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SECTION 4C-1
DIRECT AND INDIRECT IMPACTS – SUB-ALTERNATIVE C-1

4C-1.1 INTRODUCTION

This section provides an analysis of the environmental consequences that would result from implementation of Sub-Alternative C-1 – CPAI Development Plan and Sub-Alternative C-1 – FFD.

Sub-Alternative C-1 differs from Alternative A principally by including a more southerly bridge location over the Nigliq Channel, a road connection to Nuiqsut, a southerly road and pipeline route to CD-6 and CD-7, and road connections to all production pads, including those in the lower Colville River Delta. This alternative also contrasts with Alternative A by requiring a minimum pipeline height of 7 feet and placing powerlines on separate poles rather than on VSMs. There would be no 2-inch products pipelines to production pads. Exceptions to the same Northeast National Petroleum Reserve-Alaska IAP/EIS stipulations as for Alternative A would be required. Use of roads on BLM lands would be unrestricted. Industry and local residents would have access to other roads.

Under Sub-Alternative C-1 – FFD, roads would link all production pads to processing facilities, CD-1, and Nuiqsut. Roads in the Colville River Delta also would be constructed.

4C-1.2 PHYSICAL CHARACTERISTICS

4C-1.2.1 Terrestrial Environment

4C-1.2.1.1 Physiography

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON PHYSIOGRAPHY

CONSTRUCTION PERIOD

Effects on physiography would result from changes to landforms by construction of roads, production pads, and gravel mines. The impacts are therefore similar to those discussed in Section 4A.2.1.1 for Alternative A.

Areas that would experience direct physiographic effects from gravel mining operations include approximately 86 acres (see Section 4C-1.2.1.4) of gravel mine sites. Areas that would experience direct physiographic impacts from placement of gravel on tundra include 323 acres (see Tables 2.4.3-2 and 2.4.3-3).

OPERATION PERIOD

Impacts during the operation period would be similar to those for Alternative A.

ABANDONMENT AND REHABILITATION

Impacts of abandonment under Sub-Alternative C-1 would be similar in nature to those for Alternative A, but Sub-Alternative C-1 may leave greater marks on the physiography than Alternative A because Sub-Alternative C-1 would construct approximately 16 more miles of roads. Also, the impacts, whether of leaving roads and pads in place or removing them, will affect lands closer to Nuiqsut.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON PHYSIOGRAPHY

Areas where gravel mining operations would directly affect physiography encompass approximately 365 acres. Areas that would experience direct physiographic impacts from placement of gravel on the tundra encompass 1,225 acres.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON PHYSIOGRAPHY

Impacts to physiography would occur primarily during the construction phase and result from changes to landforms by construction of roads, pads, airstrips, and mine sites. If not properly designed and constructed, these landform changes can adversely affect thermal stability of the tundra and hydrology through thermokarsting and increased ponding.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR PHYSIOGRAPHY

No measures have been identified to mitigate impacts to physiography under Sub-Alternative C-1 or Sub-Alternative C-1 – FFD.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR TERRESTRIAL VEGETATION AND WETLANDS

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.2.1.2 Geology

Plan Area geology is comprised of marine limestones and marine and deltaic sands and shales of Mississippian to mid-Creatceous age (Gyrc 1985a), mantled largely by Quaternary-aged fluvial and glaciofluvial sediments (Rawlinson 1993). Oil production efforts in the Plan Area target a Jurassic sandstone reservoir located in the Beaufortian Sequence (BLM 2003b).

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON GEOLOGY

CONSTRUCTION PERIOD

Direct Effects

Drilling oil production wells at the five production pad locations (CD-3 through CD-7) would directly impact the physical integrity of reservoir and overlying bedrock by pulverization and fracture. The only surface bedrock identified in the Plan Area outcrops at the bend in the lower Colville River, upstream of Ocean Point (Mayfield et al. 1988b). Sub-Alternative C-1 does not propose excavation activities in this area and would, therefore, not directly impact surface bedrock. The volume of rock impacted by drilling is insignificant compared to the total volume of bedrock within the Plan Area. Direct impacts to Plan Area bedrock during construction would produce no measurable effect and are considered negligible under this alternative.

Indirect Effects

No indirect effects to geological resources are recognized for the construction period.

OPERATION PERIOD

Direct Effects

Annular disposal or injection of Class I and II wastes would directly impact the receiving bedrock via possible propagation of existing fractures, increase of pore space pressure, and alteration of pore space composition within an approximately 0.25-mile radius of the well (40 CFR 146.69 (b)). The volume of rock impacted by waste disposal is insignificant compared to the total volume of bedrock within the Plan Area. Direct impacts to Plan Area bedrock during operation would produce no measurable effect and are considered negligible under this alternative.

Production of petroleum hydrocarbons from subsurface reservoirs constitutes an irreversible and irretrievable commitment of resources. Direct impacts to petroleum hydrocarbon resources in the Plan Area would be major under this alternative.

Indirect Effects

No indirect effects are recognized for the operation period.

ABANDONMENT AND REHABILITATION

Geology will not be impacted by abandonment activities.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON GEOLOGY

Direct and indirect impacts incurred during construction and operation of Sub-Alternative C-1 – FFD would be similar to those presented above, but would be experienced over greater spatial and temporal extents. Direct impacts to Plan Area bedrock would remain negligible under Sub-Alternative C-1 – FFD. Direct impacts to Plan Area petroleum hydrocarbon reserves would be major under this alternative.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON GEOLOGY

Under either development scenario the irreversible and irretrievable commitment of petroleum hydrocarbon resources constitutes a major impact. However petroleum hydrocarbon production is the purpose of the applicant's proposed action. Impacts to bedrock under either development scenario would be negligible.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR GEOLOGY

Mitigation of impacts to petroleum hydrocarbons would be in conflict with the purpose of the proposed action. Therefore no measures have been identified to mitigate effects to geologic resources under Sub-Alternative C-1 or Sub-Alternative C-1 – FFD.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR GEOLOGY

The effectiveness of the protective measures would be similar to that under Alternative A.

4C-1.2.1.3 Soils and Permafrost

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON SOILS AND PERMAFROST

Construction and operation of Sub-Alternative C-1 would involve impacts similar in type but different in magnitude to those presented for Alternative A (see Section 4A.2.1.3). Compared to Alternative A, Sub-

Alternative C-1 involves more road construction due to an alternate road alignment and road connections between all production pads, APF-1 and the Nuiqsut road system. Sub-Alternative C-1 also proposes construction of an overhead powerline between all pads. Except where noted, assumptions involved in the following calculations of soil and permafrost impacts do not differ from those presented in Section 4A.2.1.3. Impacts of abandonment under Sub-Alternative C-1 would be similar in nature to those under Alternative A. However, Sub-Alternative C-1 would result in greater impact than Alternative A to the thermal regime because this alternative has approximately 82 more acres of roads and pads to remove.

CONSTRUCTION PERIOD

Relative to Alternative A, Sub-Alternative C-1 adds road connections between CD-1 and CD-3, to Nuiqsut, and routes the primary road alignment between CD-4 and CD-7 southward to provide road access to Clover. These road adjustments increase the total road length from 27 to 42 miles. Increase in road miles translates to a greater need for fill, an expansion of impacts associated with excavation of fill, more culverts and bridges, and increased length of ice roads. Under Sub-Alternative C-1, 2.2 million cy of fill would overlie approximately 323 acres of tundra. This footprint would be 82 acres more than that proposed for Alternative A. Extraction of the gravel required for construction of Sub-Alternative C-1 would impact a total of 86 acres of tundra and would require a total of 89 acres of ice pad for stockpiling overburden at Clover. Temporary ice roads and adjacent ice pads would cover approximately 1,581 acres of tundra over 5 winter seasons. This area is 422 acres greater than that estimated for Alternative A. Addition of road connections between CD-1 and CD-3 and to Nuiqsut and rerouting the primary road alignment increases the number of bridges required Sub-Alternative C-1 to eight, and the area of ice pads associated with bridge construction to 235 acres. Installation of 450 culverts, 620 power poles, and 4,059 VSMs under Sub-Alternative C-1 would disturb approximately 9,300, 1,177, and 14,500 cy of soil, respectively. Because power cable can be carried in a tray supported by pipeline VSMs, construction of a separate overhead powerline represents an additional impact. Impacts associated with water discharges to the tundra and tundra travel during the construction period are assumed to be the same magnitude as would be experienced under Alternative A.

OPERATION PERIOD

Additional road miles would increase the indirect impacts associated with road travel and maintenance occurring during the operation period. Greater dust fallout and accumulations of plowed snow and sprayed gravel would enlarge the area thermal impacts experienced by active layer soils and permafrost. The area of thermal impact calculated for Sub-Alternative C-1 is 1,745 acres; 593 more acres than Alternative A. Operation period impacts associated with tundra travel, transmission of warm reservoir fluids, sub-permafrost injection of waste, and accidental oil spills are assumed to be of the same magnitude as would be experienced under Alternative A.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON SOILS AND PERMAFROST

Construction and operation of Sub-Alternative C-1 – FFD would involve impacts similar in type but different in magnitude to those presented for Alternative A – FFD as described in Section 4A.2.1.3. Compared to Alternative A – FFD, Sub-Alternative C-1 – FFD connects all HPs, HPFs and Nuiqsut with gravel roads and overhead pipelines. Pipeline and road alignments do not differ from those proposed under Alternative A – FFD.

CONSTRUCTION PERIOD

Relative to Alternative A – FFD, Sub-Alternative C-1 – FFD adds road connections to HP-7, HP-12, HP-13, HP-14, and HP-22, and connects all HPs and facilities with overhead powerlines. The additional road connections follow the existing pipeline alignments, however powerline alignments do not follow any existing alignments. Addition of road connections increases the length of roads from 122 to 145 miles and translates to a greater need for fill, expansion of impacts associated with excavation of fill, more culverts and bridges, and a greater area of ice roads and pads. Under Sub-Alternative C-1 – FFD, 8.8 million cy of fill would overlie approximately 1,225 acres of tundra. This footprint would actually be 37 acres less than that proposed for Alternative A – FFD due to the elimination of airstrips. Extraction of the gravel required for construction of Sub-Alternative C-1 – FFD would

impact a total of 365 acres of tundra and would require a total of 378 acres of ice pad for stockpiling overburden; potential material source areas have not been identified. Temporary ice roads and adjacent ice pads would cover approximately 3,035 acres of tundra over 20 winter seasons. Relative to Alternative A – FFD, this alternative requires an additional 635 acres of ice roads for construction of the additional proposed roads. Addition of road connections would increase the number of bridges required for construction of Sub-Alternative C-1 – FFD. Bridge locations have not been identified and therefore the area of ice pads associated with bridge construction cannot be quantified; however it is assumed the number of bridges required for Sub-Alternative C-1 – FFD would be greater than the number required for Alternative A – FFD. Installation of 1,570 culverts, 2,742 power poles, and 14,278 VSMs for Sub-Alternative C-1 – FFD would disturb approximately 32,600; 4,942; and 50,900 cy of soil, respectively. Impacts associated with water discharges to the tundra and tundra travel during the construction period are assumed to be of the same magnitude as those under Alternative A – FFD.

OPERATION PERIOD

Addition of road miles would increase the indirect impacts associated with road travel and maintenance occurring during the operation period. Greater dust fallout and accumulations of plowed snow and sprayed gravel would enlarge the area thermal impacts experienced by active layer soils and permafrost. The area of thermal impact calculated for Sub-Alternative C-1 – FFD is 6,312 acres; 650 acres more than that for Alternative A – FFD. Operation period impacts associated with tundra travel, transmission of warm reservoir fluids, sub-permafrost injection of waste, and accidental oil spills are assumed to be of the same magnitude as those under Alternative A – FFD.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON SOILS AND PERMAFROST

Construction and operation of Sub-Alternative C-1 would impact soil and permafrost resources as much as Sub-Alternative C-2 and more than any other alternative. Sub-Alternative C-1 – FFD would impact soil and permafrost resources more than any other alternative. Under Sub-Alternative C-1, 1,993 acres and 2.2 million cy of soil would be directly impacted compared to 1,757 acres and 2 million cy of soil estimated under Alternative A. The percent of the total Plan Area impacted by construction of Sub-Alternative C-1 is 0.2 percent, which is an inconsequential impact. Under Sub-Alternative C-1 – FFD, 4,638 acres and 8.8 million cy of soil would be directly impacted compared to 4,195 acres and 8.8 million cy of soil estimated under Alternative A – FFD. The percent of the total Plan Area impacted by construction of Sub-Alternative C-1 – FFD is 0.5 percent. Under Sub-Alternative C-1 and Sub-Alternative C-1 – FFD, the placement of fill on the tundra represents the greatest direct impact to soil and permafrost; the thermal impacts associated with placement of fill on the tundra represent the greatest indirect impact.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR SOILS AND PERMAFROST

Soil and permafrost systems could recover to their pre-impact state but not without appropriate mitigation. Because impacts to soil and permafrost are generally unavoidable, mitigation aims to minimize the degree and magnitude of the action. Mitigation measures proposed for Sub-Alternative C-1 and Sub-Alternative C-1 – FFD are the same as those identified for Alternative A (see Section 4A.2.1.3). A recommendation specific to Sub-Alternative C-1 is to run power cable in a tray supported by pipeline VSMs to avoid construction of a separate overhead line and reduce the degree and magnitude of impacts to soil and permafrost.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR SOILS AND PERMAFROST

The effectiveness of the protective measures would be similar to that under Alternative A.

4C-1.2.1.4 Sand and Gravel

Once used, sand and gravel resources for construction of roads, production pads, or airstrips may only be available for re-use upon abandonment.

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON SAND AND GRAVEL

CONSTRUCTION PERIOD

The estimated gravel volume for Sub-Alternative C-1 – CPAI Development Plan is 2.2 million cy (see Tables 2.4.3-2 and 2.4.3-3). Sub-Alternative C-1 impacts to sand and gravel resources would be similar to, but less than those identified for Alternative A.

OPERATION PERIOD

During the operation period, relatively small amounts of gravel are expected to be extracted from existing permitted mine sites for repair of road or pad embankments.

ABANDONMENT AND REHABILITATION

Sand and gravel impacts will be similar to those under Alternative A.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON SAND AND GRAVEL

Sub-Alternative C-1 – FFD would use and build off of the same road network that would be constructed under Sub-Alternative C-1 – CPAI Development Plan. Sub-Alternative C-1 – FFD, depicted in Figure 2.4.3.3-1, is estimated to need 8.8 million cy of gravel (see Tables 2.4.3-11 and 2.4.3-12). The source of this gravel has not yet been determined.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON SAND AND GRAVEL

Once used, sand and gravel resources for construction of roads, production pads, or airstrips could only be available for re-use upon abandonment. Removal of gravel fill is not currently a scheduled phase of abandonment.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR SAND AND GRAVEL

No measures have been identified to mitigate effects on sand and gravel resources under Sub-Alternative C-1 or Sub-Alternative C-1 – FFD.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR SAND AND GRAVEL

The effectiveness of the protective measures would be similar to that under Alternative A.

4C-1.2.1.5 Paleontological Resources

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON PALEONTOLOGICAL RESOURCES

CONSTRUCTION PERIOD

Under Sub-Alternative C-1, the impacts to paleontological resources could be greater than under Alternatives A and B because road segments between the HPs would be generally longer, and an additional road segment would be constructed to connect CD-3 to CD-1. Additional road construction would require additional sand and gravel excavation, an activity most likely to affect paleontological resources. Excavation of sand and gravel material at the ASRC Mine Site and at Clover could affect approximately 86 acres of paleontological resources. As in Alternative A, drilling; placement of gravel pads, VSMs, and powerline poles; and construction of bridges is very unlikely to impact paleontological resources, though under this alternative there would be more VSMS, powerline poles, and bridges.

ABANDONMENT AND REHABILITATION

Paleontological resources will not be impacted by abandonment activities.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON PALEONTOLOGICAL RESOURCES

Under Sub-Alternative C-1 – FFD, the mechanisms associated with effects on paleontological resources would remain the same as those described under Sub-Alternative C-1, except the intensity of the actions would increase as a result of the greater extent of the development. The primary potential cause of impacts would be excavation of gravel on approximately 365 acres. Approximately three gravel mine sites would be developed to provide the volume of construction material necessary under Sub-Alternative C-1 – FFD. The location of the gravel mine sites is not known, but could be in locations that would impact paleontological resources. It is likely that the additional sand and gravel mine sites would be situated in the vicinity of the Fish–Judy Creeks Facility Group and/or the Kalikpik–Kogru Rivers Facility Group. In addition, approximately 1,225 acres could be covered by gravel during the construction of production pads, roads, and airstrips.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON PALEONTOLOGICAL RESOURCES

Surface activities such as construction of pad, road, and airfield embankments are not likely to affect paleontological resources. Impacts could result from those activities involving subsurface disturbance such as gravel mining. Installation of VSMs, power poles, and bridge piles would occur only after route surveys had been conducted, so important paleontological resources would be known and avoided. Excavation of sand and gravel (under approximately 86 acres for Sub-Alternative C-1 and 365 acres for Sub-Alternative C-1 – FFD) constitute the greatest risk to paleontological resources. This "greatest risk" represents inconsequential impact potential to paleontological resources.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR PALEONTOLOGICAL RESOURCES

No potential measures have been identified to mitigate impacts to paleontological resources under Sub-Alternative C-1-1.

SUB-ALTERNATIVE C-1-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR PALEONTOLOGICAL RESOURCES

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.2.2 Aquatic Environment

4C-1.2.2.1 Water Resources

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN ON WATER RESOURCES

Sub-Alternative C-1 provides different road routes compared to those under Alternative A. More specifically: a southern bridge would be located over the Nigliq Channel; a southern road route would link to Nuiqsut; a road in the Colville River Delta would link CD-1 and CD-3; a bridge would replace a culvert battery along the road from CD-1 to CD-4; and roads instead of airstrips would be connected to all HPs, including those in the lower Colville River Delta (see Figure 2.4.3.1-1).

Impacts to water would be greater under this alternative than those under other alternatives because of the increased acres of gravel fill, and particularly because of the likely erosion and sediment from the road in the lower Colville River Delta to CD-3, whether the road is left in place or removed at abandonment.

GENERAL IMPACTS

In general, Sub-Alternative C-1 would affect the same water resources (i.e., subsurface waters, lakes, creeks, rivers, and the nearshore environment) to a similar extent as Alternative A. The primary difference in impacts between the two alternatives is their location. Quantitative hydrologic analyses of the effects of Sub-Alternative C-1 have not been made, so analyses are qualitatively based on the Alternative A analysis. Tables 4C-1.2.2.1-1 and 4C-1.2.2.1-2 provide summaries of potential construction and operation impacts to water resources under Sub-Alternative C-1 in the general vicinities surrounding CD-3, CD-4, CD-5, CD-6, and CD-7 (including the roads and pipelines connecting the facilities) (see Section 4A.2.2.1).

CONSTRUCTION IMPACTS

As described in Sections 3.2.2.1 and 4A.2.2.1, groundwater resources within the North Slope are rare and primarily shallow, and brackish to saline sub-permafrost groundwater is non-potable. Deep groundwater injections are not expected to affect the quality or quantity of shallow groundwater.

Because Sub-Alternative C-1 proposes fewer ice roads relative to Alternative A, the water supply demand on lakes would be less. While this changes short-term impacts on the lakes, it has no bearing on long-term impacts since lakes sufficiently recharge on an annual basis. Further, because there would be fewer ice roads, the indirect effect of ice road melting on basin hydrology would be less.

Winter construction of gravel roads, pads and pipelines could disturb tundra soil, which would be mobilized during break-up. The mobilized soil would result in increased sedimentation in downstream areas of the Delta and in Harrison Bay.

OPERATION IMPACTS

The magnitudes and types of Sub-Alternative C-1 impacts are expected to be similar to those modeled for Alternative A, but the locations of the impacts would be different. For example, under Sub-Alternative C-1, the bridge over the Nigliq Channel would be approximately 3 miles south of the Alternative A location, but this location will be just as susceptible to erosion and sedimentation processes. The Nigliq Channel and subordinate channels in the Delta, and the Ublutuoch River, Fish Creek, and other creeks in the area can be affected when operation activities associated with roads and pipelines block, divert, impede, or constrict flows. Blockage or diversions to areas with insufficient flow capacity can result in seasonal or permanent impoundments. Constricting flows can result in increased stream velocities and a higher potential for ice jams, ice impacts, scour, and streambank erosion. Impeding flows can result in a higher potential for bank overflows and floodplain inundation. These potential impacts need to be minimized by incorporating design features to protect

the structural integrity of the road- and pipeline-crossing structures to accommodate for all but the rarest flood events.

Because the Delta is subject to flooding during spring break-up induced by rain in the Brooks Range, and exposed to storm surges, the proposed year-round road to CD-3 would require additional studies of the road corridors of the various bridge locations that cross the Delta channels. These studies are necessary to develop adequate designs that meet specific design criteria to protect bridges and the road from failure and to minimize erosion and sedimentation processes. For example, to meet the minimum height requirements during design, more embankment material would be necessary for the CD-3 road than that used on the typical North Slope road.

Similarly, the effect of the CD-4 road on east–west flow would need to be better understood and designs would be developed (i.e., a sufficient number of cross-culverts) to minimize its effect (i.e., maintain a water surface elevation difference of not more than 6 inches).

As the Delta is subject to flooding during break-up and rain, the road connecting CD-1 and CD-3 could have adverse effects on the peak water surface elevations (that were used to design existing CD-1 and CD-2 facilities). If model results for Alternative A are applied to Sub-Alternative C-1 conditions, the road and pad are expected to divert and block water, causing changes in water surface elevation.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON WATER RESOURCES

Under Sub-Alternative C-1 – FFD, roads link all production pads to processing facilities and to CD-1 (and Nuiqsut). The alignment of the interconnecting road through the hypothetical development area has been modified from the five-pad Sub-Alternative C-1 alignment. The spine road continues west from the Nuiqsut junction to HPF-1, rather than curving north to CD-6. Roads in the Colville River Delta have also been included.

Table 4C-1.2.2.1-3 provides summaries of potential construction and operation impacts to water resources under Sub-Alternative C-1 – FFD. Compared to Alternative A, the overall impacts to water resources under Sub-Alternative C-1 – Sub-Alternative C-1 – FFD would be more extensive to stream and creeks for road and pipeline crossings because of the proposed expansion of the gravel road system. However, the overall impacts to lakes (i.e., from water supply) would be less because the lengths of ice roads would be lower..

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON WATER RESOURCES

Due to its smaller number of ice roads, Sub-Alternative C-1 would reduce impacts on lake water resources compared to Alternative A, but greater potential exists for impacts associated with ice flows and storm surge (scour, erosion, washout) due to proposed roads in the Delta region and a somewhat greater extent of roads elsewhere. Local effects of the Nigliq Bridge on water surface elevation, channel velocity, and channel scour would shift further south of the bridge.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR WATER RESOURCES

All data needs and mitigation measures recommended for Alternative A are also applicable for Sub-Alternative C-1 and Sub-Alternative C-1 –FFD.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR WATER RESOURCES

The effectiveness of the protective measures would be similar to that under Alternative A.

TABLE 4C-1.2.2-1 SUB-ALTERNATIVE C-1 – POTENTIAL CONSTRUCTION IMPACTS TO WATER RESOURCES

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN											
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS					ESTUARIES & NEARSHORE ENVIRONMENT	
CD-3 AND VICINITY											
	Shallow round water	Deep round water	Small Shallow Lakes and Ponds	Large Deep Lakes	Ulamnigiaq Channel	Tamayayak Channel	Sakoonang Channel	Colville River	Minor Streams	Colville River Delta Mouth	Harrison Bay
Gravel Road Segment from CD-1 to CD-3	8	NI	5	5	3,4,5,6,7	3,4,5,6,7	3,4,5,6,7	NI	3,4,5,6,7	7	6
Pipeline Segment from CD-1 to CD-3	NI	NI	NI	NI	2,7	2,7	2,7	NI	2,7	6	NI
Bridges/Culverts	NI	NI	NI	NI	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	NI	NI	6	6
Production Pad	8	NI	NI	8	2,3	2,3	2,3	NI	1,2,3	6	6
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI	NI	NI	NI
CD-4 AND VICINITY											
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Colville River Delta Including the Nigliq Channel			Minor Streams		Harrison Bay	
Gravel Road Segment from CD-1 to CD-4	8	NI	NI	NI	2,7			2,3,4,5,6		NI	
Pipeline Segment from CD-1 to CD-4	NI	NI	NI	NI	NI			2,7		NI	
Bridges	NI	NI	1,2,5	NI	2,3,4,5,6,7			2,3,4,5,6,7		NI	
Production Pad	8	NI	8	NI	NI			1,2,3,4,5,6		NI	
Groundwater Wells	9	9	NI	NI	NI			NI		NI	
Surface water extraction for potable and construction use	NI	NI	10	10	NI			NI		NI	

TABLE 4C-1.2.2-1 SUB-ALTERNATIVE C-1 – POTENTIAL CONSTRUCTION IMPACTS TO WATER RESOURCES (CONT'D)

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN								
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS			ESTUARIES & NEARSHORE ENVIRONMENT
CD-5 AND VICINITY								
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Nigliq Channel	Minor Streams		Harrison Bay
Gravel Road Segment from CD-4 to Intersection with CD-5	8	NI	2,5,6	NI	2,4,5,6,7	2,4,5,6		NI
Pipeline Segment from CD-4 to Intersection with CD-5	NI	NI	NI	NI	2,7	2,7		NI
Production Pad	8	NI	8	NI	NI	2		NI
Bridges/Culverts	NI	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7		NI
Groundwater Wells	9	9	NI	NI	NI	NI		NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI		NI
CD-6 and Vicinity								
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creek Basin	Ublutuoch River Basin	Minor Streams	Harrison Bay
Gravel Road Segment from CD-5 to CD-6	8	NI	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7	NI
Pipeline Segment from CD-5 to CD-6	NI	NI	NI	NI	NI	2, 7	2, ,7	NI
Production Pad	8	NI	8	NI	NI	NI	2	NI
Bridges/Culverts	NI	NI	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI

TABLE 4C-1.2.2-1 SUB-ALTERNATIVE C-1 – POTENTIAL CONSTRUCTION IMPACTS TO WATER RESOURCES (CONT'D)

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN							
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS		ESTUARIES & NEARSHORE ENVIRONMENT
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creek Basin	Minor Streams	Harrison Bay
CD-7 AND VICINITY							
Gravel Road Segment from CD-6 to CD-7	8	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7	NI
Pipeline Segment from CD-6 to CD-7	NI	NI	NI	NI	2, ,7	2, ,7	NI
Production Pad	8	NI	8	NI	NI	2	NI
Bridges/Culverts	NI	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI

Notes:

1 = Shoreline disturbance & thermokarsting

2 = Blockage of natural channel drainage

3 = Increased stages & velocities of floodwater

4 = Increased channel scour

5 = Increased bank erosion

6 = Increased sedimentation

7 = Increased potential for over banking (due to inundation or wind-generated wave run-up)

8 = Removal /compaction of surface soils/gravel and changes in recharge potential

9 = Underground disposal of non-hazardous wastes10 = Water supply demand

NI = No Impact

TABLE 4C-1.2.2-2 SUB-ALTERNATIVE C-1 – POTENTIAL OPERATIONAL IMPACTS TO WATER RESOURCES

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN											
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS					ESTUARIES & NEARSHORE ENVIRONMENT	
CD-3 AND VICINITY											
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Ulamnigiaq Channel	Tamayayak Channel	Sakoonang Channel	Colville River	Minor Streams	Colville River Delta	Harrison Bay
Gravel Road Segment from CD-1 to CD-3	8	NI	NI	5	6	6	6	NI	6	7	6
Pipeline Segment from CD-1 to CD-3	NI	NI	NI	NI	2,7	2,7	2,7	NI	2,7	6	NI
Bridges/Culverts	NI	NI	NI	NI	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	NI	NI	6	6
Production Pad	8	NI	NI	8	2,3	2,3	2,3	NI	2,3	6	6
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI	NI	NI	NI
CD-4 AND VICINITY											
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Colville River Delta including the Nigliq Channel		Minor Streams			Harrison Bay	
Gravel Road Segment CD-1 to CD-4	8	NI	NI	NI	NI		2,3,4,5,6,7			6	
Pipeline Segment from CD-1 to CD-4	NI	NI	NI	NI	NI		2,7			NI	
Bridges	NI	NI	1,2,6,7	NI	NI		NI			6	
Production Pad	8	NI	6,8	NI	NI		2,3,4,5,6			6	
Groundwater Wells	9	9	NI	NI	NI		NI			NI	
Surface water extraction for potable and construction use	NI	NI	10	10	NI		NI			NI	

TABLE 4C2.2.2-2 SUB-ALTERNATIVE C-1 – POTENTIAL OPERATIONAL IMPACTS TO WATER RESOURCES (CONT'D)

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN								
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS			ESTUARIES & NEARSHORE ENVIRONMENT
CD-5 AND VICINITY								
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Nigliq Channel	Minor Streams		Harrison Bay
Gravel Road Segment from CD-4 to Intersection with CD-5	8	NI	NI	NI	2,4,5,6,7	2,4,5,6		NI
Pipeline Segment from CD-4 to Intersection with CD-5	NI	NI	NI	NI	2,7	2,7		NI
Production Pad	8	NI	8	NI	NI	2		NI
Bridges/Culverts	NI	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7		NI
Groundwater Wells	9	9	NI	NI	NI	NI		NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI		NI
CD-6 AND VICINITY								
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creek Basin	Ublutuoch River Basin	Minor Streams	Harrison Bay
Gravel Road Segment from CD-5 to CD-6	8	NI	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7	NI
Pipeline Segment from CD-5 to CD-6	NI	NI	NI	NI	NI	2,7	2, ,7	NI
Production Pad	8	NI	8	NI	NI	NI	NI	NI
Bridges/Culverts	NI	NI	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI

TABLE 4C-1.2.2-2 SUB-ALTERNATIVE C-1 – POTENTIAL OPERATIONAL IMPACTS TO WATER RESOURCES (CONT'D)

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN							
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS		ESTUARIES & NEARSHORE ENVIRONMENT
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creek Basin	Minor Streams	Harrison Bay
CD-7 PAD AND VICINITY							
Gravel Road Segment from CD-6 to CD-7	8	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7	NI
Pipeline Segment from CD-6 to CD-7	NI	NI	NI	NI	27	2, 7	NI
Production Pad	8	NI	1,7,8	NI	NI	NI	NI
Bridges/Culverts	NI	NI	NI	NI	2,3,4,5,6,7	2,3,4,5,6,7	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI

Notes:

1 = Shoreline disturbance & thermokarsting

2 = Blockage of natural channel drainage

3 = Increased stages & velocities of floodwater

4 = Increased channel scour

5 = Increased bank erosion

6 = Increased sedimentation

7 = Increased potential for over banking (due to inundation or wind-generated wave run-up)

8 = Removal/compaction of surface soils/gravel and changes in recharge potential

9 = Underground disposal of non-hazardous wastes

10 = Water supply demand

NI = No Impact

TABLE 4C-1.2.2-3 SUB-ALTERNATIVE C-1 – POTENTIAL CONSTRUCTION AND OPERATIONAL IMPACTS TO WATER RESOURCES

SUB-ALTERNATIVE C-1 - FULL FIELD DEVELOPMENT														
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS								ESTUARIES & NEARSHORE ENVIRONMENT	
COLVILLE RIVER FACILITY GROUP	Shallow Groundwater	Deep Ground-water	Small Shallow Lakes and Ponds	Large Deep Lakes	Nigliq Channel	Sakoonang Channel	Tamayayak Channel	Ulamnigiaq Channel	Elaktoveach Channel	Kupigruak Channel	Colville River	Minor Streams	Colville River Delta Mouth	Harrison Bay
HPS 4, 5, 7, 8, 12, 13, AND 14														
Gravel Road Segments: CD-4 to HP-4; CD-2 to HP-5; HP-7 road to airstrip; HP-12 road to airstrip; HP-13 road to airstrip; HP-14 road to airstrip	8	NI	NI	NI	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	1,2,3,4,5,6,7	6
Ice Roads: CD-3, HPs 7, 12, 13, and 14	NI	NI	10	10	NI	NI	3	3	3	3	3	3	1,2,3,4,5,6,7	NI
Pipeline Segment: HP-4 to CD-4; HP-5 to CD-2; HP-7 to CD-3/1 pipeline; HP-12 to HP-7; HP-13 to HP-12; HP-13 to HP-12	NI	NI	NI	NI	2,7	2,7	2,7	2,7	2,7	2,7	2,7	2,7	1,2,7	NI
Production Pads: All Proposed and Hypothetical Satellite Locations	8	NI	8	8	2,3,6,7	2,3,6,7	2,3,6,7	2,3,6,7	2,3,6,7	2,3,6,7	NI	2,3	2,3	6
Airstrips: CD-3, HPs 7, 12, 13, and 14	8	NI	NI	NI	NI	NI	3,4,5,6,7	3,4,5,6,7	3,4,5,6,7	3,4,5,6,7	NI	3,4,5,6,7	6	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

TABLE 4C-1.2.2-3 SUB-ALTERNATIVE C-1 – POTENTIAL CONSTRUCTION AND OPERATIONAL IMPACTS TO WATER RESOURCES (CONT'D)

SUB-ALTERNATIVE C-1 – FULL FIELD DEVELOPMENT										
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS					ESTUARIES & NEARSHORE ENVIRONMENT
	Shallow Ground water	Deep Ground water	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish Creek Basin	Inigok Creek Basin	Judy Creek Basin	Ublutuoch River Basin	Minor Streams	Harrison Bay
HPF-1 AND HPS 1, 2, 3, 6, 9, 10, 11, 15, 16, 17, AND 19										
Gravel Road Segments: CD-7 to HP-2; HP-3 to CD-6/5; HP-6 to CD-5/6 ; HP-6 to HP-9; HP-10 to HP-7/HP-2 ; HP-9 to HP-11; HP-6 to HP-15; HPF-1 to HP-16; HP-16 to HP-17; HP-17 to HP-19	8	NI	3,5,6,7	3,5,6,7	2,3,4,5,6,7	2,3,4,5,6,7	2,3,4,5,6,7	2,3,4,5,6,7	2,3,4,5,6,7	NI
Pipeline Segment: HP-1 to CD-6/5 ;CD-7 to HP-2; HP-3 to CD-6/5; HP-6 to CD-5/6 ; HP-6 to HP-11; HP-10 to CD-7/HP-2 ; HP-9 to HP-11; CD-6 to HP-15; HPF-1 to HP-16; HP-16 to HP-17; HP-17 to HP-19	NI	NI	2,7	2,7	2,7	2, 7	2,7	2, 7	2, 7	NI
Production Pads: All Proposed and Hypothetical Satellite Locations	8	NI	8	NI	2,3,6,7	2,3,6,7	2,3,6,7	2,3,6,7	2,3,6,7	NI
Processing Facility: HPF-1	8	NI	NI	NI	NI	NI	2,3,4,5,6	NI	NI	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI	NI	NI

TABLE 4C-1.2.2-3 SUB-ALTERNATIVE C-1 – POTENTIAL CONSTRUCTION AND OPERATIONAL IMPACTS TO WATER RESOURCES (CONT'D)

SUB-ALTERNATIVE C-1 – FULL FIELD DEVELOPMENT								
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS			ESTUARIES & NEARSHORE ENVIRONMENT
KALIKPIK-KOGRU RIVER FACILITY GROUP	Shallow Ground water	Deep Ground water	Small Shallow Lakes & Ponds	Large Deep Lakes	Kalikpik River Drainage	Kogru River	Minor Streams	Harrison Bay
HPF-2 AND HPS 18, 20, 21, AND 22								
Gravel Road Segments: HP-18 to HPF-1; HP-20 to HPF-2/HP-18 road; HP-19 to HPF-2; HP-21 to HP-22, HP-22 road to airstrip; HPF-2 to HP-18; HPF-2 road to airstrip	8	NI	3,5,6	3,5,6	2,3,4,5,6	NI	2,3,4,5,6	NI
Ice Roads: HP-22	NI	NI	10	10	NI	3,4,5,6,	3,4,5,6,	3,4,5,6,
Pipeline Segment: HP-18 to HPF-1; HP-20 to HPF-2/HP-18 road; HP-19 to HPF-2; HP-22 to HP-21; HPF-2 to HP-18	NI	NI	NI	NI	2,7	2,7	2,7	NI
Production Pads: All HPs and HPFs	8	NI	NI	NI	2,3,4,5,6	2,3,4,5,6	2,3,4,5,6	NI
Airstrips: HP-2, HPF-2	8	NI	NI	NI	3,4,5,6	3,4,5,6,7	3,4,5,6,7	NI
Processing Facility: CD-1 (existing)	8	NI	NI	NI	3,4,5,6	NI	NI	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI

Notes:
1 = Shoreline disturbance & thermokarsting
2 = Blockage of natural channel drainage
3 = Increased stages & velocities of floodwater
4 = Increased channel scour
5 = Increased bank erosion
6 = Increased sedimentation
7 = Increased potential for over banking (due to inundation or wind-generated wave run-up) potential
8 = Removal/compaction of surface soils/gravel and changes in recharge
9 = Underground disposal of non-hazardous wastes
10 = Water supply demandNI =No Impact

4C-1.2.2.2 Surface Water Quality

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON SURFACE WATER QUALITY

CONSTRUCTION PERIOD

Total water withdrawal volumes required for ice road construction would be higher for Sub-Alternative C-1 than for Alternative A during the 5-year construction phase of the project. There would be an increased chance that ice roads would be routed across lakes, potentially leading to higher incidences of reductions in dissolved oxygen concentrations (as described for Alternative A). The estimated miles of ice roads required each year during construction vary from a minimum of 56 to a maximum of 83 (see Table 2.4.3-4).

The increase in total gravel for this alternative would increase the potential impacts to water quality from increased turbidity caused by erosion and sedimentation. Sub-Alternative C-1 would have approximately 322 acres covered with gravel. This represents a 34 percent increase in the gravel coverage estimated under Alternative A.

OPERATION PERIOD

Dust fallout from roads would be expected to be higher under Sub-Alternative C-1 compared to Alternative A for two reasons. First, this alternative allows the broadest range of users on the roads. This would increase the number of vehicles traveling on the roads, although probably not by a measurable percentage. Second, this alternative would include construction of 42 miles of gravel roads, which represents an increase from Alternative A of 61 percent. This increase in the miles of gravel road constructed, combined with the fact that roads in the Colville Delta would be subject to potential impacts from upslope impoundments, flooding, and erosion, increases the potential for water quality impacts.

ABANDONMENT AND REHABILITATION

Impacts to water quality would be greater under this alternative than for the other alternatives because of the increased acres of gravel fill, and particularly because of the likely erosion and sediment from the road in the lower Colville River Delta to CD-3, whether the road is left in place or removed at abandonment.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON SURFACE WATER QUALITY

Ice road construction under Sub-Alternative C-1 – FFD would require up to a maximum of 254 ac-ft of water to be withdrawn from lakes each year, based on the estimated miles of ice roads shown in Table 2.4.3-14. The lengths of ice roads to be constructed each year would, on average, be higher for this Sub-Alternative C-1 compared with Alternative A. Because the total estimated miles of ice roads constructed under Sub-Alternative C-1 – FFD would be approximately 26 percent higher, there would be an increased chance that ice roads would be routed across lakes, likely leading to higher incidences of reductions in dissolved oxygen concentrations (as described for Alternative A). The likelihood of this impact occurring is very low because industry does not typically route ice roads over deeper lakes.

The increase in total gravel would increase the potential impacts to water quality from increased turbidity caused by erosion and sedimentation. Sub-Alternative C-1 – FFD would cover approximately 1,225 acres with gravel. This represents a 3 percent increase from the gravel coverage estimated under Alternative A. The area of tundra potentially affected by thermokarst erosion would be equivalent to twice the area directly covered by gravel, or approximately 2,450 acres under Sub-Alternative C-1 – FFD.

Dust fallout from roads would be expected to be higher for this Sub-Alternative C-1ompared to Alternative A, due to greater access to use of the road and construction of more roads than in Alternative A. The

increase in the miles of gravel road constructed, combined with the fact that roads in the Colville Delta would be subject to the potential for impacts from upslope impoundments, increases potential for water quality impacts.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON SURFACE WATER QUALITY

Sub-Alternative C-1 proposes constructing roads in alternate locations, including a road connection to Nuiqsut and roads to all production pads in the Colville Delta. No new airstrips would be constructed except at the processing facilities for Sub-Alternative C-1 – FFD. In comparison with Alternative A, this alternative would have more sources of potential impacts to surface water quality because of the increased gravel placement for road construction, including:

- Increased miles of ice roads to be built compared to Alternative A, raising the chance that ice roads would be routed across lakes, and potentially affecting dissolved oxygen concentrations
- Increased area potentially affected by thermokarst erosion compared to Alternative A, leading to increased impacts to water quality from increased turbidity caused by erosion and sedimentation
- Increased potential for dust fallout and upslope impoundments compared to Alternative A, resulting in more incidences of turbidity impacts.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR SURFACE WATER QUALITY

No additional mitigation measures identified for Sub-Alternative C-1 or Sub-Alternative C-1 – FFD.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR SURFACE WATER QUALITY

The effectiveness of the protective measures would be similar to that under Alternative A.

4C-1.2.3 Atmospheric Environment

4C-1.2.3.1 Climate and Meteorology

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON CLIMATE AND METEOROLOGY

CONSTRUCTION PERIOD

The impacts to climate and meteorology are the same as those under Alternative A.

OPERATION PERIOD

Impacts from GHG emissions would be similar to those stated under Alternative A.

ABANDONMENT AND REHABILITATION

Sub-Alternative C-1 abandonment and rehabilitation activities would cause similar impacts to those under Alternative A.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON CLIMATE AND METEOROLOGY

The impacts to climate and meteorology are the same as those discussed for Alternative A – FFD, except there would be no airstrips in the lower Colville Delta. This would not change the overall impact from GHG emissions.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON CLIMATE AND METEOROLOGY

The impacts are the same as those under Alternative A.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR CLIMATE AND METEOROLOGY

No mitigation measures have been identified.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR CLIMATE AND METEOROLOGY

The effectiveness of the protective measures would be similar to that under Alternative A.

4C-1.2.3.2 Air Quality

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON AIR QUALITY

CONSTRUCTION PERIOD

The amount of fugitive dust could increase compared to Alternative A because of the construction of more miles of roads.

OPERATION PERIOD

Air quality impacts would be about the same for this alternative as for Alternative A, except emissions would be from vehicles instead of aircraft at CD-3.

ABANDONMENT AND REHABILITATION

Impacts from abandonment and rehabilitation would be similar to those under Alternative A—short-term and transient.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON AIR QUALITY

Air impacts would be similar to those stated for Alternative A, though impacts from aircraft would be reduced and those from road vehicles would be increased.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON AIR QUALITY

The impacts would be roughly the same as Alternative A, including emissions from aircraft traffic.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR AIR QUALITY

Air quality impacts, including fugitive dust, from the project would be limited through the permitting process, which ensures that no significant new air pollution sources contribute to a deterioration of the ambient air quality. Mitigation measures for limiting fugitive dust would include road watering, vehicle washing, covering of stockpiled material, ceasing construction during wind events, and the use of chemical stabilizers. These measures may vary for the frozen season and non-frozen season. Dust may be reduced by utilizing sealing agents and chip-seal on pads and heavily utilized portions of the road system. Watering of dust-prone areas would also reduce dust associated with the project.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR AIR QUALITY

The effectiveness of the protective measures would be similar to that under Alternative A.

4C-1.2.3.3 Noise

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN NOISE IMPACTS

CONSTRUCTION PERIOD

Noise impacts are about the same for this alternative as for those under Alternative A.

OPERATION PERIOD

The noise impacts during the operation period of Sub-Alternative C-1 are about the same for this alternative as under Alternative A, except there would be noise from vehicles instead of aircraft flights at CD-3.

ABANDONMENT AND REHABILITATION

Noise impacts would be similar to those associated with construction, minus drilling noise. The level of impact would be less than construction under Sub-Alternative C-1 if gravel fill is not removed.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO NOISE IMPACTS

The noise impacts would be similar to those described under Alternative A – FFD, except there would be noise from aircraft flights at only two new airstrips, and none of these would be in the lower Colville River Delta. Instead, roads would access all pads, and road vehicle noise would replace aircraft noise to and from most lower Delta pads.

SUB-ALTERNATIVE C-1 – SUMMARY OF NOISE IMPACTS (CPAI AND FFD)

Impacts under Sub-Alternative C-1 – CPAI Development Plan and FFD would be similar to those under Alternative A. The major difference would be the reduction in aircraft noise and the increase in vehicle noise in the lower Colville River Delta.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR NOISE

No potential mitigation measures have been identified for Sub-Alternative C-1 nor Sub-Alternative C-1 – FFD.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR NOISE

The effectiveness of the protective measures would be similar to that under Alternative A.

4C-1.3 BIOLOGICAL RESOURCES

4C-1.3.1 Terrestrial Vegetation and Wetlands

4C-1.3.1.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Terrestrial Vegetation and Wetlands

The project design would minimize the facility footprints to reduce the loss of vegetation and habitat from gravel placement and associated indirect impacts. Biologists, geologists, facilities and reservoir engineers worked together combining information from waterbird distribution maps and wildlife habitat maps based on physical features (surface landforms, soil types, vegetation types) to locate facilities in drier habitats avoiding impacts to aquatic, Nonpatterned Wet Meadow, Patterned Wet Meadow, and Moist Sedge-Shrub Meadow habitats preferred by many waterbirds (CPAI 2004a). Figure 4C-1.3.1-1 and Figure 4C-1.3.1-2 show vegetation and habitat potentially affected, and Table 4C-1.3.1-1 and Table 4C-1.3.1-2 summarize the area of vegetation classes and habitat types affected under the Sub-Alternative C-1 – CPAI Development Plan. Terrestrial vegetation and wetlands impact calculation methods for CPAI's Alternatives A through F are described in Section 4A.3.1.1. Key wetland habitats correlated to those identified in the Northeast National Petroleum Reserve-Alaska Final ROD (BLM and MMS 1998b) are described in Section 3.3.1 and identified in Table 4C-1.3.1-2. Oil spills, should they occur, would also directly or indirectly affect vegetation and wetlands in the Plan Area. The impacts of oil and chemical spills and the potential for spills in the Plan Area are described in Section 4.3.

See Section 2.7 (Table 2.7-1) for a comparison of impacts to tundra habitat in the Plan Area among alternatives.

CONSTRUCTION PERIOD

The construction period includes gravel placement, grading of the gravel surface, placement of all facilities, and initial drilling.

GRAVEL PADS, ROADS, AND AIRSTRIPS

Gravel facilities would be designed and constructed as described in Section 2. Under Sub-Alternative C-1, a total of approximately 323 acres of vegetation would be covered with gravel fill for the construction of well pads (46 acres) and approximately 42 miles of primary and spur roads (277 acres). In addition to impacts from roads, pads, and an airstrip, about 1.5 acres of tundra vegetation would be lost for the construction of a boat launch ramp at CD-4 and the associated access road, and a floating dock and an access road at CD-3 as described in Section 2.3.8. Gravel facilities would be constructed and maintained to hold their designed dimensions; however, some gravel slumping from side-slopes could occur, which could potentially increase the impact area by approximately 16 percent (assuming a maximum increase from a 2H:1V to a 3H:1V sideslope). The type of impact from gravel slumping could range from direct loss of tundra vegetation to an alteration of vegetation communities depending on the thickness of gravel sloughed onto adjacent tundra. These potential impacts are included in the indirect impact area calculations from dust, gravel spray, snowdrifts, impoundments, and thermokarst discussed below. Vegetation classes and habitat types lost under Sub-Alternative C-1 due to gravel placement are summarized in Tables 4C-1.3.1-1 and 4C-1.3.1-2, respectively.

Proposed gravel sources would be the same as those described under Alternative A. Gravel extraction for the construction of Sub-Alternative C-1 would result in a permanent loss of approximately 86 acres of tundra habitat while the mine sites are active and an alteration from tundra to aquatic habitat when the gravel sites are reclaimed (Appendix O). The vegetation classes and habitat types affected by gravel extraction would be the same as those described under the CPAI Development Plan Alternative A.

The types of impacts of vegetation loss and alteration from gravel pads, roads, and airstrips and mitigation measures identified for these impacts would be the same as described under CPAI Development Plan Alternative A.

DUST FALLOUT FROM ROADS

Under Sub-Alternative C-1, potential indirect impacts from dust fallout, gravel spray, snow accumulation, and thermokarst and impoundments would result in alteration of about 1,745 acres of tundra vegetation, assuming that these impacts occur within 164 feet (50 meters) of gravel facilities as described under the CPAI Development Plan Alternative A. Table 4C-1.3.1-1 and Table 4C-1.3.1-2 summarize the surface area by vegetation and habitat types within this impact area. Because Sub-Alternative C-1 proposes the highest number of road miles to be constructed, indirect impacts from dust fallout would be increased compared to all other CPAI development alternatives. The type of impacts from dust and associated mitigation measures would be the same as those described under CPAI Development Plan Alternative A.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative C-1, a total of about 326 miles of ice roads would be constructed over the life of the project for construction-related activities, resulting in a maximum of approximately 1,580 acres of vegetation disturbed. This is a maximum-case scenario that assumes the ice roads would be built in a different location each year as required by existing stipulations on BLM-administered land. The actual surface area disturbed would likely be much less, especially if ice roads are overlapped in subsequent years to minimize the aerial extent of impacts. Ice roads placed for the construction of gravel roads and pipeline would follow adjacent to the road/pipeline routes and would tend to affect the same habitat and vegetation types (see Table 4C-1.3.1-1 and Table 4C-1.3.1-2).

In addition to ice roads, ice pads would be used as staging areas during pipeline construction. Approximately 87 acres of vegetation would be disturbed by ice pad staging areas for the construction of the pipeline. Ice pads may also be used to stockpile overburden material associated with the ASRC Mine Site and Clover. Impacts from these ice pads would be the same as those described under CPAI Development Plan Alternative A. Ice pads also would be constructed at each end of each proposed bridge to stage equipment. These ice pads used as staging areas would vary with the size of the bridge installation and equipment needs. Given the number of road bridges proposed under Sub-Alternative C-1 – CPAI Development Plan and assuming the maximum pad size would be 800 feet by 800 feet surrounding the abutment structure at each end of a bridge (Section 2.3.9), then a maximum of 235 acres of vegetation would be affected by ice pads for bridge construction. The effects of ice pads on vegetation would be similar in type to ice roads. Mitigation measures for ice pads would be the same as those described under CPAI Development Plan Alternative A.

More snow would presumably need to be plowed under Alternatives A and C-1 because more miles of road would be built. This would result in an increased alteration of vegetation by snow accumulation and stockpiles. Sub-Alternative C-1 would have slightly greater impacts than Alternative A and habitat alteration resulting from snow accumulation and stockpiling would be less extensive under Alternatives B and D because of their mostly roadless designs.

TABLE 4C-1.3.1-1 CPAI SUB-ALTERNATIVE C-1 – SUMMARY OF SURFACE AREA (ACRES) OF VEGETATION CLASSES AFFECTED

VEGETATION CLASSES	COLVILLE RIVER DELTA					NPR-A (WESTERN BEAUFORT COASTAL PLAIN)					
	DIRECT IMPACTS			INDIRECT IMPACTS		DIRECT IMPACTS			INDIRECT IMPACTS		
	PRIMARY ROADS	WELL PADS	BOAT LAUNCHES, DOCK, & ACCESS ROADS	DUST, MOISTURE REGIME, & THERMAL	TOTALS FOR DELTA	PRIMARY ROADS	SPUR ROADS	WELL PADS	DUST, MOISTURE REGIME, & THERMAL	TOTALS FOR NPR-A	TOTALS FOR SUB-ALTERNATIVE C-1
Water	3.3		<0.1	35.8	39.1	<0.1	<0.1		3.8	3.8	42.9
Riverine Complex							0.3		2.4	2.7	2.7
Fresh Grass Marsh				1.6	1.6						1.6
Fresh Sedge Marsh						0.2	0.1		6.3	6.6	6.6
Deep Polygon Complex	1.1			6.9	8.0						8.0
Young Basin Wetland Complex						2.1		2.5	14.5	19.1	19.1
Old Basin Wetland Complex						1.7	6.2		56.4	64.4	64.4
Wet Sedge Meadow Tundra	57.2	18.4	0.2	352.8	428.6	3.1	7.9	6.2	87.9	105.2	533.8
Salt-killed Wet Meadow											
Halophytic Sedge Wet Meadow	1.5			12.4	13.9						13.9
Halophytic Grass Wet Meadow				1.6	1.6						1.6
Moist Sedge-Shrub Tundra	14.1			80.6	94.7	28.5	22.6	0.8	331.7	383.7	478.4
Tussock Tundra	0.1				0.1	81.2	31.3	17.1	665.9	795.5	795.6
Dryas Dwarf Shrub Tundra	1.3			7.8	9.1						9.1
Cassiope Dwarf Shrub Tundra					0.0	0.3	0.1		2.9	3.3	3.3
Halophytic Willow Dwarf Shrub Tundra					0.0						
Open and Closed Low Willow Shrub	11.4		1.1	50.6	63.2	0.6		0.7	6.3	7.6	70.8
Open and Closed Tall Willow Shrub											
Dune Complex											
Partially Vegetated	0.3		0.2	11.1	11.6						11.6
Barrens	0.8		<0.1	5.1	5.9		<0.1		0.3	0.3	6.2
Total Area	**91.3**	**18.4**	**1.5**	**566.4**	**677.6**	**117.7**	**68.6**	**27.4**	**1178.4**	**1392.1**	**2069.7**

Notes:

Spur Roads are airstrip and/or well pad access roads that branch off of the primary road.

Calculation methods are described in text in Section 4A.3.1.

Columns may not sum to exact numbers in the total row because of rounding, particularly when vegetation classes have impacts of <0.1.

TABLE 4C-1.3.1-2 CPAI SUB-ALTERNATIVE C-1 – SUMMARY OF SURFACE AREA (ACRES) OF HABITAT TYPES AFFECTED

HABITAT TYPE	COLVILLE RIVER DELTA					NPR-A (WESTERN BEAUFORT COASTAL PLAIN)					TOTALS FOR SUB-ALTERNATIVE C-1
	DIRECT IMPACTS			INDIRECT IMPACTS		DIRECT IMPACTS			INDIRECT IMPACTS		
	PRIMARY ROADS	WELL PADS	BOAT LAUNCHES, DOCK, & ACCESS ROADS	DUST, MOISTURE REGIME, & THERMAL	TOTALS FOR DELTA	PRIMARY ROADS	SPUR ROADS	WELL PADS	DUST, MOISTURE REGIME, & THERMAL	TOTALS FOR NPR-A	
OPEN NEARSHORE WATER											
Brackish Water											
Tapped Lake with Low-water Connection				3.0	3.0						3.0
Tapped Lake with High-water Connection				1.2	1.2						1.2
Salt Marsh*	1.5			14.1	15.6						15.6
Tidal Flat*											
Salt-killed Tundra*											
Deep Open Water without Islands*	0.1			3.1	3.2	<0.1			0.4	0.4	3.6
Deep Open Water with Islands or Polygonized Margins*	1.1			12.7	13.8						13.8
Shallow Open Water without Islands				0.3	0.3				0.3	0.3	0.6
Shallow Open Water with Island or Polygonized Margins							<0.1		2.6	2.6	2.6
River or Stream	2.2		<0.1	15.4	17.6	<0.1			0.4	0.4	18.0
Aquatic Sedge Marsh						0.2	0.1		6.3	6.6	6.6
Aquatic Sedge with Deep Polygons	1.1			6.9	8.0						8.0
Aquatic Grass Marsh*				1.6	1.6						1.6
Young Basin Wetland Complex*						2.1		2.5	14.5	19.1	19.1
Old Basin Wetland Complex*						1.7	6.2		56.4	64.4	64.4
Riverine Complex*							0.3		2.4	2.7	2.7
Dune Complex											
Nonpatterned Wet Meadow	4.5	6.3		36.5	47.3	1.4		5.9	16.8	24.1	71.4

TABLE 4C-1.3.1-2 CPAI SUB-ALTERNATIVE C-1 – SUMMARY OF SURFACE AREA (ACRES) OF HABITAT TYPES AFFECTED (CONT'D)

HABITAT TYPE	COLVILLE RIVER DELTA					NPR-A (WESTERN BEAUFORT COASTAL PLAIN)					TOTALS FOR SUB-ALTERNATIVE C-1
	DIRECT IMPACTS			INDIRECT IMPACTS		DIRECT IMPACTS			INDIRECT IMPACTS		
	PRIMARY ROADS	WELL PADS	BOAT LAUNCHES, DOCK, & ACCESS ROADS	DUST, MOISTURE REGIME, & THERMAL	TOTALS FOR DELTA	PRIMARY ROADS	SPUR ROADS	WELL PADS	DUST, MOISTURE REGIME, & THERMAL	TOTALS FOR NPR-A	
Patterned Wet Meadow	52.7	12.1	0.2	316.3	381.3	1.7	7.9	0.3	71.1	81.1	462.3
Moist Sedge-Shrub Meadow	14.1			80.6	94.7	29.0	22.6	1.5	336.4	389.5	484.3
Moist Tussock Tundra	0.1				0.1	81.2	31.3	17.1	665.9	795.5	795.6
Riverine Low and Tall Shrub*				5.5	5.5	0.1			1.1	1.2	6.7
Upland Low and Tall Shrub				0.1	0.1				0.6	0.6	0.7
Upland and Riverine Dwarf Shrub*						0.3	0.1		2.9	3.3	3.3
Riverine or Upland Shrub*	12.8		1.1	52.7	66.6						66.6
Barrens (riverine, eolian, or lacustrine)	1.1		0.2	16.2	17.5						17.5
Artificial (water, fill, peat road)							0.1		0.3	0.4	0.4
Total Area	**91.3**	**18.4**	**1.5**	**566.4**	**677.6**	**117.7**	**68.7**	**27.4**	**1178.4**	**1392.2**	**2069.7**

Notes:

Spur Roads are airstrip and/or well pad access roads that branch off of the primary road.

Calculation methods are described in text in Section 4A.3.1.

Columns may not sum to exact numbers in the total row because of rounding, particularly when habitat types have impacts of <0.1.

* Represents key wetland habitats that were correlated to Bergman et al. (1977) habitats and riparian shrub habitats identified as key wetlands in the Northeast National Petroleum Reserve-Alaska Final IPA/EISROD (BLM and MMS 1998b)

OFF-ROAD TUNDRA TRAVEL

Development and operation of oil facilities in the Plan Area may require access across tundra. Such access could be necessary to respond to spills or other emergencies, conduct pipeline maintenance and repair, and facilitate ice road construction. The types of impacts to vegetation from off-road travel and associated mitigation measures would be similar to those described under CPAI Development Plan Alternative A; however, impacts from off-road travel would presumably be the lowest under Sub-Alternative C-1 because all pads and most of the pipeline would be accessible by road. Impacts of off-road travel would be slightly less in Alternative A than in Sub-Alternative C-1. Alternatives B and D would likely require more off-road travel because of the mostly roadless designs.

IMPOUNDMENTS AND THERMOKARST

Indirect impacts from dust fallout, gravel spray, snow accumulation, impoundments, and thermokarst associated with roads, pads, and airstrips are expected to occur within 164 feet (50 meters) of gravel facilities (Hettinger 1992) as described under CPAI's Development Plan Alternative A. Table 4C-1.3.1-1 and Table 4C-1.3.1-2 summarize the surface area of disturbance by vegetation classes and habitat types within this impact area. The types of impacts from impoundments and thermokarst and associated mitigation measures are described under CPAI Development Plan Alternative A. Sub-Alternative C-1 would potentially affect the greatest area of vegetation because it proposes the highest number of road miles. The potential of Alternative A for impoundment and thermokarst impacts would be slightly less than Sub-Alternative C-1. Habitat alteration resulting from impoundments and thermokarst would be less extensive under Alternatives B and D because of their mostly roadless designs.

CROSS-DRAINAGE AND WATER FLOW

The types of cross-drainage and water flow impacts and associated mitigation measures are described under CPAI Development Plan Alternative A. The largest area of vegetation would potentially be affected by Sub-Alternative C-1 because it proposes the most miles of road. The potential for cross-drainage and water flow impacts in Sub-Alternative C-1 would be slightly greater than in Alternative A. Habitat alteration resulting from interception of natural water flow by gravel roads and pads would be less extensive under Alternatives B and D because of their mostly roadless designs.

AIR POLLUTION

Project construction would cause a localized and temporary impact on air quality. The sources of air pollution during the construction period are described under CPAI Development Plan Alternative A. These sources are not expected to produce sufficient levels of pollutants to adversely affect vegetation. Air quality mitigation measures would be the same as those described under CPAI Development Plan Alternative A.

PIPELINES

Beside the disturbance from ice roads and staging pads for the construction of pipelines (discussed above), the only other impact to vegetation from pipeline construction under Sub-Alternative C-1 is from VSM borings. Given the maximum diameter of VSM borings and the projected number of VSMs to be constructed under Sub-Alternative C-1 (presented in Section 2.4.3), and adding a 0.5-foot disturbance buffer to account for potential spoils and thermal impacts around the borings, about 0.6 acre of vegetation would be lost to VSM installation. The vegetation classes and habitat types affected would depend on the exact location of the VSM. An elevated pipeline design reduces impacts to vegetation and habitat types compared to buried pipeline designs.

POWER LINES

Given the maximum pole diameter and the projected number of poles to be placed under Sub-Alternative C-1 (described in Section 2.4.3), and adding a 0.5-foot disturbance buffer to account for potential spoils and thermal

impacts around the poles, approximately 338 square yards of tundra vegetation would be affected by pole placement for suspended power lines. The entirely suspended power line design in Sub-Alternative C-1 would result in greater impacts than the other alternatives that propose partially suspended or VSM-mounted power lines (Alternatives A and D). Alternative B would have the greatest impact on vegetation by power line trenching.

OPERATION PERIOD

The operation period includes continued drilling and day-to-day operations and maintenance once production has begun.

GRAVEL PADS, ROADS, AND AIRSTRIPS

Additional vegetation losses following construction could occur during the operational period during maintenance of gravel roads (such as snow removal) or if flood events wash out portions of roads or pads and deposit gravel on tundra. The impacts of these activities/events are described under CPAI Development Plan Alternative A.

The largest area of vegetation would potentially be affected by maintenance of gravel roads and washouts under Sub-Alternative C-1 because it proposes the greatest number of road miles. The impacts of Sub-Alternative C-1 would likely be slightly greater than those of Alternative A. Impacts to vegetation resulting from maintenance of gravel roads and washouts would be less extensive under Alternatives B and D because of their mostly roadless designs.

DUST FALLOUT FROM ROADS

During the operation period, effects of dust from roads, pads, and airstrips are expected to be realized within the 164-foot impact zone. The effects of dust on vegetation were described above in the Construction Period section. Table 4C-1.3.1-1 and Table 4C-1.3.1-2 summarize the surface area of disturbance by vegetation classes and habitat types within this impact area.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Ice roads and pads would not likely be needed during the operational period under Sub-Alternative C-1 because all pads would be accessible by roads. As during the construction period, snowdrifts or plowed snow would accumulate on tundra adjacent to roads, well pads, and airstrips. Impacts would be similar to those discussed above in the Construction Period section.

OFF-ROAD TUNDRA TRAVEL

Some off-road tundra travel would continue during the operational period to respond to spills or other emergencies, to conduct pipeline maintenance and repair, and to facilitate ice road construction. See the Construction Period discussion above for potential impacts.

IMPOUNDMENTS AND THERMOKARST

Some habitat loss and alteration would continue to occur from thermokarst and impoundments during the project operation. These impacts are more likely to be initiated during construction.

CROSS-DRAINAGE AND WATER FLOW

Disruption of cross-drainage and interception of sheet flow impacts may continue to cause impacts during the operational phase of this project. These impacts are initiated during the construction period and are discussed above.

AIR POLLUTION

Air pollution levels would increase during operations with the ACX upgrade of the existing APF-1 and increased emissions from traffic, drilling equipment, and well servicing and production equipment; however, this increase is not expected to generate levels of pollutants that would adversely affect vegetation. Air quality impacts from emissions from well servicing and drilling equipment would be intermittent and localized. Air quality mitigation measures would be the same as those described under CPAI Development Plan Alternative A.

PIPELINES

Pipeline operation would not cause additional vegetation losses or alteration. However, indirect impacts discussed above in the Construction Period section, associated with snow drifting and shading, would continue to occur during the operation period. Effects of pipeline spills on tundra are described in Section 4.3.

POWER LINES

No additional impacts to vegetation would occur from power lines during the operational period.

ABANDONMENT AND REHABILITATION

Impacts of abandonment under Sub-Alternative C-1 would be similar in nature to that for Alternative A. However, because more miles of gravel roads would be created, the alteration in the vegetation and wetlands that could occur at abandonment would be correspondingly greater.

4C-1.3.1.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Terrestrial Vegetation and Wetlands

In addition to the impacts of Sub-Alternative C-1 – CPAI Development Plan under the FFD scenario for Sub-Alternative C-1, approximately 1,284 acres of tundra vegetation would be covered with gravel fill for the construction of pads (well pads, HPF pads, and storage pads) and airstrips and associated aprons (332 acres), and 147 miles of roads (952 acres). Approximately 6,312 acres of vegetation would be indirectly affected by dust, gravel spray, snowdrifts, impoundments, and thermokarst. The effects of FFD on terrestrial vegetation and wetlands would depend on the location and extent of development in specific locations within each area. Table 4C-1.3.1-3 and Table 4C-1.3.1-4 summarize the estimated areas of vegetation classes affected under Sub-Alternative C-1 – FFD. Impact calculation methods are described in Section 4A.3.1.2. Impact calculation methods for FFD are described in Section 4A.3.1.2. The type of direct and indirect impacts to vegetation related to gravel fill; dust fallout from roads; ice roads and snow stockpiles; off-road tundra travel; impoundments and thermokarst; cross-drainage and water flow; air pollution; pipelines; and power lines in the three facility groups (Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers Facility Groups) and proposed mitigation measures would be the same types as those described under CPAI Development Plan Alternative A.

COLVILLE RIVER DELTA FACILITY GROUP

GRAVEL PADS, ROADS, AND AIRSTRIPS

In addition to habitat loss described under Sub-Alternative C-1 – CPAI Development Plan, approximately 225 acres of vegetation would be lost in the Colville River Delta Facility Group under Sub-Alternative C-1 – FFD from the construction of pads (hypothetical production pads HP-4, HP-5, HP-7, HP-8, HP-12, HP-13, and HP-14 and storage pads) and airstrips (64 acres) and connecting roads (161 acres) (Table 4C-1.3.1-3 and Table 4C-1.3.1-4). The dominant vegetation class in the vicinity of Colville River Delta is Wet Sedge Meadow Tundra. The types of disturbances and impacts to vegetation associated with gravel fill would be the same as those described previously for CPAI Development Plan Alternative A.

Gravel extraction for the hypothetical FFD would result in the destruction of approximately 365 acres of vegetation; however, specific gravel sources for the hypothetical FFD scenario have not been identified. The development process of any future gravel source would include planning, design, permitting, temporary staging areas, removal of overburden, blasting and excavation of gravel, and an approved rehabilitation plan. Analysis of impacts and appropriate mitigation measures would be examined before approval of future mine sites.

DUST FALLOUT FROM ROADS

Under Sub-Alternative C-1 – FFD, indirect impacts, including dust impacts, are expected to occur within 164 feet (50 meters) of gravel facilities as described in CPAI Development Plan Alternative A (Section 4A.3.1.1), resulting in an alteration of about 1,095 acres of tundra vegetation in the Colville River Delta Facility Group (Table 4C-1.3.1-3 and Table 4C-1.3.1-4). The types of impacts to vegetation and mitigation measures associated with dust fallout would be the same as those described previously for CPAI Development Plan Alternative A.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative C-1 for FFD, approximately 147 miles of ice roads would be constructed in the Colville River Delta Facility Group over the life of the project, affecting approximately 713 acres of vegetation. The maximum area covered by ice roads in the Colville River Delta Facility Group in a single year would be 160 acres, with an average of 119 acres per year. As with Sub-Alternative C-1 – CPAI Development Plan, ice pads would be used as staging areas during pipeline construction, to stockpile overburden material associated with gravel mine sites and for equipment staging areas for bridge installation. The types of impacts to vegetation associated with snow stockpiles would be the same as those described previously for CPAI Development Plan Alternative A, although the construction of more roads, pads, and airstrips under the FFD scenario would result in potential increased impacts to vegetation.

OFF-ROAD TUNDRA TRAVEL

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under CPAI Development Plan Alternative A. Under Sub-Alternative C-1 – FFD, the surface area affected would increase because of the increased length of pipeline and roads that may require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

IMPOUNDMENTS AND THERMOKARST

The types of impacts to vegetation associated with thermokarst and ponding and the proposed mitigation measures for these impacts would be the same as those described previously for CPAI Development Plan Alternative A. Under Sub-Alternative C-1 – FFD, the construction of more roads and pads would potentially result in increased impacts and alteration of vegetation communities from thermokarst and ponding. These impacts are expected to occur within the 164-foot impact zone as described in CPAI Development Plan Alternative A (Section 4A.3.1.1). Table 4C-1.3.1-3 and Table 4C-1.3.1-4 summarize the potential surface area of disturbance by vegetation class within this impact zone for each facility group.

TABLE 4C-1.3.1-3 SUB-ALTERNATIVE C-1 – FFD: SUMMARY OF VEGETATION IMPACTS FROM PADS, AIRSTRIPS, APRONS, AND STORAGE PADS

VEGETATION CLASSES	COLVILLE DELTA				FISH-JUDY CREEK				KALIKPIK-KOGRU			
			Direct Impacts	Indirect Impacts			Direct Impacts	Indirect Impacts			Direct Impacts	Indirect Impacts
	Acres (%) in Colville Delta FFD Circles		Gravel (Acres)	Dust & Thermal (Acres)	Acres (%) in Fish-Judy Creek FFD Circles		Gravel (Acres)	Dust & Thermal (Acres)	Acres (%) in Kalikpik-Kogru FFD Circles		Gravel (Acres)	Dust & Thermal (Acres)
Riverine Complex	0	(0.0%)	0.0	0.0	30	(0.1%)	0.1	0.2	0	(0.0%)	0.0	0.0
Fresh Grass Marsh	56	(0.3%)	0.2	0.3	278	(0.6%)	1.0	1.7	49	(0.3%)	0.3	0.4
Fresh Sedge Marsh	3	(0.0%)	<0.1	<0.1	3,343	(7.5%)	12.4	19.9	1,483	(8.8%)	9.0	13.4
Deep Polygon Complex	550	(2.6%)	1.6	2.9	4,833	(10.9%)	18.0	28.8	1,493	(8.9%)	9.1	13.4
Young Basin Wetland Complex	0	(0.0%)	0.0	0.0	2,013	(4.5%)	7.5	12.0	721	(4.3%)	4.4	6.5
Old Basin Wetland Complex	0	(0.0%)	0.0	0.0	1,261	(2.8%)	4.7	7.5	0	(0.0%)	0.0	0.0
Wet Sedge Meadow Tundra	9,494	(44.1%)	28.1	50.7	9,856	(22.1%)	36.7	58.6	6,533	(39.0%)	39.8	58.8
Salt-killed Wet Meadow	1,633	(7.6%)	4.8	8.7	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Halophytic Sedge Wet Meadow	1,210	(5.6%)	3.6	6.5	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Halophytic Grass Wet Meadow	32	(0.1%)	0.1	0.2	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Moist Sedge-Shrub Tundra	782	(3.6%)	2.3	4.2	4,318	(9.7%)	16.1	25.7	0	(0.0%)	0.0	0.0
Tussock Tundra	139	(0.6%)	0.4	0.7	14,936	(33.5%)	55.6	88.9	5,452	(32.5%)	33.2	49.1
Dryas Dwarf Shrub Tundra	29	(0.1%)	0.1	0.2	238	(0.5%)	0.9	1.4	0	(0.0%)	0.0	0.0
Cassiope Dwarf Shrub Tundra	0	(0.0%)	0.0	0.0	395	(0.9%)	1.5	2.4	284	(1.7%)	1.7	2.6
Halophytic Willow Dwarf Shrub Tundra	8	(0.0%)	<0.1	<0.1	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Open and Closed Low Willow Shrub	1,929	(9.0%)	5.7	10.3	520	(1.2%)	1.9	3.1	1	(0.0%)	0.0	0.0
Open and Closed Tall Willow Shrub	0	(0.0%)	0.0	0.0	172	(0.4%)	0.6	1.0	0	(0.0%)	0.0	0.0
Dune Complex	0	(0.0%)	0.0	0.0	902	(2.0%)	3.4	5.4	185	(1.1%)	1.1	1.7
Partially Vegetated	1,183	(5.5%)	3.5	6.3	412	(0.9%)	1.5	2.5	154	(0.9%)	0.9	1.4
Barrens	4,487	(20.8%)	13.3	24.0	1,030	(2.3%)	3.8	6.1	411	(2.5%)	2.5	3.7
Totals	**21,536**	**(100.0%)**	**63.7**	**115.0**	**44,537**	**(100.0%)**	**165.8**	**265.0**	**16,768**	**(100.0%)**	**102.1**	**151.0**

Notes:Calculation methods are described in text in Section 4A.3.1.2.

Columns may not sum to exact numbers in the total row because of rounding, particularly when vegetation classes have impacts of <0.1.

TABLE 4C-1.3.1-4 SUB-ALTERNATIVE C-1 – FFD: SUMMARY OF VEGETATION IMPACTS FROM ROADS

VEGETATION CLASSES	COLVILLE DELTA				FISH-JUDY CREEK				KALIKPIK-KOGRU			
			Direct Impacts	Indirect Impacts			Direct Impacts	Indirect Impacts			Direct Impacts	Indirect Impacts
	Acres (%) in Colville Delta Road Buffer		Gravel (Acres)	Dust & Thermal (Acres)	Acres (%) in Fish-Judy Creek Road Buffer		Gravel (Acres)	Dust &Thermal (Acres)	Acres (%) in Kalikpik-Kogru Road Buffer		Gravel (Acres)	Dust & Thermal (Acres)
Riverine Complex	9	(0.4%)	0.6	3.7	72	(0.2%)	1.0	6.2	0	(0.0%)	0.0	0.0
Fresh Grass Marsh	13	(0.5%)	0.8	5.1	1,510	(4.2%)	21.6	131.4	17	(15.3%)	41.7	253.3
Fresh Sedge Marsh	0	(0.0%)	0.0	0.0	377	(1.0%)	5.4	32.8	0	(0.0%)	0.0	0.0
Deep Polygon Complex	11	(0.4%)	0.7	4.3	50	(0.1%)	0.7	4.3	0	(0.0%)	0.0	0.0
Young Basin Wetland Complex	43	(1.7%)	2.7	16.6	3,247	(9.0%)	46.5	282.5	10	(9.5%)	25.9	157.5
Old Basin Wetland Complex	0	(0.0%)	0.0	0.0	1,201	(3.3%)	17.2	104.5	0	(0.0%)	0.0	0.0
Wet Sedge Meadow Tundra	1,154	(46.1%)	74.3	451.5	6,736	(18.6%)	96.5	586.1	17	(15.7%)	42.9	260.3
Salt-killed Wet Meadow	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Halophytic Sedge Wet Meadow	3	(0.1%)	0.2	1.1	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Halophytic Grass Wet Meadow	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Moist Sedge-Shrub Tundra	268	(10.7%)	17.3	104.9	4,394	(12.2%)	62.9	382.3	0	(0.0%)	0.0	0.0
Tussock Tundra	231	(9.2%)	14.9	90.6	8,471	(23.4%)	121.3	737.1	54	(49.9%)	135.9	825.6
Dryas Dwarf Shrub Tundra	0	(0.0%)	0.0	0.0	110	(0.3%)	1.6	9.6	0	(0.0%)	0.0	0.0
Cassiope Dwarf Shrub Tundra	231	(9.2%)	14.9	90.3	8,409	(23.3%)	120.5	731.7	8	(7.3%)	19.9	120.7
Halophytic Willow Dwarf Shrub Tundra	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Open and Closed Low Willow Shrub	313	(12.5%)	20.2	122.6	851	(2.4%)	12.2	74.0	2	(1.5%)	4.1	25.0
Open and Closed Tall Willow Shrub	0	(0.0%)	0.0	0.0	79	(0.2%)	1.1	6.9	0	(0.0%)	0.0	0.0
Dune Complex	0	(0.0%)	0.0	0.0	232	(0.6%)	3.3	20.2	0	(0.0%)	0.0	0.0
Partially Vegetated	77	(3.1%)	5.0	30.3	146	(0.4%)	2.1	12.7	0	(0.0%)	0.0	0.0
Barrens	152	(6.1%)	9.8	59.3	265	(0.7%)	3.8	23.1	1	(0.8%)	2.1	12.6
Totals	**2,506**	**(100.0%)**	**161.4**	**980.4**	**36,149**	**(100.0%)**	**517.8**	**3,145.3**	**109**	**(100.0%)**	**272.5**	**1,655.1**

Notes:

Calculation methods are described in text in Section 4A.3.1.2.

Columns may not sum to exact numbers in the total row because of rounding, particularly when vegetation classes have impacts of <0.1.

CROSS-DRAINAGE AND WATER FLOW

The types of impacts to vegetation associated with disruption of cross-drainage and interception of sheet flow would be the same as those described previously for CPAI Development Plan Alternative A. These impacts would be greatest in the vicinity of the Colville River Delta because of unstable flow regimes and ocean-induced storm surges. In addition, roads would likely cross many ephemeral streams in the Colville River Delta area, and culverts would need to be installed. Gravel placement could potentially disturb sheet flow in the spring and could impact local moisture regimes. Culverts allow surface water flow, but they tend to ice up and increase flow in a small area relative to typical sheet flow. Alteration of sediment disposition patterns during flood events may occur due to obstructions from roads and redirection of floodwaters through culverts. These changes may result in alteration of vegetation succession and long-term alteration of habitat types.

AIR POLLUTION

No additional processing facilities would be built in the Colville River Delta area under Sub-Alternative C-1 – FFD; however, the increased number of vehicles and equipment associated with the well pads and roads would increase air pollution. This increase is not expected to generate levels of pollutants that would adversely affect vegetation.

PIPELINES

In addition to the impacts from Sub-Alternative C-1 – CPAI Development Plan, a total of approximately 2 acres of vegetation would be lost to VSM installation under the FFD scenario for Sub-Alternative C-1, of which about 0.4 acre would occur in the Colville River Delta Facility Group. The vegetation and habitat types affected would depend on the exact location of the VSM, which are generally spaced at 55 to 65 foot intervals. The types of impacts to vegetation associated with snow drifting or shading from the aboveground pipelines would be the same as those described previously for CPAI Development Plan Alternative A.

POWER LINES

Under Sub-Alternative C-1 – FFD, power lines would be suspended from poles. Less than 1 acre of vegetation would be affected by pole placement.

FISH-JUDY CREEKS FACILITY GROUP

GRAVEL PADS, ROADS, AND AIRSTRIPS

In addition to habitat loss described under Sub-Alternative C-1 – CPAI Development Plan, approximately 684 acres of vegetation would be lost in the Fish-Judy Creeks Facility Group under Sub-Alternative C-1 – FFD for the construction of pads (a processing facility; production pads HP-1, HP-2, HP-3, HP-6, HP-9, HP-10, HP-11, HP-15, HP-16, HP-17, and HP-19; and storage pads) and airstrips (166 acres), and connecting roads (518 acres) (Table 4C-1.3.1-3 and Table 4C-1.3.1-4). Dominant vegetation classes in the Fish-Judy Creeks Facility Group are *Dryas* Tundra and Wet Sedge Meadow Tundra. The types of disturbances and impacts to vegetation associated with gravel fill placement would be the same as those described previously for CPAI Development Plan Alternative A.

DUST FALLOUT FROM ROADS

In the Fish-Judy Creeks Facility Group, indirect impacts from dust, gravel spray, snowdrifts, impoundments, and thermokarst would alter approximately 3,410 acres of vegetation (Table 4C-1.3.1-3 and Table 4C-1.3.1-4). The types of impacts to vegetation and mitigation measures associated with dust fallout would be the same as those described previously for CPAI Development Plan Alternative A.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative C-1 for FFD, approximately 283 miles of ice roads would be constructed in the Fish-Judy Creeks Facility Group over the life of the project, affecting about 1,372 acres of vegetation. The maximum area covered by ice roads in the Fish-Judy Creeks Facility Group in a single year would be 228 acres, with an average of 137 acres per year. The types of impacts to vegetation associated with ice roads and snow stockpiles would be the same as those described previously for Alternative A, although the construction of more roads, pads, and airstrips under the FFD scenario would result in increased impacts to vegetation.

OFF-ROAD TUNDRA TRAVEL

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under CPAI Development Plan Alternative A. Under Sub-Alternative C-1 – FFD, the surface area affected would be increased because of the increased length of pipeline, roads, and number of remote facilities that may require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

IMPOUNDMENTS AND THERMOKARST

The types of impacts to vegetation associated with thermokarst and ponding and the proposed mitigation measures for these impacts would be the same as those described previously for CPAI Development Plan Alternative A. The construction of more roads and pads under Sub-Alternative C-1 – FFD would potentially increase impacts and alteration of vegetation communities from thermokarst and ponding. These impacts are expected to occur within the 164-foot impact zone as described in CPAI Development Plan Alternative A (Section 4A.3.1.1). Table 4C-1.3.1-3 and Table 4C-1.3.1-4 summarize the potential surface area of disturbance by vegetation class within this impact area for each facility group.

CROSS-DRAINAGE AND WATER FLOW

The types of impacts to vegetation associated with the disruption of cross-drainage and interception of sheet flow would be the same as those described previously for CPAI Development Plan Alternative A, although the construction of more roads with culverts would potentially cause increased impacts to vegetation communities from disturbance of local water flow.

AIR POLLUTION

The construction of an additional processing facility in the Fish-Judy Creek Facility Group would result in a localized increase in air pollution levels. This increase is not expected to generate levels of pollutants that would adversely affect vegetation.

PIPELINES

In the FFD scenario for Sub-Alternative C-1, approximately 1.1 acres of vegetation would be lost in the vicinity of Fish-Judy creeks as a result of VSM placement.

POWER LINES

Under Sub-Alternative C-1 – FFD, power lines would be suspended from poles. Less than 1 acre of vegetation would be affected by pole placement.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

GRAVEL PADS, ROADS, AND AIRSTRIPS

In addition to habitat loss described under Sub-Alternative C-1 – CPAI Development Plan, approximately 374 acres of vegetation would be lost in the Kalikpik-Kogru Rivers Facility Group under Sub-Alternative C-1 – FFD for the construction of pads (hypothetical processing facility; production pads HP-18, HP-20, HP-21, and HP-22; and storage pads) and airstrips (102 acres), and connecting roads (272 acres). The dominant vegetation classes in the Kalikpik-Kogru Rivers Facility Group are Tussock Tundra and Sedge/Grass Meadow. The types of disturbances and impacts to vegetation associated with gravel fill placement would be the same as those described previously for CPAI Development Plan Alternative A.

DUST FALLOUT FROM ROADS

Under Sub-Alternative C-1 – FFD, indirect impacts, including dust impacts, would result in alteration of about 1,806 acres in the Kalikpik-Kogru Rivers Facility Group (Table 4C-1.3.1-3 and Table 4C-1.3.1-4). The types of impacts to vegetation and mitigation measures associated with dust fallout would be the same as those described previously for CPAI Development Plan Alternative A.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative C-1 for FFD, approximately 196 miles of ice roads would be constructed during construction in the Kalikpik-Kogru Rivers Facility Group over the life of the project, affecting about 950 acres of vegetation. The maximum area covered by ice roads in the Kalikpik-Kogru Rivers Facility Group in a single year would be 407 acres, with an average of 238 acres per year. The types of impacts to vegetation associated with ice roads and snow stockpiles would be the same as those described previously for CPAI Development Plan Alternative A, although the construction of more roads, pads, and airstrips under the FFD scenario would result in potentially increased impacts to vegetation.

OFF-ROAD TUNDRA TRAVEL

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under CPAI Development Plan Alternative A. Under Sub-Alternative C-1 – FFD, the surface area affected would be increased because of the increased length of pipeline and roads that could require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

IMPOUNDMENTS AND THERMOKARST

The types of impacts to vegetation associated with thermokarst and ponding and the proposed mitigation measures for these impacts would be the same as those described previously for CPAI Development Plan Alternative A. Under Sub-Alternative C-1 – FFD, the construction of more roads and pads would result in increased impacts and alteration of vegetation communities from thermokarst and ponding. These impacts are expected to occur within the 164-foot impact zone as described in CPAI Development Plan Alternative A (Section 4A.3.1.1). Table 4C-1.3.1-3 and Table 4C-1.3.1-4 summarize the potential surface area of disturbance by vegetation class within this impact area for each facility group.

CROSS-DRAINAGE AND WATER FLOW

The types of impacts to vegetation associated with the disruption of cross-drainage and interception of sheet flow would be the same as those described previously for CPAI Development Plan Alternative A, although the construction of more roads and culverts under Sub-Alternative C-1 – FFD would cause increased impacts to vegetation communities from disturbance of local water flow.

AIR POLLUTION

The construction of an additional processing facility in the Kalikpik-Kogru Rivers Facility Group would result in a localized increase in air pollution levels. This increase is not expected to generate levels of pollutants that would adversely affect vegetation.

PIPELINES

In the FFD scenario for Sub-Alternative C-1, approximately 0.6 acre of vegetation would be lost in the Kalikpik-Kogru Rivers Facility Group area by VSM placement. The types of impacts to vegetation associated with snow drifting or shading from pipeline placement would be the same as those described previously for CPAI Development Plan Alternative A.

POWER LINES

Under Sub-Alternative C-1 – FFD, power lines would be suspended from poles. Less than 1 acre of vegetation would be affected by pole placement.

4C-1.3.1.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Terrestrial Vegetation and Wetlands

Impacts of Sub-Alternative C-1 – CPAI Development Plan to vegetation and habitat types are summarized in Tables 4C-1.3.1-1 and 4C-1.3.1-2, respectively. Impacts from Sub-Alternative C-1 – FFD are summarized in Table 4C-1.3.1-3 and Table 4C-1.3.1-4.

Vegetation maps cover the entire Plan Area, and detailed wildlife habitat maps are available for the entire area affected by CPAI's proposed Sub-Alternative C-1 (Figure 4C-1.3.1-2). Vegetation classes and wildlife habitat types are cross-referenced in Table 3.3.1-3. Summary of impacts are presented as percentages of available vegetation type or habitat class within the Colville River Delta or the National Petroleum Reserve-Alaska portions of the Plan Area. Wildlife habitat mapping covers 100 percent of the Colville River Delta, 24 percent of the National Petroleum Reserve-Alaska portion of the Plan Area, and 37 percent of the total Plan Area.

Under CPAI Sub-Alternative C-1, approximately 409 acres of tundra vegetation would be lost by gravel fill and extraction associated with roads, pads, airstrips, and gravel mines; and 3,647 acres would be altered or disturbed by ice roads and pads, dust, snowdrifts, and changes to thermal or moisture regimes; combined representing less than one percent of the Plan Area (Table 4C-1.3.1-1 and Table 4C-1.3.1-2).

In the Colville River Delta portion of the Plan Area, the highest surface area impacts are to Wet Sedge Meadow Tundra vegetation (429 acres lost or altered; 1.1 percent of available in the area) and Patterned Wet Meadow habitat (316 acres lost or altered; 1.4 percent of available in the area). In the National Petroleum Reserve-Alaska portion of the Plan Area, the highest surface area impacts are to Tussock Tundra vegetation (796 acres lost or altered; 0.4 percent of available in the area) and Moist Tussock Tundra habitat 796 acres lost or altered; 1.6 percent of available mapped habitat in the area) (Table 4C-1.3.1-1 and Table 4C-1.3.1-2).

Under CPAI Sub-Alternative C-1, key wetland habitats that would be lost or altered in the 146,637 acre Colville River Delta are: riparian shrubland (72 of 7,575 acres); aquatic grass marsh (1.6 of 369 acres); deep open lakes (17 of 7,810 acres); basin-complex wetlands (0 of 2 acres); and coastal wetlands (16 of 29,022 acres). Key wetland habitats that would be lost or altered in the 175,153 acres mapped in the National Petroleum Reserve-Alaska are: riparian shrubland (7.2 of 4,741 acres); aquatic grass marsh (0 of 501 acres); deep open lakes (0.4 of 22,374 acres); basin-complex wetlands (83 of 16,297 acres); and coastal wetlands (0 of 36 acres). Thus, impacts to all key wetlands, including those that contain *Arctophila* and *Carex aquatilis*, will be minor.

Under Sub-Alternative C-1 – FFD, approximately 1,590 acres of tundra vegetation (less than one percent of Plan Area) would be lost by gravel fill and extraction associated with roads, pads, airstrips, and gravel mines;

and 9,725 acres (approximately one percent of the Plan Area) would be altered or disturbed by ice roads, pads, dust, and changes to thermal or moisture regimes (Table 4C-1.3.1-3 and Table 4C-1.3.1-4). Habitat types were not assessed for FFD because habitat mapping does not cover the entire Plan Area (Figure 3.3.1.3-1) (Jorgenson et al. 2003c).

4C-1.3.1.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Terrestrial Vegetation and Wetlands

Potential mitigation measures would be the same as those identified for CPAI Development Plan Alternative A (Section 4A.3.1).

4C-1.3.1.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Terrestrial Vegetation and Wetlands

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.3.2 Fish

Sub-Alternative C-1 (Figure 2.4.3.1-1) provides an alternative road configuration. The principal differences from Alternative A are that Sub-Alternative C-1 includes a more southerly road/pipeline bridge location over the Nigliq Channel near CD-4; a road from CD-1 to CD-3; a more southerly road system to CD5, CD-6, and CD-7 that includes a link to Nuiqsut; and power lines on poles routed on relatively straight alignments between production pads. The locations of the production pads are the same, and airstrips would be constructed only at hypothetical processing facilities.

As in Alternative A, the primary concern in the Plan Area is maintaining winter habitat. Also of concern are maintaining suitable feeding and spawning areas and access to these areas, because those areas are often in different geographic locations; water withdrawal; alteration of flow patterns; release of contaminants during the life of the project; and the impacts of oil spills.

Impacts of and measures to prevent, control, and mitigate spills are not addressed in this section, but can be found in Section 4.3. Further, that section includes an assessment of the project effects on marine fish and habitats. Normal construction and operation impacts for this alternative would not be expected to have measurable impacts on Harrison Bay and nearshore Beaufort Sea environments and biota. Most impacts are to freshwater and migratory species and impacts will be similar on all freshwater and migratory species.

4C-1.3.2.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Fish

The impacts of Sub-Alternative C-1 are largely the same as those of Alternative A, discussed in Section 4A.3.2. Major differences from Alternative A are addressed in the following text.

CONSTRUCTION PERIOD

WATER WITHDRAWAL

The main potential impacts of Sub-Alternative C-1 would be related to winter water withdrawal (e.g., for ice roads) from fish-bearing lakes, as described in Section 4A.3.2. Impacts are not expected if withdrawals are conducted in compliance with permit requirements. The necessary water withdrawals would be monitored to ensure that the volume of water removed from any lake does not exceed permitted amounts.

Potential water sources would be the same as those for Alternative A (Table 4A.3.2-1), plus additional lakes along the more southerly Sub-Alternative C-1 proposed road route (Table 4C-1.3.2-1). Water sources for ice roads to construct the power lines from CD-4 to CD-7 would be those listed for Alternative A (Table 4A.3.2.1). The average annual total water demands (i.e., for both construction and operational needs) for Sub-Alternative

C-1 ice roads, and thus the potential for impact on fish, are almost the same as those for Alternative A from 2005 through 2009. However, in 2010 and beyond, as the construction phase is completing and moving into the strictly operational phase, no ice roads would be needed for Sub-Alternative C-1. Thus the potential for water withdrawal impacts to fish in the operations phase would be less than in Alternative A.

TABLE 4C-1.3.2-1 SUMMARY OF FISH PRESENCE AND ESTIMATED AVAILABLE WINTER WATER IN ADDITIONAL PERMITTED LAKES IN THE SUB-ALTERNATIVE C-1 AREA

LAKE (SEE FIGURE 4C-1.3.2-1)	GIS EST. ACREAGE	MAX. DEPTH (FEET)	CALCULATED VOLUME (MIL GALS)	15% VOL. >7 FEET (MIL GALS)	SPECIFIC CONDUCTANCE (MS/CM)	TDS (MG/L)	VOLUME AVAILABLE (MIL GALS)	FISH CONFIRMED
For Sub-Alternative C-1, the following permitted lakes are in addition to those listed in Table 4A.3.2-1.								
CD-5, CD-6, and CD-7 Areas								
L9306	64.0	10.2	70.9	0.3	--	70.0	0.3	ns
L9307	650.0	6.1	430.7	--	--	--		ns
L9801	40.1	5.0	21.8	--	179.6	--	21.8	No
L9802	221.9	6.0	144.6	--	172.2	--	144.6	No
L9803	160.9	6.0	104.9	--	--	--		ns
L9804	244.2	4.0	106.1	--	--	--		ns
L9805	435.1	4.0	189.0	--	--	--		ns
L9806	392.0	6.0	255.5	--	--	--		ns
L9807	140.6	10.1	223.8	--	151.9	--		NSSB
L9809	22.7	9.0	22.2	0.04	--	--	0.04	ns

Sources: Moulton 1996a, 1996b, 1999a, 2000, 2001, 2002.
Notes:
Water Chemistry: some lakes have multiple years of measurements – most recent year is included
-- = not calculated or no measurement taken
ns = not sampled
Fish Species Code:
NSSB Ninespine Stickleback

GRAVEL MINING

The effects of gravel mining in Sub-Alternative C-1 are expected to be similar to those in Alternative A (Section 4A.3.2).

PIPELINES

Impacts of pipeline installation would be generally the same as those for Alternative A (Section 4A.3.2).

PADS AND AIRSTRIPS

The effects of constructing the pads under Sub-Alternative C-1 would be generally the same as described for Alternative A (Section 4A.3.2). Because no airstrip would be constructed at CD-3, loss of fish habitat at that facility would potentially be less than for Alternative A.

BRIDGES AND ROADS

The dynamic hydrological environment of the Colville River Delta would make construction and maintenance of the road to CD-3 highly problematic. Bridges would be required at the three major channels of the Colville River in the lower Delta (Figure 2.4.3.1-1):

- A 450-foot bridge across the Sakoonang Channel
- A 750-foot bridge across the Tamayayack Channel
- A 500-foot bridge across the Ulamnigiaq Channel

Although these channels are large enough to freeze (and thus do not overwinter fish) in a typical winter (Morris 2003, pers. comm.), in mild winters it is possible that there might be unfrozen waters in these channels that could hold fish. In such circumstances, impacts associated with construction of these bridges are expected to be generally similar to those of constructing the Nigliq Channel bridge in Alternative A (Section 4A.3.2). See Section 4C-1.3.2 for additional details on the severe hydrological conditions in the Colville River Delta.

Sub-Alternative C-1 includes construction of a 1,200-foot bridge across the Nigliq Channel near the proposed CD-4 location (Figure 2.4.3.1-1). Impacts from this bridge would be similar to those described for the Nigliq Channel bridge in Alternative A, which would be installed near CD-2 (Section 4A.3.2). Dissolved oxygen levels could be reduced to levels that are stressful or lethal to fish.

Similar to Alternative A, if a pool of low dissolved oxygen develops around any of the four aforementioned bridges in the river channel at the bottom and middle depths following construction, this anomaly could create a barrier to fish movements. If dissolved oxygen levels were depleted in the vicinity of the bridge and fish movement were to be restricted, the fish and the fishery might be displaced into other areas. Loss of fishery resources might result, decreasing human use of the area to harvest these resources.

A 40-foot bridge would be installed across the narrow portion of Lake 9323 (Figure 4C-1.3.2-1) just north of CD-4 (Figure 2.4.3.1-1). In Alternative A, this crossing would be accomplished by a culvert battery. A bridge at this crossing would eliminate the loss of fish habitat resulting from the gravel base of the culvert/roadway and the disturbance of bottom sediments during construction (Section 4A.3.2).

Once it has crossed the Nigliq Channel, the proposed road and pipeline corridor must cross some meandering, relatively large side channels in the floodplain west of the Nigliq Channel bridge crossing area. These channels do not appear to be deep enough to support overwintering by fish. Once out of the immediate floodplain, the road and pipeline corridors have been situated to avoid major water bodies, but another bridge would be required at the Ublutuoch River crossing. In all cases, none of the habitats that would be crossed appear to be deep enough to constitute winter fish habitat or winter movement corridors. Therefore, little or no winter fish habitat would be affected.

A 40-foot bridge is proposed at the Ublutuoch River (Figure 2.4.3.1-1). Because no in-stream construction activities are planned at this site, construction impacts to fish are not anticipated.

At both the Nigliq Channel and Ublutuoch River, the bridges span only the main channel, and the gravel approaches are in the floodplain terrace(s); thus, fish habitat will be altered and fish movements disrupted (see discussions of bridges in Section 4A.3.2).

CULVERTS

Impacts of culverts, if installed, would be as described in Section 4A.3.2.

BOAT RAMPS AND DOCKS

Construction of boat ramps and docks, should any be needed for spill response purposes, may have in-stream impacts similar to those of bridge construction.

POWER LINES

Because power lines would be installed in winter, no adverse direct impacts to fish populations would be expected. See Water Withdrawal (above) for a discussion of potential impacts of ice roads that would be needed for winter installation of power poles.

HUMAN ACCESS

The availability of the ice roads during winter construction would increase human access to the Ublutuoch River, the Fish Creek drainage, and the Colville River Delta. There would be a direct connection to Nuiqsut, local residents would use these roads, and increased fishing pressure could result.

OPERATION PERIOD

ROADS AND PIPELINES

The Sub-Alternative C-1 road to CD-3 would cause the redistribution of floodwater during large events. The proposed road would force flow to the east, increase velocities across portions of the floodplain, and cause scouring and sedimentation in numerous places where it would not normally occur. Despite armoring and stabilization, the potential for continual erosional degradation of the road as well as transport of sediment into the river would be high. Degradation of the road periodically could force its closing and subsequent increased maintenance activity; alternative means of access (e.g., aircraft) to CD-3 could be necessary when the road is closed. The combination of these factors could change the physiography of the Delta and severely degrade overwintering potential and summer habitats. Because the hydrology of the lower Colville River is so dynamic, the severity of changes to stream morphology is naturally high. The natural changes are so severe that some of the aforementioned added effects from road-caused flooding would not necessarily have any additional impacts on fish.

The connection of the road network to Nuiqsut would increase human use of the Colville River Delta in summer. Road use under Sub-Alternative C-1 would be unrestricted on BLM-administered lands, and both industry personnel and local residents would be permitted to use the other segments of the road. A policy prohibiting fishing and hunting would, however, be applied to industry personnel. Overall, this could increase fishing pressures throughout the Plan Area when waters are not frozen, as well as in overwintering areas such as the lower Delta, the Nigliq Channel, and the Ublutuoch River.

The more southerly alignment of the road and pipeline is farther from the Fish Creek drainage than the alignment in Alternative A. This reduces the potential for contaminant releases from accidents to enter these important fish habitats.

The roads to CD-4, CD-5, and CD-6 are perpendicular to the primary drainage pattern. Without adequate culverts or bridges over low-lying areas, the roads may function as dams over much of their length, potentially disrupting natural hydrology and fish movement, with a subsequent loss of fish resources in the Fish Creek drainage.

PADS

The effects from the five production pads in Sub-Alternative C-1 would be the same as described under Alternative A.

BRIDGES

The bridges at the Nigliq Channel and the Ublutuoch River should be designed to accommodate 200-year return flood events plus 1 foot of freeboard. Other design considerations such as scour protection, ice jams, and storm surges should prevent bridge or road failure. However, if the bridge or road in this area did fail, the primary impacts would be related to oil spills; potential impacts from spills are addressed in Section 4.3. Also, debris

resulting from a bridge failure potentially could additionally disrupt flow and obstruct fish movements in the main channel.

If a bridge does not span the Nigliq Channel floodplain, but rather includes in its design gravel bridge approaches across the floodplain terrace(s), the normal flood stage hydrology of the watercourse would be altered. This could also be a concern at the Ublutuoch River. The potential impacts at these two rivers would be similar to those expected for Alternative A (Section 4A.3.2) and could affect substantial numbers of fish. Building the Nigliq Channel and Ublutuoch River bridges, as specified in the BLM's potential mitigation measures (see Section 4C-1.3.2.4), so that they span the floodplain terrace(s) in addition to the main channel would eliminate the potential for these impacts.

Flow around the in-stream piers at the Nigliq Channel bridge would be altered; however, the effects would be minimal and would not result in an impact on fish or on fish habitat. Features such as these piers often attract and hold fish.

The three lower Colville River Delta road bridges are in frequently flooded areas. Ice jams might occur at these locations with effects similar to those described for Alternative A (Section 4A.3.2).

CULVERTS

Culverts, should they be installed, would be designed to maintain adequate water flow and fish passage. The nature of the potential impacts of installed culverts would be as described in Section 4A.3.2. Because of the greater length of roads proposed for Sub-Alternative C-1, there potentially would be more culverts, and thus a higher potential for impacts compared with Alternative A.

HUMAN ACCESS

Human access to the Ublutuoch River, the Fish Creek drainage, and the Colville River Delta would be increased by the extension of the road system into Nuiqsut. The use of the road would be unrestricted in BLM-administered lands, and both industry and local residents could use the other segments of the road system. This could result in increased fishing pressure. CPAI's no-fishing policy would restrict use of fish resources by non-resident employees.

ABANDONMENT AND REHABILITATION

Impacts to fish from abandonment and rehabilitation would be of the same type as those associated with Alternative A. Removal of the road and associated bridges over three important channels of the Colville River to CD-3 would create impacts to fish similar to those experienced during construction and would be greater than those experienced by fish in these channels under other alternatives. Also, because more ice roads would be necessary to remove power lines considerable distances from the roads and pipelines, there could be more impacts to fish from water withdrawal than in Alternative A.

4C-1.3.2.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Fish

Types of impacts of future development in the Plan Area generally will be similar to those described above for the applicant's five-pad proposed project (Section 4A.3.2). However, development on the scale postulated will, depending on precise siting, destroy or alter fish habitat substantially more than Sub-Alternative C-1 – CPAI Development Plan. Overwintering, rearing, migration, and spawning habitats could be affected.

The road and pipeline network would create subtle alteration of flows of waterways on a landscape scale that could lead to unexpected shifts in drainage and loss of fish resources. Impacts to fish passage would be minimized by installation of culverts or bridges as determined during future permitting efforts. However, culvert failure (see Section 4A.3.2) could cause widespread habitat alteration and obstruction of fish movement.

The extent of road development under this scenario suggests that there would be increased potential for human access to fish resources throughout the Plan Area, thus creating greater pressure on fish populations. This is especially true given the road connection to Nuiqsut that would be built under the Sub-Alternative C-1 five-pad CPAI Development Plan. However, road access would be unrestricted on BLM land and open to industry and locals elsewhere, and some traditional users of the area might chose other locations to avoid industrial activity altogether.

State-of-the-science construction and operation approaches would be used to minimize impacts, and human access to resources could be controlled as described in Section 4A.3.2. Withdrawal of fresh water necessary to support this scale of infrastructure development plus well drilling should not affect fish if withdrawals are done in compliance with permit restrictions. However, total water withdrawal for construction, given the need for separate ice roads for road construction and power pole installation, would be far greater than that envisioned for the Alternative A FFD scenario. Future mitigation measures are expected to be successful based on previous projects' impacts to fish habitat passage.

The following subsections summarize concerns specific to facility groups.

COLVILLE RIVER DELTA FACILITY GROUP

In the Colville River Delta, seven new production pads are hypothesized. Of particular note are production pads HP-12 and HP-14 on the eastern side of the outer Delta, which are in the vicinity of the commercial (Helmericks) fishery as well as subsistence fisheries. Spills, addressed in Section 4.3, would be of major concern with these two hypothetical facilities.

The following bridges in the Colville River Delta have been identified for Sub-Alternative C-1:

- A 1,100-foot bridge across the Tamayayak Channel between CD-1 and HP-7
- A 400-foot bridge across an unnamed channel between HP-7 and HP-12
- A 1,000-foot bridge across the Elaktoveach Channel between HP-7 and HP-12
- A 3,500-foot bridge across the Iaktoveach Channel between HP-7 and HP-12
- A 150-foot bridge across an unnamed channel between HP-12 and HP-13
- An 800-foot bridge across an unnamed channel between HP-12 and HP-13
- A 400-foot bridge across an unnamed channel between HP-12 and HP-14
- A 4,800-foot bridge across the channel between HP-12 and HP-14

Construction of these bridges and the roads to HP-7, HP-12, HP-13, and HP-14 would be in the same problematic environment as described for the road to CD-3 (Section 4C-1.3.2). Once installed, these roads would face the same severe, dynamic hydrology as described for CD-3 (Section 4C-1.3.2). The roads would divert floodwaters to the east across almost the entire breadth of the Delta. Widespread physiographic changes could result that would severely degrade overwintering and summer habitats across the Delta. As noted above for CD-3, the naturally severe and dynamic hydrology of the lower Colville River might mean that added effects from road-caused flooding would not necessarily cause any additional impacts to fish. These channels are expected to freeze in typical winters, thus no impacts to fish would be expected. In mild winters, these waters might not freeze, and thus there is potential for impacts to fish as described above.

FISH-JUDY CREEKS FACILITY GROUP

Several facilities would be situated in sensitive areas as designated by the BLM and MMS (1998a): HP-1, HP-16, HP-17, and HPF-1 in the Fish and Judy creek drainages and HP-11 near the Colville River. Fish habitats in

these drainages are important for spawning, migration, rearing, and overwintering for anadromous and resident species. This may affect subsistence users who do not like to fish near development, especially industrial sites.

The road network of this hypothetical development is extensive. If roads are not routed along high ground to the extent possible, relatively large areas of fish habitat could be affected during road construction. The roads from CD-7 to HP-18 and from CD-6 to HP-15 would be perpendicular to the primary drainage flow and thus could function as dams on a landscape scale, disrupting natural hydrology and obstructing fish movement over a wide area. Bridges or culverts installed in low-lying areas may mitigate this effect.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

As with the Fish-Judy Creeks Facility Group, the road network of this hypothetical development is extensive. Thus relatively large areas of fish habitat might be affected during road construction if roads are not routed along high ground to the extent possible. The road from HP-18 to HPF-2 would be perpendicular to the primary drainage flow and thus could function as a dam on a landscape scale, disrupting natural hydrology and obstructing fish movement over a wide area. Bridges or culverts installed in low-lying areas might mitigate this effect.

4C-1.3.2.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Fish

Within the Plan Area, the primary impacts of concern are those that affect winter habitat, as well as those affecting feeding and spawning areas and access to these areas. Water withdrawal for winter construction could create overcrowding and reduce the available pool of dissolved oxygen in a water body, with fish mortality a possible result. Low dissolved oxygen could also result from suspension of oxygen-demanding materials during construction of the Nigliq Channel bridge. Total water demands for Sub-Alternative C-1 ice roads, and thus the potential for impact to fish, would be far greater than for Alternative A because the length of roads in Sub-Alternative C-1 is greater than in Alternative A, and power lines in Sub-Alternative C-1 do not parallel roads. Impacts are not expected to be significant if withdrawals are conducted in compliance with permit requirements.

Pad, road, and pipeline construction is likely to have no measurable adverse effect on arctic fish populations. However, the severe and dynamic hydrology in the lower Colville River Delta would make construction and maintenance of roads problematic in that area. These lower Delta roads would divert floodwaters to the east across the entire breadth of the Delta, although the incremental effects may not have any added impacts on fish that are already exposed to these highly erosive conditions. Construction of ice roads or airstrips on fish overwintering areas may cause freezing to the bottom and block fish movement if state requirements to maintain fish passage are not met. The new road system might facilitate increased human access to fishing areas, potentially increasing subsistence fishing pressures.

Gravel mining would most likely have direct impacts if it were done within the floodplains of rivers. Sedimentation from erosion could affect fish and other aquatic organisms by interfering with respiration and vision and by smothering benthic habitat. Permit conditions would minimize erosion potential.

Bridge approaches at the Nigliq Channel and Ublutuoch River would extend into the floodplain terrace(s), altering flow and blocking fish passage during high flood stages, and likely adversely affecting the floodplain vegetation. The roads to CD-5 and CD-6 and the long network of roads in the FFD scenario could result in alteration of regional surface hydrology, including interruption of fish movements. Low dissolved oxygen could be caused by sediment suspension during bridge construction, but this effect would be temporary, although even temporary episodes of extremely low oxygen could be lethal. Permit conditions would minimize sedimentation and erosion potential.

If culverts are installed, failures could impound water; this would create a new pond or lake upstream of the culvert and diminish flow downstream, interrupting fish movement. Stream morphology changes could occur downstream of culverts as a result of altered flow.

Release of contaminants over the project duration and the impacts of oil spills are important concerns for fish resources; these issues are addressed in Section 4.3.

The potential impacts described above, should they occur, are likely to be localized and temporary and thus would have no significant effects on fish populations within and adjacent to the Plan Area. Given the total amount of construction proposed, the collective effects of development and production would have some effect on fish and fish habitats in the region. Whether those effects are measurable and distinguishable from naturally occurring population perturbations is uncertain. Minor shifts in habitat or population integrity, especially if they are of a temporary nature, could reasonably be absorbed by the ecosystem. Furthermore, careful planning, appropriate engineering specification and design, and rigorous safety measures should minimize impacts and ensure the reproductive sustainability of stocks overall. Localized impacts could pose a more serious threat to localized (e.g., within a single drainage) stocks if they were to occur in or near prime spawning, nursery, or overwintering sites. Continued monitoring of fisheries resources is vital for evaluating the long-term stability of the region. Monitoring and mitigation plans should be finalized and ready to address the first signs that development may be having a truly detrimental effect on local fish populations.

ESSENTIAL FISH HABITAT

The impacts of this alternative on salmon EFH are the same as those for Alternative A with one major exception. If a large flood event occurred, the road in the lower Colville River Delta would redistribute floodwaters and cause scouring and sedimentation in salmon EFH. Ongoing erosion of a road in this dynamic hydrologic environment would also be expected. However, because the hydrology of the lower Colville River is so dynamic, the severity of changes to stream morphology is naturally so severe that added effects from road-caused flooding would not necessarily have any major effects on salmon EFH. The potential impacts from Sub-Alternative C-1 to fish in general are described in Section 4C-1.3.2.

As is the case with the previous alternatives, because the Plan Area represents marginal habitat for salmon populations, the probability of affecting EFH from a species and commercial perspective is minimal under both the Sub-Alternative C-1 – CPAI Development Plan or the FFD.

4C-1.3.2.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Fish

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.3.2).

4C-1.3.2.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Fish

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.3.3 Birds

See discussions of impacts by bird group presented in Section 4A.3.3 Birds for additional descriptions of impact mechanisms and for description of impact calculation assumptions and methods.

4C-1.3.3.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Birds

Table 4C-1.3.3-1 presents the estimated number of nests displaced as a result of habitat loss, alteration and disturbance for Sub-Alternative C-1 – CPAI Development Plan by bird species and species group.

WATERFOWL AND LOONS

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss due to gravel placement for the construction of connecting roads to CD-3 and extension of the road system to the south for CD-5, CD-6 and CD-7 would affect an additional estimated 4.8 waterfowl nests and 0.4 loon nests compared to Alternative A; and an additional 6.1 waterfowl nests and 0.6 loon nests compared to Alternative B (Table 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2). Habitat alteration impacts would affect an additional estimated 15.9 waterfowl nests and 2.1 loon nests compared to Alternative A; and an additional 33.5 waterfowl nests and 4.6 loon nests compared to Alternative B. The average area covered by ice roads would be increased in Sub-Alternative C-1 compared to Alternatives A and B, affecting an additional estimated 1.4 waterfowl nests and 0.1 loon nests compared to Alternative A; and an additional 1.3 waterfowl and 0.1 loon nests compared to Alternative B. The types of effects on waterfowl and loons associated with gravel placement in Sub-Alternative C-1 would be the same as those described under Alternative A.

Colville River Delta habitats used by waterfowl, loons, and seabirds in Sub-Alternative C-1 that have additional gravel related impacts compared to Alternatives A or B are Tapped Lake with Low- or High–water Connection, Salt Marsh, Deep Open Water with and without Islands, Patterned Wet Meadow, and Moist Sedge-Shrub Meadow (Table 4C-1.3.3-2, 4B.3.3-2, and 4A.3.3-3). In most cases, except for Patterned Wet Meadow, Moist Sedge-Shrub Meadow and Riverine or Upland Shrub, less than 1 percent of available habitats used by waterfowl, loons, and seabirds would be affected in the Colville River Delta (Table 4C-1.3.3-2).

Habitats used by waterfowl, loons, and seabirds in the National Petroleum Reserve-Alaska in Sub-Alternative C-1 that have additional gravel related impacts compared to Alternatives A and B are Old Basin Wetland Complex, Moist Sedge-Shrub Meadow, and Moist Tussock Tundra. In most cases, except for Young Basin Wetland Complex and Moist Tussock Tundra, less than 1 percent of available habitats used by waterfowl, loons, and seabirds would be affected by gravel fill in the National Petroleum Reserve-Alaska area (Table 4C-1.3.3-2).

Disturbance and Displacement

Disturbances from vehicle traffic would be increased in Sub-Alternative C-1 compared to Alternative A or B by the addition of the road connecting CD-3 to CD-1 in the Colville River Delta and the more extensive road system with a connection to Nuiqsut in the National Petroleum Reserve-Alaska. Connection to Nuiqsut could lead to additional traffic from local residents. Disturbance from air traffic would be reduced in Sub-Alternative C-1 compared to Alternatives A or B by the elimination of the airstrip at CD-3 and would be reduced in Sub-Alternative C-1 compared to Alternative B by the elimination of the airstrips at CD-5 and CD-6. Air Traffic disturbance would affect an estimated 21 fewer waterfowl nest and 2.5 loon nests compared to Alternative A; and an estimated 53.8 fewer waterfowl nests and 2.8 loon nests compared to Alternative B (Table 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2).

TABLE 4C-1.3.3-1 CPAI SUB-ALTERNATIVE C-1 – ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE

SPECIES	COLVILLE RIVER DELTA					THE NPR-A AREA					GRAND TOTAL[a]
	Habitat Loss	Habitat Alteration	Ice Road Habitat Loss	Air Traffic Disturbance	Total	Habitat Loss	Habitat Alteration	Ice Road Habitat Loss	Air Traffic Disturbance	Total	
WATERFOWL											
Greater white-fronted goose	3.0	8.3	1.4	0.0	12.7	6.3	27.4	3.8	0.0	37.5	50.2
Snow goose	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canada goose	0.0	0.2	0.0	0.0	0.2	1.5	6.6	0.9	0.0	9.0	9.2
Brant	0.3	0.5	0.1	0.0	0.9	0.7	2.9	0.4	0.0	4.0	4.9
Tundra swan	0.1	0.9	0.2	0.0	1.2	0.1	0.1	0.0	0.0	0.2	1.4
Mallard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern shoveler	0.0	0.2	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.1	0.3
Northern pintail	0.2	1.2	0.2	0.0	1.6	0.3	0.5	0.1	0.0	0.9	2.5
Green-winged teal	0.0	0.2	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.2	0.4
Greater scaup	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2
Lesser scaup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
King eider	0.0	0.0	0.0	0.0	0.0	0.5	3.3	0.5	0.0	4.3	4.3
Long-tailed duck	0.3	1.0	0.2	0.0	1.5	0.6	1.9	0.3	0.0	2.8	4.3
Waterfowl Total[b]	**4.1**	**12.8**	**2.2**	**0.0**	**19.1**	**10.2**	**42.8**	**6.0**	**0.0**	**59.0**	**78.1**
Loons											
Red-throated loon	0.2	0.5	0.1	0.0	0.8	0.1	0.5	0.1	0.0	0.7	1.5
Pacific loon	0.2	1.2	0.2	0.0	1.6	0.8	4.3	0.6	0.0	5.7	7.3
Yellow-billed loon	0.1	0.2	0.0	0.0	0.3	0.1	0.5	0.1	0.0	0.7	1.0
Loon Total[b]	**0.5**	**1.9**	**0.3**	**0.0**	**2.7**	**1.1**	**5.2**	**0.8**	**0.0**	**7.1**	**9.8**
Ptarmigan											
Willow ptarmigan	0.3	1.6	0.3	0.0	2.2	0.8	1.9	0.3	0.0	3.0	5.2
Rock ptarmigan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ptarmigan Total[b]	**0.3**	**1.7**	**0.3**	**0.0**	**2.3**	**0.8**	**1.9**	**0.3**	**0.0**	**3.0**	**5.3**
Seabirds											
Parasitic jaeger	0.0	0.2	0.0	0.0	0.2	0.1	0.9	0.1	0.0	1.1	1.3
Long-tailed jaeger	0.0	0.2	0.0	0.0	0.2	0.1	0.5	0.1	0.0	0.7	0.9
Glaucous gull	0.1	0.2	0.0	0.0	0.3	0.6	3.3	0.5	0.0	4.4	4.7
Sabine's gull	0.1	0.0	0.0	0.0	0.1	0.2	1.0	0.1	0.0	1.3	1.4
Arctic tern	0.2	0.9	0.2	0.0	1.3	0.5	3.3	0.5	0.0	4.3	5.6
Seabird Total[b]	**0.5**	**1.7**	**0.3**	**0.0**	**2.5**	**1.5**	**8.9**	**1.3**	**0.0**	**11.7**	**14.2**

TABLE 4C-1.3.3-1 CPAI SUB-ALTERNATIVE C-1 – ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE CONT.

SPECIES	COLVILLE RIVER DELTA					THE NPR-A AREA					GRAND TOTAL[a]
	Habitat Loss	Habitat Alteration	Ice Road Habitat Loss	Air Traffic Disturbance	Total	Habitat Loss	Habitat Alteration	Ice Road Habitat Loss	Air Traffic Disturbance	Total	
Shorebirds											
Black-bellied plover	0.6	3.9	0.7	0.0	5.2	1.1	9.3	1.3	0.0	11.7	16.9
American golden-plover	0.7	4.8	0.8	0.0	6.3	1.3	6.1	0.9	0.0	8.3	14.6
Bar-tailed godwit	0.1	0.9	0.2	0.0	1.2	0.6	2.4	0.3	0.0	3.3	4.5
Semipalmated sandpiper	6.9	44.9	7.9	0.0	59.7	7.3	53.2	7.5	0.0	67.9	127.6
Baird's sandpiper	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.0	0.6	0.6
Pectoral sandpiper	13.1	85.0	15.0	0.0	113.1	12.4	51.1	7.1	0.0	70.6	183.7
Dunlin	0.5	3.0	0.5	0.0	4.0	1.4	7.5	1.1	0.0	10.0	14.0
Stilt sandpiper	0.6	3.9	0.7	0.0	5.2	1.4	8.4	1.2	0.0	11.0	16.2
Buff-breasted sandpiper	0.0	0.0	0.0	0.0	0.0	0.3	3.7	0.5	0.0	4.5	4.5
Long-billed dowitcher	1.0	6.6	1.2	0.0	8.8	4.6	24.0	3.4	0.0	32.0	40.8
Red-necked phalarope	3.2	21.1	3.7	0.0	28.0	6.7	26.0	3.6	0.0	36.3	64.3
Red phalarope	2.2	14.4	2.5	0.0	19.1	2.5	13.7	1.9	0.0	18.1	37.2
Shorebird Total[b]	**29.0**	**188.6**	**33.3**	**0.0**	**250.9**	**39.6**	**205.7**	**28.8**	**0.0**	**274.1**	**525.0**
Passerines											
Yellow wagtail	0.1	0.9	0.2	0.0	1.2	0.1	1.4	0.2	0.0	1.7	2.9
Savannah sparrow	0.7	4.8	0.8	0.0	6.3	1.7	9.0	1.3	0.0	12.0	18.3
Lapland longspur	13.2	86.0	15.2	0.0	114.4	24.7	118.4	16.6	0.0	159.7	274.1
Common redpoll	0.1	0.9	0.2	0.0	1.2	1.0	6.5	0.9	0.0	7.5	8.7
Passerine Total[b]	**14.3**	**92.6**	**16.3**	**0.0**	**123.2**	**27.5**	**135.3**	**18.9**	**0.0**	**181.6**	**304.8**

Notes:

[a] See Section 4A.3.3 Birds for analysis method

[b] Totals rounded to include birds with <0.1 nests/km_2

TABLE 4C-1.3.3-2 CPAI SUB-ALTERNATIVE C-1 – SUMMARY OF AFFECTED HABITAT TYPES USED BY WATERFOWL, LOONS AND SEABIRDS

HABITAT TYPES (KEY WETLANDS IN BOLD/ITALICS)	COLVILLE DELTA						THE NPR-A				
	ACRES IN COLVILLE RIVER DELTA[b]	LOSS OR ALTERATION[c] (ACRES AND % OF AVAILABLE HABITAT)		SPECIES[a] (16)			ACRES IN THE NPR-A[D]	LOSS OR ALTERATION[c] (ACRES AND % OF AVAILABLE HABITAT)		SPECIES[a] (20)	
				NESTING (16)	BROOD-REARING (13)	STAGING (3)				NESTING (20)	BROOD-REARING (15)
Open Nearshore Water	1,162					1	0				
Brackish Water	1,807			2		2	2				
Tapped Lake with Low-water Connection	5,397	3.0	<0.1%			1	412				
Tapped Lake with High-water Connection	5,146	1.2	<0.1%	5			7				
Salt Marsh	4,473	15.6	0.3%	2	1	1	36				
Tidal Flat	18,187					1	0				
Salt-killed Tundra	6,362			5	1	1	0				
Deep Open Water without Islands	5,650	3.2	<0.1%	4	5		12,386	0.4	<0.1%	1	3
Deep Open Water with Islands or Polygonized Margins	2,160	13.8	0.6%	12	8	1	9,988			3	6
Shallow Open Water without Islands	547	0.3	<0.1%				1,744	0.3	<0.1%	5	3
Shallow Open Water with Islands or Polygonized Margins	155			4	4		2,877	2.6	<0.1%	11	7
River or Stream	20,306	17.6	<0.1%			1	1,456	0.4	<0.1%		
Aquatic Sedge Marsh	32						3,037	6.6	0.2%	10	2
Aquatic Sedge with Deep Polygons	3,275	8.0	0.2%	12	3		66				
Aquatic Grass Marsh	369	1.6	0.4%	2			501			2	
Young Basin Wetland Complex	0						624	19.1	3.1%	9	3
Old Basin Wetland Complex	2						15,673	64.4	0.4%	12	4
Riverine Complex	0						698	2.7	0.4%	3	1
Dune Complex	0						1,889				
Nonpatterned Wet Meadow	11,162	47.3	0.4%	7	2		5,697	24.1	0.4%	4	
Patterned Wet Meadow	27,969	381.3	1.4%	8	4		19,861	81.1	0.4%	7	1
Moist Sedge-Shrub Meadow	2,927	94.7	3.2%	2			42,071	389.5	0.9%	8	1
Moist Tussock Tundra	525	0.1	<0.1%				49,647	795.5	1.6%	3	1
Riverine Low and Tall Shrub	1,270	5.5	0.4%				1,803	1.2	<0.1%		1
Upland Low and Tall Shrub	419	0.1	<0.1%				735	0.6	<0.1%		
Upland and Riverine Dwarf Shrub	0						2,240	3.3	0.1%		
Riverine or Upland Shrub	6,305	66.6	1.1%	2			0				
Barrens (riverine, eolian, or lacustrine)	20,993	17.5	<0.1%	2			1,552				
Artificial (water, fill, peat road)	38						150	0.4	0.3%		
Total Area	**146,638**	**677.6**	**0.5%**				**175,152**	**1392.2**	**0.8%**		

Notes:

[a] Numbers of species using habitats by life history stage (Johnson et al. 2004). Species included are: greater white-fronted goose, snow goose, Canada goose, brant, tundra swan, northern pintail, green-winged teal, greater scaup, spectacled eider, king eider, long-tailed duck, red-breasted merganser, red-throated loon, Pacific loon, yellow-billed loon, parasitic jaeger, long-tailed jaeger, glaucous gull, Sabine's gull, Arctic tern,

[b] Habitat type mapped for the Colville River Delta (Jorgenson et al. 1997) within the Plan Area boundaries

[c] Total includes gravel for pads and airstrips and area indirectly affected by dust, snowdrifts, and alteration in thermal or moisture regimes (see Table 4B.3.1-1)

[d] Habitat type mapped for the NPR-A area (Jorgenson et al. 2003c) within the Plan Area boundaries

Obstructions to Movement

The interconnected road system in Sub-Alternative C-1 compared to Alternative A or B would obstruct some movements of waterfowl and loon broods, especially if traffic levels are increased due to local traffic.

Mortality

Potential mortality resulting from collisions with vehicles would be higher in Sub-Alternative C-1 than in Alternatives A or B, with the development of the interconnected and more extensive road system. The potential mortality from collisions with aircraft would be reduced in Sub-Alternative C-1, compared to Alternatives A or B, with the elimination of the airstrip at CD-3 from Alternatives A and B and airstrips from CD-5 and CD-6 in Alternative B. Any increase in predator populations attracted to the development areas would result in decreased reproductive success for waterfowl and loons. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as long-tailed ducks (Mallek et al. 2003) and red-throated loons (Larned et al. 2003b); and to colonial nesting species which concentrate in specific locations such as brant and snow geese. Placement of all power lines on poles instead of VSMs would potentially increase nest and gosling or duckling depredation from raptors and ravens in Sub-Alternative C-1 compared to Alternatives A or B by providing perches.

OPERATION PERIOD

Habitat Loss, Alteration, and Enhancement

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Habitat loss and alterations increased in Sub-Alternative C-1 compared to Alternatives A and B because of the more extensive gravel fill, interconnected road system, numerous drainage crossings and potentially higher traffic levels due to local access from Nuiqsut. Habitat alterations from low-ground-pressure vehicles during summer or winter would be reduced in Sub-Alternative C-1 compared to Alternative A or B because of the road access to all facilities.

Disturbance and Displacement

Disturbance from vehicle traffic would be increased in Sub-Alternative C-1 compared to Alternatives A or B at CD-3 and potentially at CD-4, CD-5, CD-6, and CD-7 because of local access from Nuiqsut. Disturbance from air traffic would be reduced in Sub-Alternative C-1 compared to Alternatives A or B by the elimination of the airstrip at CD-3 from Alternatives A and B and the elimination of airstrips at CD-5 and CD-6 from Alternative B.

Obstructions to Movement

Obstructions to movements of waterfowl and loon broods across roads would continue during project operation. This potential obstruction would be higher than in Alternatives A or B because of the longer interconnected road system and local access from Nuiqsut, which may lead to increased traffic levels.

Mortality

Potential mortality from collisions with vehicles would be higher in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive road system. Increased traffic resulting from local access from Nuiqsut would also potentially increase mortality from collisions with vehicles. Mortality from subsistence harvest may also increase if residents use the road system for access; alternatively, subsistence related mortality may decrease if hunters avoid areas with developments. Mortality from collisions with aircraft would be reduced in Sub-Alternative C-1 compared to Alternatives A or B because of the elimination of the airstrip at CD-3 from Alternatives A and B and the elimination of airstrips at CD-5 and CD-6 from Alternative

B. Mortality due to collisions with power lines would be increased in Sub-Alternative C-1 compared to Alternatives A or B by the placement of all power lines on poles. Nest and duckling or gosling mortality due to depredation by raptors or ravens would be increased by the presence of power lines on poles which can be used for perching by raptors and ravens. Potential mortality from depredation by seabirds may also be increased in Sub-Alternative C-1 compared to Alternatives A or B by the increased vantage from the 7-foot versus the 5-foot elevated pipeline.

Any increase in predator populations attracted to the development would result in decreased reproductive success for waterfowl and loons. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as long-tailed ducks (Mallek et al. 2003) and red-throated loons (Larned et al. 2003b); and to colonial nesting species which concentrate in specific locations providing an abundant and predictable protein source.

PTARMIGAN

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss from gravel fill would result in an estimated 3 to 6 ptarmigan nests displaced across Alternatives A to C with 1.9 to 2.8 additional nests affected in Sub-Alternative C-1 compared to Alternatives A and B, respectively (Table 4C-1.3.3-1, 4B.3.3-1, 4A.3.3-2). The area of Patterned Wet Meadow and Moist Sedge-Shrub Meadow habitats used by ptarmigan for nesting and brood-rearing affected by gravel fill in Sub-Alternative C-1 increased by 59 percent from Alternative A and 41 percent from Alternative B (Table 4C-1.3.3-1, 4B3.3-1, 4A.3.3-2).

Disturbance and Displacement

Disturbance from vehicle traffic would be increased in Sub-Alternative C-1 compared to Alternatives A or B, while disturbance from air traffic would be decreased. Industry and local use of the access road connecting the Colville River Delta sites with the National Petroleum Reserve-Alaska sites and Nuiqsut could result in increased levels of vehicular traffic compared to Alternative A.

Obstruction to Movement

Potential obstructions to ptarmigan movements would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive and interconnected road system and provisions for local access.

Mortality

Potential mortality resulting from collisions with vehicles would increase in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive interconnected road system with access from local traffic. Any increase in predator populations attracted to the development would result in increased adult mortality and decreased reproductive success for ptarmigan. The magnitude and extent of decreased productivity have not been quantified. Mortality from increased depredation of adults, eggs, and chicks would be higher in Sub-Alternative C-1 compared to Alternatives A or B because of the placement of all power lines on poles, which increases avian predator efficiency by providing perches.

OPERATION PERIOD

During the operation period under Sub-Alternative C-1, the potential types of impacts to ptarmigan from habitat loss and alteration, disturbance, obstructions to movements, and mortality would be the same as those described previously for the construction period.

RAPTORS AND OWLS

Raptors are generally uncommon visitors and occasional nesters in the Plan Area. Habitat loss resulting from the proposed development in Sub-Alternative C-1 are unlikely to affect raptors because of the low numbers of birds reported in the Plan Area. Gravel roads, buildings, pipelines, and bridges would not obstruct raptor movements. Perches provided by communication towers, power poles, buildings, and pipelines at 7 feet could increase the ability of raptors to prey on other waterfowl, loons, seabirds, shorebirds, passerines, and ptarmigan. Raptors may collide with the power lines on poles, especially along the 3-mile Fish Creek buffer. The small numbers of raptors and owls that occur in the Plan Area are unlikely to suffer any mortality from collisions with vehicular traffic, buildings, bridges, or pipelines. Elimination of the airstrip at CD-3 would reduce disturbance to peregrine falcons foraging on juvenile and staging shorebirds in the lower Colville River Delta.

SHOREBIRDS

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Total habitat loss and alteration would affect an additional estimated 178.1 and 293.2 shorebird nests in Sub-Alternative C-1 compared to Alternatives A and B, respectively, because of increased gravel fill and increased dust fallout caused by the more extensive road system (Table 4C-1.3.3-1). Habitats used by shorebirds that would be most affected by increased gravel fill in Sub-Alternative C-1 compared to Alternatives A or B are Patterned Wet Meadow, Moist Sedge-Shrub Meadow, Moist Tussock Tundra, and Riverine or Upland Shrub (Table 4C-1.3.3-2, 4B.3.3-2, and 4A.3.3-3). In all cases, less than 5 percent of these habitats available in the Colville River Delta and in the National Petroleum Reserve-Alaska would be affected by gravel fill and dust deposition (Table 4C-1.3.3-2).

Disturbance and Displacement

Disturbance from vehicle traffic would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive road system and potentially increased traffic levels from local access. Disturbance to an estimated 313 staging shorebirds, within 500 meters of the airstrip in the lower Colville River Delta, due to air traffic at the CD-3 site would be eliminated with removal of this airstrip.

Obstructions to Movements

Potential obstructions to movements of shorebird broods would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive interconnected road system and potentially increased traffic levels from local access.

Mortality

Potential mortality resulting from collisions with vehicles would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive interconnected road system and potentially increased traffic levels from local access. Mortality due to collisions with power lines on poles would be increased in Sub-Alternative C-1 compared to Alternative B and C. Any increase in predator populations attracted to development areas would result in decreased reproductive success for shorebirds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with

populations which may be declining such as buff-breasted sandpipers and dunlin. Mortality from depredation of adults, nests, and chicks would be higher in Sub-Alternative C-1 than in Alternatives A or B because placement of all power lines on poles and increased pipeline elevation from 5 feet to 7 feet would increase perching habitat and improve vantage points for raptors, gulls and ravens.

OPERATION PERIOD

Habitat Loss, Alteration, or Enhancement

Impacts to shorebirds from habitat loss and alteration would continue during project operations and would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the increased gravel fill and more extensive road system. Habitat impacts from ice roads and tundra travel would be decreased in Sub-Alternative C-1 compared to Alternatives A and B because of road access to all facilities in Sub-Alternative C-1.

Disturbance and Displacement

Disturbance from vehicle traffic would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive road system and potentially increased traffic from local access. Disturbance to staging shorebirds in the lower Colville River delta would be eliminated with road access to CD-3.

Obstructions to Movements

Obstruction to movements of shorebird broods would continue during project operation and would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive interconnected road system and added local traffic.

Mortality

Mortality from collisions with vehicles would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive road system and potentially increased traffic levels. Mortality due to collisions with power lines would be increased by the placement of power lines on poles. Any increase in predators attracted to development areas would result in decreased reproductive success for shorebirds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as buff-breasted sandpipers and dunlin. Mortality from depredation of adults, nests, and chicks would be higher in Sub-Alternative C-1 than in Alternatives A or B because placement of all power lines on poles and increased pipeline elevation from 5 feet to 7 feet would increase perching habitat and improve vantage points for raptors, gulls and ravens.

SEABIRDS (GULLS, JAEGERS, TERNS)

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration resulting from gravel placement would be increased in Sub-Alternative C-1 compared to Alternatives A and B, resulting in displacement of an additional estimated 2.6 and 7.8 seabird nests compared to Alternatives A and B, respectively (Table 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2). Gravel fill would affect more acres of Deep Open Water with Islands, Old Basin Wetland Complex and Patterned Wet Meadow and fewer acres of Aquatic Sedge with Deep Polygon habitats used by nesting and brood-rearing seabirds in Sub-Alternative C-1 than in Alternatives A or B (Table 4C-1.3.3-2, 4B.3.3-2, and 4A.3.3-3). Increasing the elevation of the pipeline from 5 feet to 7 feet may provide perching habitat that would enhance foraging efficiency of seabirds.

Disturbance and Displacement

Disturbance from vehicle traffic would be increased in Sub-Alternative C-1 above that in Alternatives A or B because of the more extensive interconnected road system and local access from Nuiqsut. Disturbance from air traffic would be reduced in Sub-Alternative C-1 by elimination of the airstrip at CD-3 from Alternatives A and B and the elimination of the airstrips at CD-5 and CD-6 from Alternative B affecting an estimated 2.4 and 5.4 fewer seabird nests than Alternatives A and B, respectively (Table 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2).

Obstructions to Movement

Obstructions to movements of seabird broods would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive interconnected road system and increased access to local traffic.

Mortality

Mortality from collisions with vehicles would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive interconnected road system and increased access to local traffic. Mortality from collisions with aircraft would be decreased in Sub-Alternative C-1 compared to Alternatives A or B because of the elimination of one to three airstrips among the alternatives. Mortality from collisions with power lines would be increased by placement of all power lines on poles in Sub-Alternative C-1. Any increase in predator populations attracted to the development could result in decreased reproductive success for seabirds. The magnitude and extent of this decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as jaegers and arctic tern (Mallek et al. 2003). Mortality from increased depredation on eggs or young may also be increased by the placement of all power lines on poles and increasing the pipeline height from 5 feet to 7 feet, giving avian predators perching locations and vantage points.

OPERATION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration from gravel placement would continue during project operations and would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive interconnected road system.

Disturbance and Displacement

Under Sub-Alternative C-1, seabirds would be subjected to the same types of disturbances discussed above for Alternatives A and B, including disturbances related to vehicular traffic, noise from equipment on roads or at facilities, and pedestrian traffic. Disturbance from air traffic would be reduced in Sub-Alternative C-1 by elimination of the airstrip at CD-3 from Alternatives A and B and the elimination of the airstrips at CD-5 and CD-6 from Alternative B. Industry and local use of the access road connecting the Colville River Delta sites with the National Petroleum Reserve-Alaska sites and Nuiqsut may result in increased levels of vehicular traffic compared to either Alternative A or B.

Obstructions to Movement

Obstructions to movements of seabird broods would continue during project operations and would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive interconnected road system and potentially increased traffic resulting from local access.

Mortality

Mortality from collisions with vehicles would continue during project operation and would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive interconnected road system and potentially increased traffic levels resulting from local access. Mortality from collisions with aircraft would be reduced by the elimination of the airstrip at CD-3 from Alternatives A and B and the elimination of the airstrips at CD-5 and CD-6 from Alternative B. Mortality from collisions with power lines would be increased by the placement of all power lines on poles in Sub-Alternative C-1. Any increase in predator populations attracted to the development could result in decreased reproductive success for seabirds. The magnitude and extent of this decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as jaegers and arctic terns (Mallek et al. 2003). Potential for increased depredation from raptors or common ravens perching on power poles would be increased in Sub-Alternative C-1 compared to Alternatives A or B.

PASSERINES

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of increased gravel fill resulting in the loss of an additional estimated 98.8 to 203.2 passerine nests, primarily Lapland longspurs (Table 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-1). The areas of Riverine or Upland Shrub and Moist Sedge-Shrub Meadow habitats used by nesting passerines that would be affected by gravel related impacts in Sub-Alternative C-1 would be nearly doubled or tripled compared to Alternatives A and B. Power poles, communication towers, and buildings would provide perches for common ravens and structures for nesting. VSMs and buildings would provide nesting structures for snow buntings.

Disturbance and Displacement

Disturbance from vehicle traffic would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive interconnected road system and increased access to local traffic.

Obstructions to Movements

As with Alternatives A and B, road systems and structures would not be anticipated to obstruct passerine movements.

Mortality

Mortality from collisions with vehicles would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive interconnected road system and increased access to local traffic. Mortality from collisions with power lines would be higher in Sub-Alternative C-1 than in Alternatives A or B because of placement of all power lines on poles. Any increase in predator populations attracted to the development could result in increased adult mortality and decreased reproductive success for passerines. The magnitude and extent of this decreased productivity have not been quantified. Mortality from depredation of adults, nests, and young may be increased by using poles to support power lines, which would provide perching habitats for raptors and ravens.

OPERATION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration would continue during project operation and would be greater in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive interconnected road system and increased access for local traffic.

Disturbance and Displacement

Disturbance from vehicle traffic would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive interconnected road system and increased access to local traffic.

Obstructions to Movements

As with Alternatives A and B, operational activities would not be anticipated to obstruct passerine movements.

Mortality

Mortality from collisions with vehicles would continue during project operation and would be higher in Sub-Alternative C-1 than in Alternatives A or B because of the more extensive interconnected road system and increased access to local traffic. Any increase in predator populations attracted to the development could result in increased adult mortality and decreased reproductive success for passerines. The magnitude and extent of this decreased productivity have not been quantified. Mortality would be increased in Sub-Alternative C-1 compared to Alternatives A or B by the placement of power lines on poles, which would result in both collisions and increased depredation from raptors and common ravens perching on poles.

ABANDONMENT AND REHABILITATION

Because more ice roads would be necessary to remove pipelines and overhead power lines considerable distances from each other, more potential nest sites would be made unavailable under this alternative than under Alternative A. There would be fewer impacts to birds from air traffic, because the vast majority of traffic will be by gravel roads. The addition of road traffic to CD-3 and the longer road network in National Petroleum Reserve-Alaska would have impacts similar to those described for construction. There would be greater continued loss or alteration (depending upon on the type of rehabilitation required) of bird habitat upon abandonment, because there would be approximately 82 acres more acres of gravel fill constructed. Overall impacts of abandonment and rehabilitation activities would be localized and no adverse impacts to North Slope populations are expected.

4C-1.3.3.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Birds

The mechanisms associated with habitat loss and alteration, disturbance and displacement, obstruction to movements, and mortality for birds in the Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers facility groups would be the same as those described under Alternative A. Table 4C-1.3.3-3 summarizes impacts for Sub-Alternative C-1 FFD based on assumptions and calculation methods presented in Section 4A.3.3 for estimated numbers of bird nests affected in the Colville River Delta and the National Petroleum Reserve-Alaska. In Sub-Alternative C-1 FFD, all facilities would be supported by road access, all power lines would be place on poles, and most facilities would be moved outside of the 3-mile sensitive area around Fish Creek. Total gravel placement would be increased in Sub-Alternative C-1 compared to Alternatives A or B, resulting in the greatest potential displacement of bird nests from impacts related to gravel fill (Table 4C-1.3.3-3, 4B.3.3-3, and 4A.3.3-4).

COLVILLE RIVER DELTA FACILITY GROUP

A summary of the estimated numbers of bird nests affected by habitat loss, alteration and disturbance due to the hypothetical FFD in the Colville River Delta is presented in Table 4C-1.3.3-3.

HABITAT LOSS, ALTERATION, OR ENHANCEMENT

Total habitat loss and alteration from gravel placement and ice roads would be increased in Sub-Alternative C-1 FFD compared to Alternatives A or B FFD, resulting in an estimated additional 236 and 228 nests affected compared to Alternative A and B, respectively (Table 4C-1.3.3-3, 4B3.3-3, and 4A.3.3-4). Potential habitat loss due to flooding and road washouts in the lower Delta may not be fully accounted for using the 165-foot habitat alteration buffer. Habitat alteration from tundra travel would be reduced from FFD Alternatives A and B because of the road access to all facilities. Placement of power lines on poles rather than VSMs would provide perching habitat for raptors, common ravens, and glaucous gulls. The 7-foot pipeline elevation may decrease the amount of snow drifting in some locations and the resulting spring habitat availability. The more southern placement of the Nigliq crossing affects more willow habitat than the Alternative A crossing location.

DISTURBANCE AND DISPLACEMENT

The addition of the road system in the outer Colville River Delta under Sub-Alternative C-1 FFD would increase the disturbance to birds during nesting, brood-rearing, and fall staging from vehicular traffic and machinery compared to Alternatives A and B FFD. The road connection with Nuiqsut could allow increased levels of local traffic that would increase disturbance. The elimination of the airstrips at production pads under Sub-Alternative C-1 would eliminate disturbance associated with air traffic, including disturbance to staging shorebirds in the lower delta.

OBSTRUCTION TO MOVEMENT

The more extensive interconnected road system and local access would increase obstruction of brood-rearing waterfowl, seabirds, and shorebirds in Sub-Alternative C-1 compared to Alternatives A or B.

MORTALITY

Mortality from collisions with vehicles and power lines would be increased in Sub-Alternative C-1 FFD compared to FFD Alternatives A or B because of the more extensive interconnected road system, potentially increased traffic, and placement of power lines on poles. Mortality from collisions with aircraft would be reduced by the elimination of airstrips at pad locations. Mortality from subsistence hunting may be increased by local access to the lower Colville River Delta from the interconnected road system. Alternatively subsistence hunting may be reduced in the Delta if hunters avoid areas with development.

Any increase in predator populations attracted to development areas could result in increased adult mortality and decreased reproductive success for birds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with declining populations, with low total population sizes, and which aggregate in predictable locations year to year. Within the Plan Area, species which may be declining include long-tailed ducks (Mallek et al. 2003), red-throated loons (Larned et al. 2003b) buff-breasted sandpipers (Lanctot and Laredo 1994), dunlin, jaegers and arctic tern (Mallek et al. 2003); with low total population sizes include red-throated loons, yellow-billed loons, buff-breasted sandpipers, and dunlin; and colonial nesting species include brant and snow geese.

FISH-JUDY CREEKS FACILITY GROUP

A summary of the estimated numbers of bird nests affected by the hypothetical FFD in the Fish-Judy Creeks Facility Group area is presented in Table 4C-1.3.3-3.

HABITAT LOSS, ALTERATION, OR ENHANCEMENT

Habitat loss and alteration from gravel placement would be decreased in Sub-Alternative C-1 FFD compared to Alternative A, and increased compared to Alternative B FFD. Decreased habitat impacts due to gravel and ice roads in Sub-Alternative C-1 compared to Alternative A result in an estimated 50 fewer bird nests affected (Table 4C-1.3.3-3 and Table 4A.3.3-4). Increased habitat impacts due to gravel and ice roads in Sub-Alternative C-1 compared to Alternative B result in an estimated additional 402 nests affected (Table 4C-1.3.3-3 and 4B.3.3-3). Placement of HPF-1 and associated access roads within the 3-mile Fish Creek buffer in Alternatives A and C would potentially impact a larger number of birds compared to Alternative B. Placement of power lines on poles rather than VSMs would provide perching habitat for raptors, common ravens, and glaucous gulls. The 7-foot pipeline elevation may decrease the amount of snow drifting and the resulting habitat availability during early spring.

DISTURBANCE AND DISPLACEMENT

The addition of the road system in the Fish and Judy creeks drainage under Sub-Alternative C-1 FFD would increase the potential for disturbance to birds from vehicular traffic and machinery compared to FFD Alternatives B. The road systems in Alternatives A and C are comparable. Local access is the same for Alternatives A and C, allowing increased local traffic for these alternatives compared to Alternative B. The elimination of the airstrips at production pads under Sub-Alternative C-1 FFD would eliminate disturbance associated with air traffic compared to Alternative B, but is the same as Alternative A FFD.

OBSTRUCTION TO MOVEMENT

The more extensive interconnected road system and local access would increase obstruction of brood-rearing waterfowl, seabirds, and shorebirds in Sub-Alternative C-1 FFD compared to Alternative B. Road systems are comparable for FFD Alternatives A and C.

MORTALITY

Mortality from collisions with vehicles would be increased in Sub-Alternative C-1 FFD compared to FFD Alternatives B because of the more extensive interconnected road system, and access for local traffic. Road systems are comparable for Alternatives A and C. Placement of all power lines on poles would increase mortality due to collisions in Sub-Alternative C-1 compared to Alternatives A and B. Mortality from collisions with aircraft would be reduced by the elimination of airstrips at pad locations from Alternative B, but would be the same as Alternative A. Mortality from hunting could be increased by local access over the road system; alternatively, hunting mortality could decrease if hunters avoid developed areas.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

A summary of the estimated numbers of bird nests affected by the hypothetical FFD in the Kalikpik-Kogru Rivers Facility Group area is presented in Table 4C-1.3.3-3.

HABITAT LOSS, ALTERATION, OR ENHANCEMENT

Habitat loss and alteration due to gravel placement would be increased in Sub-Alternative C-1 FFD with the road connection to HP-22 resulting in an estimated additional 154 and 210 nests affected compared to Alternatives A and B – FFD, respectively (Table 4C-1.3.3-3, 4B.3.3-3, and 4A.3.3-4). Placement of power lines on poles rather than VSMs would provide perching habitat for raptors, common ravens, and glaucous gulls. The 7-foot pipeline elevation may decrease the amount of snow drifting and the resulting spring habitat availability.

DISTURBANCE AND DISPLACEMENT

The addition of the road system in the Kalikpik-Kogru Rivers Facility Group under Sub-Alternative C-1 FFD would increase the potential for disturbance to birds from vehicular traffic and machinery compared to Alternatives A and B FFD. The road connection with Nuiqsut extending to the Kogru River could allow increased levels of local traffic that would increase disturbance. Development of HP-22, in conjunction with local road access, could lead to additional use of this area for large boat access to the Beaufort Sea. The elimination of the airstrip at HP-22 under Sub-Alternative C-1 FFD would eliminate disturbance associated with air traffic compared to Alternative A. HP-22 does not appear in Alternative B FFD.

OBSTRUCTION TO MOVEMENT

The interconnected road system, connection to HP-22, and access for local traffic would increase obstruction of brood-rearing waterfowl, seabirds, and shorebirds in Sub-Alternative C-1 FFD compared to Alternatives A and B FFD.

MORTALITY

Mortality from collisions with vehicles and power lines would be increased in Sub-Alternative C-1 FFD compared to Alternatives A and B FFD because of the more extensive road system, access for local traffic, and placement of power lines on poles. Mortality from collisions with aircraft would be reduced by the elimination of the airstrip at HP-22. Mortality from hunting may be increased by local road access to the Kogru River area if hunters use the road system for access.

Any increase in predator populations attracted to development areas could result in increased adult mortality and decreased reproductive success for birds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with declining populations, with low total population sizes, and which aggregate in predictable locations year to year. Within the Plan Area, species which may be declining include long-tailed ducks (Mallek et al. 2003), red-throated loons (Larned et al. 2003b) buff-breasted sandpipers (Lanctot and Laredo 1994), dunlin, jaegers and arctic tern (Mallek et al. 2003); with low total population sizes include red-throated loons, yellow-billed loons, buff-breasted sandpipers, and dunlin; and colonial nesting species include brant and snow geese.

4C-1.3.3.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Birds

Impacts on birds associated with construction and operation of the proposed development include habitat loss, alteration, or enhancement; disturbance and displacement; obstructions to movement; and mortality. Additional impacts due to lost productivity are not quantified by this analysis, including impacts due to increased nest depredation caused by increased predator populations. The Project Team estimated the number of nests affected by habitat loss, alteration or disturbance for each alternative based on site specific nesting densities for bird species and species groups to compare alternative development scenarios. Effects would be localized, and no measureable effects to North Slope populations would be expected. CPAI Sub-Alternative C-1 would reduce nesting by 1 percent for Plan Area waterfowl, loon and seabird populations and by 1 percent or less for Plan Area shorebird and passerine populations. Sub-Alternative C-1 – FFD would reduce nesting by 3 to 6 percent for Plan Area waterfowl, loon and seabird populations and 2 percent for Plan Area shorebird and passerine populations. Habitat loss does not involve the direct loss of active nests because winter gravel placement, ice road construction, snow dumping, and snow drifting occurs when nests are not active. Most impacts would be initiated during the construction period, including gravel placement, grading of the gravel surface, placement of all facilities, and initial drilling. The results of the affects of these activities on estimated bird production due to loss, alteration or disturbance of nesting habitat for Sub-Alternative C-1, CPAI and FFD, are presented in Table 4C-1.3.3-4.

4C-1.3.3.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Birds

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.3.3).

4C-1.3.3.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Birds

The effectiveness of the protective measures would be similar to Alternative A.

TABLE 4C-1.3.3-3SUB-ALTERNATIVE C-1 – FFD - ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE

BIRD GROUP	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL[a]
COLVILLE RIVER DELTA FACILITY GROUP					
Waterfowl	5	23	3	0	31
Loons	1	4	0	0	5
Ptarmigan	1	3	0	0	4
Raptors and Owls	0	0	0	0	0
Seabirds	1	3	0	0	4
Shorebirds	75	365	39	0	479
Passerines	37	179	19	0	235
Total Nests	**120**	**577**	**61**	**0**	**758**
FISH-JUDY CREEKS FACILITY GROUP					
Waterfowl	38	125	5	15	183
Loons	5	15	0	2	22
Ptarmigan	2	5	0	1	8
Raptors and Owls	0	0	0	0	0
Seabirds	8	26	1	3	38
Shorebirds	185	602	24	0	811
Passerines	122	396	16	0	534
Total Nests	**360**	**1,169**	**46**	**21**	**1,596**
KALIKPIK-KOGRU RIVERS FACILITY GROUP					
Waterfowl	14	66	8	15	103
Loons	2	8	1	2	13
Ptarmigan	1	3	0	1	5
Raptors and Owls	0	0	0	0	0
Seabirds	3	14	2	3	22
Shorebirds[b]	66	319	42	0	427
Passerines	43	210	28	0	281
Total Nests	**129**	**620**	**81**	**21**	**851**

Notes:
[a] see Section 4A.3.3 for assumptions and calculation methods

TABLE 4C-1.3.3-4 SUB-ALTERNATIVE C-1 (CPAI AND FFD) – ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE

CPAI SUB-ALTERNATIVE C-1 TOTALS[a]					
BIRD GROUP	**HABITAT LOSS**	**HABITAT ALTERATION**	**ICE ROAD HABITAT LOSS**	**AIR TRAFFIC DISTURBANCE**	**TOTAL**
Waterfowl	14	56	8	0	78
Loons	2	7	1	0	10
Ptarmigan	1	4	0	0	5
Seabirds	2	11	1	0	14
Shorebirds	69	394	62	0	525
Passerines	42	228	35	0	305
Total Nests	**130**	**700**	**107**	**0**	**937**
SUB-ALTERNATIVE C-1 – FFD TOTALS[a]					
Waterfowl	57	214	16	30	317
Loons	8	27	1	4	40
Ptarmigan	4	11	0	2	17
Seabirds	12	43	3	6	64
Shorebirds	326	1,286	105	0	1,717
Passerines	202	785	63	0	1,050
Total Nests	**609**	**2,366**	**188**	**42**	**3,205**

Notes:
[a] See Section 4A.3.3 Birds for assumptions and calculation methods. Totals from Tables 4C-1.3.3-1 and 4C-1.3.3-3.

4C-1.3.4 Mammals

4C-1.3.4.1 Terrestrial Mammals

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON TERRESTRIAL MAMMALS

Important characteristics of Sub-Alternative C-1 with regard to affects on terrestrial mammals include the following. Sub-Alternative C-1 would include 42 miles of road and 42 miles of pipeline (Figure 2.4.3.1-1). This is 16 miles more road and 6 miles more pipeline than in Alternative A. Essentially all of the pipelines in Sub-Alternative C-1 have an adjacent road, including the route to CD-3 in the Colville River Delta. Most pipelines in Alternative A have adjacent roads, except the route to CD-3. The area covered by gravel in Sub-Alternative C-1 includes 46 acres of gravel pads and 277 acres of gravel road and approximately 86 acres of vegetation cover lost at Clover. This is 20 acres fewer of pads/airstrips than Alternative A and 104 acres more of road than Alternative A. There are no airstrips in Sub-Alternative C-1. The total gravel fill (pads, roads, airstrips) for Sub-Alternative C-1 is 82 acres more than that for Alternative A. The road/pipeline routes in Sub-Alternative C-1 are substantially different from those in Alternative A. Sub-Alternative C-1 differs from Alternative A in that there is a road connecting Nuiqsut, Alpine CD-1, and all the new facilities (CD-3 through CD-7). Unlike Alternatives A and B, there is a road accompanying the pipeline from CD-1 to CD-3. The route of the road/pipelines connecting CD-2 and CD-4 through CD-7 is several miles to the south of the road/pipeline routes in Alternatives A, B, and D. In Sub-Alternative C-1, pipelines would be elevated to 7 feet, and roads would be by used by industry, local residents, and the public (on BLM lands).

CONSTRUCTION PERIOD

Direct Habitat Loss, Alteration, or Enhancement

In Sub-Alternative C-1, the amount of area to be covered by gravel would increase by 82 acres compared to Alternative A. See the Operation Period section under Sub-Alternative C-1 for quantification of habitat types

lost or altered under gravel fill. The road from the Clover Potential Gravel Source to CD-6 and CD-7 might cover one existing inactive (in summer 2002) arctic fox den (Johnson et al. 2003b).

Disturbance and Displacement

In Sub-Alternative C-1, disturbance and displacement effects during winter and summer construction would be similar to those described for Alternative A but in the different Sub-Alternative C-1 locations of the road/pipeline corridors. There would be increased construction between CD-1 and CD-3 because of the road included in Sub-Alternative C-1. This might increase the potential for disturbance of denning grizzly bears and polar bears. The road/pipeline routes between CD-4, CD-5, CD-6, and CD-7 would be farther to the south than those in Alternative A. Construction activity could cause some disturbance and displacement of wintering caribou, muskoxen, moose, and denning grizzly bears, as with Alternative A. The potential for disturbance of caribou could be greater in Sub-Alternative C-1 than in Alternative A because past winter distributions of caribou have included the southeast part of the Plan Area. The potential for disturbance of moose may be greater in Sub-Alternative C-1 than in Alternative A because moose tend to occur farther to the south in the winter.

Obstruction to Movements

The access road to CD-6 and CD-7 under Sub-Alternative C-1 would be approximately 5 miles south of that proposed in Alternative A. This could affect the movements of more caribou in winter (BLM and MMS 2003a). As discussed under Alternative A, there would probably be few moose, muskoxen, wolves, or wolverines near construction areas during the winter. Construction in the riparian zones (e.g., along the Ublutuoch River) could obstruct movements of these species in summer or winter. The potential for obstruction of movements to have adverse effects on terrestrial mammals would be greatest if there are energy demands and less forage available because of cold temperatures or heavy snowfall.

Mortality

Mortality associated with construction of Sub-Alternative C-1 would likely be similar to that described for Alternative A. Because the construction of the Sub-Alternative C-1 road from CD-4 to CD-6 and CD-7 would occur in an area that has had more wintering caribou, more vehicle-collisions could occur along this route. The construction activity for Sub-Alternative C-1 may disturb some denning grizzly bears, possibly resulting in mortality from human conflict or exposure of cubs or adults to harsh winter conditions.

OPERATION PERIOD

Direct Habitat Loss, Alteration, or Enhancement

Direct habitat lost for foraging by terrestrial mammals would be the area covered by gravel fill. This would be restricted to the roads and facility pads because there would be no new airstrips. Sub-Alternative C-1 would have 82 acres more gravel fill than Alternative A. The additional gravel fill in Sub-Alternative C-1 could increase potential insect-relief habitat. The road from CD-1 to CD-3 could provide additional potential insect-relief habitat in the northern part of the Colville River Delta.

The two most important foraging habitat types for caribou in summer are Moist Sedge-Shrub Meadow and Moist Tussock Tundra (Lawhead et al. 2003, Russell et al. 1993, Jorgenson et al. 2003c). The Barrens habitat type primarily provides insect relief to caribou in summer (Jorgenson et al. 2003c). The most important habitat types for muskoxen include Riverine, Upland Shrub, and Moist Sedge-Shrub Meadow habitat types (PAI 2002a; BLM and MMS 2003a, and references therein). These habitat types, as well as Barrens, are the most important habitat types for grizzly bears (Shideler and Hechtel 2000; Jorgenson et al. 2003c; PAI 2002a, and references therein). The Riverine and Upland Shrub habitat types are also the most important habitat types for moose. These habitat types potentially lost from gravel fill (roads, pad, and airstrips) under Sub-Alternative C-1 are quantified below.

A total of 2,927 acres of Moist Sedge-Shrub Meadow are available in the Colville River Delta (Table 4C-1.3.2-2). A habitat map is available for 175,152 acres in the National Petroleum Reserve-Alaska, but not for the entire area. The total area of Moist Sedge-Shrub Meadow in the habitat-typed area of the National Petroleum Reserve-Alaska is 42,071 acres (Table 4C-1.3.1-2). A total of 67.2 acres (14.1 acres in the Colville River Delta, 53.1 acres in the National Petroleum Reserve-Alaska) of Moist Sedge-Shrub Meadow habitat type would be lost as a result of gravel placement (roads, pads, and airstrips) under Sub-Alternative C-1 (Table 4C-1.3.1-2). The potential loss of Moist Sedge-Shrub Meadow from placement of gravel fill is less than 0.1 percent of that available on the Colville River Delta. The habitat potential loss in the National Petroleum Reserve-Alaska cannot be calculated because a habitat map is not available for all of the National Petroleum Reserve-Alaska lands in the Plan Area. However, the potential loss under gravel fill in the part of the National Petroleum Reserve-Alaska for which there is habitat mapping is less than 0.1 percent of the Moist Sedge-Shrub Meadow habitat type available in that area. In addition to gravel fill, 417.0 acres (80.6 acres in the Colville River Delta, 336.4 acres in the National Petroleum Reserve-Alaska) of Moist Sedge-Shrub Meadow habitat type would be indirectly altered (Table 4C-1.3.1-2).

The combined area of riverine and upland shrub habitats in the Colville River Delta is 7,994 acres (Table 4C-1.3.2-2). The combined area of Riverine and Upland Shrub habitat types in the National Petroleum Reserve-Alaska is 4,778 acres (Table 4C-1.3.2-2). A total of 14.4 acres (13.9 acres in the Colville River Delta, 0.5 acre in the National Petroleum Reserve-Alaska) of riverine and upland shrub habitats would be lost as a result of gravel placement (roads, pads, and airstrips) under Sub-Alternative C-1. The potential loss of riverine and upland shrub habitats constitutes less than 0.1 percent of the riverine and upland shrub habitats available on the Colville River Delta. In addition, 62.9 acres (58.3 acres in the Colville River Delta, 4.6 acres in the National Petroleum Reserve-Alaska) of riverine and upland shrub habitats would be indirectly altered by gravel fill (Table 4C-1.3.1-2).

A total of 525 acres of Moist Tussock Tundra habitat type is available in the Colville River Delta (Table 4C-1.3.2-2). The total area of Moist Tussock Tundra in the habitat-typed area of the National Petroleum Reserve-Alaska is 49,647 acres (Table 4C-1.3.2-2). A total of 129.7 acres (0.1 acres in the Colville River Delta, 129.6 in the National Petroleum Reserve-Alaska) of Moist Tussock Tundra would be lost as a result of gravel placement (roads, pads, and airstrips) (Table 4C-1.3.1-2). The potential loss of habitat in the Colville River Delta would be less than 0.1 percent. The potential habitat loss in the National Petroleum Reserve-Alaska cannot be calculated because habitat mapping is not available for all of the National Petroleum Reserve-Alaska lands in the Plan Area. However, the potential loss under gravel fill in the part of the National Petroleum Reserve-Alaska for which there is habitat mapping is less than 0.1 percent of that available in that area. In addition to gravel fill, 665.9 acres of Moist Tussock Tundra habitat type would be altered by dust fallout in the National Petroleum Reserve-Alaska (Table 4C-1.3.1-2), while no habitat would be altered in the Colville River Delta.

The total area of Barrens habitat type in the Colville River Delta is 20,993 acres (Table 4C-1.3.3-2). The total area of Barrens in the habitat-typed area of the National Petroleum Reserve-Alaska is 1,552 acres (Table 4C-1.3.3-2). A total of 1.3 acres of Barrens habitat type would be lost as a result of gravel placement (roads, pads, and airstrips) in the Colville River Delta, and no Barrens would be lost or altered in the National Petroleum Reserve-Alaska under Sub-Alternative C-1 (Table 4C-1.3.1-2). The potential loss of Barrens habitat is less than 0.1 percent of that available in the Colville River Delta. In addition to gravel fill in the Colville River Delta, 16.2 acres of Barrens habitat type would be indirectly altered in the Colville River Delta by gravel fill related impacts under Sub-Alternative C-1 (Table 4C-1.3.1-2), while no acreage in the National Petroleum Reserve-Alaska would be affected.

Disturbance and Displacement

There would be 16 miles more road in Sub-Alternative C-1 than in Alternative A. Traffic on this additional mileage could increase the amount of disturbance to caribou, muskoxen, moose, and grizzly bears compared to Alternative A. The lack of airstrips in Sub-Alternative C-1 would result in less disturbance than in Alternative A, which has an airstrip at CD-3. Access by local residents in Sub-Alternative C-1 could disturb and displace terrestrial mammals if hunting is done. The road connection from Nuiqsut to the project roads could allow

easier access to local residents and increase the disturbance impacts associated with hunting. A high level of hunting could prevent terrestrial mammals from habituating to industry activities and result in displacement away from the roads and facilities. In the National Petroleum Reserve-Alaska portion of the Plan Area, unrestricted public access could substantially increase the amount of vehicle traffic and hunting pressure. This could add a considerable amount of disturbance to terrestrial mammals in the Plan Area.

Obstruction to Movements

Sub-Alternative C-1 would include 42 miles of road/pipeline combination (including the road from CD-1 to CD-3) compared to 26 miles in Alternative A. This is 16 miles more road/pipeline than in Alternative A (Figure 2.4.3.1-1 and Figure 2.3.3.1-1). Although roads with elevated pipelines are not barriers to caribou movement, they could deflect or delay crossing (Murphy and Lawhead 2000). It is important to note that the Sub-Alternative C-1 pipelines would be elevated to 7 feet (versus 5 feet in Alternative A). Elevating pipelines to at least 5 feet is considered adequate for caribou crossing, although higher elevations might enhance crossing success. Therefore, the potential for obstruction of caribou movement because of the greater amount of road/pipeline combination in Sub-Alternative C-1 would be mitigated by the higher elevation of the pipelines. Also, caribou would be in the vicinity of the roads in winter, and snow could accumulate under or around pipelines. The 7-foot pipelines could allow easier winter movements. In Sub-Alternative C-1, the east-west oriented pipeline from CD-6 and CD-7 past the Clover Potential Gravel Source is situated in the lee of the road and generally more parallel to prevailing winds than the pipeline in Alternative A. Thus, this pipeline could cause more snow to accumulate than the pipeline in Alternative A.

Also, separating the roads and pipelines by more than 300 feet can enhance crossing success. The road from CD-1 to CD-3 would probably have a limited effect on caribou movements because it would be separated from the pipeline by 0.5 to 1 mile for much of its 6-mile length.

Access to roads by industry and local residents (and the public on BLM lands) could result in traffic that contributes to obstruction of caribou movements. If hunting were to occur from the roads, caribou, moose, muskoxen, and grizzly bears could associate the roads with danger and avoid, rather than cross, them.

Mortality

In Sub-Alternative C-1, accidental mortalities caused by collisions with vehicles could be greater than in Alternative A because of a longer road system. As with Alternative A, road access by local residents could result in hunting mortality of terrestrial mammals. This impact would potentially occur in the area between CD-1 and CD-3 in Sub-Alternative C-1, but not in Alternative A. In addition, direct access from Nuiqsut to the road system, and the more southerly route to CD-6 and CD-7 could result in increased harvest by hunters. In the BLM portion of the Plan Area, unrestricted public access could substantially increase the amount of non-local hunting pressure. This could add a considerable amount of mortality of terrestrial mammals in the Plan Area.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON TERRESTRIAL MAMMALS

The primary characteristic of the impacts on terrestrial mammals of Sub-Alternative C-1 FFD is the effect of the network of roads connecting all of the facilities. The pipeline routes in Sub-Alternative C-1 are similar to those of Alternative A, although there is some different routing among the alternatives to the CD-6, HP-1, and HP-15 sites in the Fish-Judy Creeks Facility Group. The pipelines in Sub-Alternative C-1 would be elevated to 7 feet, while in Alternative A they are elevated 5 feet. Access to the production sites would be unrestricted on BLM lands and open to industry and local residents elsewhere.

The total amount of gravel fill under Sub-Alternative C-1 would be approximately 1,225 acres, versus 1,262 for Alternative A. Because neither detailed site locations nor habitat mapping are available, we cannot quantify specific terrestrial mammal habitat lost under Sub-Alternative C-1. However, Sub-Alternative C-1 has the

largest acreage covered with gravel of the six alternatives and the largest direct loss of vegetated habitat. A large proportion (78 percent) of the Sub-Alternative C-1 gravel would be roads with associated impacts.

COLVILLE RIVER DELTA FACILITY GROUP

The primary differences between the FFD Alternatives A and C in the Colville River Delta is that there would be roads accompanying the pipelines to facilities in the lower Delta and no airstrips at the facilities (CD-3, HP-7, HP-12, HP-13, and HP-14) under Sub-Alternative C-1. In addition, Sub-Alternative C-1 would have pipelines elevated to 7 feet, and access would be open to local residents and industry.

Direct Habitat Loss, Alteration, or Enhancement

The roads to production sites in the lower Delta under Sub-Alternative C-1 would result in the maximum amount of habitat covered with gravel fill among the alternatives. This would be somewhat compensated by the lack of airstrips at the Colville River Delta Facility Group sites under Sub-Alternative C-1. The increased amount of roadway could provide additional insect-relief habitat during the summer. Some bear den habitat in the Delta could be covered by the gravel fill.

Disturbance and Displacement

The increased roads accompanying pipelines to the lower Delta production sites could result in some disturbance of caribou and other terrestrial mammals. Access to the roads by local residents could result in traffic levels that impose disturbance more than in existing oilfields with only industrial traffic. Caribou, moose, and muskoxen using the Delta during the summer could be most affected.

Obstruction to Movements

The roads accompanying pipelines to the lower Delta production pads could result in some obstruction or deflection of caribou movements. Elevated pipelines adjacent to roads usually allow crossing by caribou. In Sub-Alternative C-1, pipelines would be elevated 7 feet which could mitigate obstruction impacts further. However, access to the roads by local residents could result in traffic levels that obstruct movements more than in existing oilfields with only industrial traffic.

Mortality

The roads to the lower Delta production sites could result in a higher mortality of caribou and other terrestrial mammals from vehicle collisions than in Alternative A. Access to the roads by local residents could result in traffic levels leading to a higher probability of vehicle-animal collision than in existing oilfields with only industrial traffic. Caribou using the Delta during the summer could be most affected. In addition, access by local residents could increase harvest by hunters.

FISH-JUDY CREEKS FACILITY GROUP

Direct Habitat Loss, Alteration, or Enhancement

All of the production sites in the Judy-Fish Creeks Facility Group would have road access. This would result in an amount of habitat loss similar to that in Alternative A, although the routing to CD-6, HP-1, and HP-15 differs between alternatives.

Disturbance and Displacement

The primary impact of Sub-Alternative C-1 compared to Alternative A under FFD in this facility group would result from unrestricted access to BLM lands. Increased vehicle and foot traffic could disturb caribou,

muskoxen, moose, and grizzly bears from the road system. Increased access by local and non-local hunters could have disturbance impacts.

Obstruction to Movements

The network of road/pipeline combinations in the Judy-Fish Creeks Facility Group under Sub-Alternative C-1 FFD could obstruct the movement of terrestrial mammals. Pipelines would be elevated 7 feet, and roads and pipelines would be separated more than 300 feet so obstruction would be considerably mitigated. This could be particularly effective in winter when snow may effectively reduce the height of pipelines. In addition, roads with traffic (more than 15 vehicles per hour) and associated pipelines could obstruct caribou movements, so the extent of obstruction would most likely be a function of the traffic level.

Mortality

The primary impact of FFD in Sub-Alternative C-1 compared to Alternative A in the Fish-Judy Creeks Facility Group would result from unrestricted access to BLM lands. Increased vehicle traffic could cause more vehicle-animal collisions and mortality of caribou, muskoxen, moose, and grizzly bears. Increased access by local and non-local hunters would also increase mortality.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

The primary difference between Alternatives C and A under FFD in this area is the existence of a road accompanying the pipeline from HP-21 to HP-22 on the coast.

Direct Habitat Loss, Alteration, or Enhancement

The road from HP-21 to HP-22 would cover 11 miles in Sub-Alternative C-1. Otherwise, the loss of habitat would be the same as in Alternative A.

Disturbance and Displacement

The primary impacts of Sub-Alternative C-1 FFD compared to Alternative A FFD in this area would result from the road to HP-22 and unrestricted access to BLM lands. Increased vehicle and foot traffic could disturb caribou, muskoxen, moose, and grizzly bears from the road system. This is particularly true in the northwest part of the area, which is used by considerable numbers of caribou during the calving season. Calving caribou could be displaced from roads with traffic in this area. Otherwise, impacts from FFD under Sub-Alternative C-1 would be the same as for Alternative A.

Obstructions to Movement

The location of the road/pipeline combination from HPF-2 to HP-21 and HP-22 could cause some obstruction or deflection of movement of caribou during the calving, post-calving, and winter seasons. Roads with pipelines elevated to at least 5 feet are not necessarily barriers to caribou movement, and under Sub-Alternative C-1 pipelines would be elevated to 7 feet. This could mitigate potential obstruction impacts.

Mortality

The primary impact of Sub-Alternative C-1 FFD compared to Alternative A FFD would result from unrestricted access to BLM lands and the road to HP-22. Increased animal-vehicle collisions and increased mortality from hunting could result from these characteristics of Sub-Alternative C-1.

ABANDONMENT AND REHABILITATION

Abandonment and rehabilitation would cause similar types of impacts under Alternative A and Sub-Alternative C-1, though the magnitude of the impacts would be greater under the latter. As during construction, Sub-Alternative C-1 would have greater potential to disturb or displace denning grizzly and polar bears (but only if the CD-3 pad and the road to it are removed) and caribou and moose (both of which tend to winter closer to the Sub-Alternative C-1 road route, than the Alternative A route). Traffic during winter abandonment and rehabilitation activities might cause higher mortality to caribou and moose along this southern route. Finally, if the roads are maintained in useable condition following abandonment, they will continue to provide improved access to hunting areas with consequent hunting pressure on caribou and other subsistence species.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON TERRESTRIAL MAMMALS

The Sub-Alternative C-1 CPAI Development Plan would cover 323 acres of undeveloped land with gravel fill. This is a small percentage of the land in the Plan Area, although it is 82 acres more than Alternative A. The amount of habitat types preferred by caribou, muskoxen, and moose affected by this fill is a small proportion of that available in the Plan Area. Sub-Alternative C-1 would result in the largest loss of habitat of the alternatives considered. However, this is a small loss of terrestrial mammal habitat compared to that available in the Plan Area.

Disturbance, obstruction of movements, and mortality impacts of Sub-Alternative C-1 would be similar to those of Alternative A. However, these impacts would be of greater magnitude in Sub-Alternative C-1 than in Alternative A because of the larger amount of road/pipeline combinations and associated higher levels of vehicle traffic. The obstruction of movements would be mitigated somewhat by elevation of pipelines to 7 feet. Sub-Alternative C-1 includes access by industry and local residents and unrestricted access on the National Petroleum Reserve-Alaska lands. Access by local residents and other public would result in disturbance and hunting mortality. The potential positive and negative aspects of hunting mortality described for Alternative A would occur to a greater extent in Sub-Alternative C-1 because of the unrestricted public access.

Impacts from the Sub-Alternative C-1 FFD would be the same as described for the CPAI Development Plan over a larger area. An exception is the potential for increased disturbance of calving caribou of the TCH in the northwestern part of the Plan Area.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR TERRESTRIAL MAMMALS

Potential mitigation measures for Sub-Alternative C-1 would be essentially the same as those described for Alternative A. The road access to local residents and the public on BLM lands could make communication among stakeholders regarding activities in the Plan Area, including hunting by local residents, especially relevant. Also, the pipeline/road combinations between all production sites might make buried sections of pipeline more important than in the other alternatives. However, the elevation of pipelines to 7 feet in Sub-Alternative C-1 could reduce the need for buried sections of pipeline.

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR TERRESTRIAL MAMMALS

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.3.4.2 Marine Mammals

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON MARINE MAMMALS

A characteristic of Sub-Alternative C-1 that could affect marine mammals differently from Alternative A is the location of the road/pipeline crossing of the Nigliq Channel. The crossing site in Sub-Alternative C-1 is

approximately 3 miles south of the crossing site in Alternative A. This could result in little or no construction activity and operational traffic disturbance impacts to marine mammals in the channel. In addition, Sub-Alternative C-1 has no new airstrips, which would remove the potential for aircraft noise disturbance discussed for Alternative A. Another possible difference is that the more southerly crossing of the Nigliq Channel results in a longer distance from the pipeline crossing the channel to the Beaufort Sea. This could allow response to oil spills farther inland, and reduce the likelihood that oil spills that enter the channel will reach the Beaufort Sea.

RINGED SEAL AND BEARDED SEAL

Impacts to ringed seals from Sub-Alternative C-1 are not expected to change appreciably compared to Alternative A. During summer, ringed seals are generally not immediately offshore of the Plan Area, and during winter, noise from vehicles and operations is not expected to propagate into ringed seal habitat.Under Sub-Alternative C-1 there would be no aircraft traffic to CD-3, and thus less potential for disturbance than with Alternative A. In addition, direct access from Nuiqsut to the Sub-Alternative C-1 road system could enhance access by hunters to coastal areas. This could result in greater harvest and disturbance of seals.

SPOTTED SEALS

Sub-Alternative C-1 could have fewer disturbance impacts on spotted seals than Alternative A. The crossing site of the Nigliq Channel in Sub-Alternative C-1 is approximately 3 miles south of the crossing site in Alternative A. This could result in little or no disturbance impacts from construction activity and operations on spotted seals in the Nigliq Channel. In addition, Sub-Alternative C-1 has no new airstrips, which would remove the potential for aircraft noise disturbance of spotted seals in the rivers and nearshore Beaufort Sea that was discussed for Alternative A. The lack of aircraft traffic to and from CD-3 would reduce the potential for disturbance to spotted seals hauled out in the Nigliq Channel and main channel of the Colville River. However, increased hunting access (and associated harvest and disturbance) could result from the direct connection of Nuiqsut to the ASDP Area road system.

POLAR BEARS

The impacts to polar bears expected under Sub-Alternative C-1 would not change appreciably from those that would occur under Alternative A. It is possible that the road construction and traffic to CD-3 would result in disturbance and hunter access to polar bears (including dens) in the Colville River Delta. However, the lack of an airstrip at CD-3 would remove the potential noise impacts in this area. Because polar bears tend to occur near the coast, the more southerly route of the road/pipeline from CD-4 to CD-5 and CD-6 could reduce the potential for disturbance of denning bears or hunter harvest of active bears.

BELUGA WHALES

Potential impacts on beluga whales under Sub-Alternative C-1 would be like those for spotted seals. Belugas might come into the channels and rivers to some extent. The more southerly crossing of the Nigliq Channel in Sub-Alternative C-1 and the lack of an airstrip at CD-3 could result in less disturbance than with Alternative A. However, the road to CD-3 and direct access from Nuiqsut to the project road system could enhance hunter access, harvest, and disturbance.

ABANDONMENT AND REHABILITATION

Impacts of abandonment and rehabilitation under Sub-Alternative C-1 would be similar to that for Alternative A. There would be less potential impact from aircraft flights, because there would not be an airstrip to CD-3, and fewer impacts to spotted seals from removal of the bridge across the Nigliq Channel because the bridge would be located farther upstream.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON MARINE MAMMALS

In general, the impacts to marine mammals under Sub-Alternative C-1 FFD would not differ appreciably from those of Alternative A FFD. However, some characteristics of Sub-Alternative C-1 might be relevant to marine mammals. These include the different road route crossing the Nigliq Channel from CD-4 to HP-3, the road to HP-22 on the coast, and the unrestricted access on BLM lands. The crossing of the Nigliq Channel in Sub-Alternative C-1 is farther upstream and could cause less disturbance than the crossing in Alternative A. The unrestricted access to BLM lands, particularly the road to HP-22 on the coast, could result in more disturbance to, and hunting mortality of, marine mammals than in other alternatives.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON MARINE MAMMALS

Impacts to marine mammals under Sub-Alternative C-1 would be similar to those in Alternative A. The road accompanying the pipeline between CD-1 and CD-3 could increase disturbance in that area. The unrestricted access to BLM lands could result in higher mortality of polar bears from road kills and DLP kills.

Impacts from Sub-Alternative C-1 FFD would be the same as those described for the CPAI Development Plan over a larger area.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR MARINE MAMMALS

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.3.4).

SUB-ALTERNATIVE C-1 – EFFECTIVENESS OF PROTECTIVE MEASURES FOR MARINE MAMMALS

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.3.5 Threatened and Endangered Species

4C-1.3.5.1 Bowhead Whale

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON BOWHEAD WHALE

No potential impacts of Sub-Alternative C-1 on bowhead whales are expected, as described for Alternative A. A possible difference is that the more southerly crossing of the Nigliq Channel results in a longer distance from the pipeline crossing the channel to the Beaufort Sea. This could allow response to oil spills farther inland, and reduce the likelihood that oil spills that enter the channel will reach the Beaufort Sea.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON BOWHEAD WHALE

If, in the event of FFD, sealifts are required to transport drilling or processing facilities, there is the potential for impact to bowhead whales. Impacts to bowheads could result from noise, habitat degradation, displacement from the migration corridor, and vessel strikes. However, the use of docks was determined not to be a practical means of developing the facilities proposed by CPAI or during future development (Section 2.6.5). In addition, the road access to the coast at HP-22 could result in new access to the Kogru River and Beaufort Sea. This could add disturbance and hunter access to bowheads. Aircraft noise could also disturb bowheads, although this impact would probably be of limited magnitude and duration.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON BOWHEAD WHALE

The potential impacts from Sub-Alternative C-1 would be the same as those for Alternative A. Under the Sub-Alternative C-1 – FFD there would be fewer airstrips than in Alternative A and reduced potential for disturbance. Sub-Alternative C-1 includes roads to areas near the coast at the HP-13, HP-14, and HP-22 sites. This could result in construction and operational noise that could affect whales that occur in the nearshore area.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR BOWHEAD WHALE

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.3.5).

4C-1.3.5.2 Spectacled Eider

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN IMPACTS ON SPECTACLED EIDER

CONSTRUCTION PERIOD

Habitat Loss and Alteration

Additional gravel placement for the construction of connecting roads would increase habitat loss and alteration by 44 to 56 percent in the Colville River Delta compared to Alternatives A, B, D, and F; and by 22 to 74 percent in the National Petroleum Reserve-Alaska portion of the Plan Area. Habitat loss and alteration would affect an estimated 0.9 spectacled eider nests in Alternative C. Ice road requirements would be similar among alternatives during construction, but would be reduced in Sub-Alternative C-1 compared to Alternatives A and B during project operations. The types of impacts on spectacled eiders associated with gravel placement in Sub-Alternative C-1 would be the same as those described under Alternative A. Habitat alteration impacts due to the CD-3 road may be underestimated using the 165-foot impact area if road washouts and flooding effects are common from this road in the lower Colville River Delta.

Colville River Delta pre-nesting and nesting habitats used by spectacled eiders in Sub-Alternative C-1 that have additional gravel cover compared to Alternatives A or B are Tapped Lake with High–water Connections, Salt Marsh, and Patterned Wet Meadow (Table 4A.3.5-2). In the National Petroleum Reserve-Alaska portion of the Plan Area, pre-nesting and nesting spectacled eider habitats in Sub-Alternative C-1 that have additional gravel cover compared to Alternatives A or B are Old Basin Wetland Complex and Patterned Wet Meadow (Table 4A.3.5-3). In all instances, habitat impacts would affect less than 1 percent of habitats available in the Colville River Delta and in the National Petroleum Reserve-Alaska portion of the Plan Area (Table 4A.3.5-2 and Table 4A.3.5-3).

Disturbance and Displacement

Disturbances from vehicle traffic would be increased in Sub-Alternative C-1 compared to Alternative A or B by the addition of the road connecting CD-3 to CD-1 in the Colville River Delta and the more extensive road system with a connection to Nuiqsut in the National Petroleum Reserve-Alaska. Connection to Nuiqsut could lead to additional traffic from local residents. Disturbance from air traffic would be reduced in Sub-Alternative C-1 compared to Alternatives A or B by the elimination of the airstrip at CD-3 and would be reduced in Sub-Alternative C-1 from Alternative B by the elimination of the airstrips at CD-5 and CD-6. Elimination of these airstrips would result in an estimated 1.2 fewer spectacled eider nests displaced in Sub-Alternative C-1 compared to Alternatives A and B.

Obstructions to Movement

The additional road system in Sub-Alternative C-1 compared to Alternative A or B would potentially obstruct some movements of spectacled eider broods, especially if traffic levels are increased because of access by local traffic.

Mortality

Potential mortality from collisions with vehicles and power lines is increased in Sub-Alternative C-1 compared to Alternatives A or B with the development of the more extensive road system and placement of all power lines on poles. The potential mortality from collisions with aircraft is reduced in Sub-Alternative C-1 compared to Alternatives A or B with the elimination of the airstrip at CD-3 from Alternatives A and B and airstrips from CD-5 and CD-6 in Alternative B.

Spectacled eider nesting success in the Plan Area was generally low (33 percent) (Johnson et al. 2004). Any increase in predator populations attracted to the development areas would result in decreased reproductive success for spectacled eiders. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified, but would be most detrimental to spectacled eiders because they are known to nest in specific locations year after year and have a low total population size. The potential for increased nest and duckling depredation from raptors and ravens would be increased in Sub-Alternative C-1 compared to Alternatives A or B by the placement of all power lines on poles instead of VSMs. Mortality due to subsistence hunting could also increase with development of the road system if hunters use roads for access.

OPERATION PERIOD

Habitat Loss and Alteration

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Habitat alterations from dust fallout and surface water flow interruption would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the more extensive road system and potentially higher traffic levels resulting from local access from Nuiqsut. Habitat alterations from low-ground-pressure vehicles during summer or winter would be reduced in Sub-Alternative C-1 compared to Alternative A or B because of the road access to all facilities.

Disturbance and Displacement

Disturbance from vehicle traffic would be increased in Sub-Alternative C-1 compared to Alternatives A or B at CD-3 and potentially at CD-4, CD-5, CD-6, and CD-7 because of the connected road system, including local traffic from Nuiqsut. The greatest potential for vehicular traffic to affect spectacled eiders would be along the route of the CD-3 road where eider densities are higher. Potential disturbance from air traffic would be reduced in Sub-Alternative C-1 compared to Alternatives A or B by the elimination of the airstrip at CD-3 from Alternatives A and B, and the elimination of airstrips at CD-5 and CD-6 from Alternative B. Elimination of the airstrip at CD-3 in Sub-Alternative C-1 would eliminate displacement by air traffic disturbance for one spectacled eider nest.

Obstructions to Movement

Potential obstructions to waterfowl and loon brood movements across roads would continue during project operation. This potential obstruction would be increased over Alternatives A or B because of the more extensive road system and local access from Nuiqsut, which could lead to increased traffic levels. The greatest potential impact to spectacled eiders would occur along the route of the road connecting CD-3 with CD-1 because of higher spectacled eider densities in this area.

Mortality

Potential mortality from collisions with vehicles would be increased in Sub-Alternative C-1 compared to Alternatives A or B because of the increased road system. Increased traffic resulting from local access from Nuiqsut would also potentially increase mortality from collisions with vehicles. Mortality from harvest may also increase as a result of increased access to local traffic. Mortality from collisions with aircraft would be reduced in Sub-Alternative C-1 compared to Alternatives A or B by the elimination of the airstrip at CD-3 from Alternatives A and B and the elimination of airstrips at CD-5 and CD-6 from Alternative B.

Potential mortality from collisions with power lines would be increased in Sub-Alternative C-1 compared to Alternatives A or B by the placement of all power lines on poles. Any increase in predator populations attracted to the development areas would result in decreased reproductive success for spectacled eiders. The magnitude and extent of decreased productivity have not been quantified. Potential mortality by depredation from raptors or ravens would be increased for nesting spectacled eiders by the presence of power line poles used for perching by raptors and ravens. Potential mortality by depredation from seabirds may also be increased in Sub-Alternative C-1 compared to Alternatives A or B by the increased vantage from the 7-foot versus the 5-foot elevated pipeline.

SUB-ALTERNATIVE C-1 – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON SPECTACLED EIDER

The mechanisms associated with habitat loss and alteration, disturbance and displacement, obstruction to movements, and mortality for birds in the Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers facility groups would be the same as those described under Alternative A (Section 4A.3.5.2). Potential impacts are summarized for Sub-Alternative C-1 FFD based on assumptions and calculation methods presented in Section 4A.3.5.2 for estimated numbers of spectacled eider nests affected in the Colville River Delta and the National Petroleum Reserve-Alaska. In Sub-Alternative C-1 FFD, all facilities would be supported by road access and most facilities would be moved outside of the 3-mile buffer around Fish Creek. Total gravel placement would be increased in Sub-Alternative C-1 compared to Alternatives A or B, resulting in the most potential displacement for bird nests from gravel fill and dust fallout. Habitat-related impacts by vegetation class for Sub-Alternative C-1 – FFD are summarized in Table 4C-1.3.5-1 by facility group.

COLVILLE RIVER DELTA FACILITY GROUP

Table 4A.3.5-4 presents a summary of the estimated numbers of spectacled eider nests potentially affected by the hypothetical FFD.

Habitat Loss, Alteration, or Enhancement

Additional gravel placement for the construction of connecting roads would increase habitat loss and alteration by 34 to 42 percent in the Colville River Delta Facility Group compared to FFD Alternatives A, B, and D. Habitat loss and alteration would affect an estimated 3.8 spectacled eider nests in Sub-Alternative C-1 – CPAI Development Plan. Ice road requirements would be similar among alternatives during construction, but would be reduced in Sub-Alternative C-1 compared to Alternatives A, B, and D during project operations. The types of impacts on spectacled eiders associated with gravel placement in Sub-Alternative C-1 would be the same as those described under Alternative A. Habitat alteration impacts due roads in the lower Colville River Delta may be underestimated using the 165-foot impact area if road washouts and flooding effects are common. Re-routing of the Nigliq Channel bridge and access road would move these facilities into an area of lower spectacled eider density (Figure 3.3.5.2-1). The 7-foot pipeline elevation could decrease the amount of snow drifting and the resulting habitat alteration. Vegetation classes used by spectacled eiders that would receive increased gravel fill related impacts compared to Alternative A, B, and D are Fresh Sedge Marsh and Wet Sedge Meadow Tundra (Table 4C-1.3.5-1, 4B.3.5-1, 4A.3.5-5, and 4D.3.5-1).

Disturbance and Displacement

The addition of the road system in the outer Colville River Delta under Sub-Alternative C-1 FFD would increase the potential for disturbance to birds from vehicular traffic and machinery compared to Alternatives A, B, or D FFD. The road connection with Nuiqsut could allow access to local traffic that would increase disturbance. The elimination of the airstrips at production pads under Sub-Alternative C-1 would eliminate disturbance associated with air traffic. The greatest effects of disturbance to spectacled eiders likely would be in the CD-3 and HP-5 areas, where spectacled eiders are more abundant (Figure 3.3.5.2-1).

Obstruction to Movement

The increased road system and local access would increase obstruction of brood-rearing spectacled eiders in Sub-Alternative C-1 compared to Alternatives A, B, or D.

Mortality

Mortality from collisions with vehicles and power lines would be increased in Sub-Alternative C-1 FFD compared to Alternatives A, B, or D FFD because of the increased road system, potentially increased traffic, and placement of power lines on poles. Mortality from collisions with aircraft would be reduced by the elimination of airstrips at pad locations. Mortality from hunting could be increased by greater local access over the road system if hunters use roads for access. Any increase in predator populations attracted to the development areas would result in decreased reproductive success for spectacled eiders. The magnitude and extent of decreased productivity have not been quantified.

FISH-JUDY CREEKS FACILITY GROUP

Table 4A.3.5-1 presents a summary of the estimated numbers of spectacled eider nests affected by the hypothetical FFD, including the Fish-Judy Creeks Facility Group. In the Fish-Judy Creeks Facility Group area, the potential effects of Sub-Alternative C-1 FFD on spectacled eider habitat loss and alteration, disturbance and displacement, obstruction of movements, and mortality would be the same as those discussed under Alternative A.

Habitat Loss, Alteration, or Enhancement

Additional gravel placement for the construction of connecting roads would increase habitat loss and alteration by 27 to 64 percent in the Fish-Judy Creeks Facility Group compared to FFD Alternatives B and D, and would decrease habitat impacts 6 percent compared to Alternative A. Habitat loss and alteration would affect an estimated 1.4 spectacled eider nests in Alternative C. Ice road requirements would be similar among alternatives during construction, but would be reduced in Sub-Alternative C-1 compared to Alternatives A, B, and D during project operations. The 7-foot pipeline elevation may decrease the amount of snow drifting and the resulting habitat alteration. The types of impacts on spectacled eiders associated with gravel placement in Sub-Alternative C-1 would be the same as those described under Alternative A. Vegetation classes used by spectacled eiders that would receive increased gravel fill related impacts compared to Alternative B and D are Old Basin Wetland Complex and Wet Sedge Meadow Tundra (Table 4C-1.3.5-1, 4B.3.5-1, 4A.3.5-5, and 4D.3.5-1).

Disturbance and Displacement

The addition of the road system in the Fish-Judy creeks drainage under Sub-Alternative C-1 FFD would increase the potential for disturbance to spectacled eiders from vehicular traffic and machinery compared to Alternatives A or B FFD. The road connection with Nuiqsut could allow increased levels of local traffic that would increase disturbance. The elimination of the airstrips at production pads under Sub-Alternative C-1 FFD would reduce disturbance associated with air traffic.

Obstruction to Movement

The additional road system and local access would increase obstruction of brood-rearing spectacled eiders in Sub-Alternative C-1 FFD compared to Alternatives A or B FFD.

Mortality

Mortality from collisions with vehicles and power lines would be increased in Sub-Alternative C-1 FFD compared to Alternatives A or B FFD as a result of the increased road system, potentially increased traffic, and placement of power lines on poles. Mortality from collisions with aircraft would be reduced by the elimination of airstrips at pad locations. Mortality from subsistence hunting could be increased by added local access over the road system if hunters used the road system for access. Any increase in predator populations attracted to the development areas would result in decreased reproductive success for spectacled eiders. The magnitude and extent of decreased productivity have not been quantified.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

Table 4A.3.5-1 presents a summary of the estimated numbers of spectacled eider nests potentially affected by the hypothetical FFD, including the Kalikpik-Kogru Rivers Facility Group.

Habitat Loss, Alteration, or Enhancement

Additional gravel placement for the construction of connecting roads would increase habitat loss and alteration by 18 to 71 percent in the Kalikpik-Kogru Facility Group compared to FFD Alternatives A, B, and D. This additional habitat loss would result from the access road to HP-22. Habitat loss and alteration would affect an estimated 0.7 spectacled eider nests in Alternative C. Ice road requirements would be similar among alternatives during construction, but would be reduced in Sub-Alternative C-1 compared to Alternatives A, B, and D during project operations. The 7-foot pipeline elevation may decrease the amount of snow drifting and the resulting habitat alteration. The types of impacts on spectacled eiders associated with gravel placement in Sub-Alternative C-1 would be the same as those described under Alternative A. Vegetation classes used by spectacled eiders that would receive increased gravel fill related impacts compared to Alternatives A, B, and D are Fresh Grass Marsh and Wet Sedge Meadow Tundra (Table 4C-1.3.5-1, 4B.3.5-1, 4A.3.5-5, and 4D.3.5-1).

Disturbance and Displacement

The addition of the road system in the Kalikpik-Kogru River Facility Group area under Sub-Alternative C-1 FFD would increase the potential for disturbance to birds from vehicular traffic and machinery compared to Alternatives A or B FFD. The road connection with Nuiqsut could allow increased levels of local traffic that would increase disturbance. The elimination of the airstrips at production pads under Sub-Alternative C-1 FFD would reduce disturbance associated with air traffic.

Obstruction to Movement

The increased road system and local access would increase obstruction of brood-rearing spectacled eiders in Sub-Alternative C-1 FFD compared to Alternatives A or B FFD.

Mortality

Mortality from collisions with vehicles and power lines would be increased in Sub-Alternative C-1 FFD compared to Alternatives A or B FFD because of the increased road system, potentially increased traffic, and placement of power lines on poles. Mortality from collisions with aircraft would be reduced by the reduction of airstrips at pad locations. Mortality from subsistence hunting could be increased if hunters used the road system for access. Any increase in predator populations attracted to the development areas would result in decreased reproductive success for spectacled eiders. The magnitude and extent of decreased productivity have not been quantified.

SUB-ALTERNATIVE C-1 – SUMMARY OF IMPACTS (CPAI AND FFD) ON SPECTACLED EIDER

Impacts to spectacled eiders associated with construction and operation of the proposed development include habitat loss, alteration, or enhancement; disturbance and displacement; obstructions to movement; and mortality. Spectacled eiders occur in greater numbers near proposed developments in the Colville River Delta than in the National Petroleum Reserve-Alaska portion of the Plan Area. Additional impacts due to lost productivity are not quantified by this analysis, including impacts due to increased nest depredation caused by increased predator populations. The project team estimated the number of nests effected by habitat loss, alteration and disturbance for each alternative, based on site specific nesting densities for spectacled eiders to compare alternative development scenarios. Effects would be localized, and no measureable effects to North Slope populations would be expected. CPAI Sub-Alternative C-1 would reduce nesting by 2 percent for Plan Area spectacled eiders. Sub-Alternative C-1 – FFD would reduce nesting by 15 percent for Plan Area spectacled eiders and less than 1 percent for the North Slope population. Habitat loss does not involve the direct loss of active nests because winter gravel placement, ice road construction, snow dumping, and snow drifting occurs when nests are not active. Most impacts would be initiated during the construction period, including gravel placement, grading of the gravel surface, placement of all facilities, and initial drilling. The results of effects of these activities on estimated spectacled eider production due to loss, alteration or disturbance of nesting habitat for Alternative B, CPAI Development Plan is presented in Table 4A.3.5-1 and for the FFD is presented in Table 4A.3.5-4. Impacts from CPAI Alternatives A through F on habitats used by spectacled eiders are summarized in Table 4A.3.5-2 and Table 4A.3.5-3. Summaries of vegetation classes affected directly and indirectly by gravel fill for Sub-Alternative C-1 – FFD are presented in Table 4C-1.3.5-1.

SUB-ALTERNATIVE C-1 – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR SPECTACLED EIDER

Potential mitigation measures would the same as those identified for Alternative A (Section 4A.3.5.2).

TABLE 4C-1.3.5-1 SUB-ALTERNATIVE C-1 – SUMMARY OF AFFECTED VEGETATION CLASSES FOR FFD USED BY SPECTACLED EIDERS

VEGETATION CLASSES	COLVILLE RIVER DELTA FACILITIES GROUP[a]		FISH-JUDY CREEKS FACILITY GROUP[a]		KALIKPIK-KOGRU FACILITY GROUP[a]		GRAND TOTAL	PLAN AREA TOTALS[b]		SPECTACLED EIDER HABITATS
	Loss (acres)	Alteration (acres)	Loss (acres)	Alteration (acres)	Loss (acres)	Alteration (acres)		Acres	Percent Affected	
Riverine Complex	0.6	3.7	1.1	6.4	0.0	0.0	11.8	698.3	2%	
Fresh Grass Marsh	1.0	5.4	22.6	133.1	42.0	253.7	457.6	2583.7	18%	√
Fresh Sedge Marsh	<0.1	<0.1	17.8	52.7	9.0	13.4	88.3	40953.6	<1%	√
Deep Polygon Complex	2.3	7.2	18.7	33.1	9.1	13.4	78.0	55208.0	<1%	√
Young Basin Wetland Complex	2.7	16.6	54.0	294.5	30.3	164.0	559.5	22910.8	2%	
Old Basin Wetland Complex	0.0	0.0	21.9	112.0	82.7	0.0	133.1	15674.5	1%	√
Wet Sedge Meadow Tundra	102.4	502.2	133.2	644.7	0.0	319.1	1766.3	185820.8	1%	√
Salt-Killed Wet Meadow	4.8	8.7	0.0	0.0	0.0	0.0	13.5	6368.7	<1%	√
Halophytic Sedge Wet Meadow	3.8	7.6	0.0	0.0	0.0	0.0	11.4	4453.2	<1%	√
Halophytic Grass Wet Meadow	0.1	0.2	0.0	0.0	0.0	0.0	0.3	398.3	<1%	√
Moist Sedge-Shrub Tundra	19.6	109.1	79.0	408.0	0.0	0.0	612.8	44405.7	1%	
Tussock Tundra	15.3	91.3	176.9	826.0	169.1	874.7	2133.8	208178.9	1%	
Dryas Dwarf Shrub Tundra	0.1	0.2	2.5	11.0	0.0	0.0	13.6	1358.6	1%	
Cassiope Dwarf Shrub Tundra	14.9	90.3	122.0	734.1	21.6	123.3	1105.4	7734.0	14%	
Halophytic Willow Dwarf Shrub Tundra	<0.1	<0.1	0.0	0.0	0.0	0.0	0.2	143.1	<1%	√
Open and Closed Low Willow Shrub	25.9	132.9	14.1	77.1	4.1	25.0	278.8	13557.3	2%	
Open and Closed Tall Willow Shrub	0.0	0.0	1.7	7.9	0.0	0.0	9.5	687.2	1%	
Dune Complex	0.0	0.0	6.7	25.6	1.1	1.7	34.2	5913.9	1%	
Partially Vegetated	8.5	36.6	3.6	15.2	0.9	1.4	65.8	10149.3	1%	
Barrens	23.1	83.3	7.6	29.2	4.6	16.3	162.4	44009.2	<1%	
Totals	225.1	1095.4	683.6	3410.3	374.6	1806.1	7536.3	671207.1	1%	

Notes:

[a] Totals from Tables 4C-1.3.1-3 and 4C-1.3.1-4

[b] Totals from Table 3.3.1-1 (no-data, shadows and water categories not included)

4C-1.3.5.3 Steller's Eider

This section describes the potential impacts of the Alpine Satellite development on threatened Steller's eiders. Impacts to other bird groups associated with the proposed development are described in Section 4C-1.3.4 and can be referred to for a more detailed description of the mechanisms of specific impacts. In general, impacts to Steller's eider are potentially the same as those described for spectacled eider under all of the alternatives. However, the likelihood of impacts occurring to Steller's eider are very small, even under FFD scenarios, because Steller's eiders occur very rarely in the Plan Area. The ASDP would result in a loss of potential Steller's eider habitat. Given the current distribution of Steller's eider in the Plan Area, it is unlikely that any of the project alternatives would have impacts on this species.

4C-1.3.5.4 Abandonment and Rehabilitation

There would be less potential for disturbance, displacement, or killing of spectacled eiders by aircraft use compared to Alternative A, but increased potential for disturbance, displacement, and mortality due to vehicle traffic. There would be greater loss or alteration (depending upon on the type of rehabilitation required) of eider habitat upon abandonment, because there would be approximately 82 acres more gravel fill constructed, the road to CD-3 being the most significant for eiders. Overall impacts of abandonment and rehabilitation activities would be localized and no adverse impacts to North Slope eider populations are expected.

4C-1.3.5.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Threatened and Endangered Species

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4 SOCIAL SYSTEMS

4C-1.4.1 Socio-Cultural Characteristics

4C-1.4.1.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Socio-Cultural Characteristics

Socio-cultural impacts under Sub-Alternative C-1 – CPAI Development Plan would generally be similar to those under Alternative A with the following differences.

Under Sub-Alternative C-1, additional roads would be included with some providing direct access to Nuiqsut. This direct access may increase contact between non-resident industry workers and members of the village. Increased demand for local services could result in increasing induced employment and local wage and business income to the cash economy.

Changes to subsistence harvest impacts (as described in Section 4C-1.4.3) may result from the increased length of roads. To the extent that they occur, changes to subsistence harvest may increase indirect effects on community health and welfare.

ABANDONMENT AND REHABILITATION

Impacts will be similar to those under Alternative A, however, it is more likely that Nuiqsut residents would have become accustomed to using the oilfield roads to access subsistence resources and become integrated into the satellite operations. Thus, if other oilfields are not active in the area to provide jobs, the community will be more likely face a time of adjustment.

4C-1.4.1.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Socio-Cultural Characteristics

Socio-cultural impacts under Sub-Alternative C-1 – FFD are expected to be the same as those under Alternative A with the following differences.

Under Sub-Alternative C-1 – FFD additional roads would be included with some providing direct access to Nuiqsut. This direct access may increase contact between non-resident industry workers and members of the village. Increased demand for local services could result in increasing induced employment and local wage and business income to the cash economy.

Two additional airstrips, with associated increased aircraft operations, would also be included in this alternative. Changes to subsistence harvest impacts (as described in Section 4C-1.4.3) may result from the increased length of roads and additional airstrips. To the extent that they occur, changes to subsistence harvest may increase indirect effects on community health and welfare.

4C-1.4.1.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Socio-Cultural Characteristics

Impacts to socio-cultural characteristics under Sub-Alternative C-1 (CPAI and FFD) are generally expected to be the same as those under Alternative A. Exceptions under Sub-Alternative C-1 are the potential for increased local economic activity and increased indirect community health and welfare impacts to the extent that they are caused by increased impacts to the subsistence harvest.

4C-1.4.1.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Socio-Cultural Characteristics

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.4.1).

4C-1.4.1.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Socio-Cultural Characteristics

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4.2 Regional Economy

4C-1.4.2.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Regional Economy

There is no information to lead to the assumption that overall oil production under Sub-Alternative C-1 – CPAI Development Plan would vary materially from the estimates given in Section 4A.4.2, Production, that were estimated for Alternative A. Because the economic impacts are directly related to oil production, the economic impacts of Sub-Alternative C-1 would be similar to those determined for Alternative A. However**,** the road connection linking Nuiqsut to all of the production pads and to the existing Alpine facilities could increase local employment and local wage and business income. Project capital costs would be approximately $158 million (14.9 percent) more than Alternative A.

ABANDONMENT AND REHABILITATION

Employment created by removing facilities and rehabilitation the land may be comparable to that during construction if gravel fill is removed. Once oil ceases to flow from the satellites and termination activities are complete, economic stimulus from the satellites—with the exception of relatively insignificant employment from monitoring and long-term rehabilitation—would cease.

4C-1.4.2.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Regional Economy

There is no information to lead to the assumption that overall oil production under Sub-Alternative C-1 – FFD would vary materially from the estimates given in Section 4A.4.2, Production, that were estimated for Alternative A. Because the economic impacts are directly related to oil production, the economic effects of Sub-Alternative C-1 – FFD would be similar to those determined for Alternative A Full-Field Development Scenario. However, the road connection linking Nuiqsut to all of the production pads and to the existing Alpine facilities could increase local employment and local wage and business income.

4C-1.4.2.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Regional Economy

Overall, economic impacts from Sub-Alternative C-1 would be the same as those determined for Alternative A, although there may be additional economic stimulus to Nuiqsut.

4C-1.4.2.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Regional Economy

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.4.2).

4C-1.4.2.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Regional Economy

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4.3 Subsistence

4C-1.4.3.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Subsistence

Effects for similar components in Alternative A would be the same for Sub-Alternative C-1 (gravel mines, pads, roads, and pipelines outside the Fish and Judy creeks sensitive area) and are not specifically discussed in this section. The Sub-Alternative C-1 discussion focuses on ways in which this alternative differs from Alternative A.

CONSTRUCTION PERIOD

Road and pipeline construction effects on subsistence uses would be the same as for Alternative A (disturbance to wildlife resources in the vicinity of the roads and adjacent pipelines), except these effects would be closer to Nuiqsut west of the Nigliq Channel. Connecting the road to Nuiqsut would bring the construction effects even closer to Nuiqsut and increase traffic in the community. The construction of a road from CD-1 to CD-3 would increase sedimentation and change flow patterns, which would reduce available summer and winter fish habitat and decrease the availability of fish for subsistence uses. The relocated Nigliq Channel bridge would have the same effect on summer and winter fish habitats and subsistence uses as discussed in Alternative A, but the effect would occur closer to the community.

During pipeline and road construction, availability of subsistence resources, especially caribou, would be reduced along the construction corridors and hunter access would be reduced as hunters avoid hunting and shooting near workers and equipment. Construction of an overhead power line several miles north of the road and pipeline corridor (the more direct route from CD-5 to CD-7 to CD-7) also would reduce wildlife availability and hunter access along this corridor during the construction period. Constructing the power line within the 3-mile Fish and Judy creeks sensitive area would move this effect closer to the subsistence camps in the area.

OPERATION PERIOD

Under Sub-Alternative C-1, the addition of a road from Nuiqsut to development areas would increase access to subsistence-use areas with vehicles, primarily in periods without snow. However, increased traffic would deflect terrestrial mammals, reducing availability of these resources in development areas. In addition, increased access would result in increased competition for subsistence resources in the development area as more hunters are focused on the road corridor. Unrestricted access on BLM-administered lands (National Petroleum Reserve-Alaska, including Fish and Judy creeks) could eventually provide increased access to people who do not live in the area. Because no outside road currently provides connection to this area, however, access by people who do not live in the area is not an immediate effect. The increase of the minimum pipeline height to 7 feet would allow for less obstruction to terrestrial mammals and subsistence hunters, especially in winter. Locating the road and pipeline west of the Nigliq Channel closer to Nuiqsut would bring any activity on the road and corresponding disturbance to wildlife and associated reduced availability closer to Nuiqsut for the life of the applicant's proposed action. The power line located in the Fish Creek sensitive area would affect subsistence after construction if it provided an access corridor during the summer. In addition, this alternative would completely surround the community of Nuiqsut with construction, deflecting caribou from the vicinity and adding to the perception that the community is encircled by development and thus disconnected from traditional use areas.

ABANDONMENT AND REHABILITATION

Impacts of abandonment and rehabilitation on subsistence may be greater under this alternative than under Alternative A. While there would be less infrastructure to be removed near Fish Creek, there would be more infrastructure to remove overall and more of it would be closer to Nuiqsut. Impacts following the dismantlement and removal phase would be similar to those described for Alternative A.

4C-1.4.3.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Subsistence

Effects caused by the FFD scenario are analyzed in a more general way than those for Sub-Alternative C-1 – CPAI Development Plan because of the hypothetical nature of the scenario. For assessment of effects to subsistence because of the FFD scenario, the Plan Area is divided into groups: the Colville River Delta Facility Group, the Fish-Judy Creeks Facility Group, and the Kalikpik-Kogru Rivers Facility Group. Sub-Alternative C-1 – FFD is discussed in Section 2.4.3.

COLVILLE RIVER DELTA FACILITY GROUP

Roads in the Colville River Delta area would increase sedimentation and change flow patterns, reducing available summer and winter fish habitat, and therefore decreasing the availability of fish for subsistence uses. The construction of roads would require the construction of bridges, which would improve access for subsistence users. However, these bridges might decrease fish habitat and road traffic may deflect terrestrial subsistence resources, which would decrease availability of these resources for subsistence uses. The higher pipeline required in this alternative would allow for less obstruction to terrestrial mammals and subsistence hunters, especially in the winter.

FISH-JUDY CREEKS FACILITY GROUP

Roads connecting Nuiqsut and the 11 additional pads and additional production facility in the Fish and Judy Creeks Facility Group would provide increased vehicle access to subsistence resources and would cause increased competition for subsistence resources if more hunters were focused on the road corridors. At the same time, the roads would result in local deflection and disturbance of terrestrial mammals near the roads, depending on traffic frequency, and therefore reduce subsistence availability of resources along the roads.

The road network connecting the 12 new pads and the facility would provide summer access to areas customarily accessible only by boat at that time of year and would likely change historical and current

subsistence use patterns. (Harvesters could drive over land to Fish Creek in summer, instead of traveling down the Colville River to Harrison Bay to Fish Creek.)

Unrestricted road access on BLM-managed lands could eventually provide increased access to the Fish and Judy Creeks area by people who do not live in the area and increase competition for resources. Because no outside road currently provides connection to this area, however, access by people who do not live in the area is not an immediate effect. As with Alternative A**,** the location of the production and processing pads, roads, and pipelines within the Fish and Judy creeks sensitive area would result in bringing the development infrastructure near important subsistence use and locations of cabins and camps. In short, more roads would result in more traffic, which would result in more disturbances to subsistence resources that would cause less resource availability to subsistence users in those areas. The increase of the minimum pipeline height to 7 feet would allow for less obstruction to terrestrial mammals and subsistence hunters, especially in winter.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

The effects of roads connected to Nuiqsut and the higher pipeline are similar to the effects for the other two groups discussed above.

4C-1.4.3.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Subsistence

Effects from construction and operation for Sub-Alternative C-1 (CPAI and FFD) would be similar to those from Alternative A, with the exception of those effects to subsistence discussed above. Effects from construction and operation for Sub-Alternative C-1 (CPAI and FFD) are expected to continue for the life of the development and are expected to be primarily local in extent for the CPAI scenario and regional in extent for the FFD scenario. Construction and operation would affect availability of key subsistence resources because of deflection or displacement of these resources (by road traffic) from customary harvest locations. Access to subsistence resources would be affected by pipelines, especially in the winter because of snowdrifts (mitigated by 7-foot pipelines that allow for less obstruction to terrestrial mammals and subsistence hunters), avoidance of pads and industrial areas, the perception of regulatory barriers, the reluctance to shoot rifles in the vicinity of industrial development, the difficulty of negotiating road berms while hunting in the winter, and a preference for animals not habituated to industrial development. As noted in NRC (2003:156), "Even where access is possible, hunters are often reluctant to enter oilfields for personal, aesthetic, or safety reasons. There is thus a net reduction in the available area, and this reduction continues as the oilfields spread."

Roads connecting pads to production facilities and a road connecting Nuiqsut to the development area would provide increased vehicle access to subsistence resources and would cause increased competition for subsistence resources if more hunting efforts are focused on the road corridors. At the same time, vehicular traffic on the roads would result in local deflection and disturbance of terrestrial mammals near the roads and, therefore, would reduce subsistence availability of resources. This impact would be greatest for Sub-Alternative C-1 because it has more roads than any other alternative and is the only alternative that provides a road connection to Nuiqsut.

The road network connecting 17 of the 24 new locations and four of the five proposed drilling and production pads would provide summer access to areas generally reachable only by boat in the summer and would likely change current subsistence use patterns (harvesters could drive over land to Fish Creek or Judy Creek or the Kalikpik River in summer instead of only traveling by boat).

Indirect effects would include hunters going to other areas that would result in harvesting in traditional places less often and increased effort, costs, and risk associated with traveling farther. Sub-Alternative C-1 would occur in seasonal and general use areas for key subsistence resources that are used for multiple seasons each year, have been used for multiple generations, and are used for multiple resources each year. Effects from construction and operation would occur in key geographic areas relative to other areas of subsistence availability and would pertain to individual subsistence users, groups of users, and the overall pattern of Nuiqsut subsistence uses. Construction and operation of the planned or hypothesized facilities would contribute to

Nuiqsut residents' perception of being surrounded by development. Competition for certain resources among Nuiqsut, Anaktuvuk Pass, Barrow, and Atqasuk would increase as Nuiqsut hunters avoid traditional subsistence-use areas closer to Nuiqsut and travel to farther outlying areas.

4C-1.4.3.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Subsistence

Potential mitigation measures would be similar to those identified for Alternative A (Section 4A.4.3), except that pipelines would already be a minimum of 7 feet.

4C-1.4.3.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Subsistence

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4.4 Environmental Justice

4C-1.4.4.1 Introduction

The basis for identifying disproportionate impacts to minority and low-income populations is described in Section 4A.4.4.

4C-1.4.4.2 Sub-Alternative C-1 – Disproportionate Impacts (CPAI and FFD) on Environmental Justice

Disproportionate impacts under Sub-Alternative C-1 (CPAI and FFD) are expected to be the same as those under Alternative A for both cases (see Section 4A.4.4). Changes in the access to production facilities incorporated in Sub-Alternative C-1 are not expected to change the type or level of impacts identified. Relaxation of access restriction limitations that would increase access to BLM lands may increase competition for subsistence resources.

4C-1.4.4.3 Abandonment and Rehabilitation

Impacts will be similar to Alternative A.

4C-1.4.4.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Environmental Justice

Potential mitigation measures to reduce or avoid disproportionate impacts would be the same as those identified for Alternative A (Section 4A.4.4).

4C-1.4.4.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Environmental Justice

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4.5 Cultural Resources

4C-1.4.5.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Cultural Resources

Despite the relocation and the addition of roads in the lower Colville River Delta, the impacts on cultural resources for Sub-Alternative C-1 – CPAI Development Plan would be approximately the same as for Alternative A. Under Sub-Alternative C-1, no additional documented cultural resources are in the immediate vicinity of the proposed operational facilities, roads, or pipelines. Section 106 consultations should assure that Sub-Alternative C-1 would have no direct effect and negligible indirect effect on known cultural resources

during construction and operation. Additional need for gravel will increase the risk to unknown cultural resources through excavation at mine sites.

ABANDONMENT AND REHABILITATION

It is unlikely that cultural resources would be impacted by abandonment activities.

4C-1.4.5.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Cultural Resources

Despite the relocation of some roads and the addition of more roads in the lower Colville River Delta, development under this alternative would have approximately the same impacts to known cultural resources as Alternative A. Because more gravel would be used in this alternative, the risk to unknown cultural resources from gravel extraction will be increased.

4C-1.4.5.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Cultural Resources

Impacts resulting from implementation of Sub-Alternative C-1 are similar to those of Alternative A. Known cultural resource sites that could be affected under Sub-Alternative C-1 are the same as Alternative A. Because more gravel will be needed, the risk of impacts to unknown cultural resources from extraction will be greater than for Alternative A.

4C-1.4.5.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) on Cultural Resources

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.4.5).

4C-1.4.5.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Cultural Resources

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4.6 Land Uses and Coastal Management

4C-1.4.6.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Land Uses and Coastal Management

LAND OWNERSHIP AND USES

Sub-Alternative C-1 – CPAI Development Plan would affect the same landowners as described in Alternative A. Implementation of this development would not change ownership status on lands within the Plan Area, but would happen under negotiated leases. In addition, Kuukpik Corporation is still able to select lands, and those lands would likely be within the oil reserves. As previously stated, those lands selected are under BLM jurisdiction until patented.

The proposed development of oil production satellites and related facilities under Sub-Alternative C-1 would result in more total area developed within the Plan Area as compared to Alternatives A or B. Sub-Alternative C-1 calls for development of approximately 350 acres, including production pads, roads, and airstrips, and 42.3 miles of pipelines. This would result in an increase of approximately 3 times the total number of acres currently developed for oil production activities within the Plan Area.

Sub-Alternative C-1 would provide road access from the existing Alpine facilities east of Nigliq Channel to the satellite facilities west of the channel, as well as road access from the Alpine Field to CD-3 in the Colville River Delta. Access would be limited to oil industry personnel and Nuiqsut residents on the roads outside the National Petroleum Reserve-Alaska, but would be unrestricted on BLM-managed lands. The increased access and

activity levels in the Colville River Delta and the National Petroleum Reserve-Alaska could change areas used for subsistence or recreation. Effects to subsistence and recreation are discussed further in Sections 4C-1.4.3 and 4C-1.4.7. Other permitted uses within the Plan Area, such as scientific studies, communications- and navigation-related uses, and overland resupply transport between villages, are not expected to be affected by the proposed development.

Sub-Alternative C-1 is similar to Alternative A in its conformance with the BLM stipulations developed to protect sensitive resources within the National Petroleum Reserve-Alaska. Under Sub-Alternative C-1, the CD-6 production pad, access road and pipelines would be located within the 3-mile buffer around Fish Creek. This would require an exception from the stipulations to allow for permanent oil and gas surface facilities in this area. In addition, exceptions would be required for facilities located within 500 feet of some other water bodies and for the road access between separate oilfield facilities in National Petroleum Reserve-Alaska. As with Alternatives A and B, some facilities would be located within the CRSA. Facilities in this area must be able to provide maximum protection of surface resources, consistent with the goal of allowing oil resource development. No other Special Areas or LUEAs would be directly affected by Sub-Alternative C-1.

Because of the larger overall development area associated with Sub-Alternative C-1, gravel extraction operations would increase. There could be slightly less flight activity during operations under Sub-Alternative C-1 because of increased road access to all satellite production facilities.

COASTAL MANAGEMENT

Development proposed under Sub-Alternative C-1 includes construction and operation of five satellite production pads, as well as roadways and pipelines. Sub-Alternative C-1 includes development on lands within National Petroleum Reserve-Alaska and outside National Petroleum Reserve-Alaska in the Colville River Delta area. Although many of these facilities are proposed to be on federal lands that are excluded from the coastal zone under the CZMA, development in these areas is required to comply with state coastal management programs to the extent possible. Therefore, all activities proposed under this alternative were evaluated in terms of the state and NSB coastal management policies.

ALASKA COASTAL MANAGEMENT PROGRAM

The coastal standards are evaluated for Sub-Alternative C-1 below.

Coastal Development (6 AAC 80.040)

Sub-Alternative C-1 – CPAI Development Plan increases road development within the coastal zone. As discussed under previous alternatives, there are no feasible inland alternatives to allow for development of these oil reserves. Stipulations on development within the National Petroleum Reserve-Alaska require that there continue to be access to the coastal resources used for subsistence and traditional land uses; therefore, development of these facilities is not expected to displace other important coastal uses. Although Sub-Alternative C-1 requires exceptions from the existing BLM stipulations related to the Fish Creek buffer area, some other water body setbacks, and road access between separate oilfields within National Petroleum Reserve-Alaska, compliance with the project specific procedures in Chapter 2, the remaining BLM stipulations in Appendix D, and alternative measures potentially required by the state, is anticipated to result in conformance with the coastal development standard.

Geophysical Hazard Areas (6 AAC 80.050)

Facilities proposed under Sub-Alternative C-1 would be required to incorporate design measures to protect permafrost and natural drainage patterns and to protect the built structures from flood events, scour, ice jams, and storm surges. It would be more difficult to meet this standard under Sub-Alternative C-1 because of the extent of roadways proposed to be constructed in the Colville River Delta. The dynamic hydrogeology and

extensive floodwaters of the delta would require these roads to be constructed with much higher embankments and with much more stabilization to address potential damage from floods and ice floes in this area.

Recreation (6 AAC 80.060)

Development proposed under Sub-Alternative C-1 would result in direct road access from Nuiqsut to all of the satellite facilities. Road access to CD-3 from the existing Alpine facilities would be limited to industry personnel, contractors, agencies, and Nuiqsut residents. Road access within the National Petroleum Reserve-Alaska, however, would not be restricted. This would increase access to the National Petroleum Reserve-Alaska areas because people could fly to Nuiqsut and travel by road into areas of the National Petroleum Reserve-Alaska that were previously hard to access and is likely to result in higher activity levels in these areas. Effects on recreation from this increased access are addressed further in Section 4C-1.4.7. Development within the Plan Area would comply with BLM stipulations (with the exception noted previously) and with alternative measures potentially required by the state to reduce impacts to recreation use, and therefore, the development is expected to conform with the coastal recreation standard.

Energy Facilities (6 AAC 80.070)

Sub-Alternative C-1 conforms less with the energy facility standards by proposing more road development, thus increasing the distance for shipping routes and area affected within the Colville River Delta from the existing Alpine Facility to CD-3. This alternative would also provide direct road access from Nuiqsut to areas within the Fish Creek buffer area and proposes location of CD-6 and its access roads within the buffer area. The increased development footprint and increased access into remote areas is likely to increase adverse effects on coastal resources beyond those of other alternatives.

Transportation and Utilities (6 AAC 80.080)

The development proposed under Sub-Alternative C-1 would substantially increase road development within the ASDP Area. Sub-Alternative C-1 includes road connections to all satellite fields, with connections to the existing Alpine facilities and the village of Nuiqsut. The proposed roads are primarily inland, but do cross into the Fish Creek buffer area, which was established to protect sensitive fisheries habitat.

Mining and Mineral Processing (6 AAC 80.110)

Development under Sub-Alternative C-1 would require gravel pad, road, and airstrip development covering approximately 325 acres. The increased development of road access under this alternative would increase the amount of gravel needed. Any effects, however, could be minimized though permits. Gravel sources for this alternative would be the same as those discussed under Alternative A.

Subsistence (6 AAC 80.120)

The proposed ASDP under Sub-Alternative C-1 would provide new road access from Nuiqsut to CD-3 in the Colville River Delta and to CD-6 within the Fish Creek buffer area. This direct road connection would be expected to result in increased access to and activity in areas used for subsistence. The potential for adverse effects on subsistence from the proposed development are discussed in more detail in Section 4C-1.4.3. Effects on subsistence would be minimized through BLM stipulations (with the exceptions noted) and alternative measures potentially required by the state. With these considerations, Sub-Alternative C-1 would be expected to conform to the subsistence standard.

Habitats (6 AAC 80.130)

Development under Sub-Alternative C-1 would maximize the effects on sensitive habitats through increased development within the ASDP Area. In particular, the additional road proposed to connect CD-3 to the existing Alpine Facility and other satellite sites would increase effects on wetlands, lakes, and other sensitive habitats.

Air, Land, and Water Quality (6 AAC 80.140)

Compliance with ADEC and USEPA regulations, required for acquisition of permits for the development, would result in conformance with this coastal management standard for Sub-Alternative C-1 – CPAI Development Plan .

Historic, Prehistoric, and Archaeological Resources (6 AAC 80.150)

Development under Sub-Alternative C-1 would require the same process for protection of cultural resources as discussed under previous alternatives. The increased access resulting from more roads and more access to remote sites would be likely to increase the potential for inadvertent impacts to previously undocumented cultural resources. Compliance with Section 106, the project specific procedures in Chapter 2, other cultural resource stipulations in Appendix D, and alternative measures potentially required by the state, is expected to minimize adverse effects and result in compliance with the cultural resource standard.

NORTH SLOPE BOROUGH COASTAL MANAGEMENT PROGRAM

Sub-Alternative C-1 – CPAI Development Plan would be less consistent with the current NSB *Standards for Development* (NSB CMP 2.4.3) because of the location of facilities within buffer areas and water body setbacks and the increased road access to areas used for subsistence. Potential effects on subsistence and cultural resources would be expected to be higher for this alternative than for Alternatives A or B.

Sub-Alternative C-1 would comply with the current NSB *Required Features for Applicable Development* (NSB CMP 2.4.4) through compliance with project specific procedures listed in Chapter 2, most BLM stipulations, and with alternative measures potentially required by the state. Overall vehicle use throughout the area would increase under Sub-Alternative C-1, however, because of the increased access provided by connecting all satellites with roads.

Development under Sub-Alternative C-1 would address current NSB *Best Effort Policies* (NSB CMP 2.4.5). These policies call for protection of sensitive coastal resources, including subsistence and cultural resources. These issues have been addressed above in the ACMP discussion. Again, Sub-Alternative C-1 would be expected to have a higher potential for adverse effects because of the increased access to the remote satellites.

The current NSB CMP also contains standards for *Minimization of Negative Impacts* (NSB CMP 2.4.6). The proposed development under Sub-Alternative C-1 includes design measures to protect permafrost and to address geophysical hazards as discussed above under the ACMP. The extensive road development proposed under Sub-Alternative C-1, however, would not minimize impacts to sensitive habitats, particularly in the Colville River Delta.

NORTH SLOPE BOROUGH LAND MANAGEMENT REGULATIONS

As discussed under Alternative A, most of the land within the NSB is zoned as "Conservation," with the exception of some village sites and the existing oilfields at Prudhoe Bay and Alpine Field. The NSB's "Resource Development" zoning classification covers areas designated for oil development activities. Development to the east of the National Petroleum Reserve-Alaska in the Colville River Delta under Sub-Alternative C-1 would require a re-zoning of the development areas to the "Resource Development" classification and permitting of activities through the approval of a master plan. Application of the NSB's land management regulations to oil and gas activities on federal lands is subject to legal constraints and therefore must be evaluated on a case-by-case basis as particular activities are proposed.

ABANDONMENT AND REHABILITATION

Land ownership would not be affected by abandonment and rehabilitation. Upon completion of abandonment and rehabilitation, land uses and management may return to something similar to the current situation. For

discussion of subsistence and recreation use after abandonment and rehabilitation, see sections 4C-1.4.3 and 4C-1.4.7, respectively.

4C-1.4.6.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Land Uses and Coastal Management

LAND OWNERSHIP AND USES

Sub-Alternative C-1 – FFD would affect the same landowners as described in Alternative A – . Implementation of these developments would not change ownership status on lands within the ASDP Area, but would happen under negotiated leases.

FFD would result in development throughout the Plan Area, with an additional 22 production pads, two additional processing facilities, and associated roads and airstrips for a total development of 1,283 acres and 149 miles of pipelines. FFD would result in a substantial increase in the area developed within the Colville River Delta, Fish-Judy Creeks, the Kalikpik-Kogru Rivers facility groups, and within the Colville River Special Area. Road access would be constructed to all remote satellites throughout the three facility groups. Access would remain limited to oil industry personnel and Nuiqsut residents on roadways in the Colville River Delta but would be unrestricted within the National Petroleum Reserve-Alaska. There would likely be a substantial increase in activity levels in these areas from operation of the facilities and the increased access. Effects on subsistence resources and recreation for FFD are discussed in Sections 4C-1.4.3 and 4C-1.4.7.

The FFD scenario under Sub-Alternative C-1 would include development of road access to all satellite production facilities. The increased development areas associated with this scenario would likely require development of new gravel resources and would likely have more potential for adverse effects on sensitive resources.

COASTAL MANAGEMENT

The coastal standards are evaluated for Sub-Alternative C-1 – FFD in this section.

ALASKA COASTAL MANAGEMENT PROGRAM

Coastal Development (6 AAC 80.040)

Sub-Alternative C-1 – FFD proposes the same 22 production satellites described under Alternative A. Road access is proposed to all satellite facilities, including those in the lower Colville River Delta and on the shore near the Kogru River. The extensive road development within the Colville River Delta would be expected to result in a higher potential for adverse effects on coastal resources than the other alternatives, which limit road construction in these areas. Sub-Alternative C-1 – FFD conforms less with the coastal standard than do Alternatives A or B.

Geophysical Hazard Areas (6 AAC 80.050)

As with Sub-Alternative C-1 – CPAI Development Plan, facilities proposed under FFD would be required to incorporate design measures to protect permafrost and natural drainage patterns and to protect the built structures from flood events, scour, ice jams, and storm surges. It would be more difficult to meet this standard under FFD for Sub-Alternative C-1 because of the extent of roadways proposed to be constructed in the Colville River Delta. The Delta's dynamic hydrogeology and extensive floodwaters would require these roads to be constructed with much higher embankments and with much more stabilization to address potential damage from floods and ice floes in this area.

Recreation (6 AAC 80.060)

Development of facilities under FFD would result in road access throughout the lower Colville River Delta as well as the Fish-Judy Creeks and the Kalikpik-Kogru Rivers facility groups. Increased access under this scenario would be likely to result in a substantial increase in activity throughout these areas. Effects on recreation from this increased access are addressed further in Section 4C-1.4.7.

Energy Facilities (6 AAC 80.070)

Full-field development under Sub-Alternative C-1 would increase the potential for environmental impacts by increasing road construction and situating roads, bridges, and other facilities within buffers, water body setbacks, and areas restricted from surface uses. Thus, Sub-Alternative C-1 FFD conforms less with this standard than do Alternatives A or B FFD.

Transportation and Utilities (6 AAC 80.080)

The FFD scenario calls for development of road access to all satellite facilities situated throughout the ASDP Area. Development of extensive roads throughout the Colville River Delta does not conform to the standard for siting roads inland and away from shorelines. Other alternatives that propose access by air to areas in the Colville River Delta conform more closely with this standard.

Mining and Mineral Processing (6 AAC 80.110)

Sub-Alternative C-1 FFD would require substantially more gravel than FFD under Alternative A. FFD would likely require gravel resources beyond those currently identified. Any new gravel mining operation within the coastal zone would be required to receive a permit, which would maximize compliance with state coastal management standards and protection of coastal resources.

Subsistence (6 AAC 80.120)

FFD would result in widespread development of roadways to access satellite facilities throughout the ASDP Area. Access on industry roads in the Colville River Delta would be limited, but access on roads in the National Petroleum Reserve-Alaska would be unrestricted. Increased access and increased activity levels in formerly remote areas could affect subsistence resources. Potential effects on subsistence from development under the FFD scenario are discussed further in Section 4C-1.4.3.

Habitats (6 AAC 80.130)

FFD would result in additional impacts to coastal habitats. Impacts from FFD under Sub-Alternative C-1 would exceed the impacts from other alternatives because of the significant increase in road access and acres developed.

Air, Land, and Water Quality (6 AAC 80.140)

Compliance with ADEC and USEPA regulations would result in conformance with this coastal management standard for the proposed Sub-Alternative C-1 FFD.

Historic, Prehistoric, and Archaeological Resources (6 AAC 80.150)

Sub-Alternative C-1 – FFD would require the same process for protection of cultural resources as discussed under Alternatives A and B. The increased access resulting from more roads and more access to remote sites would be likely to increase the potential for inadvertent impacts to previously undocumented cultural resources.

NORTH SLOPE BOROUGH COASTAL MANAGEMENT PROGRAM

Sub-Alternative C-1 – FFD would be less consistent with the current NSB *Standards for Development* (NSB CMP 2.4.3) because of the location of facilities within buffer areas and water body setbacks and the increased road access to areas used for subsistence. Potential effects on subsistence and cultural resources would be expected to be higher for this alternative than for FFD Alternatives A or B.

Sub-Alternative C-1 – FFD would address the current NSB *Required Features for Applicable Development* (NSB CMP 2.4.4) through compliance with project specific procedures discussed in Chapter 2, most of the BLM stipulations in Appendix D, and alternative measures potentially required by the state. Overall vehicle use throughout the area would increase substantially under Sub-Alternative C-1 FFD because of the increased access provided by connecting all satellites with roads.

Sub-Alternative C-1 – FFD would address current NSB *Best Effort Policies* (NSB CMP 2.4.5). These policies call for protection of sensitive coastal resources, including subsistence and cultural resources. These issues have been addressed above in the ACMP discussion. Again, Sub-Alternative C-1 FFD would be expected to have a higher potential for adverse effects because of the increased access to the remote satellites.

The current NSB CMP also contains standards for *Minimization of Negative Impacts* (NSB CMP 2.4.6). The proposed development under Sub-Alternative C-1 FFD includes design measures to protect permafrost and to address geophysical hazards as discussed above under the ACMP. The extensive road development proposed under Sub-Alternative C-1 FFD, however, would not minimize impacts to sensitive habitats, particularly in the Colville River Delta.

NORTH SLOPE BOROUGH LAND MANAGEMENT REGULATIONS

As discussed under Alternative A – FFD, most of the land within the NSB is zoned as "Conservation," with the exception of some village sites and the existing oilfields at Prudhoe Bay and Alpine Field. The NSB's "Resource Development" zoning classification covers areas designated for oil development activities. Development east of the National Petroleum Reserve-Alaska in the Colville River Delta under Sub-Alternative C-1 FFD would require a re-zoning of the development areas to the "Resource Development" classification and permitting of activities through the approval of a master plan. Application of the NSB's land management regulations to oil and gas activities on federal lands is subject to legal constraints and therefore must be evaluated on a case-by-case basis as particular activities are proposed.

4C-1.4.6.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Land Uses and Coastal Management

Impacts resulting from implementation of Sub-Alternative C-1 – CPAI Development Plan are similar to those of Alternative A. Construction and operation of Sub-Alternative C-1 – CPAI Development Plan would not be anticipated to result in adverse effects on existing land use and ownership. A direct impact, however, would be the increase in the acres of developed land. Development under this alternative would result in nearly quadrupling the total number of acres developed for oil production within the ASDP Area. Additional impacts of concern for Sub-Alternative C-1 on special use areas would be the construction and operation of facilities within the designated Fish Creek buffer zone and the CRSA. Construction of CD-6 and associated and pipeline roads would require an exception allowing for development within Fish Creek buffer area. Additional exceptions would be required for facilities within 500 feet of some other water bodies, and for a road connecting separate oilfields in National Petroleum Reserve-Alaska. Development within the Colville River Special Area would be required to maximize protection of surface resources consistent with the purpose of producing oil.

FFD of a production pad and associated pipeline in the area near the Kogru River designated for no surface activities would require an additional exception from the surface use restrictions for that area. FFD would also

require approval for additional development within the Fish Creek buffer area, Sensitive Consultation areas, and the special caribou stipulation area.

The proposed CPAI development under Sub-Alternative C-1, constructed and operated in compliance with the project specific procedures in Chapter 2, all but three of the existing BLM stipulations for the area, and alternative measures potentially required by the state, is expected to be consistent with state and NSB coastal management policies. Sub-Alternative C-1 FFD would have more potential for adverse resource impacts than other FFD alternatives and would therefore not be considered to have met the standards for maximizing conformance with ACMP and NSB coastal policies. Implementation of the CPAI proposal and/or the FFD would require NSB re-zoning of plan areas east of National Petroleum Reserve-Alaska from "Conservation" to "Resource Development" and permitting of activities through the approval of a master plan. Application of the NSB's land management regulations to oil and gas activities on federal lands is subject to legal constraints and therefore must be evaluated on a case-by-case basis as particular activities are proposed.

4C-1.4.6.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Land Uses and Coastal Management

No mitigation measures have been identified for Sub-Alternative C-1 (CPAI and FFD).

4C-1.4.6.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Land Uses and Coastal Management

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4.7 Recreation Resources

4C-1.4.7.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Recreation Resources

The impacts of Sub-Alternative C-1 – CPAI Development Plan to existing recreation use and values will be similar to those for Alternative A**.** The applicant's proposed action to develop five pads could potentially affect the recreational experience, including values of solitude, quietude, naturalness, and wilderness, over approximately 40,000 acres. However, the current recreational use of the Plan Area is very low, and most recreation occurs directly along the Colville River where activities associated with Nuiqsut already have decreased some of these recreation values. Sub-Alternative C-1's road connection to Nuiqsut could create opportunities for increased recreational from the village. Nevertheless, as with Alternative A, recreational opportunities in the Plan Area would remain consistent with the BLM's SPM classification.

ABANDONMENT AND REHABILITATION

Impacts from abandonment and rehabilitation activities would be similar to those for Alternative A. If upon completion of abandonment, roads are left in place and made available for the public, there would be substantially greater access opportunities through Nuiqsut and Alpine, if the recreationists are allowed to use the latter.

4C-1.4.7.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Recreation Resources

Under the FFD alternative, the types of effects on hunting, fishing, and birding opportunities and the qualities of solitude, quietude, naturalness, and wilderness would be the same as those described for Sub-Alternative C-1 – CPAI Development Plan. However, the potential for such effects would increase under FFD because of the increased geographic scope of development. In addition to the potential effects on approximately 40,000 acres from the CPAI Development Plan, the recreational opportunities on up to an additional 192,000 acres could be affected if as many as 24 proposed processing or production pads were to be developed. The level of impacts

for FFD would be similar to that under Alternative A, with the exception of increased recreational use by Nuiqsut residents.

4C-1.4.7.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Recreation Resources

Construction and operation of the facilities proposed under Sub-Alternative C-1 (CPAI and FFD) may increase recreational opportunities by Nuiqsut residents, but otherwise is not expected to result in more than local adverse effects to the currently lightly used recreational resources of the Plan Area.

4C-1.4.7.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Recreation Resources

No mitigation measures have been identified.

4C-1.4.7.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Recreation Resources

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4.8 Visual Resources

4C-1.4.8.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Visual Resources

CONSTRUCTION PERIOD

Construction impacts for Sub-Alternative C-1 – CPAI Development Plan would be roughly the same as those described for Alternative A. Construction of more roads, and especially roads closer to Nuiqsut, could increase visual impacts from construction.

OPERATION PERIOD

Under this alternative there would be a road connection to Nuiqsut, resulting in more vehicular traffic and fugitive dust viewable in the foreground to middle-ground zone for Nuiqsut residents. Pipelines that parallel roads closer to Nuiqsut may also marginally increase the visual impact on residents of that community. The minimum elevation of pipelines would be 7 feet instead of 5 feet above the tundra. When viewed from the foreground-middle-ground zone, the pipelines would create slightly more contrast with the natural landscape. Power lines hung from 60-foot power poles rather than VSMs would create substantially more vertical contrast with the natural landscape than the other alternatives.

ABANDONMENT AND REHABILITATION

The impacts of abandonment and rehabilitation would be similar to those for Alternative A, but the increased gravel road mileage and the proximity of some roads to Nuiqsut will increase the visual impacts.

4C-1.4.8.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Visual Resources

Construction- and operation-related impacts would be similar to those described for Alternative A. There would be more gravel roads and power poles and slightly higher pipelines compared to Alternative A. These changes would have moderate impacts because the increased number of power poles introduces a vertical contrast into the predominantly horizontal landscape.

4C-1.4.8.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Visual Resources

Sub-Alternative C-1 would result in greater adverse impacts to visual resources than Alternatives A and B. An increase in vehicular traffic, fugitive dust along with the utilization of power poles and increased height of the proposed pipeline, would result in and increase of impacts as compared to other proposed alternatives.

4C-1.4.8.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Visual Resources

Potential mitigation measures would include those identified for Alternative A (Section 4A.4.8), as well as burying pipeline most visible from Nuiqsut near the junction with the spur road to the village.

4C-1.4.8.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Visual Resources

The effectiveness of the protective measures would be similar to Alternative A.

4C-1.4.9 Transportation

4C-1.4.9.1 Sub-Alternative C-1 – CPAI Development Plan Impacts on Transportation

ROADWAYS

Sub-Alternative C-1 – CPAI Development Plan would result in the construction of 42.1 miles of new gravel roads, and 42.3 miles of pipelines within the Plan Area. No airstrips would be constructed because all of the production pads would be accessible by road. On BLM-managed lands, use of the roadways would be unrestricted; outside of National Petroleum Reserve-Alaska, use of the roadways would be limited to oil industry personnel and residents of the village of Nuiqsut. The road network would connect to Nuiqsut.

CONSTRUCTION PERIOD

Construction activities, phasing, and workforce under Sub-Alternative C-1 would be the same as under Alternative A. No adverse effects on public roadway systems are anticipated.

OPERATIONS PERIOD

Operation of the facilities proposed under Sub-Alternative C-1 would result in a greater level of traffic within the Plan Area than under Alternative A both because there would be more roads (and no new airstrips) and because road access directly to Nuiqsut would facilitate more traffic by local residents.

RAILROAD TRANSPORTATION

Rail transport needs and effects would be the same for Sub-Alternative C-1 as under Alternatives A and B.

MARINE FACILITIES

Marine transportation need and effects for Sub-Alternative C-1 would be the same as under Alternatives A and B.

RIVER TRANSPORTATION

CONSTRUCTION PERIOD

Effects on river transportation from construction activities would be similar to those described in Alternative A. Due to the increased road coverage and increased number of bridges, construction impacts would be expected to be greater than those associated with alternatives A and B.

OPERATIONS PERIOD

Sub-Alternative C-1 proposes construction of more gravel roads and adds road bridges over the Sakoonang, Tamayagiaq, and Ulamnigiaq channels on the road to CD-3. Bridge designs would address water surface elevations and velocities, scour protection, ice impacts and jams, storm surges, and waterway opening requirements. Although bridges will be designed to minimize effects on river transportation, the addition of road bridges on commonly used channels in the Colville River Delta may be more likely to adversely affect river transportation. Therefore, operation of the facilities proposed under Sub-Alternative C-1 would have more potential to adversely affect river transportation than Alternatives A or B.

AVIATION FACILITIES

Air transport of the construction workforce to the North Slope would be the same as under Alternative A. Less construction air support would be required for later construction phases because there would be road access to all construction sites. In addition, construction workers could be flown directly from Deadhorse to Nuiqsut and access construction sites by road from Nuiqsut after the gravel roads were constructed.

The demand for aviation support for the production pads under Sub-Alternative C-1 would require less flight support than under Alternatives A or B because direct road access would be available to all construction sites. Operations would not be expected to adversely affect air transportation resources within the region.

Sub-Alternative C-1 proposes putting all electric lines on 60-foot poles. As discussed under Alternative A, local aviation interests have expressed concerns that these poles, although well below heights typically regulated by FAA for safety hazards, could create a safety hazard for very low level flight operations during poor visibility conditions.

PIPELINES

As in Alternatives A and B, there would be no effects on existing pipeline facilities during the construction phase, production flows will likely be managed to remain within the capacity of the existing sales oil pipeline, and the projected increase in throughput to TAPS is expected to remain well within the capacity of the pipeline.

ABANDONMENT AND REHABILITATION

Impacts would be similar to those associated with Alternative A.

4C-1.4.9.2 Sub-Alternative C-1 – Full-Field Development Scenario Impacts on Transportation

ROADWAYS

Construction impacts to public roadways would be similar to those identified for Alternative A. Operations traffic associated with Sub-Alternative C-1 would be substantially higher and more widespread than that associated with other FFD scenarios. The extensive network of roads and bridges would provide year-round access across the entire Plan Area. This road network would also connect to Nuiqsut. Operations activities would result in substantially more traffic throughout the Plan Area compared to other alternatives, particularly

during summer months when there had been very limited previous access to many of these areas. The traffic generated would not adversely affect any public roads.

RAILROAD TRANSPORTATION

The effects on rail transport for Sub-Alternative C-1 would be the same as those for Alternatives A and B.

MARINE FACILITIES

The effects on marine transportation for Sub-Alternative C-1 would be the same as those for Alternativs A and Alternative B.

RIVER TRANSPORTATION

Effects on river transportation under Sub-Alternative C-1 would be greater than for the earlier alternatives, particularly in the Colville River Delta where more navigable channels would be bridged.

AVIATION FACILITIES

The FFD Scenario under Sub-Alternative C-1 would require less air support during construction and operations than under Alternatives A or B because all sites would be accessible by road. This alternative would have the highest potential for creating aviation safety hazards for aircraft operations at very low levels, due to the construction of power lines connecting the various sites.

PIPELINES

Pipeline needs for the FFD Scenario under Sub-Alternative C-1 are similar to those discussed under Alternatives A and B and should be able to be met with existing infrastructure.

4C-1.4.9.3 Sub-Alternative C-1 – Summary of Impacts (CPAI and FFD) on Transportation

Construction and operation of the facilities proposed under Sub-Alternative C-1 (CPAI and FFD) in the Plan Area are not expected to result in adverse effects to transportation resources. Existing and proposed roads, airstrips, and pipelines are expected to adequately transport personnel, materials, and product throughout the Plan Area and into statewide transportation systems. Both local and statewide transportation systems are considered to have adequate capacity to accommodate the level of activity anticipated during construction and operation of the facilities.

4C-1.4.9.4 Sub-Alternative C-1 – Potential Mitigation Measures (CPAI and FFD) for Transportation

To address the potential safety hazard associated with the electric lines, these poles could be marked according to FAA requirements for structures above 200 feet. This could consist of red lights on the poles and high visibility markers on lines where appropriate.

The potential for impacts to river navigation during construction could be mitigated through development of a navigation plan for commonly navigated channels that would be crossed by pipelines or bridges. The navigation plan should be submitted to the USCG for review prior to the start of construction of pipelines or bridges over commonly navigated channels. This could help minimize impacts to river navaigation and help assure reasonable navigation means during construction (see Section 4A.4.9.4 for additional details).

4C-1.4.9.5 Sub-Alternative C-1 – Effectiveness of Protective Measures for Transportation

The effectiveness of the protective measures would be similar to Alternative A.