ENVIRONMENTAL REPORT

Eastern North Slope Oil and Gas Pipelines

February 2, 2006

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1.0 INTRODUCTION

Pursuant to AS 38.35, the Department of Natural Resources (DNR), Office of Project Management and Permitting (OPMP) is submitting this document to obtain Conditional Right-of-Way Leases for oil and gas pipelines that the OPMP desires to own (i.e. "the Project"), connecting reserves east of the Prudhoe Bay field with existing Prudhoe Bay oil facilities and gas facilities that will be constructed in the near future. The OPMP does not know of other persons who own or presently plan to own an interest in the proposed pipelines.

The State of Alaska is currently in negotiations under the Stranded Gas Act for a natural gas pipeline connecting North Slope natural gas to facilities in the Lower 48 states. Gas from the Eastern North Slope Gas Pipeline can be shipped to Lower 48 markets when the larger gas pipeline is constructed. Oil shipped through the Eastern North Slope Oil Pipeline can be shipped to Lower 48 markets through the Trans-Alaska Pipeline System (TAPS).

1.1 ROUTE SUMMARY

The Eastern North Slope Oil and Gas Pipelines originate at oil and gas processing plants to be constructed in the vicinity of Point Thomson. The oil pipeline will terminate at a point of connection to the TAPS and the gas pipeline will terminate at a point of connection to the proposed Alaska Natural Gas Pipeline. Both pipelines' routes are approximately forty-five (45) miles long and are illustrated in Attachment A to the Applications.

1.2 LAND OWNERSHIP

The project is located entirely on State-owned lands. The township, range and section information is provided in Attachment B to the Applications. The State of Alaska has jurisdiction over State lands, freshwater lakes, rivers and streams, tide and submerged lands within three (3) miles of the shoreline, barrier islands, as well as over State waters, including offshore waters within three (3) miles of the shoreline.

The State owns both the surface and sub-surface estates of the lands within the project area. A number of oil and gas leases have been issued along the North Slope, including in the project area. Under the terms of the State's lease, the lessee has a right to use as much of the surface as reasonably necessary to develop and produce the sub-surface minerals. The surface estate, however, is reserved to the State; therefore the state may issue road and pipeline rights-of-way to the extent that such rights-of-way do not interfere with the rights of the mineral lessee.

All lands within the project area are designated as "Special Use Lands" by the DNR (ADL 50666; 11 A.A.C. 96.014(b)(1)). The following activities, in addition to those requiring a DNR permit under A.S. 38 and 11 A.A.C. 96, require authorization: geophysical activity; other exploration activity; construction activity; and transportation activity, except along established roads.

Two Native allotments exist in the project vicinity, both located in T 10N, R 18E, U.M. The project will not cross or otherwise interfere with either Native allotment.

2.0 ENVIRONMENTAL OVERVIEW

2.1 PHYSICAL GEOGRAPHY

The project area is in the Arctic Coastal Plain, which lies between the northern foothills of the Brooks Range and the Beaufort and Chukchi Seas. Shallow lake basins, wind-oriented lakes and ice wedge polygons dominate the Coastal Plain (Lewellen 1971). The rolling landscape rises twenty (20) to twenty-five (25) feet above the river and stream channels along the Coastal Plain (Schick and Noel 1995).

The land over which the pipeline rights-of-way traverse is a broad, relatively flat, treeless alluvial fan, rising in elevation from the Arctic Ocean toward the foothills of the Brooks Mountain Range. It is known as the ancient Canning River alluvial fan, which is divided into a coastal zone and an inland zone. The coastal zone is located within two (2) to three (3) miles of the coastline and attains elevations of up to twenty-five (25) to thirty (30) feet above mean sea level (Miller 2003; URS 2001). A poorly defined terrace face marks the transition from the coastal zone to the relatively higher, better-drained inland zone. Surface drainage in the coastal zone is characterized primarily as channel flow, which consists of a network of shallow lakes and streams, while surface drainage in the inland zone is generally not confined to defined channels and is characterized as sheet flow (ExxonMobil 2003).

The project route is located in the coastal zone and passes close to numerous shallow lakes and crosses several stream channels. In this area, runoff and water from thaw of the near surface soils accumulates above the permafrost, resulting in slow run-off into small streams and in the swampy character of much of the tundra during the summer (Miller 2003). Wind-oriented thaw lakes dominate the landscape on the ancient Canning River alluvial fan coastal zone. The thaw-lake basins originate in areas of restricted drainage, where shallow ponding results in a warmer surface temperature that causes the underlying ground ice to thaw resulting in subsidence. Most of the ponds and lakes are relatively shallow. The thaw lakes are considered dynamic and impermanent, and often go through an annual cycle of development, expansion, drainage, and revegetation (Lewellen 1972; Miller 2003).

Permafrost is defined as the thermal condition of soil or rock in which temperatures below thirty-two (32) degrees Fahrenheit, or zero (0) degrees Celsius, persist over at least two (2) consecutive winters and the intervening summer; ground ice and other moisture may or may not be present. In the project area, ground ice is present above the permafrost and extends to the base of the active layer of the permafrost. The active layer is the layer that thaws during summer months, protecting and insulating the remaining permafrost. The thickness of the active layer in the project area averages about two (2) feet (URS 2001).

Topography is typically flat, particularly along the coast. Sharp topographic breaks and features are uncommon, although low ridges exist at lake and stream edges and adjacent to ice wedges. Small (e.g. typically less than one (1) foot), seasonal variation in local tundra elevation due to freezing and thawing of the active layer is common (ExxonMobil 2003).

The principal marine environment in the Prudhoe Bay and Eastern North Slope area is a relatively shallow marine lagoon that is situated south of a barrier island complex with water depths typically between five (5) and thirteen (13) feet. The barrier islands parallel the coast and along most of the project area. The barrier islands partially protect and stabilize much of the shoreline in this area from exposure to waves, storm surges and ice surges generated in the Beaufort Sea. Sea level variation due to tide action during the open water season is typically less than one (1) foot. Storm surges in the eastern North Slope area are generally less than three (3) feet, but during extreme storms can reach up to eight (8) feet. Positive storm surges are associated with westerly winds and negative storm surges are associated with easterly winds (URS 2001).

Aside from a federal Distant Early Warning (DEW) Line station, several remaining gravel exploration pads built and used in the 1970's to support oil and gas exploration, and the Badami Pipelines, the Eastern North Slope area is essentially undeveloped.

See the Design Basis documents for more information on the physical geography of the project area.

2.2 SOILS

Except for the active layer during summer and thaw pockets, which extend up to two (2) feet in deep lakes and large river channels, continuous permafrost extends from the surface to one thousand eight hundred (1800) feet below (ExxonMobil 2003; Miller 2003). Drainage is poor in the region due to the impermeable nature of the permafrost. All water from snow, rain and summer thaw accumulates above the permafrost, resulting in the swampy character of the tundra during summer months (Miller 2003).

Soils beneath the tundra in the project area typically consist of a surficial layer of organic material and silt, with sand and gravel located at greater depth. The base of the silt is typically eight (8) to ten (10) feet beneath the tundra surface in the coastal zone. Sand and gravel deposits at three (3) to six (6) feet depth are common in this area. Soils vary from the eastern end of the right-of-way to the western end. The eastern end tends to have more silt and the west more gravel (ExxonMobil 2003).

The underlying outwash material is typically composed primarily of sandy gravel and gravelly sand with some traces of silt. Although much of the outwash material is ice-bonded, the ice content is generally small in these soils. Occasionally massive bodies of segregated ice are found in this area, the shallower of which are probably associated with ice wedge development. In general, the ice content in soils found from the surface to a depth of fifty (50) feet typically ranges between fifteen (15) and twenty (20) percent (ExxonMobil 2003).

See the Design Basis documents for more information on the soils within the project area.

2.3 SEISMICITY

The project is located in the North Slope seismic region, 70° to 71° N Latitude and 146° to 151° W Longitude. Under the previous governing code, the Uniform Building Code,

this region was previously classified a Design Seismic Zone 1, the lowest-risk category in Alaska. The current governing code is the International Building Code, latest edition adopted by the State of Alaska, Section 1615, which requires that design be based on the mapped spectral accelerations for the proposed site location (ExxonMobil 2003).

The North Slope is considered to be an area with low to moderate seismic risk. The project area is a region of low seismicity and low magnitude, generally considered an area of low earthquake activity. In the general vicinity of Point Thomson, at the eastern end of the route, approximately two hundred (200) earthquakes were recorded between August 1965 and December 1993. These included a magnitude of 5.3 on the Richter scale, offshore near Barter Island in 1968, and a 5.1 event about one hundred (100) miles southwest of the area in 1969 (ExxonMobil 2003).

Most seismicity in the area is shallow (less than twenty (20) miles deep), indicating near-surface faulting, but no active faults are recognized at the surface in this area. Accelerations in areas underlain by thick, soft sediments are likely to be higher than in bedrock due to amplification. Thick permafrost, which underlies the project area, may cause the earthquake response of the alluvial sediments to act more like bedrock, limiting amplification and tending to prevent earthquake-induced ground failure, such as liquefaction (ExxonMobil 2003).

See the Design Basis documents for more information on the seismicity of the project area.

2.4 METEOROLOGY

The Arctic Coastal Plain is heavily influenced by solar radiation (Lewellen 1972). The sun does not rise above the horizon from late-November to mid-January and does not dip below the horizon from mid-May to August (URS 2001). Typically, spring break-up occurs around the second week of June. July is the warmest month and also the month with the greatest amount of precipitation.

The Beaufort Sea is usually ice-free from late-July or early-August to mid-October. Lakes and ponds begin freezing in late September. In winter months, the wind packs the snow, with large drifts gathering near river and lake beds (Lewellen 1972). The project area has an arctic coastal climate, with a mean annual temperature of nine (9) degrees Fahrenheit (Miller 2003).

Wind, which is constant year-round, typically comes from the northeast; however strong westerly and southwesterly winds can occur during storms (Miller 2003). The windiest month is January, with July being the calmest. Positive storm surges are associated with westerly winds and negative storm surges are associated with easterly winds (URS 2001).

See the Design Basis documents for more meteorological information for the project area.

2.5 STREAMS AND FLOODPLAIN CROSSINGS

The project area falls within the North of the Brooks Range Hydrological Region, within the Arctic Slope Drainage. Small, meandering streams originating on the coastal plain are slow moving and generally are the first to freeze in fall/winter and last to break up in spring/summer. Peak discharges of these streams generally occur during break up. Typically these streams are confined to one channel and are not braided; however many of the streams consist of a series of small lakes connected by short streams (URS 2001).

Major rivers within the project area are the Sagavanirktok, Shaviovik, Kavik, and Kadleroshilik Rivers, all of which appear to be navigable, based upon preliminary hydrological data. The Sagavanirktok River originates in the Brooks Range and is approximately one hundred eighty (180) miles long. The Sagavanirktok is highly braided, particularly as it nears the Beaufort Sea, with shifting channels. The Shaviovik River's headwaters are in Juniper Creek in the Brooks Range and it runs approximately one hundred (100) miles to the coast. The main tributary is the Kavik River. The Kadleroshilik originates in the Arctic Foothills and flows to the coast (CH2MHILL 2005).

Winter flows in these rivers are small to nonexistent, but can lead to accumulations of ground fast ice (aufeis). Ice jams are common on all of the major rivers prior to break up and can affect the hydrology of the river. On the North Slope, breakup produces maximum water levels in streams and rivers, thereby creating management concerns for roadways, culverts, pipelines and other structures located in areas subject to ice accumulation (CH2MHILL 2005).

Snowmelt floods on small streams also occur, typically at the same time each year. As the snow melts, the runoff flows over the frozen ground, rather than penetrating into the ground. The runoff then collects behind snowdrifts, where it gathers until the snowdrift thaws, when more runoff is released downstream where it collects behind other snowdrifts or flows into open waters. The collecting and releasing of the waters results in sporadic river flows during break-up (URS 2001).

Heavy, sustained rains in the Brooks Range, while infrequent, can trigger peak flows in the Sagavanirktok, Shaviovik and Kavik Rivers. Flows increase rapidly in response to rainfall events because the characteristics of the Brooks Range and permafrost conditions of the North Slope result in low storage capacity for precipitation. Flooding due to large amounts of precipitation in the summer is unlikely in the Kadleroshilik River and smaller rivers and streams in the project area because they are not influenced by rain in the Brooks Range (URS 2001).

Flat-bottomed lakes dominate the landscape of the coastal zone in the planning area. Most lakes are less than three (3) feet deep and freeze during the winter months (Lewellen 1972). See the above discussion in Section 2.1, Physical Geography, for more lake information.

For the locations of streams and floodplains, refer to the route map, included as Attachment A to the Right-of-Way Lease Applications. See the Design Basis documents for more information on the streams and floodplain crossings within the project area.

2.6 VEGETATION AND WETLANDS

The project area is mostly covered by water, including subtidal bays and inlets, rivers, streams, lakes and ponds. The project area is considered the lowland tundra vegetative zone, as the Arctic Coastal Plain supports lowland tundra vegetation types. Predominant vegetation types are Moist Sedge, Dwarf Shrub/Wet Sedge tundra complexes, which are typically located in high-center and low-center polygon areas and in reticulated tundra, Moist Sedge and Dwarf Shrub tundra. Other vegetation types include Wet Sedge Tundra, Dry Dwarf Shrub Lichen Tundra and salt march areas (URS 2001). A portion of the project area has been disturbed by the Badami pipeline and other development associated with oil and gas development in the region.

Most of the vegetation types in the project area are considered to be wetlands. Exceptions are the well-drained dwarf shrub, crustose and fruticose lichen communities associated with pingos and some high-center polygons, respectively, and partially vegetated sand dunes. Some riparian areas also are likely to be considered uplands (URS 2001).

No threatened or endangered plant species are known to exist in or near the project area. Seven species of rare plants occur on the North Slope, however, and may be present in the project area, including *Mertensia drummondii* (currently considered a species of concern under the Endangered Species Act)*, Potentilla stipularis, Pleuropogon sabinei, Draba adamsii, Poa hertzii, Erigeron muirii, and Aster pygmaeus* (URS 2001).

There are no timber resources in the project area (Alaska Department of Natural Resources 1997).

2.7 FISH

Fish in the project area include Dolly Varden char, Arctic grayling, lake trout, ninespine stickleback, round whitefish, broad whitefish, fourhorn sculpin, humpback whitefish,

least cisco, burbot, slimy sculpin, Arctic char, chum salmon and pink salmon. Ponds and lakes associated with the streams and rivers may contain lake trout, ninespine stickleback, Dolly Varden, grayling, and possibly whitefish (McLean 2003, URS 2001).

Table 2.7: Fish Species Likely to Occur in Rivers in and near the Project Vicinity (Alaska Department of Natural Resources 1997).

Common Name	Scientific Name
Arctic Grayling	*Thymallus arcticus*
Broad Whitefish	*Coregonus nasus*
Burbot	*Lota lota*
Chum Salmon	*Oncorhynchus keta*
Dolly Varden	*Salvelinus malma*
Fourhorn Sculpin	*Myoxocephalus quadricornis*
Humpback Whitefish	*Coregonus clupeaformis*
Least Cisco	*Coregonus sardinella*
Ninespine Stickleback	*Pungitius pungitius*
Pink Salmon	*Oncorhynchus gorbuscha*
Round Whitefish	*Prosopium cylindraceum*
Slimy Sculpin	*Cottus cognatus*
Lake Trout	*Salvelinus namaycush*
Arctic Char	*Salvelinus alpinus*

Dolly Varden usually spawn from mid-August to November. The eggs hatch in spring, four (4) to five (5) months after fertilization. Young Dolly Varden emerge from the streambed gravel in June and rear in the streams before migrating to the ocean in their third or fourth year. After the first migration, Dolly Varden winter in the freshwater rivers on the North Slope. Dolly Varden on the North Slope reach maturity between ages five (5) and nine (9) and return to the stream in which they originated to spawn (Alaska Department of Fish and Game 2005).

Arctic grayling occur throughout the Arctic and can be highly migratory, utilizing different streams for spawning, rearing, summer feeding and overwintering. Arctic grayling have a tolerance for low dissolved oxygen levels, which allows them to survive long winters in areas where salmonids would not. Each spring Arctic grayling migrate upstream to spawning grounds; grayling spawn for the first time around four (4) to five (5) years of age. After spring break-up, adult grayling move to summer feeding grounds and segregate within a stream according to age and maturity. Fry hatch about three (3) weeks after spawning and tend to occupy the calm waters. Grayling begin a downstream migration to overwintering areas in early fall (Alaska Department of Fish and Game 2005).

Lake trout occupy large, deep, cold lakes. Spawning takes place along rocky lake bottoms at nights from September to November. Eggs hatch early the following spring and it is believed that young feed on plankton for their first years. The first spawning occurs after seven (7) or eight (8) years and adults spawn every-other year in northern Alaska (Alaska Department of Fish and Game 2005).

Whitefish are the most abundant group of fish in northern Alaska, occupying almost every river and freshwater habitat. The broad whitefish spawns over a gravel bottom in the fall. The humpback whitefish first spawn at four (4) to five (5) years and begin the upstream migration in the summer and fall. Spawning takes place in October over a gravel bottom. The least cisco is sometimes mistaken for a herring. Least cisco reach maturity around age six (6) and migrate upstream in the fall to spawn in clear streams with gravel bottoms. Spawning usually takes place in October (Alaska Department of Fish and Game 2005).

In general, burbot are long-lived and slow-growing – burbot older than twenty (20) years are not uncommon in Alaska. Most burbot spawn for the first time after age six (6) or seven (7). During spawning, which takes place under ice in February and March, burbot have been observed milling together in a large ball. Young burbot feed on insects and

invertebrates and by the age of five (5), burbot feed on fish and sometimes mice or shrews (Alaska Department of Fish and Game 2005).

The Arctic char is present in North America in both anadromous and nonanadromous forms; however on Alaska's North Slope Arctic char only occur in lakes. Little is known of Arctic char in Alaska, but in other areas, Arctic char reach maturity between ages six (6) and nine (9) and are believed to spawn every-other year. Spawning usually occurs from August through October (Alaska Department of Fish and Game 2005).

Adult pink salmon move into streams between late June and mid-October. Chum salmon spawn in small channels and other out-of-the-way areas of large rivers, as well as in small streams and intertidal zones. Spawning takes place in the fall. After spawning, both male and female salmon die. Both chum and pink salmon fry move into the ocean in the spring; however pink salmon migrate to the ocean earlier than chum. Both chum and pink fry feed on small insects in the stream before forming larger schools in the ocean, where they feed on zooplankton. By fall, they move into the Bering Sea, where they spend one (1) or more winters (Alaska Department of Fish and Game 2005).

Most of the rivers, streams, ponds and lakes in the area are shallow and provide little to no over-wintering habitat (McLean 2003). The main channel of the Sagavanirktok River is considered sensitive year-round because of rearing and over-wintering areas. The main channel is considered critically sensitive from May through June because of Arctic grayling spawning and from August through October because of Dolly Varden migration and spawning. Over-wintering occurs to a lesser extent in the Shaviovik, Kavik and Kadleroshilik Rivers. The Sagavanirktok River and some of its smaller channels are classified as anadromous fish habitat (URS 2001).

Portions of arctic rivers supporting overwintering fish can freeze to the bottom in shallow areas or in areas lacking upwelling groundwater discharge, like the Sagavanirktok, Kadleroshilik and Shaviovik Rivers in the project area. Unfrozen groundwater zones are

present beneath the beds of these rivers; however significant flow only occurs at the Sagavanirktok River (Alaska Department of Natural Resources 1997).

Fish are very important to the subsistence lifestyle of the local villages. Additionally, a small amount of sport fishing occurs in portions of the rivers and streams in the project area, primarily for Dolly Varden and Arctic grayling. No commercial fishery has been identified in the project area (Alaska Department of Natural Resources 1997).

2.8 AMPHIBIANS AND REPTILES

No reptiles occur in northern Alaska. One species of amphibian, the wood frog (*Rana sylvatica*), is present in the Interior Region and has been found north of the Brooks Range. Wood frogs breed in shallow ponds and other wetlands such as fens and, to a lesser extent, bogs as soon as open water appears in spring. In summer and fall, wood frogs feed on insects in moist wooded areas. Overwintering occurs in leaf litter in forested habitats (Alaska Department of Natural Resources 2004). The presence of wood frogs in the project area has not been documented.

2.9 MARINE MAMMALS

Polar Bear (Ursus maritimus)

Polar bears are the only marine mammals expected in the project area. Polar bears are present in the project area during ice-covered months and infrequently during the summer/warmer months (Alaska Department of Natural Resources 1997). Polar bears only occur in the northern hemisphere, in Russia, Norway, Denmark, Canada and the United States, and are almost always associated with the presence of sea ice. Polar bears resemble large brown bears, except their fur is white and water repellent and their teeth are specialized for a carnivorous diet (Alaska Department of Fish and Game 2005).

Polar bears live alone for most of the year. Males seek out females for mating in late March, April and May. Pregnant females den in late October and November, typically in drifted snow on sea ice or on land, with land denning becoming more frequent in recent years (Alaska Department of Fish and Game 2005; Alaska Department of Natural Resources 1997). Cubs, born in the den in December, weigh between one (1) and two (2)

pounds at birth. By March or early April, when the mother and cub emerge from the den, the cub weighs about fifteen (15) pounds. The mother and cub remain near the den until the cub is able to travel on the sea ice. Cubs usually remain with the mom until they are about twenty-eight (28) months old. Females typically produce litters every third year (Alaska Department of Fish and Game 2005).

The ringed seal is the main staple in the polar bear diet. Polar bears capture ringed seals by waiting for them at breathing holes and at the edges of the ice, and by stalking them as they rest on top of the ice. Polar bears also prey on bearded seals, walrus and beluga whales, as well as small mammals, bird eggs and vegetation when other food sources are not available (Alaska Department of Fish and Game 2005).

Polar bears are managed under the federal Marine Mammal Protection Act of 1972. This law provides that only Alaska Natives are allowed to hunt polar bears (Alaska Department of Fish and Game 2005).

Recorded den sites are located within the project area. Non-denning polar bears may also be present in the project area, given its proximity to the coast (Alaska Department of Natural Resources 1997).

2.10 TERRESTRIAL MAMMALS

The project area is located in Game Management Unit 26B.

Table 2.10: Terrestrial Mammal Species Likely to Occur in and near the Project Area

Common Name	Scientific Name
Moose	*Alces alces*
Caribou	*Ranfiger tarandus*
Brown Bear	*Ursus arctos*
Black Bear	*Ursus americanus*

Muskox	*Ovibos moschatus*
Arctic Fox	*Alopex lagopus*
Red Fox	*Vulpes vulpes*
Wolf	*Canis lupus*
Wolverine	*Gulo gulo*
Ermine	*Mustela erminea*
Least Weasel	*Mustela rixosa*
Arctic Ground Squirrel	*Spermophilus parryii*
Brown Lemming	*Lemmus sibiricus*
Collared Lemming	*Dicrostonyx groenlandicus*
Singing Vole	*Microtus miurus*
Tundra Vole	*Microtus oeconomus*
Barrenground Shrew	*Sorex ugyunak*
Tundra Shrew	*Sorex tundrensis*
Alaska Hare	*Lepus othus*

Moose

Moose are the largest member of the deer family and the Alaska race is the largest of all moose (Alaska Department of Fish and Game 2005). Moose are uncommon in the project area; the North Slope represents the northern boundary for moose populations in Alaska. In 2003, the Alaska Department of Fish and Game estimated approximately 400-500 moose in Game Management Unit 26B (Lenart 2004). On the North Slope, moose primarily occupy riparian shrub communities in river valleys containing sufficient browse to support them (Alaska Department of Natural Resources 2004). Moose on the eastern Coastal Plain are found in the northern foothills of the Brooks Range. Moose on the western Coastal Plain are located near the major river drainages, including the Sagavanirktok, Kavik and Shaviovik Rivers (Lenart 2004).

Prior to the 1950's, few moose lived on the North Slope. The lack of habitat on the North Slope limits the potential for large moose populations. The moose populations along the major river drainages became more easily accessible to hunters in the 1990's. Additionally, the moose on the North Slope were impacted by disease, changes in weather, habitat limitations, insect harassment, and increased brown bear and wolf predation in the 1990's. Due to a substantial decline in population numbers, moose hunting on the North Slope closed in 1996 (Lenart 2004).

Cow moose generally breed at twenty-eight (28) months. Breeding activities begin in early fall and continue through early October. Adult males joust during the rut, sometimes causing serious injuries, with the winner mating with the female (Alaska Department of Fish and Game 2005). Calving occurs in mid-May to early June and the cow-calf bonds are strong. While moose are not highly social animals, calves will remain with the cow until a subsequent calving, usually one (1) to two (2) years (Alaska Department of Natural Resources 2004). Adult male moose shed their antlers annually, beginning in November and continuing through January (Alaska Department of Fish and Game 2005).

Moose eat a wide variety of foods, including willow, birch, aspen, sedges, equisetum, pond weeds and grasses. Most moose make seasonal migrations, ranging from only a few miles to sixty (60) miles, for calving, rutting and wintering (Alaska Department of Fish and Game 2005).

Caribou

With the exception of the Chisana herd, Alaska's caribou are the barren-ground subspecies. Barren-ground caribou may consist of small, resident herds or larger, migratory herds (Alaska Department of Natural Resources 2004). Four caribou herds exist in northern Alaska: the Western Arctic Herd (WAH), the Teshekpuk Lake Herd (TLH), the Central Arctic Herd (CAH), and the Porcupine Herd (PCH). Mainly caribou from the CAH and PCH utilize the project area, although caribou from the TLH have been monitored in the area in recent years.

The CAH habitat ranges from the Colville River on the west to the Canning River on the east and extends approximately thirty (30) miles inland (Department of Natural Resources 2004). In 2002, the Alaska Department of Fish and Game (ADF&G) estimated the herd consisted of 31,857 caribou; in 2003 the herd estimates were 32,000 caribou post-calving (Lenart 2003B; Alaska Department of Natural Resources 2004). The herd tends to split into "segments" during summer months, with one half of the herd calving and spending the "insect season" on the east side of the Sagavanirktok River and the other half on the west side (Lenart 2003B; McLean 2003). The western segment regularly encounters industrial activities from the Prudhoe Bay Field and surrounding infrastructure. The eastern segment encounters less industrial activity, but likely is familiar with the Badami pipeline. The eastern segment calving and insect season area is located within the project area.

The CAH caribou tend to move closer to the shore on warm days and spend cool and windy days further inland (Lenart 2003B). Calving typically occurs in June (Alaska Department of Natural Resources 2004). From mid-June through early August, caribou move closer to the shoreline and river deltas to escape biting insects (McLean 2003).

Most caribou in the CAH migrate south towards the Brooks Range to breed and winter. The migration begins in August and is nearly complete by September. Due to warmer weather in recent years, however, the caribou have stayed near the coast longer, sometimes through September (Lenart 2003B). Additionally, a larger proportion of the herd have utilized southern portions of the Brooks Range for winter habitat in recent years – historically those lands were not used for wintering grounds in the 1970's and 1980's (Arthur and Del Vecchio 2004). At the time of rut in October, CAH caribou are distributed on both sides of the Brooks Range and as far south as the Chandalar Shelf (Alaska Department of Natural Resources 2004).

The PCH habitat range extends from the western edge of the Arctic National Wildlife Refuge (ANWR), which lies to the east of the project area, to the north-central Yukon

and western Northwest Territories in Canada. This herd calves and spends the insect season on the coastal plain and foothills of the Brooks Range in ANWR and the Yukon Territory (Stephenson 2003). In rare instances, Caribou from the PCH have joined with caribou from the eastern segment of the CAH and migrated towards the Point Thomson areas for calving and the insect season (URS 2001). The PCH migrates south of the Brooks Range in the Yukon and eastern Alaska to breed and winter. In 2001, the ADF&G estimated the herd at 123,052 caribou (Stephenson 2003).

The TCH typically calve and spend the insect months near Teshekpuk Lake and then disperse across the coastal plain in late summer, moving closer to the coast for insect relief. The fall TCH migration varies, with most caribou wintering on the coastal plain near Atqasuk, although the wintering location ranges from Teshekpuk Lake to south of the Brooks Range (Carroll 2003). However, during October of 2003, about 1/3 of the herd traveled two hundred fifty (250) miles east from the Teshekpuk Lake area and wintered in the ANWR. During both the eastward and westward migration to the ANWR the movements were affected by the combination of the TAP and the Dalton Highway. During the move back to the west a substantial number of TCH caribou were stopped by a combination of the TAPS, Dalton Highway, and the flooding Sagavanirktok River and calved near the eastern section of the CAH calving area. During the winter of 2004-2005, about half of the TCH wintered between the Itkillik and Canning Rivers. These movements to the east are unprecedented during the time that the herd has been observed (since 1990) and it is difficult to predict where they will range in future years (Carroll 2005). In 2002 the ADF&G estimated the TCH herd at 45,166 caribou (Carroll 2003).

Occasionally, caribou from the WAH mix with the CAH during the fall and winter months. Caribou from the CAH also mix with the TCH in late summer, fall and winter, and with the PCH during winter and summer (Lenart 2003B).

Brown Bear

Brown bears occur throughout Alaska but are less concentrated on the Arctic Coastal Plain. Brown bears have large home ranges and can travel thirty (30) miles in one (1) day (URS 2001). Except for females with cubs, bears usually live solitary lives.

Brown bears are opportunistic omnivores – habitats with abundant food resources are used on an as-available basis. The availability of food and waste near Prudhoe Bay resulted in a high density of brown bears; however improved waste management systems have abated the problem. Brown bears prey on caribou calves and also sometimes take adult caribou and scavenge on carrion. Brown bears also prey on moose, squirrels, other small mammals and salmon, as well as feeding on berries and roots (Alaska Department of Natural Resources 2004; Alaska Department of Fish and Game 2005). Most brown bear habitat in the project area is riparian along the major river drainages (URS 2001).

Brown bears mate from May through July. Cubs are born the following January or February in the winter den, weighing less than a pound at birth (Alaska Department of Fish and Game 2005). Brown bears typically den from October through April in the foothills of the Brooks Range and move north to the coastal plain in June and July to hunt (URS 2001). Pregnant females are the first to enter the dens in the fall and the last to leave in the spring with their cubs. Cubs stay with the mother until they are about two (2) years old and in some areas of Alaska, particularly where food sources are limited, cubs remain until they are three (3) to five (5) years old. The North Slope is an area of low brown bear productivity, with only one (1) bear for every three hundred (300) miles (Alaska Department of Fish and Game 2005).

Brown bears have been observed in the project area, with known denning sites located near the Badami pipeline (McLean 2003); however most brown bears are observed south of the project area (Department of Natural Resources 1997).

Black Bear

Black bears are infrequent in the northern third of the State and rarely, if ever, occur north of the Brooks Range (Alaska Department of Fish and Game 2005). Black bears are omnivorous, feeding on plants, buckbean, fruits, berries, fish, invertebrates, rodents, hares, moose calves, birds, eggs and carrion. Black bears den near the first significant snowfall, typically in forested habitat (Alaska Department of Natural Resources 2004).

Muskox

Muskoxen native to the North Slope were extinct by the late 1800's and were reintroduced on the coastal plain at Barter Island in 1969 and at the Kavik River in 1970. Today, muskoxen herds extend eastward into the Yukon Territory and westward to Fish Creek in the National Petroleum Reserve Alaska. Lone bulls and small groups have also been reported south of the Brooks Range near Arctic Village and along the Yukon River near Eagle (Lenart 2003A).

In the mid-1990's, the population reached five hundred (500) to six hundred (600) muskoxen and was considered stable; however by 1999 the population had started to decline. Factors that may have contributed to the decline include: emigration; annual changes in weather; adults calving every-other year; increasing brown bear predation; muskoxen moving onto the coastal ice and not returning to traditional habitat; and disease (Lenart 2003A). In 2004, the ADF&G estimated two hundred and fifty (250) to three hundred (300) muskoxen remain in Game Management Unit 26B (Alaska Department of Natural Resources 2004).

Muskoxen winter in larger groups, ranging from six (6) to sixty (60) members. Typically muskoxen stay in one location for the entire winter, usually where the snow cover is low so they can easily forage for food (Lenart 2003A, McLean 2003). Wind-scoured areas such as ridges, plateaus and bluffs are important winter habitat for muskoxen because they are unable to dig through deep snow to access food (Alaska Department of Natural Resources 2004). Muskoxen summer in smaller groups, five (5) to twenty (20) members, and move more frequently (Lenart 2003A). Most muskoxen activities on the coastal plain occur in riparian habitat along the major river drainages and adjacent uplands

(McLean 2003). Calving typically occurs upstream of the Shaviovik-Kavik confluence, which is south of the project area (Alaska Department of Natural Resources 1997).

Mating begins in late summer and continues through October. Single calves are born in April, May and June, weighing twenty-two (22) to thirty-one (31) pounds. Cows typically breed once they are two (2) years old. Battles between bulls during rut can be very violent – bulls charge each other from distances of fifty (50) yards, colliding with their foreheads. The sound of the impact can be heard from a mile away. This continues until one bull turns and runs in the opposite direction, sometimes after twenty (20) clashes (Alaska Department of Fish and Game 2005).

Arctic Fox

Arctic fox are prevalent near the coast of the Arctic Coastal Plain where they den in the slopes of pingos and riverbanks in unfrozen soil (Stephenson 2004; McLean 2003; Alaska Department of Natural Resources 2004). Arctic Fox mainly feed on lemmings, squirrels, voles, birds, eggs and carrion but will exploit artificial food sources, such as waste at oil and gas facilities, where available (McLean 2003; Alaska Department of Natural Resources 2004).

Mating occurs in early March and April. Arctic fox pups are born in dens, which can extend from six (6) to twelve (12) feet underground. Arctic fox are monogamous in the wild, with both parents rearing the pups. The pups begin to emerge from the dens at about three (3) weeks old and begin to hunt and roam away from the den at three (3) months. The family units begin to break up in September and October, with foxes leading a solitary life during the winter months (Alaska Department of Fish and Game 2005).

The home range of arctic fox varies throughout the year and is dependent on the availability of food. In late winter and spring, arctic fox move to terrestrial areas to den and rear their young. Arctic fox move seaward in fall and early winter (Alaska Department of Natural Resources 1997). In winter, arctic fox travel onto the sea ice to

scavenge seal kills made by polar bears and can travel long distances over the sea ice (Alaska Department of Natural Resources 2004; Alaska Department of Fish and Game 2005).

Arctic fox dens have been located in the project area (Alaska Department of Natural Resources 1997).

Other mammals

Red fox may occur in the project area along the major rivers; however red fox are typically found further inland from the coast. Red fox excavate dens in slopes and whelp in spring. Pups stay near the den for several months. Red fox prey on small rodents, squirrels, birds, eggs, insects, vegetation and carrion. Red fox appear to be more wary of human activities than arctic fox (Alaska Department of Natural Resources 2004).

Wolves are widely distributed to the east and west of the project area, but occur in low densities estimated at approximately six (6) to eight (8) wolves per one thousand (1,000) square miles, with few resident packs on the coastal plain. Wolves typically whelp four (4) to seven (7) pups in May or early June, using dens excavated in well-drained, unfrozen soil. Pups remain near the dens until mid-summer. Wolves prey on caribou, muskox, moose, and small mammals (Alaska Department of Natural Resources 2004). Wolves are most prevalent in the project area during summer months (Alaska Department of Natural Resources 1997).

Wolverines may occur in low numbers in the project area – wolverines are uncommon on the North Slope (Alaska Department of Natural Resources 1997). Wolverines are solitary animals that exist at a low density (one (1) wolverine per fifty-four (54) square miles) and range over large distances. Wolverines scavenge on the remains of ungulates and also prey on voles, squirrels and birds. Kits are born in snow dens in late winter and become independent in five (5) to six (6) months (Alaska Department of Natural Resources 2004).

Ermine and least weasels are also common to the coastal plain and most likely present in the project area (Alaska Department of Natural Resources 1997). Ermine are solitary animals and feed on voles, lemmings, birds, insects and fish. Least weasels are also solitary animals that feed on voles and lemmings. Both ermine and least weasels have litters of three (3) to ten (10) young in May or June in borrows. The young remain near the den for two (2) months. The distribution of ermine and least weasels follows prey distributions (Alaska Department of Natural Resources 2004).

Arctic ground squirrels are prevalent on the Arctic Coastal Plain. These squirrels are hibernators that excavate colonies in well-drained soils in coastal and alpine tundra habitats. Arctic ground squirrels feed heavily on vegetation over the summer (Alaska Department of Natural Resources 2004).

Both brown lemmings and collared lemmings occur on the coastal plain. Lemming densities near Prudhoe Bay are much lower than those at Barrow – lemming densities along the project area should be similar to those at Prudhoe Bay (Alaska Department of Natural Resources 1997). Lemmings occupy dry arctic and alpine tundra and are mainly herbivorous, although lemmings can become cannibalistic or eat insects and meat (Alaska Department of Natural Resources 2004; Alaska Department of Fish and Game 2005). Lemmings begin to breed before they are full grown. Breeding may occur in the winter but typically occurs in June through September. Lemmings are not migratory animals; however movements do occur during times of high populations (Alaska Department of Fish and Game 2005).

Voles, including the singing vole and tundra vole, also occur in the project area in high numbers. Voles tend to be colonial and feed on grasses, seeds and arctic tundra (Alaska Department of Natural Resources 2004). Voles live in colonies ranging in number from a few to three hundred (300). Breeding begins in late winter and continues through August. Young voles reach maturity and can begin breeding at three (3) to six (6) weeks (Alaska Department of Fish and Game 2005).

Shrews are the smallest mammal in the project area. The barrenground shrew and tundra shrew live on the North Slope. Shrews are solitary animals that live under the grass and leaf litter and eat small invertebrates. Breeding begins in March and continues through August; females often have several litters each year (Alaska Department of Fish and Game 2005).

Alaska hares also occupy the North Slope between Prudhoe Bay and the Brooks Range. Alaska hares are larger and more social than snowshoe hares and feed on willow shoots and other vegetation in upland tundra habitats (Alaska Department of Natural Resources 2004).

2.11 BIRDS

Table 2.11: Bird Species Likely to Occur in and near the Project Area (Alaska Department of Natural Resources 1997; URS 2001).

Common Name	Scientific Name
Short-tailed Shearwater	*Puffinus tenuirostris*
Red-throated Loon	*Gavia stellata*
Pacific Loon	*Gavia pacifica*
Common Loon	*Gavia immer*
Yellow-billed Loon	*Gavia adamsii*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Greater White-fronted Goose	*Anser albifrons*
Emperor Goose	*Chen canagica*
Snow Goose	*Chen caerulescens*
Canada Goose	*Branta canadensis*
Brant	*Branta bernicla*
Tundra Swan	*Cygnus columbianus*
American Wigeon	*Anas americana*
Mallard	*Anas platyrhynchos*

Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Steller's Eider	*Polysticta stelleri*
Spectacled Eider	*Somateria fischeri*
King Eider	*Somateria spectabilis*
Common Eider	*Somateria mollissima*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Black Scoter	*Melanitta nigra*
Long-tailed Duck/Oldsquaw	*Clangula hyemalis*
Common Goldeneye	*Bucephala clangula*
Red-breasted Merganser	*Mergus serrator*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
Rough-legged Hawk	*Buteo lagopus*
Golden Eagle	*Aquila chrysaetos*
Gyrfalcon	*Falco rusticolus*
Peregrine Falcon	*Falco peregrinus*
Willow Ptarmigan	*Lagopus lagopus*
Rock Ptarmigan	*Lagopus mutus*
Sandhill Crane	*Grus canadensis*
Black-bellied Plover	*Pluvialis squatarola*
American Golden-Plover/Lesser Golden-Plover	*Pluvialis dominicus*
Semipalmated Plover	*Charadrius semipalmatus*

Killdeer	*Charadrius vociferus*
Lesser Yellowlegs	*Tringa flavipes*
Wandering Tattler	*Heteroscelus incanus*
Upland Sandpiper	*Bartramia longicauda*
Whimbrel	*Numenius phaeopus*
Hudsonian Godwit	*Limosa haemastica*
Bar-tailed Godwit	*Limosa lapponica*
Ruddy Turnstone	*Arenaria interpres*
Black Turnstone	*Arenaria melanocephala*
Red Knot	*Calidris cauntus*
Sanderling	*Calidris alba*
Semipalmated Sandpiper	*Calidris pussila*
Western Sandpiper	*Calidris mauri*
Red-necked Stint	*Calidris ruficollis*
Least Sandpiper	*Calidris minutilla*
White-rumped Sandpiper	*Calidris fuscicollis*
Baird's Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*
Sharp-tailed Sandpiper	*Calidris acuminata*
Dunlin	*Calidris alpina*
Stilt Sandpiper	*Calidris himantopus*
Buff-breasted Sandpiper	*Tryngites subruficollis*
Ruff	*Philomachus pugnax*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Common Snipe	*Gallinago gallinago*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*Phalaropus fulicaria*
Pomarine Jaeger	*Stercorarius pomarinus*

Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Ringed-billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Slaty-backed Gull	*Larus schistisagus*
Glaucous-winged Gull	*Larus glaucescens*
Glaucous Gull	*Larus hyperboreus*
Sabine's Gull	*Xema sabini*
Ross's Gull	*Rhodostethia rosea*
Ivory Gull	*Pagophila eburnea*
Arctic Tern	*Sterna paradisaea*
Black Guillemot	*Cephus grylle*
Snowy Owl	*Nyctea scandiaca*
Northern Hawk Owl	*Surnia ulula*
Short-eared Owl	*Asio flammeus*
Common Raven	*Corvus corax*
Northern Flicker	*Colaptes auratus*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Bank Swallow	*Riparia riparia*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Arctic Warbler	*Phylloscopus borealis*
Bluethroat	*Luscinia svecica*
Northern Wheatear	*Oenanthe oenanthe*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
Yellow Wagtail	*Motacilla flava*
American Pipit	*Anthus rubescens*

European Starling	*Sturnus vulgaris*
Orange-crowned Warbler	*Vermivora celata*
Yellow Warbler	*Dendroica petechia*
Black-and-white Warbler	*Mniotilta varia*
American Redstart	*Setophaga ruticilla*
Northern Waterthrush	*Seiurus noveboracensis*
Wilson's Warbler	*Wilsonia pusilla*
American Tree Sparrow	*Spizella arborea*
Savannah Sparrow	*Passerculus sandwichensis*
Fox Sparrow	*Passerella iliaca*
Lincoln's Sparrow	*Melospiza lincolnii*
White-throated Sparrow	*Zonotrichia albicollis*
Harris' Sparrow	*Zonotrichia querula*
White-crowned Sparrow	*Zonotrichia leucophrys*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Dark-eyed Junco	*Junco hyemalis*
Lapland Longspur	*Calcarius lapponicus*
Smith's Longspur	*Calcarius pictus*
Snow Bunting	*Plectrophenax nivalis*
Rusty Blackbird	*Euphagus carolinus*
Common Redpoll	*Carduelis flammea*
Hoary Redpoll	*Carduelis hornemanni*

Bird and waterfowl habitat is prevalent throughout the Arctic Coastal Plain, including the project area. Approximately ten million birds, comprised of over two-hundred and forty (240) species, occur in the Beaufort Sea region (URS 2001). Bird and waterfowl populations are most concentrated during the summer months when snow-free nesting grounds and open water are available; however a few species remain in the area year-round, including gyrfalcons, ptarmigan, snowy owls and ravens (Alaska Department of

Natural Resources 1997; URS 2001). Species present in the project area can be divided into three major groups – waterfowl, tundra-nesting birds, and predatory birds.

Waterfowl

Waterfowl and other water birds include tundra swans, geese, brant, eiders, ducks, loons, grebes and seabirds (URS 2001; Alaska Department of Natural Resources 2004). Moderate to large numbers of tundra swans and geese, including the greater white-fronted goose, emperor goose, lesser snow goose and Canada goose, inhabit the project area from May through September and breed on the Coastal Plain (McLean 2003; Alaska Department of Natural Resources 2004). Eiders in the project area include the spectacled eider, king eider, Steller's eider and common eider. Several species of ducks, both breeders and non-breeders, are present in the project area (URS 2001). Loons on the North Slope include the Pacific and red-throated loons. Grebes, while potentially present in the project area, are accidental on the North Slope (Alaska Department of Natural Resources 2004).

Tundra swans on the North Slope breed in northwest Alaska and the Canadian arctic and migrate to the Atlantic Coast in late September or October. Swans mate for life and begin breeding in years three (3) through five (5). Swans begin nesting early in the spring, on elevated sites near large ponds. Both males and females take turns incubating the eggs. Due to the shorter summers in the arctic, young tundra swans fledge earlier than trumpeter swans. Swans feed on foliage, seeds and tubers of marsh plants (Alaska Department of Fish and Game 2005).

Geese tend to form life-long bonds with mates and begin breeding at two (2) to three (3) years of age. Geese graze on vegetation and are very social, except during nesting. Small numbers of emperor geese nest in northwest Alaska, laying four (4) to five (5) eggs. Emperor geese winter on the Aleutian Islands, Alaska Peninsula and Kodiak Island. Young survival rates are low. The greater white-fronted goose breeds throughout the western and central arctic and winters in Texas and Mexico. Greater white-fronted geese are among the first waterfowl to return each spring. They nest near water and

average four (4) to six (6) eggs. The winter migration begins in early fall, with most gone by mid-September. Lesser snow geese are more sensitive to the timing of ice and snow melt because of their short breeding season and because they nest in the far north – a late spring may mean no nesting. The lesser snow goose winters California. Taverner's Canada geese nest from the Yukon-Kuskokwim Delta to the Arctic Slope and winter in Washington and Oregon. Brant, which are distantly related to Canada geese, also nest on the Arctic Slope. Each fall, brant from Alaska, Canada and Russia join together on Izembek Lagoon near Cold Bay, where they feed on eel grass. Brant leave Izembek Lagoon in late October or early November in the non-stop migration towards Baja Mexico (Alaska Department of Fish and Game 2005).

Eiders, also known as sea ducks, winter in northern waters and migrate towards nesting grounds on the arctic tundra as soon as spring ice break-up occurs. Migration occurs side-by-side along coastlines hovering a few feet above the water. Eiders breed after two (2) years of age. Common eiders nest in colonies along the coast, on barrier islands or on sand spits. The common eider nests after the sea ice has melted and winters in the Bering Sea and Aleutian Islands. The king eider, spectacled eider and Steller's eider are solitary breeders, nesting on islands and peninsulas in tundra ponds. Pairs form during winter months and nesting begins as soon as the pair reaches the breeding grounds. King eiders arrive on the breeding grounds in early April and May and winter near Kodiak, the Alaska Peninsula and the Aleutian Islands. Spectacled eiders arrive on the coastal plain in mid-June and winter in a huge mass between St. Lawrence and St. Matthew Islands. The Steller's eider, the least abundant eider in Alaska, arrives on the coastal plain the latest of the eiders and winters on the Alaska Peninsula and Aleutian Islands (Alaska Department of Fish and Game 2005).

The long-tailed duck is a confirmed breeder in the project area. Northern pintails also most likely nest in the area, although no known nesting has been documented. Ducks arrive on the North Slope in mid to late May and begin the southern migration in August or early September. Young ducks hatch in mid-July and most fledge by late August.

Ducks prefer aquatic habitat, including aquatic sedge and grass marshes, ponds, river channels, larger lakes and coastal lagoons (URS 2001).

The Pacific loon and red-throated loon are common breeders across the coastal plain (Alaska Department of Natural Resources 2004). Pacific loons winter on southcentral and southeastern Alaska coasts; red-throated loons winter along the Pacific coast, from the Aleutian Islands to Baja Mexico. Loons reach maturity at age two (2), mate for life and arrive at the nesting grounds in late May, returning each year to the same breeding area. Two (2) eggs are laid in late May or June; however young survival rate is low due to predation and human disturbance. Loons are deep divers, feeding on small fish, aquatic vegetation, insects, mollusks and frogs (Alaska Department of Fish and Game 2005).

Tundra-nesting Birds

Tundra-nesting birds include ptarmigan, shorebirds and songbirds. Shorebirds, many of which are confirmed breeders, include the black-bellied plover, American golden-plover, semipalmated plover, buff-breasted sandpiper, western sandpiper, lesser yellowleg and red-necked stint (URS 2001). Songbirds on the coastal plain include Say's phoebe, northern shrike, common raven, horned lark, cliff swallow, American dipper, Arctic warbler, bluethroat, northern wheatear, gray-cheeked thrush, American robin, yellow wagtail, sparrow, white-crowned sparrow, dark-eyed junco, Lapland longspur, Smith's longspur, snow bunting, rusty blackbird, common redpoll and hoary redpoll (Alaska Department of Natural Resources 2004).

Willow ptarmigan are common on the North Slope. Male ptarmigan establish territories in early spring, preparing for breeding. Ptarmigan nest soon after snowmelt and the eggs typically hatch in late June and early July. In fall, the ptarmigan migrate south, typically only traversing one hundred (100) to one hundred fifty (150) miles. Ptarmigan are social in winter months and return to breeding grounds in April and early May. Willow ptarmigan feed on willow, birch, insects, berries, seeds, leaves and flowers (Alaska Department of Fish and Game 2005).

Shorebirds arrive on the Arctic Coastal Plain in late May and migrate south in August and September. Young hatch between late June and mid-July and fledge within three (3) to four (4) weeks. Shorebirds utilize multiple habitats for nesting, from drier uplands to wet sedge meadows and grassy marshes. After the young fledge, many shorebirds have been observed in large, mixed flocks along the coastal habitats. Shorebirds mainly feed on insects and small invertebrates (URS 2001).

Most songbirds also spend only the summers on the coastal plain and winter in tropical regions of the Americas or in southern Asia; only the common raven, which is also considered a predatory bird and is discussed below, and the American dipper remain on the North Slope through the winter (Alaska Department of Natural Resources 2004). Dippers can dive underwater and are well-insulated to withstand Alaska waters and weather. Dippers feed mainly on aquatic insects. During winter months, the dipper inhabits the ice-free spring areas of the North Slope (Alaska Department of Fish and Game 2005).

Predatory Birds

Predatory birds in include raptors, gulls, jaegers, owls, arctic tern and ravens. Raptors include golden eagles, gyrfalcons and Arctic peregrine falcons. The North Slope supports breeding pomerine, parasitic, and long-tailed jaegers, as well as mew gull, glaucous gull and Sabines's gull (Alaska Department of Natural Resources 2004). The common raven tends to associate closely with human activity and does not occur regularly on the Coastal Plain.

None of the raptors, including eagles, are common breeders on the coastal plain; rather raptors tend to nest and breed inland. Golden eagles nest in the Brooks Range and traverse over the adjacent tundra foothills. Gyrfalcons hunt over arctic and alpine tundra preying primarily on ptarmigan. Peregrines prey on waterbirds and songbirds. The Arctic peregrine falcon nests on river bluffs along the coastal plain (Alaska Department of Natural Resources 2004).

The glaucous gull breeds along the coast of northern Alaska, including on islands in the Bering Sea, and often winters on the Aleutian Islands. They are scavengers and predators, feeding on carcasses, fish, waterfowl and seabirds. Nests are built on tundra ponds and colonies are typically small. Breeding begins in May and chicks begin moving to the sea in September and October (Alaska Department of Fish and Game 2005).

The North Slope provides habitat for snowy owls and short-eared owls**.** Snowy owls perch and nest on the ground in tundra, often on small mounds, and prey on lemmings as their primary food source during the breeding season. Short-eared owls are common breeders in the ANWR but may not breed in the project area. This species occurs regularly in the project area, feeding on small rodents similar to the snowy owl (Alaska Department of Natural Resources 2004).

Arctic terns breed throughout Alaska, including the Arctic Coastal Plain. Terns arrive on the breeding grounds each May. Nests are built near water on sandpits, beaches or wet tundra. The young fledge within one (1) month and are mature for breeding in three (3) to four (4) years. Each fall, arctic terns traverse twenty-five thousand (25,000) miles to winter in the Antarctic (Alaska Department of Fish and Game 2005).

The common raven mates for life and begins breeding at three (3) to four (4) years of age. Raven pair in mid-January and pairs nest in mid-March. Ravens do not migrate long distances for winter. Ravens are scavengers and predate on small birds and animals, as well as consume plants. Ravens are closely associated with human activities and will utilize human infrastructure for nesting sites when it is near the coast (Alaska Department of Fish and Game 2005).

2.12 THREATENED AND ENDANGERED SPECIES

Although unlikely, the Eskimo curlew, which was thought to be extirpated in Alaska and are officially designated by the State of Alaska as endangered, may be located in the project area (McLean 2003; Alaska Department of Natural Resources 1997).

The Spectacled eider and Steller's eider, both of which are listed by the federal government as threatened species, also may be located in the project area. The Spectacled eider nests and rears in riparian habitat - basin wetland areas, waterbodies with emergent vegetation, deep open lakes, shallow open water and drainage impoundments (McLean 2003, URS 2001). Most likely, other than the Sagavanirktok River delta and between the Kadleroshilik and Shaviovik Rivers, the project area does not support Spectacled eiders, although some nesting is possible (Alaska Department of Natural Resources 1997; McLean 2003). The Steller's eider nests on the Arctic Coastal Plain, particularly near Barrow. The breeding range, however, is believed to end near Point Barrow (McLean 2003). Therefore, the project will likely not affect the Steller's eider (Alaska Department of Natural Resources 1997).

The Arctic peregrine falcon, which has been removed from the Endangered Species List but still receives special monitoring under the Migratory Bird Treaty Act, occurs in the project area but does not use the area for nesting (URS 2001). The ADF&G lists the Arctic peregrine falcon as a State of Alaska Species of Special Concern. Under this listing, activities in the area are managed to avoid disturbance during the nesting period, disturbance from low-flying aircraft and other noise-producing activities, ground level activities, and construction near nest sites during critical nesting times. Activities that could have negative impacts throughout the year (not only during nesting periods) include habitat alterations, construction of permanent facilities and pesticide use (Alaska Department of Natural Resources 2004).

2.13 RECREATION

Limited recreational activities exist along the project area, mostly occurring within ANWR and along the Dalton Highway. Although the Dalton Highway provides access to the North Slope, the majority of the visitors stay within the highway right-of-way (URS 2001). Individuals may park along the highway and travel by foot, all-terrain vehicle, boat or small aircraft to access remote areas. Tourists can fly or drive to Prudhoe Bay/Deadhorse, but can only access the Prudhoe Bay Unit and adjacent unitized

operating areas with approved tour operators. Public access is allowed on State lands that are not unitized operating areas.

Backpacking, hunting and fishing and other forms of recreation also occur, however, due to the remoteness of the area and limited road access, these activities are widely dispersed. Recreational opportunities available while floating the Canning River and other rivers in ANWR or camping in ANWR include scenic viewing, camping, sport fishing, hiking, hunting, rafting, recreational gold mining, and photography.

2.14 HISTORICAL AND ARCHEOLOGICAL RESOURCES

The National Register of Historic Places (36 CFR 800) lists prehistoric, or historic, sites. A site must be over fifty (50) years old to be considered historic under the act, unless it has exceptional national, state or local significance. Native sacred sites or traditional cultural properties may also be eligible for the National Register. The Alaska Office of History and Archaeology and the North Slope Borough Inupiat History, Language, and Culture Commission are the primary sources of archaeological and historic land use data for the North Slope.

Historic shipwrecks, particularly those associated with whaling activities, are often found near waterways. Additionally, tools left behind by Native ancestors may be as old as 11,800 years, or as recent as 8,800 years. Archeological resources left behind by commercial whalers in the 1800's, summer traders, and commercial fur-trappers may exist in the pipeline area. Although prior surveys have not produced many archeological sites, undiscovered sites may still exist in the project area and would need to be preserved and protected during pipeline construction, operation and termination activities (URS 2001).

Based on the Alaska Heritage Resources Survey, there are six (6) known archeological sites located within the Point Thomson Unit: (1) the Leffingwell Camp, a National Historic Landmark; (2) Point Gordon; (3) Point Hopson; (4) Point Thomson; (5) Flaxman Island Graves; and (6) East Flaxman Island. All of these sites are located along the

shoreline (Bittner 2002). Potential archeological sites may be located within or along the remainder of the alignment (west of the Point Thomson Unit). A complete survey will be required along the entire project area prior to any field work.

2.15 SOCIOECONOMICS

The North Slope Borough, which encompasses the entire northern coast of Alaska (89,000 square miles), was incorporated in 1972. The North Slope Borough is bordered to the south by the Brooks Range Mountains and to the north by the Arctic Ocean. The North Slope Borough has 6,290 residents, seventy percent (70%) of whom are Inupiat Eskimos (North Slope Borough 2005).

The project area, which lies entirely on State land within the North Slope Borough, does not cross or interfere with any communities – the closest communities are Prudhoe Bay/Deadhorse, Kaktovik, Nuiqsut and Atqasuk. Prudhoe Bay/Deadhorse is primarily a workers' community with very few, if any, year-round residents. All residents work in oil and gas development-related jobs, including drilling, pipeline operations, cargo transportation and other support services. Most workers travel home when off duty (Alaska Department of Commerce, Community and Economic Development 2005).

Kaktovik, which lies east of the project area on Barter Island, has approximately 284 residents. The village is located within ANWR. Once a major trade center for the Inupiat, Kaktovik was incorporated in 1971. Residents rely heavily upon caribou for subsistence. Unemployment is high in Kaktovik, due to the remote location. Most workers are employed in education and providing village services, or work for the North Slope Borough. Air travel provides the only year-round access (Alaska Department of Commerce, Community and Economic Development 2005).

Nuiqsut, located to the west of the project area in the Colville River Delta (approximately 136 miles southeast of Barrow), has approximately 430 residents. The Colville River Delta is a traditional gathering and trade location for the Inupiat. The old village of Nuiqsut (Itqilippaa) was abandoned in 1940. The village was resettled in 1973 and was

incorporated in 1975. The majority of residents are Inupiat Eskimos, who practice a traditional subsistence lifestyle. Unemployment is also high in Nuiqsut; the Kuukpik Native Corporation, village school and North Slope Borough are the major employers. Air travel provides the only year-round access (Alaska Department of Commerce, Community and Economic Development 2005).

Atqasuk, located approximately sixty (60) miles south of Barrow, has 247 residents. The area has traditionally served as hunting and fishing grounds for Inupiat Eskimos. During World War II, bituminous coal was mined in Atqasuk and shipped to Barrow. From 1951 to 1957, the village had a post office under the name Meade River. No residents lived in Atqasuk in 1970; however the village was re-established in 1977 and incorporated in 1982. Subsistence activities are very important to villagers. Education and other government services provide the majority of employment. Air travel provides the only year-round access (Alaska Department of Commerce, Community and Economic Development 2005).

2.16 SUBSISTENCE

Most rural Alaska families rely on subsistence hunting, fishing and harvesting of edible plants and berries. In 2000, the annual subsistence harvest for rural Alaskans was approximately 375 pounds per person per year, compared to an average of only twenty-two (22) pounds for urban Alaskans. In the Arctic region, about 516 pounds per person per year were attributable to annual subsistence harvests (Wolfe 2000).

Eight predominantly Native communities make up the resident population of the North Slope: Anaktuvuk Pass, Atqasuk, Barrow, Kaktovik, Nuiqsut, Point Hope, Point Lay, and Wainwright. The project area encompasses lands traditionally and presently used for subsistence harvest by residents of Nuiqsut, Kaktovik and Atqasuk; however other communities have used the lands in the past or presently use them intermittently. Traditional subsistence land use of the project area includes harvesting fish, marine mammals, terrestrial mammals, birds, furbearing animals, and plants – more specifically, grayling, white fish, polar bear, seal, walrus, bowhead and beluga whale, caribou, moose,

geese and ptarmigan (Alaska Department of Commerce, Community and Economic Development 2005). In addition, many of the marine mammal, fish, and terrestrial mammal species harvested by North Slope residents in areas other than the project area migrate through the project area.

Spring subsistence activities in Nuiqsut include seal hunting on the sea ice and hunting and trapping inland for furbearers and caribou. No spring whaling is done in the vicinity of Nuiqsut. Some Nuiqsut residents travel to Barrow to participate in spring whaling there. As rivers and lakes become ice-free, grayling, cod, and lake trout are taken with hook and line, and whitefish are taken with nets from camps along Fish Creek and the Colville River. Waterfowl are taken during the spring and summer. Fall is an active season for harvest activities. Caribou and moose are hunted inland along the Colville River and its tributaries. Whitefish are caught in nets prior to freeze-up, and arctic grayling and burbot are jigged through the ice following freeze-up. Bowhead whaling begins in mid- September. Nuiqsut whale crews travel east as far as the Canning River in pursuit of whales, taking seal, waterfowl, polar bear, and caribou out of coastal whale camps. Trapping occurs during the winter months, along with occasional hunts for caribou and moose. Polar bear is taken along the coast. During late winter and early spring, trapping, caribou hunting, and ice fishing activities increase. Bearded seal hunting begins in April (Department of Natural Resources 2004).

Spring subsistence activities in Kaktovik are highlighted by inland trips to mountain and foothill areas where sheep and caribou are hunted along with ptarmigan, ground squirrel, and marmot. Char are caught through the ice by jigging at traditional inland river locations prior to breakup. As overland travel is difficult at breakup, summer subsistence activities are concentrated along the coast, where waterfowl and seal are hunted. Dolly Varden, char, whitefish, and pink salmon are caught with nets and rod and reel at coastal camps. Caribou are harvested throughout the summer and fall near the coast. The Canning River delta is an especially productive summer caribou hunting and fishing area for Kaktovik residents. Fall whaling takes place in August and September, with whalers

traveling far out into the open waters in search of bowhead whales. Seals are also harvested in conjunction with whaling expeditions. Following freeze-up, inland travel by snowmachine resumes. In October and November, trips are made to traditional mountain area camps for sheep and caribou hunting. The Hulahula River is a major corridor for fall and winter land use activities. Fishing through the ice occurs for char, arctic grayling, whitefish, and burbot. Mid-winter is a time of reduced land use activity; trapping and furbearer hunting is engaged in by some and polar bears are occasionally hunted near the village. In late winter, inland harvest of fish, caribou, and sheep occur, and moose are occasionally taken when encountered. Inland subsistence activities intensify as breakup approaches and the cycle begins again (Alaska Department of Natural Resources 2004).

Kaktovik residents have historically used the project area for subsistence fishing activities, particularly the Shaviovik, Kavik and Kadleroshilik Rivers, along the coast and offshore islands of Mikkelsen Bay, and portions of Foggy Island Bay. More recent information, however suggests that most, if not all, of Kaktovik residents' fish harvests currently occur east of the Canning River. Nuiqsut residents have fished near Bullen Point, which is located on the eastern end of the project area (Alaska Department of Natural Resources 1997).

Residents of Kaktovik historically used the project area for waterfowl hunting; however current use is not documented. Nuiqsut residents also report using the Bullen Point area for waterfowl hunting. Subsistence hunts of waterfowl in the project area typically occur in May and June, with some activity through September (Alaska Department of Natural Resources 1997).

Kaktovik residents historically gathered vegetation south of the project area (Alaska Department of Natural Resources 1997).

Attaching a monetary value to the subsistence uses is difficult, as many subsistence products do not circulate in markets. Consumption, on the other hand, is easily determined - approximately forty-eight percent (48%) of the North Slope population's calories come from subsistence harvests. In 2000, sixty-three percent (63%) of Arctic households participated in subsistence activities involving harvesting game and ninety-two percent (92%) of Arctic households participated in subsistence activities using game. Similarly, seventy-eight percent (78%) of Arctic households participated in subsistence activities involving harvesting fish and ninety-six percent (96%) participated in subsistence activities using fish. (Wolfe 2000).

3.0 PROJECT SPECIFICS

3.1 CONSTRUCTION METHODS

Construction activities will be confined to the winter months and will take place on ice pads and roads and frozen lake surfaces along the route. All construction activities will be closely supervised. Any leaks of oil or other substances onto iced working surfaces will be cleaned up and reported immediately. All materials will be disposed of in accordance with state and local regulations.

The rights-of-way are also wide enough to accommodate construction and winter maintenance access using ice roads and tundra-rated vehicles, such as Rolligons. Use of heavy equipment will necessitate use of ice roads in the winter and temporary construction mats in the summer, because of their heavier tire and track loadings. Tundra-rated vehicles may access the rights-of-way all-year; however they can support only reconnaissance, inspection and light maintenance activities. The only permanent access roads may be for valves located at the point of tie-ins of production or oil fields and at each side of streams or rivers that require remotely operated valves (ROVs) for shut-offs. The exact location of permanent roads, if any, has not been determined at this time. Should any permanent roads be deemed necessary for the project, they will be applied for under the appropriate DNR application process (i.e. AS 38.35 amendment to this application or A.S. 38.05 if not located entirely within the rights-of-way).

During operations, the pipelines will be monitored regularly. All planned maintenance will be undertaken using the same precautions as construction-related activities. Any emergency maintenance will use best practices to avoid disturbance to the tundra. At all times, tundra-approved vehicles will be used to access the rights-of-way.

The size, location and types of field camps and housing for construction personnel cannot be estimated at this time. Electrical power will be generated on-site, as is the case for other remote North Slope developments.

Compressor, refrigeration and pumping stations are not anticipated to be necessary. At present, none of the North Slope pipelines have these facilities and it is usually more economic to design a pipeline to obviate the need for intermediate facilities. Should the project require such facilities, either for original design or (more likely) to increase capacity after original design, the facilities will be permitted using the normal right-of-way lease amendment procedures.

The proposed pipelines will cross several streams, lakes and floodplains. The pipelines may be buried underneath the waterways or VSM's may be installed within the water. The location of VSM's within the active channel will be avoided wherever possible. A hydrology report, analyzing the hydrological characteristics of each stream will be prepared prior to any activity taking place in the field and this data will be used when determining how to best cross each waterway along the route.

The proposed pipelines will be constructed for a lifetime of a minimum thirty (30) years, which is typical of production pipelines on the North Slope. Pipelines can be operated indefinitely under most circumstances, with the appropriate level of maintenance.

See the Design Basis documents for more information on construction methods for the project.

3.2 EROSION CONTROL AND RIGHT-OF-WAY RESTORATION

Erosion control along the right-of-way is important when determining the pipeline design and construction techniques. With proper design and control, the surface water and groundwater flow patterns will remain the same as before construction. Drainage will be controlled in accordance with state and federal regulations. Hydrotest water will be discharged in accordance with applicable permits to avoid sedimentation and erosion. Pipeline burial will be designed to minimize erosion potential.

No grading, cutting, or filling is anticipated for the oil pipeline, as it will be supported above the surface on VSM's, or for the gas pipeline should it also be supported above the

surface on VSM's. The gas pipeline, if buried, will likely be installed using a trenching machine that is similar to those used in mining, placing spoils near the trench. A second crew will install the spoils in the recently mined trench to preserve the hole. Another crew will uncover the hole later and install the pipeline, using automated welding techniques. This is similar to the construction method proposed for the Alaska Natural Gas Transportation System pipeline. All necessary steps will be taken to thermally stabilize the project area after any cuts. Additionally, fill will be accomplished by laying down lifts onto the surface with no preparation or grading, thereby minimizing damage to the tundra.

Any permanent gravel pads required will be placed over the top of the vegetation, leaving the organic layer intact, which provides a large amount of insulation to the underlying permafrost. Damage to the organic layer can result in subsidence and consequent thermal erosion and can cause changes to the surface runoff, causing additional subsidence.

State-of-the-art construction techniques will be used to stabilize rivers and stream banks. Bank stabilization will comply with federal and state regulations to prevent erosion and sedimentation.

3.3 MATERIAL SITES

Deposits of sand, gravel and quarry stones are difficult to locate on the North Slope due to the amount of ice in the soils; however the supply is quite plentiful. Sands and gravels can be found in glacial till deposits and in flood plains along river valleys, especially near the Brooks Range. Sands, gravels and quarry stones have been mined and used for oil and gas infrastructure in Prudhoe Bay, the Dalton Highway and the TAPS.

Gravel used for the construction of the pipeline and associated facilities will be obtained from permitted sites within the vicinity of the project. Gravel removal operations will only be conducted in the winter when soils and tundra are frozen, thereby mitigating impacts to surface hydrology and nearby freshwater quality. Existing material sites are

located near the project area; however the sites have not been inventoried time. Accordingly, the exact locations of material sites are unknown at this time.

3.4 WATER USE

The proposed project will require freshwater sources to construct ice roads, pad construction, drilling, and potable water for construction camps. Many lakes in the project area are shallow and freeze to the bottom. These lakes could only serve as water sources early in the winter. Several deeper lakes within the project area have been identified as having potential for water withdrawal; however, lake survey data is still needed to determine freshwater sources, particularly in the eastern portion of the project area where significantly fewer lakes occur.

Since there are few deep lakes in the project area, former gravel mine sites that have now filled with freshwater, such as the former mine sites at Badami, Shaviovik Pit, and Point Thomson may be the best sources of freshwater. Some of these waterbodies may support overwintering fish populations; therefore water withdrawal will be limited to fifteen percent (15%) of the available free water under the ice. Appropriate lake volume estimation methods such as the Average End Area Method (Using Vertical Planes) or other acceptable techniques using full bathymetric surveys and, in certain circumstances, the Cone Method will be used. Table 3-4 shows examples of permitted volumes for water sources in the Point Thomson area and to the West.

Table 3-4 Examples of Permitted Volumes for Water Sources in the Point Thomson Area and to the West

WATER SOURCE	GENERAL LOCATION	CURRENT/ PAST BPXA PERMIT #	PERMITTED VOLUME TOTAL FOR ALL SOURCES (CURRENT OR PAST)	ESTIMATED VOLUME (GAL)	ADF&G RESTRIC-TIONS?	COMMENTS
Duck Island Mine Site	Endicott Road	LAS 13290	221 acre-ft per year (72,000,000 gal)	600,000,000	Yes	Past permitted volumes based on need rather than availability
Sag Mine Site C (Vern Lake)	Endicott Road	LAS 13629		792,000,000	Yes	
Badami Reservoir	Badami Development	LAS 19045	61.6 acre-ft per year (20,000,000 gal)	86,000,000	Yes	Drinking water source
Turkey Lake	South of Badami CPU			730,000	No	Relatively shallow lake
Shaviovik Pit	Shaviovik River Delta, west of Badami CPU	LAS 14042	1125.27 acre-ft per year (370,000,000 gal)	125,000,000	No	Typically used in ice roads to Badami
Point Thomson Old Mine Site	Point Thomson Unit development area			104,000,000	Unknown	
Unnamed Lake	Point Thomson Unit development area (Sec. 22 & 23, south of airstrip)			923,000	No	Used for Yukon Gold and Sourdough ice roads

3.5 SPILL AND LEAK PREVENTION

Per 49 CFR 195, all crude-oil pipelines must be constructed with shut-off valves or U.S. Department of Transportation approved leak prevention loops at navigable waterways. The pipelines will have isolation valves at its inlets and outlets, and at all branch connections. The pipelines will be piggable, to allow better assessment through In-Line Inspection and to allow better maintenance, cleaning and corrosion control.

The pipelines will include a computational leak detection system in accordance with federal and state requirements. The system will perform real-time monitoring for pipeline

leakage and will use operating data such as liquid hydrocarbon flow and pressure meter data. The equipment, at a minimum, will be used to compute mass-balance calculations that will be able to detect a leak volume of at least one percent (1%) of the daily throughput, per Alaska Department of Environmental Conservation regulations. Pipeline crossings buried under rivers and streams may require additional leak detection.

Spill containment personnel and equipment will be staged as necessary and prescribed by state law. The OPMP will draft comprehensive response plans for DNR review and approval prior to construction.

See the Right-of-Way Lease Applications and the Design Basis for more details on spill and leak prevention.

4.0 POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

Winter construction is a proven, low impact technology used extensively on Alaska's North Slope. The pipelines will be constructed during winter months from ice workpads and ice roads. The OPMP will submit a detailed construction plan for DNR review and approval prior to construction activities taking place.

The following criteria were considered when determining the rights-of-way route location:

- Avoid locating VSM's in lakes and locate all stream crossings so as to minimize the need for VSM's in active channels to ensure long-term integrity of VSMs adjacent to the streams;
- Require a minimum of five hundred (500) feet separation between linear structures, or alternatively group the pipeline structures together, in order to facilitate wildlife movement; and
- Minimize the impact on environmentally sensitive areas and valuable habitat, such as salt marshes and drained lake basins.

See Part IV of the Right-of-Way Lease Applications for more information on mitigation measures that will be taken for this project.

4.1 STREAMS AND FLOODPLAIN CROSSINGS

See the discussion in Section 4.3 for more information on stream crossings.

4.2 VEGETATION AND WETLANDS

Impacts to the surrounding vegetation and wetlands will be minimal. The VSM footprints and gravel pads, which will be located mainly near river crossings, will be the only long-term vegetation loss. Riparian habitat disturbed during construction activities will be re-established through natural processes over time. Some compression of the tundra may occur during construction activities; however this will not result in vegetation loss and will be regenerated over time.

All backfill will be reseeded with native species. Prior to construction, the OPMP will submit a detailed revegetation and rehabilitation plan for DNR review and approval.

Construction activities will be confined to the winter months and will take place on ice pads and roads and frozen lake surfaces along the route. All construction activities will be closely supervised. Any leaks of oil or other substances onto iced working surfaces will be cleaned up and reported immediately. All materials will be disposed of in accordance with state and local regulations.

During operations, the pipelines will be monitored regularly. All planned maintenance will be undertaken using the same precautions as construction-related activities. Any emergency maintenance will use best practices to avoid disturbance to the tundra. At all times, tundra-approved vehicles will be used to access the rights-of-way.

Prior to construction activities, a vegetation survey is necessary to determine whether any of the seven species of rare plants occur in the project area. Appropriate measures will be taken to protect the species and surrounding habitat, should any of the plants be found.

4.3 FISH

Water withdrawal and changes to hydrology caused by ice roads may impact freshwater fish habitat in the project area. Water withdrawals will be required to support pipeline construction and maintenance activities, as well as ice road construction and maintenance. The water withdrawal sites have not been determined at this time.

Buried pipeline crossings constructed during summer months when water is flowing generate suspended solids, which adversely affect fish and fish habitat. Winter construction will mitigate this affect, as any suspended solids will be retained in the trench or discharged outside the riverbed. Buried river crossings require excavation (trenching), including blasting. All buried crossings will be located in areas that freeze to the bottom, thereby avoiding impacts to overwintering fish. Excavation may disrupt fish

habitat in river crossing areas; however measures will be taken to reduce the impact on fish habitat through proper backfill of the pipeline trench, reconstruction of the river banks and grading of excess alluvial material. Rivers will be returned to natural contours.

Diversion or discharge of water from river-crossing excavations may affect downstream overwintering fish habitat. For this reason, minimal amounts of water will be diverted or discharged and measures will be taken to mitigate any downstream affects, including diverting the flow to another channel to maintain the overall downstream flow. Any impacts to downstream fish and fish habitat would be confined to the winter of construction.

Ice roads and work pads have the potential to influence ice melting during break-up and may alter drainage patterns. All site-specific construction plans, including details as to river crossing methods and locations, will be submitted for approval by the DNR and the ADF&G.

Marine fish populations will not be affected by construction and maintenance activities associated with the project.

4.4 AMPHIBIANS AND REPTILES

As discussed in above, wood frogs have been found north of the Brooks Range. The project will likely not impact the wood frog habitat; however more research is necessary to determine the extent of wood frog populations, if any, in the project area.

4.5 MARINE MAMMALS

Polar Bears

As with brown and black bears, the most likely impact of the pipeline construction and maintenance is human interaction. Polar bears may encounter the project any time of the year and may be attracted to the increased human activity. Additional protection for

workers and equipment will be necessary. Prevention of animal feeding and best management practices for waste management will reduce the impact on polar bears. A bear management plan will be created to provide both worker safety and appropriate prevention and deterrence measures for the bears.

Denning female bears may be encountered during winter construction or maintenance activities. Aroused female bears may abandon the den, potentially leaving cubs. Additionally, increased energy expenditure could negatively impact the cub survival. Prior to any field activity, a complete polar bear den survey will be completed. Construction and maintenance activities will not take place near known polar bear dens. Occupied dens encountered in the field will be immediately reported to ADF&G and subsequently avoided.

The Eastern North Slope Gas Pipeline may be partially or fully buried or it may be partially or fully supported on VSM's. If buried, it will not affect polar bear crossings. If supported on VSM's, like the Eastern North Slope Oil Pipeline, it will be elevated at least seven (7) feet above the tundra, thereby allowing polar bears to cross underneath. Additionally, no permanent road is associated with the project – only ice roads will be used for construction and maintenance activities.

4.6 TERRESTRIAL MAMMALS

Moose

Moose are unlikely to be affected by the project. The Eastern North Slope Gas Pipeline may be partially or fully buried or it may be partially or fully supported on VSM's. If buried, it will not affect moose crossings. If supported on VSM's, like the Eastern North Slope Oil Pipeline, it will be elevated at least seven (7) feet above the tundra, thereby allowing moose to cross underneath. Additionally, no permanent road is associated with the project – only ice roads will be used for construction and maintenance activities.

Caribou

Caribou are the most sensitive terrestrial mammals in the project area. Caribou on the North Slope have acclimated to above-ground pipelines on the North Slope, as long as traffic on any associated roads is infrequent and does not create a barrier. Caribou are also sensitive to human activities in calving areas.

The Eastern North Slope Gas Pipeline may be partially or fully buried or it may be partially or fully supported on VSM's. If buried, it will not affect caribou crossings. If supported on VSM's, like the Eastern North Slope Oil Pipeline, it will be elevated at least seven (7) feet above the tundra, thereby allowing caribou to migrate underneath. Additionally, no permanent road is associated with the project – only ice roads will be used for construction and maintenance activities. Finally, the proposed pipelines will be constructed during winter months, with little to no human activity along the rights-of-way during the spring and summer months, thereby mitigating any interference in calving activities.

Brown Bear

Winter construction may disturb a denning brown bear, resulting in the brown bear expending increased energy and potentially leaving the den. Any cubs in the den would most likely die if the den were abandoned. Prior to any field activity, a complete brown bear den survey will be completed. Occupied dens encountered in the field will be immediately reported to ADF&G and subsequently avoided. Construction and maintenance activities will not take place near known brown bear dens.

As with polar and black bears, the most likely impact of the pipeline construction and maintenance is human interaction. Brown bears may impact workers on the project, should maintenance activities take place during the spring or summer months. Additional protection for workers and equipment will be necessary. Prevention of animal feeding and best management practices for waste management will reduce the impact on brown bears. A bear management plan will be created to provide both worker safety and appropriate prevention and deterrence measures for the bears.

The Eastern North Slope Gas Pipeline may be partially or fully buried or it may be partially or fully supported on VSM's. If buried, it will not affect brown bear crossings. If supported on VSM's, like the Eastern North Slope Oil Pipeline, it will be elevated at least seven (7) feet above the tundra, thereby allowing brown bears to cross underneath. Additionally, no permanent road is associated with the project – only ice roads will be used for construction and maintenance activities.

Black Bear

As with polar and brown bears, the most likely impact of the pipeline construction and maintenance is human interaction. Black bears may impact workers on the project, should maintenance activities take place during the spring or summer months. Additional protection for workers and equipment will be necessary. Prevention of animal feeding and best management practices for waste management will reduce the impact on black bears. A bear management plan will be created to provide both worker safety and appropriate prevention and deterrence measures for the bears.

The Eastern North Slope Gas Pipeline may be partially or fully buried or it may be partially or fully supported on VSM's. If buried, it will not affect black bear crossings. If supported on VSM's, like the Eastern North Slope Oil Pipeline, it will be elevated at least seven (7) feet above the tundra, thereby allowing black bears to cross underneath. Additionally, no permanent road is associated with the project – only ice roads will be used for construction and maintenance activities.

Muskoxen

Muskoxen are most sensitive during the winter months, when they tend to be located south of the project area. Because the project is located near the coastline, winter construction will likely not affect the muskoxen population.

Whether muskoxen migration patterns are affected by above-ground pipelines is unknown at this time. There are reports of muskoxen crossing the Kuparuk Pipeline and

other feeder lines on the North Slope (McLean 2003). The Eastern North Slope Gas Pipeline may be partially or fully buried or it may be partially or fully supported on VSM's. If buried, it will not affect muskoxen crossings. If supported on VSM's, like the Eastern North Slope Oil Pipeline, it will be elevated at least seven (7) feet above the tundra, thereby allowing muskoxen to cross underneath.

Arctic Fox

Arctic fox are prevalent along the North Slope and are easily attracted to human activity. Increased arctic fox populations could negatively impact bird populations due to increased predation. Accordingly, measures to reduce human-fox interactions are very important. All waste will be properly contained and disposed of at all times. Additionally, all employees and workers involved in construction and maintenance activities will be prohibited from feeding, or otherwise interacting, with the foxes. Prevention of animal feeding and best management practices for waste management will reduce the impact on arctic fox.

Other Mammals

The impact of the pipeline construction and maintenance activities on small herbivores will be slight due to winter construction. Some impact from the minor loss of habitat due to the location of gravel pads may occur. Prevention of animal feeding and best management practices for waste management will reduce the impact on wolves and wolverines, as these species tend to be impacted more by human interaction.

4.7 BIRDS

Resident ptarmigan, gyrfalcons, snowy owls and ravens may be present in the project area during construction activities; however, the impacts to these species will be slight. Migrant bird species, which account for the vast majority of the avian species on the North Slope, will not be present during construction activities.

Winter construction will have little effect on the bird nesting and breeding habitat. A small amount of habitat will be removed due to the footprint of the pipelines. Losses will

also occur near VSM's and gravel pads, particularly near river crossings. However all of these losses will be minor. Temporary loss of habitat may also occur near river crossings due to excavation and other construction techniques. These impacts should be regenerated by natural processes over time.

All planned maintenance activities will take place during the winter months. Should any maintenance activity be required between May and October, the OPMP will take all precautions necessary to protect the nesting birds and bird habitat.

A potential project affect is the increase in avian predators due to garbage being left near the project. Accordingly, all waste will be properly contained and disposed of at all times.

4.8 THREATENED AND ENDANGERED SPECIES

Construction of the pipelines from a temporary snow/ice workpad should have little to no impact on the summer-resident threatened and endangered species. Habitat loss will be slight, limited to the footprint of the pipelines post-construction.

Specific mitigation measures for these species will be included in the species-specific biological assessments prepared by the U.S. Fish and Wildlife Service and the ADF&G.

4.9 RECREATION

Very few recreational activities currently take place in the project area. Recreational activities along the Dalton Highway will not be affected by the project, nor will activities in ANWR. Public access to the project area may be restricted during construction activities for public safety; however any public access restrictions will be reviewed and approved by the DNR and alternative access will be ensured.

4.10 HISTORICAL AND ARCHEOLOGICAL RESOURCES

A.S. 38.35 requires the OPMP, as applicant, to protect state and private property interests along the rights-of-way, including cultural resources. Additionally, the Alaska Historic

Preservation Act prohibits the excavation, removal, injury or destruction of any state-owned historic, prehistoric (paleontological) or archeological site without a permit (A.S. 41.35). All employees, including agents, contractors, subcontractors and their employees, will be required to comply with AS 38.35 and the Alaska Historic Preservation Act at all times. Should any sites be discovered during the course of construction, maintenance, operation and termination of the pipelines, the activity will cease and the DNR and coastal district will be notified immediately.

A complete archeological assessment will be completed, and reviewed and approved by DNR prior to construction activities taking place. This will ensure that cultural resources within the rights-of-way will not be disturbed during construction and maintenance activities.

The proposed rights-of-way are not located directly along the shoreline. Accordingly, the six (6) known archaeological sites located within the Point Thomson Unit will not be affected by the project.

Material sites have not been delineated at this time. The OPMP will ensure that all material sites will not indirectly or directly affect the known archaeological sites in the project area.

4.11 SOCIOECONOMICS

The pipeline project is unlikely to affect the population base of the nearby towns. Development of the known and unknown oil and gas reserves east of Prudhoe Bay, however, will bring training, part-time and full-time employment, added personal income and capital investments in housing, schools, health facilities, transportation and communications systems, waste treatment systems, potable water systems, and increased public safety. These impacts will benefit Nuiqsut and Kaktovik residents, as well as other North Slope Borough villages.

Oil and gas-related employment includes both direct and indirect services in the industry – from construction workers to vendors to spill response teams. A stimulated economy generates private and public sector jobs. All pipeline construction, maintenance, operational and termination positions will be filled with local residents, to the extent practicable and possible.

4.12 SUBSISTENCE

The construction and maintenance of the proposed pipelines will not enhance nor diminish subsistence opportunities in the project area. As discussed above, winter construction, along with best management practices, will mitigate impacts to fish, wildlife and vegetation. All construction and operation employees, including agents, contractors and their employees, will be informed of applicable hunting, fishing and trapping laws and regulations. These measures will discourage increased competition for fish and wildlife in the project area.

Prior to construction, the OPMP will identify subsistence uses and areas potentially affected by the project. All construction and operation employees, including agents, contractors and their employees, will be required to attend subsistence resource sensitivity training. Additionally, the OPMP will coordinate, to the extent practicable and possible, project activities with subsistence communities in the project area, including Kaktovik, Nuiqsut and Atqasuk.

5.0 PROJECT AUTHORIZATIONS AND PERMITS

This section addresses the requirements set out in Parts IV and V of the Right-of-Way Lease Applications. The pipeline rights-of-way will be subject to strict state and federal laws enacted to protect the public health and safety, fish and wildlife resources and habitats, subsistence, individuals, property and other environmental concerns. The following is a list of permits and authorizations that may be required for this project, as well as state and federal statutes and regulations relevant to this project. Other permits and authorizations may be identified during the state and federal review processes. Applications for required permits and authorizations for this project will be submitted prior to any activity taking place on the ground along the rights-of-way.

5.1 FEDERAL PERMITS AND AUTHORIZATIONS

- U.S. Army Corps of Engineers
  - Clean Water Act, Section 404 Certification
- U.S. Environmental Protection Agency (EPA)
  - National Pollutant Discharge Elimination System (NPDES) Permit for Trench Dewatering and Hydrostatic Test Water Discharges, Notice of Intent for Storm Water Discharges Associated with Construction Activity Under an NPDES Permit
- U.S. Fish and Wildlife Service
- Federal Communications Commission (FCC)
  - Radio License and Permit to Operate Radio Equipment

5.2 STATE PERMITS AND AUTHORIZATIONS

- Alaska Department of Natural Resources
  - Alaska Coastal Management Program (ACMP) Consistency Review & Determination

  - Temporary Water Use Permit
  - Office of Habitat Management and Permitting Title 41 Fish Habitat Permit
  - AS 38.35 Common Carrier Pipeline Right-of-Way Lease
  - National Historic Preservation Officer Section 106 Consultation (SHPO) and Cultural Survey and Clearance
- Alaska Department of Fish and Game
  - Bear Interaction Plan
- Alaska Department of Environmental Conservation
  - State of Alaska, Section 401 Water Quality Certification of Section 404 Permit
  - Air Quality Construction and Operations Permits
  - Spill Prevention and Response
  - Notice of Wastewater Disposal from Excavation Dewatering, General Permit
  - Notice of Disposal of Wastewater from Hydrostatic Test Dewatering, General Permit
  - Temporary Waste Storage

5.3 LOCAL GOVERNMENT PERMITS AND AUTHORIZATIONS

- North Slope Borough
  - Land Use Permits and Utility Permits
  - Conditional Use Permits
  - Temporary Waste Storage

5.4 ALASKA STATUTES AND ADMINISTRATIVE CODE SECTIONS RELATED TO OIL AND GAS ACTIVITIES

DNR/ Division of Mining Land and Water

AS 38.05.127 / 11 AAC 53.330	Reserves easements to ensure access to navigable and public waters.
AS 38.05.075	Establishes leasing procedures - leasing shall be made at public auction to the highest qualified bidder.
AS 38.05.850	The director may issue permits, rights-of-way or easements on State land for roads, trails, ditches, field gathering lines or transmission and distribution lines, log storage, oil well drilling sites and production facilities and other similar uses.
11 AAC 93.210	Procedures to authorize the temporary use of water.
11 AAC 96.010	Uses requiring a permit on State land.

DNR/Division of Oil and Gas

AS 38.05.035 (a)(9)(C)	All geological, geophysical and engineering data, supplied, whether or not concerned with the extraction or development of natural resources shall remain confidential upon request of the person supplying the information.
AS 38.05.131-134	Oil and Gas Exploration Licenses and Leases.
AS 38.05.180	Establishes the oil and gas and gas only leasing programs for orderly exploration and development of State-owned resources.

DNR/State Pipeline Coordinator's Office

AS 38.35	Right-of-Way Leasing Act
11 AAC 80.005-085	Regulations implementing AS 38.35 pipeline right-of-way leases.

DNR/Office of Habitat Management and Permitting

AS 41.14.840	Fishway required
AS 41.14.870	Protection of fish and game.

DNR/Office of Project Management and Permitting

AS 46.40	Alaska Coastal Management Program (ACMP)
11 AAC 110	Regulations implementing the ACMP.
11 AAC 112	State-wide standards for coastal development.

Department of Environmental Conservation

AS 46.03	Policy and powers of Department of Environmental Conservation.
AS 46.04	Oil and Hazardous Substance Pollution Control Act
18 AAC 15	Department of Environmental Conservation Administrative Procedures
18 AAC 50	Air Quality Control
18 AAC 60	Solid Waste Management
18 AAC 70	Water Quality Standards
18 AAC 75	Oil and Hazardous Substance Pollution Control

Alaska Oil and Gas Conservation Commission

AS 31.05	Alaska Oil and Gas Conservation Act
20 AAC 25	Alaska Oil and Gas Conservation Commission regulations.

Department of Military and Veteran's Affairs

AS 26.23.071	Alaska State Emergency Response Commission

5.5 FEDERAL STATUTES RELATED TO OIL AND GAS ACTIVITIES

- U. S. Army Corps of Engineers (USACE)
    - Clean Water Act (CWA) - 33 U.S.C. §§ 1251-1387

- 33 U.S.C. § 1343 – Permit is required to excavate, fill, alter, or modify the course or condition of navigable or U. S. waters
- 33 U.S.C. § 1344 - Discharge of Dredge and Fill

- Environmental Protection Agency (EPA) Regulations
  - 40 C.F.R. § 109 - Criteria for Oil Removal Contingency Plans
  - 40 C.F.R. § 110 - Discharge of Oil
  - 40 C.F.R. § 112 - Oil Pollution Prevention
  - 40 C.F.R. § 112.7 - Guidelines for implementation of SPCC plan
  - 40 C.F.R. § 113 and § 114 - Civil Penalties for Violation of Oil Pollution Regulations
  - 40 C.F.R. § 116 - Designation of Hazardous Substances
  - 40 C.F.R. § 117 - Determination of Reportable Quantities for Hazardous Substances
  - 40 C.F.R. § 121 - State Certification of Activities Requiring a Federal Permit
  - 40 C.F.R. § 136 - Test Procedures for Analysis of Pollutants
  - 40 C.F.R. § 122 - NPDES Permit Regulations
  - 40 C.F.R. § 231 - Disposal Site Determination
  - 40 C.F.R. § 300 - National Oil and Hazardous Substances Pollution Contingency Plan
  - 42 U.S.C. § 300 - Safe Drinking Water Act
  - 40 C.F.R. § 144 - Permit Regulations for the Underground Injection Control Program
  - 40 C.F.R § 146 - Criteria and Standards for Underground Injection Control Program

    - 40 C.F.R. § 147 - State Underground Injection Control Program

- U.S. Fish and Wildlife Coordination Act - 16 U.S.C. §§ 661-666(c) - Allows comment on § 404 permit applications by USF&WS, NOAA Fisheries, and EPA
- Endangered Species Act - 7 U.S.C. §136; 16 U.S.C. §460 *et seq*
- Magnuson-Stevens Fisheries Conservation and Management Act - 16 U.S.C. §1801-1882 - NOAA Fisheries makes recommendations regarding any action that would adversely effect essential fish habitat
- Coastal Zone Management Act (CZMA) - 16 U.S.C. §§ 1451-1464
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) - 42 U.S.C. §§ 9601-9675
- Solid Waste Disposal Act, as amended by Resource Conservation and Recovery Act (RCRA) -42 U.S.C., §§ 6901-6991
- Clean Air Act (CAA) - 42 U.S.C. §§ 740l-7642
- Toxic Substances Control Act - 15 U.S.C. §§ 2601
- National Environmental Policy Act (NEPA) - 42 U.S.C. §§ 4321-4347
    - Council on Environmental Quality (CEQ) Regulations - 40 C.F.R. §§ 1500-1508 - Implementing NEPA Procedures
- Migratory Bird Treaty Act - 16 U.S.C. §§ 703-711
- National Historic Preservation Act - 16 U.S.C. § 470
- Leases and Permits on Restricted Properties - 25 C.F.R. § 162

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