rejoins ASAP v6 at MP 408.44.
51	426.14 - 429.40	Reroute improves the Tatalina River crossing.	This reroute avoids an eroding cut bank and a bend of the Tatalina River. The reroute begins at MP 426.14 and rejoins ASAP v6 at MP 429.40.
52	434.47 - 437.54	Reroute avoids small lakes, adjusts the Chatnika River crossing and avoids a private property south of the river. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute moves further away from a private parcel south of the Chatnika River. It also avoids two small lakes. The reroute begins at MP 434.47 and rejoins ASAP v6 at MP 437.54.

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
53	440.18 - 451.96	Reroute moves alignment away from Native Allotments and upslope to drier terrain. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute runs along the toe of the hills to avoid several Native Allotments and to run upslope in drier terrain. This reroute begins at MP 440.18 and rejoins ASAP v6 at MP 451.96.
54	452.82 - 462.76	Reroute minimizes impacts to wetlands and avoids private property.	This reroute generally runs on drier terrain and moves west to avoid several private parcels. The reroute begins at MP 452.82 and rejoins ASAP v6 at MP 462.76.
55	463.90 - 466.44	Reroute minimizes impact to wetlands and avoids private property.	This reroute moves the alignment to the west to avoid bisecting a large marshy area located at MP 465. Reroute then heads due south to avoid a private parcel at MP 466. The reroute begins at MP 463.90 and rejoins ASAP v6 at MP 466.44.
56	468.69 - 469.22	Reroute avoids Native Allotments.	This reroute moves the alignment east to avoid Native Allotments which cross the Parks Highway. The reroute begins at MP 468.69 and rejoins ASAP v6 at MP 469.22.
57	471.99 - 508.32	Reroute avoids private property, Native Allotments and improves the Nenana River crossing. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute moves the alignment east to avoid impacting the private parcel at MP 473. The crossing of the Nenana River is also moved downstream. The reroute also avoids a series of private parcels and Native Allotments between MP 486.5 - MP 491 and MP 493 - MP 495. After crossing the Parks Highway, the reroute follows drier terrain along the Nenana River floodplain on the east side of the Parks Highway. The reroute begins at MP 471.99 and rejoins ASAP v6 at MP 508.32.
58	509.27 - 527.91	Reroute avoids private property and Native Allotments in and around town of Healy. It also moves to a location which provides more space to cross the Healy Fault. Portions of the AKLNG route were adopted because the two routes are closely aligned. Reroute minimizes impacts to a nearby subdivision, as well as recreation and tourism	This reroute follows drier terrain along the Nenana River floodplain on the east side of the Parks Highway to approximately MP 518. It crosses the highway and turns south to avoid the town of Healy and improves the crossing at Dry Creek. After passing Otto Lake, it turns east to rejoin the ASAP v6 corridor near MP 525. This reroute begins at MP 509.27 and rejoins ASAP v6 at MP 527.91. The route does not impact Hilltop Rd.
59	535.77 - 579.00	Reroute reduces sidehill, improves crossings of the Nenana and Jack rivers, relocates the Denali Fault crossing to a more accessible area and avoids private property and Native Allotments. Portions of the AKLNG route were adopted because the two routes are closely aligned.	From MP 549 to MP 551 the reroute moves east out of a wetlands complex between the highway and Intertie. Starting at MP 555 the alignment is shifted closer to the highway bridge crossing the Nenana River. West of the river, near MP 556, the reroute turns south to the Denali Fault. After crossing the Denali Fault the reroute heads southwest, crossing Reindeer Mountain and generally following the Intertie to by-pass Cantwell. The reroute crosses the Jack River adjacent to the old highway bridge alignment south of Cantwell. The reroute heads west to a crossing of the Parks Highway and the AK RR near MP 567. After crossing the railroad, the reroute continues southwest avoiding the Summit airstrip and then reconnecting at MP 579. The reroute begins at MP 535.77 and ends at MP 579.

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
60	579.82 - 580.78	Reroute improves Middle Fork Chulitna River crossing and avoids probable high quality fish habitat.	This reroute moves the Middle Fork Chulitna River crossing upstream to avoid probable high quality fish habitat. The reroute begins at MP 579.82 and rejoins ASAP v6 at MP 580.78.
61	582.14 - 600.11	Reroute refines several stream crossings, straightens the alignment and moves onto drier terrain. Portions of the AKLNG route were adopted because the two routes are closely aligned.	The reroute begins at MP 582 and changes the AK RR and Parks Highway crossings then heads south to a new crossing of the East Fork Chulitna River. From there it generally follows the existing power lines from MP 584 to MP 590. Then it moves upslope improving the stream crossing at Antimony Creek, Honolulu Creek and Little Honolulu Creek. This reroute increases sidehill slopes between MP 590 and MP 597, however, it reduces crossings of string bogs. This reroute begins at MP 582.14 and rejoins ASAP v6 at MP 600.11.
62	602.58 - 603.00	Reroute moves railroad crossing onto drier ground.	This reroute moves the railroad crossing south onto drier ground. The reroute begins at MP 602.58 and rejoins ASAP v6 at MP 603.00.
63	606.17 - 607.00	Reroute avoids having to remove a beaver dam and potentially resulting in large scale impacts on upstream wetlands.	This reroute moves the road crossing about 1,000 feet north along the Parks Highway. Construction at the current site would remove a beaver dam and potentially have large scale impacts on upstream wetlands. The reroute begins at MP 606.17 and rejoins ASAP v6 at MP 607.
64	609.55 - 610.49	Reroute improves stream crossing.	The reroute moves the alignment off of a deeply incised channel to flatter, but wetter, terrain. This reroute begins at MP 609.55 and rejoins ASAP v6 at MP 610.49.
65	612.34 - 613.07	Reroute reduces impacts to wetlands.	The reroute moves the alignment onto drier terrain and avoids a wetland at MP 612.9. This reroute begins at MP 612.34 and rejoins ASAP v6 at MP 613.07.
66	616.55 - 617.41	Reroute straightens out the alignment and moves it onto a dry ridgeline.	This reroute moves the alignment onto a ridgeline, out of wet areas along ASAP v6. This reroute begins at MP 616.55 and rejoins ASAP v6 at MP 617.41.
67	623.98 - 667.09	Reroute reduces visual impacts to the Veterans Memorial, moves to drier terrain and improves stream and river crossings. It avoids probable high value spawning habitat. Portions of the AKLNG route were adopted because the two routes are closely aligned.	This reroute reduces the visual impacts of cutting a right of way close to the highway opposite the Veterans Memorial. The Chulitna River crossing is shifted upstream to a narrower section. The south end of the reroute generally straightens the alignment and stays off of sidehill areas and avoids boggy areas around Trapper Creek. The reroute includes a realignment upstream by approximately 300 feet on Rabideux Creek MP 633. This reroute begins at MP 623.98 and rejoins ASAP v6 at MP 667.09.
68	669.01 - 670.86	Reroute avoids encroaching on a steep bluff by removing a PI.	This reroute moves the alignment off of a bluff area associated with the Susitna River floodplain. The reroute begins at MP 669.01 and rejoins ASAP v6 at MP 670.86.

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
69	671.87 - 672.43	Reroute avoids pool habitat in an anadromous fish stream.	This reroute avoids pool habitat in an anadromous fish stream. The reroute begins at MP 671.87 and rejoins ASAP v6 at MP 672.43.
70	673.97 - 678.16	Reroute avoids two Native Allotments and the Montana Creek State Recreational Area.	This reroute avoids the Montana Creek State Recreation Area (MP 675) and two Native Allotments at MP 674.75 and MP 677 respectively. The reroute increases the length and complexity, and adds two arterial road crossings. It increases the number of private parcels impacted but avoids impacting the Montana Creek State Recreation Area. It is not feasible to follow the railroad through the State Recreation Area. The Goose Creek stream crossing moves to the east side of the Parks Highway. This reroute begins at MP 673.97 and rejoins ASAP v6 at MP 678.16.
71	683.65 - 686.86	Reroute moves alignment out of a string bog and avoids bisecting private properties.	The reroute moves west out of a string bog between MP 685.5 and MP 686.2. Where possible, private parcels were avoided. The reroute also moves the crossings of Sheep Creek Slough and Caswell Creek slightly down stream at MP 684.15 and MP 686.3, respectively. The reroute begins at MP 683.65 and rejoins ASAP v6 at MP 686.86
72	688.64 - 692.24	Reroute avoids wetlands and lessens the impacts to private property.	This reroute avoids a large bog between MP 688.7 and MP 689.6. The reroute heads east from MP 689.6 crossing the highway to join the railroad right of way. It then follows the railroad south to rejoin ASAP v6 at MP 692.24. The reroute begins at MP 688.64 and rejoins ASAP v6 at MP 692.24.
73	698.00 - 700.07	Reroute avoids braided channels along Willow Creek.	This reroute moves the crossing of Willow Creek further downstream to avoid braided channels along ASAP v6. The reroute also moves the road crossing of Willow Creek Parkway 2,000 feet to the north. The reroute begins at MP 698 and rejoins ASAP v6 at MP 700.07. Many of the proposed roads in this area have been removed. Currently only one road accesses the alignment in this area.
74	706.78 - 712.11	Reroute avoids crossing wetlands and reduces overall wetland impacts.	This reroute avoids a wetland crossing and reduces overall wetland impacts. The reroute begins at MP 706.78 and rejoins ASAP v6 at MP 712.11.
75	716.80 - 718.33	Reroute reduces sidehill slopes.	This reroute moves the alignment to the west away from unstable soils and uneven terrain. The reroute begins at MP 716.80 and rejoins ASAP v6 at MP 718.33.

PIPELINE ROUTE REFINEMENT FORM (MAINLINE)

Change #	Milepost	Reason	Pipeline Centerline Changes
76	404.89 - 434.47	Reroute increases amount of summer construction, reduces operations and maintenance costs and reduces wetland impacts.	This reroute moves the alignment to the east to avoid the wetter terrain in and around the waterbodies of the Tolovana River, Vigor Creek and Tatalina River. The reroute follows a north/south running ridgeline on higher and drier terrain. The reroute will also allow for summer construction as opposed to currently scheduled winter construction. Operations and maintenance will be easier on the ridge as opposed to ASAP v6. The reroute begins at MP 404.89 and rejoins ASAP v6 at MP 434.47.

PIPELINE ROUTE REFINEMENT FORM (FAIRBANKS LATERAL)

Change #	Milepost	Reason	Description
1	0 - 4.03	Reroute adjusts the alignment to avoid crossing a pond, wetlands and other kettle lakes. Reroute more closely follows the proposed ASAP access road and fall line to the top of the ridge.	The alignment was adjusted to avoid crossing a pond, wetlands and other kettle lakes. The reroute also improves routing to the east by following the proposed ASAP access road and staying on the fall line. This alternate moves the mainline tie-in south approximately 2,000 feet. This reroute begins at MP 0.00 and rejoins Fairbanks v4 at MP 4.03.
2	7.70 - 11.4	Reroute avoids military property.	The reroute avoids Military property. It begins at MP 7.70 and rejoins Fairbanks v4 at MP 11.40.
3	18.84 - 20.21	Reroute uses more of the existing fire break, reduces the elevation drop from the ridge to creek bottom and improves construction access.	Reroute extends the alignment along the fire break that parallels Old Murphy Dome Road, then turns south to cross Old Murphy Dome Road and down the fall line to rejoin the alignment. This reroute takes advantage of construction access within the fire break. The reroute begins at MP 18.84 and rejoins Fairbanks v4 at MP 20.21.
4	21.21 - 22.38	Reroute avoids private property by following existing power lines.	The reroute avoids private property. This reroute begins at MP 21.21 and rejoins Fairbanks v4 at MP 22.39.
5	26.94 - 27.81	Reroute avoids developed areas, reducing the Class 2 pipeline length.	The reroute avoids developed areas, thus reducing length of Class 2 pipe required. This reroute begins at MP 26.94 and rejoins Fairbanks v4 at MP 27.81.

NOTABLE REFINEMENT OF OFF-ROW FEATURES

Change #	Feature	Milepost	Reason	Description
1	Material Source*	228 - 231	Configuration of material source boundary avoids impacts to viewshed, on the hillside across from Wiseman.	The boundary of the material site across the Dalton Hwy near Wiseman does not encroach upon the hillside. Expanding the disturbed land laterally rather than up in elevation eliminates impacts to the viewshed.
2	Material Source	437-439	Design avoids impacts of Material Sites to a state game refuge.	Material Source Investigation Areas that were located in Minto Flats State Game Refuge were not selected and removed
3	Access Road**	450 - 451	Redesign avoids impacts to wetlands, wildlife, existing road alignment and nearby communities.	Use of Standard Creek Rd to access material sites would have required expanding the road to 25.5 miles in length and adjusting the alignment of the existing road. This would have been to access material sources, which have been eliminated in this location.
4	Construction Camp	698 - 707	Redesign avoids impact to Willow Creek State Rec Area; minimizes impacts to lands used heavily for recreation and closer to the community.	The 1,000 person construction camp (Rustic Wilderness) was relocated 9 miles north, out of the Willow Creek State Rec Area to an area in a more expansive, forested area on State of Alaska land. This is further away from homes and recreational areas.
5	Material Source	704 - 710	Redesign avoids impacts of these sites to recreation and the Willow community.	Two material sources in Willow near the Willow State Rec Area were removed from project footprint. This avoids impacts associated with winter trail use and other activities, and it keeps Material Sites out of more densely populated areas in the community.

*Note: As discussed with the Corps of Engineers, 162 Material Source Investigation Areas have been culled to 89 delineated Material Site locations, which have now been incorporated into the Project Design. The Material Site boundaries are a small percentage of the Investigation Areas that were previously under consideration. The rationale for the configuration or removal of material sites in three notable locations is provided in this table.

**Note: Access Road shapefiles will be delivered on 1/30/15, manifesting additional refinements in this feature class. The fate of this one particular road was known prior to delivery of the final design files.