3.12 WILDLIFE

The Wildlife Section addresses terrestrial wildlife, marine mammals, and birds by subsection. Analysis was based within the EIS Analysis Area unless otherwise noted. Threatened and endangered species are addressed in Section 3.14, Threatened and Endangered Species.

SYNOPSIS

This section describes current conditions and evaluates potential impacts to 1) terrestrial wildlife which includes mammals and other species, 2) marine mammals, and 3) birds from the proposed action and alternatives. Each alternative is examined by major project component (Mine Site; Transportation Corridor; and Pipeline) by project phase (Construction, Operations; and Closure). Additional bird data tables are provided in Appendix V.

EXISTING CONDITION SUMMARY

Terrestrial Mammals – No terrestrial mammals are listed as threatened or endangered under the Endangered Species Act (ESA) within the project area.

Analysis includes species managed by Alaska Department of Fish & Game (ADF&G) as game animals or as predators of game animals. These species are considered ecologically important, and are highly valued by subsistence communities, sport hunters, and for non-consumptive wildlife viewing.

Large mammals include bison, black bear, brown bear, caribou, Dall sheep, gray wolf, and moose.

Small mammals include coyote, red fox, Arctic fox, Canada lynx, American marten, American mink, least weasel, short-tailed weasel, river otter, wolverine, beaver, muskrat, porcupine, red squirrel, lemming, shrew, vole, and snowshoe hare.

Other Terrestrial Species – Analysis of effects on wood frog (*Lithobates sylvaticus)* populations, a species of interest to the Bureau of Land Management (BLM), is not possible since limited information about state populations exist.

Marine Mammals – All marine mammals are federally protected under the Marine Mammal Protection Act (MMPA) of 1972. ESA-listed marine mammals are discussed in Section 3.14, Threatened and Endangered Species.

Analysis includes harbor seal, spotted seal, beluga whale (with exception of the Cook Inlet stock which is discussed in Section 3.14, Threatened and Endangered Species), gray whale, killer whale, minke whale, Dall's porpoise, and harbor porpoise. Seals are the most common marine mammals observed in the Kuskokwim River, while sightings of beluga whales, harbor porpoises, and killer whales are rare in the upper Kuskokwim Bay and Kuskokwim River. Dall's porpoises, minke whales, and gray whales are also found in the eastern Bering Sea.

Birds – ESA-listed birds are discussed in Section 3.14, Threatened and Endangered Species.

Analysis includes bird (avian) populations and habitats within 10 miles of all Project Components, including migration corridors and downgradient (downstream) areas of habitat. The EIS Analysis Areas include a large portion of global populations of waterfowl

and shorebirds that breed or migrate through the Yukon-Kuskokwim (Y-K) Delta. Inland habitat supports thousands of migrant landbirds.

EXPECTED EFFECTS SUMMARY

Alternative 1 - No Action

Terrestrial Mammals and **Birds:** There would be no new effects on terrestrial mammals and birds. Impacts to terrestrial mammals and birds would continue from ongoing mineral exploration and from reclamation of existing exploration and related disturbance (camp, roads, and airstrip).

Marine Mammals: There would be no new impacts on marine mammals.

Alternative 2 - Donlin Gold's Proposed Action

Terrestrial Mammals: At the Mine Site, during all three phases, expected effects include habitat alteration or fragmentation from vegetation removal and modification (in some places permanent) or from potential accidental fire; behavioral disturbance from noise, vehicles and human presence including organic waste attraction; barriers to movement from project activities; potential nonnative invasive species (NNIS) introduction and spread; and potential injury and mortality from vehicle collisions or environmental contamination.

Use of the Transportation Corridor component during Construction and Operations could cause habitat alteration from vegetation removal and modification or from potential accidental fire; potential NNIS introduction and spread; behavioral disturbance from increased barge, vessel, and vehicle traffic; potential injury or mortality from vehicle collision, fugitive dust, or environmental contamination. During the Closure Phase, areas of permanent habitat alteration could remain.

At the Pipeline component during Construction and Operations, expected effects include habitat alteration or fragmentation from vegetation removal and modification or from potential accidental fire; behavioral disturbance from noise, vehicles and human presence; barriers to movement from project activities; and potential NNIS introduction and spread. During the Closure Phase, potential increased hunter and trapper access and pressure could exist. The impacts would be the same for the North Option.

Marine Mammals: Marine mammals would not be affected during all phases of the project at the Mine Site or Pipeline components.

Effects at the Transportation Corridor during Construction and Operations include behavioral disturbance or displacement from in-water port site construction, fuel and cargo barge traffic; and potential injury and mortality from vessel collisions or environmental contamination. In the Closure Phase, there would be reduced impacts as there would be less ocean barge traffic.

Birds: Effects at the Mine Site during Construction and Operations include habitat alteration or fragmentation from vegetation removal and modification (in some places permanent) including nest site loss (loss of habitat suitable for birds to nest) or disturbance, or from potential accidental fire; behavioral disturbance from noise, vehicles and human presence including organic waste attraction; barriers to movement from project activities; potential NNIS introduction and spread; potential injury and mortality from vehicle collisions or powerline collisions, or environmental contamination including pit lake attraction. During the Closure Phase, areas of permanent habitat alteration could remain.

Effects at the Transportation Corridor during Construction and Operations include habitat alteration or fragmentation from vegetation removal and modification (in some places permanent) including nest site loss or disturbance, or from potential accidental fire, behavioral disturbance from noise and vehicles, and behavioral disturbance from increased barge traffic. During the Closure Phase, areas of permanent habitat alteration could remain.

Effects at the Pipeline during Construction and Operations include habitat alteration or fragmentation from vegetation removal and modification (in some places permanent) including nest site loss or disturbance, or from potential accidental fire; behavioral disturbance from noise, vehicles and human presence; barriers to movement from project activities; potential NNIS introduction and spread; potential injury and mortality from vehicle collisions or powerline collisions, or environmental contamination. During the Closure Phase, areas of permanent habitat alteration could remain. The impacts would be similar for the North Option.

OTHER ALTERNATIVES – This section discusses differences of note between Alternative 2 and the following alternatives, but does not include a comprehensive discussion of each alternative's impacts if they are the same as or similar to Alternative 2 impacts.

Alternative 3A - LNG Powered Trucks

Terrestrial Mammals: During Construction and Operations at the Transportation Corridor**,** lesser behavioral disturbance due to reduced need for hauling diesel fuel would occur.

Marine Mammals: During Construction and Operations at the Transportation Corridor, lesser behavioral disturbance due to reduced need for hauling diesel fuel between ports and mouth of the Kuskokwim River would occur.

Alternative 3B - Diesel Pipeline

Terrestrial Mammals: At the Transportation Corridor during Construction there would be greater disturbance due to longer pipeline route and more complicated construction, but during Operations there would be lesser disturbance due to reduced need for hauling diesel fuel. During the Closure Phase, there would be greater permanent habitat alteration and greater potential of increased hunting and trapping pressure. The impacts would be similar for the Port MacKenzie Option, and for the Collocated Natural Gas and Diesel Pipeline Option.

Marine Mammals: At the Transportation Corridor during Construction and Operations there would be lesser disturbance due to reduced need for hauling diesel fuel between ports and the mouth of the Kuskokwim River but greater disturbance due to dock expansion and increased vessel traffic in Cook Inlet. The impacts would be similar for the Port MacKenzie Option and for the Collocated Natural Gas and Diesel Pipeline Option.

Alternative 4 - Birch Tree Crossing (BTC) Port

Terrestrial Mammals: At the Transportation Corridor during Construction and Operations, there would be greater disturbance due to longer port to mine road. During the Closure Phase there would be greater permanent habitat alteration.

3.12.1 REGULATORY FRAMEWORK

Within the EIS Analysis Area, various regulations and management guidance apply and are discussed below.

3.12.1.1 TERRESTRIAL MAMMALS

Big game species and certain predators are managed by Alaska Department of Fish & Game (ADF&G) as game animals and as predators of game animals under state regulations. ADF&G also manages furbearers, game birds, and other species. On the Susitna Flats State Game Refuge (SFSGR) the terms and conditions of pipeline and proposed compressor station would be based upon the SFSGR Management Plan. ADF&G issues public safety permits for non-lethal hazing and lethal take of wildlife, such as brown bears or foxes, at work sites (AS 16.05.930).

Guidance regarding predator control on BLM lands is provided by IM-AK-2010-007 that states, "Unless predator control activities conflict with on-going or anticipated BLM authorized actions, land use plan decisions for a given area, or create a threat to public safety, the BLM's position on the State's predator control program is: Predator control is a State function."

3.12.1.2 MARINE MAMMALS

The Marine Mammal Protection Act of 1972 (MMPA) prohibits the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas and the importation of marine mammals and marine mammal products into the U.S. without permit or exception. As defined under the MMPA, "take" means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The MMPA defines "harassment" as "any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering." The MMPA provides exceptions for subsistence uses by Alaska Natives and authorized (permitted) scientific research. Also allowed, through a permit application process, is the "incidental," but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing). The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) have regulatory authority for implementing the MMPA.

3.12.1.3 BIRDS

The Migratory Bird Treaty Act (MBTA) of 1918 makes it unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not. The MBTA is administered by the USFWS. A migratory bird depredation permit may be needed for operation of airstrips; permit type: Depredation at Airports (50 CFR 21.41).

Harvest of birds is regulated by the ADF&G and the USFWS. The secretary of the interior, under the authorization of the MBTA, is authorized to determine when hunting of migratory game birds can take place in the U.S.; to adopt regulations for this purpose, the responsibility is

delegated to the USFWS. Harvest of non-migratory gamebirds (grouse and ptarmigan) is regulated by the ADF&G. Subsistence hunting for migratory waterfowl is co-managed by the state and federal government through the Alaska Migratory Bird Co-Management Council, consisting of the USFWS, the ADF&G, and representatives of Alaska's Native population.

The Bald and Golden Eagle Protection Act (BGEPA) (16 USC 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." The Act is administered by the USFWS.

In addition to these two federal acts, migratory birds are also protected by treaties the U.S. has with four other countries: Canada, Japan, Mexico, and the former Soviet Union:

- Migratory Bird Treaty with Canada (Convention between the U.S. and Great Britain [for Canada] for the Protection of Migratory Birds; 39 Stat. 1702; TS 628 as amended). This 1916 treaty adopted a uniform system of protection for certain species of birds which migrate between the U.S. and Canada, in order to assure the preservation of species either harmless or beneficial to humans.
- Migratory Bird Treaty with Japan (Convention between the Government of the U.S. and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction, and Their Environment; 25 UST 3329; TIAS 7990 as amended). This 1972 Convention is designed to provide for the protection of species of birds which are common to both countries, or which migrate between them by 1) enhancement of habitat, 2) exchange of research data, and 3) regulation of hunting.
- Migratory Bird and Game Mammal Treaty with Mexico (Convention between the U.S. and the United Mexican States for the Protection of Migratory Birds and Game Mammals; 50 Stat. 1311; TS 912, as amended). This 1936 treaty adopted a system for the protection of certain migratory birds in the U.S. and Mexico, which allows, under regulation, the rational use of certain migratory birds. It provides for enactment of laws and regulations to protect birds by establishment of closed seasons and refuge zones, prohibits killing of insectivorous birds, except under permit when harmful to agriculture, and provides for enactment of regulations on transportation of game mammals across the United States-Mexican border. The treaty was amended in 1995 to establish a legal framework for the subsistence take of birds in Alaska and northern Canada by Alaska Natives and Aboriginal people in Canada.
- Migratory Bird Treaty with the Soviet Union (Convention between the U.S. and the Union of Soviet Socialist Republics Concerning the Conservation of Migratory Birds and Their Environment, TIAS 9073). This Convention was signed in Moscow on November 19, 1976, and approved by the Senate on July 12, 1978. The Convention provides for the protection of bird species that migrate between, occur in, or "have common flyways, breeding, wintering, feeding or molting areas" in the two countries.

3.12.1.4 SPECIAL STATUS SPECIES

As per BLM 6840 Manual direction (revised in December 2008), the BLM Alaska State Director must designate and manage sensitive species in part to reduce the likelihood and need for new listings under the Endangered Species Act (ESA). The BLM Alaska maintains both a Sensitive Animal List (IM-AK-2010-018a3) (BLM 2010a, BLM 2010b) and Plant and Animal Watch lists (IM-AK-2010-018a1) (BLM 2010c). The ultimate goal of the BLM's sensitive species program is to conserve and recover these species. Many of the birds on these lists occur in the EIS Analysis Area (see Appendix V, Table V-13.12-18), as do two small mammals (see Section 3.12.2.2.2).

In addition, several federal and state agencies as well as non-profit organizations, including the Bureau of Land Management (BLM), ADF&G, U.S. Geological Survey (USGS), USFWS, and Audubon Alaska, have created Alaska-specific lists of bird species of special concern or conservation needs. While these species are not protected in the same ways as others mentioned in this section, they do receive added attention and study.

3.12.1.5 PROTECTED SPECIES

There are no terrestrial mammals listed as threatened or endangered species (TES) under the ESA. ESA-listed bird and marine mammal species, along with the ESA regulatory framework, are discussed in Section 3.14, Threatened and Endangered Species. ESA-listed bird species include Steller's eider and spectacled eider (short-talked albatross occurs in the vicinity of the Project Area; see Section 3.14 for details). ESA-listed marine mammals include Steller sea lion, bearded seal, ringed seal, Pacific walrus, beluga whale, humpback whale, fin whale, North Pacific right whale, and northern sea otter.

3.12.2 AFFECTED ENVIRONMENT

This section discusses terrestrial wildlife, marine mammal, and bird habitat and species characteristics. Affected environment is discussed in terms of analysis of prior and project surveys. Impacts are discussed in Section 3.12.3, Environmental Consequences. Subsistence impacts to wildlife, while mentioned, are discussed in further detail in Section 3.21, Subsistence.

3.12.2.1 GENERAL HABITAT INFORMATION

General habitat information is discussed below by project component (Mine Site, Transportation Corridor, and Pipeline). Detailed vegetation and wetland information is discussed in Section 3.10, Vegetation and Nonnative Invasive Species, and Section 3.11, Wetlands.

The Mine Site is characterized by rolling hills with a boreal forest (taiga) ecosystem dominated by black spruce (*Picea mariana*) communities. Other habitat types include alpine tundra, herbaceous wetland, shrub, broadleaf forest, and mixed forest. The Birch Tree Crossing (BTC) mine access road would cross through a higher proportion of shrub vegetation compared to the Mine Site and the Angyaruaq (Jungjuk) Port site and associated mine access road.

In the Transportation Corridor, the Kuskokwim Delta is mostly treeless, dominated by marsh vegetation including sedges (*Carex* spp.), grasses, and herbaceous plants; further upriver, river bank (riparian) areas are shrubby or forested. The proposed Angyaruaq (Jungjuk) mine access road would traverse primarily conifer and mixed/deciduous forests and shrub habitats. The

proposed BTC mine access road would traverse similar forested and shrub habitats as well as open herbaceous areas.

The Kuskokwim River creates a natural barrier for terrestrial mammal movement during the open-water season (10 miles wide at the mouth, half mile wide at Bethel, and one-third mile wide at Angyaruaq [Jungjuk] Port site) although strong swimming mammals such as moose, caribou, beavers, and wolves may cross the river, especially in areas with mid-channel islands. Additional species may cross the river on ice in winter.

In the Pipeline component, the area near Tyonek and Beluga is characterized by extensive wetlands and low shrub habitats. North of the pipeline tie-in, mixed forest habitats are found along the larger river drainages. Large patches of herbaceous wetland grass or grass-like (graminoid) species such as sedge habitats are associated with water bodies, especially north of the Skwentna River. Steep mountain slopes support tall shrub, low shrub, alpine, sparse, or barren habitats. The area west of Rainy Pass and Big River is mainly black spruce forest habitats with large wildfire burn areas. In lowlands east of the Kuskokwim River, herbaceous and low shrub wetland habitats form a mosaic with black spruce and mixed forest habitats along rivers and streams. Lowlands west of the Kuskokwim River include black spruce forest and shrub habitats, while lower mountain slopes contain tall shrub, habitats.

3.12.2.2 TERRESTRIAL WILDLIFE

3.12.2.2.1 LARGE MAMMALS

Species considered in this section are managed by ADF&G as game animals and as predators of game animals. They are considered ecologically important, and are highly valued by subsistence communities, by sport hunters, and for non-consumptive wildlife viewing and aesthetics. Where applicable, information is discussed by project component (Mine Site, Transportation Corridor, or Pipeline).

Bison (*Bison bison*)

A small number of American plains bison were transplanted from Delta to the Farewell area north of the Alaska Range in 1965 and 1968 to provide hunting opportunities. The herd has been subject to a limited permit hunt since 1972 and grew to 350 animals by 1999. The highest number counted was 330 animals in 2012. Although fewer animals were counted in a 2013 survey, ADF&G believes there were sightability (the ability to view an object of interest) issues in 2013 and that the population of the herd appears to be growing slowly (Seavoy 2014). The plains bison herds originated from animals transported from Montana in 1928. They graze on grasses and forbs but also eat shrubby plants such as willow (Salix spp.) and birch (Betula spp.) (Griffin and Johnson 2007). They are attracted to burned areas and other early successional areas because of good grazing habitat. Part of ADF&G's management plan includes controlled burns to maintain favorable grazing condition (Peirce 2012). Calves are born between April and August, but most are born in May. Bison are often dispersed rather than in one herd, and the animals move between seasonal ranges (Griffin and Johnson 2007). The Farewell herd ranges from the east side of the South Fork of the Kuskokwim River to Windy Fork to the west, an area that is bisected by the pipeline route between approximately Milepost 150 and Milepost 165 on the north side of the Alaska Range (Figure 3.12-1). The Farewell mineral lick is frequently used, located about one-half mile from the pipeline route (Owl Ridge 2013a).

One hundred wood bison were released in spring 2015 by USFWS near the village of Shageluk into the Innoko Flats Wildlife Refuge. The potential range includes sections of the Kuskokwim River corridor, although limited information is available about population distribution or range.

Black Bear (*Ursus americanus*)

Black bears are widely distributed in North America and are common in forested areas of Alaska. Black bears feed primarily on new plant growth in spring, berries during summer, and spawning salmon during summer and fall (Johnson 2008). Many of the foods preferred by black bears, such as grasses, sedges and forbs, grow best in openings near forest habitats such as wetlands, avalanche slopes, burned and logged areas, and subalpine meadows (Ulev 2007). Winter den sites include excavated and natural depressions under tree roots, stumps, and fallen logs. Black bears hibernate between four and seven months out of the year, usually between October and May. Mating typically occurs in June and July. One to four cubs are born in the den between November and February, and females give birth every 2 or 3 years (Johnson 2008). During spring and fall, black bears migrate between the higher elevation dens and lower elevation woodlands.

Black bears are highly adaptable and can tolerate moderate disturbances from humans as long as basic requirements for food and cover are satisfied. However, they are often attracted to human garbage and food and this often leads to human-bear conflicts in residential areas and construction camps, which is very dangerous for bears as well as human safety. ADF&G does not require black bear skulls or hides to be sealed (i.e., recorded at an ADF&G office) in Game Management Unit (GMU) 19 so harvest information is not available for this unit. The number of bears killed in defense of life and property (DLP) is small.

In the Mine Site, ADF&G has only conducted black bear population surveys in the Bear Control Area around McGrath but estimates that GMU 19A contains 2,475-2,970 black bears based on habitat similarities with areas of known density (Peirce 2011). Donlin Gold Project biologists have observed black bears during all avian surveys and they appear to be the most abundant large mammal in the Mine Site area (ARCADIS 2013a).

In the Transportation Corridor, black bears are typically not present in GMU 18 and ADF&G does not report on their status in that area. The Donlin Gold Project's wildlife surveys along the Kuskokwim River did not observe black bears (Jewett et al. 2010b).

In the Pipeline component, based on known bear densities in similar habitat in other GMUs, ADF&G estimates that 3,000-6,000 black bears live in GMU 19D and 975-1,165 live in GMU 19C. ADF&G has implemented liberal hunting and baiting rules for black bears in GMU 19D with the intent of reducing predation pressure on moose calves, but the numbers of bears harvested is well below management goals and the effectiveness of this strategy is limited (Peirce 2011). ADF&G estimates that there are 3,200-3,800 black bears in GMU 16B, although the current management goal is to reduce this population through liberalized hunting and baiting rules and other control strategies (Peltier 2011).

Brown Bear (*Ursus arctos*)

Brown bears are widespread and common in many areas of Alaska, including the Kuskokwim River and Cook Inlet drainages, because of huge salmon runs that provide an abundant source of protein. In northern and interior parts of Alaska, brown bears are often called "grizzly bears"

and are typically smaller than brown bears along the coast, although they are the same species, and will be referred to as brown bears in this document. Brown bears eat berries, leaves, and roots of many plants and prey on a variety of small and large mammals (Eide and Miller 2008). Brown bears use a variety of habitats, including alpine and subalpine meadows, coastal sedge meadows, riparian areas, and forests. Brown bears often concentrate along salmon streams in the summer, move to higher elevations in the fall for berries, and hibernate for the winter in caves or under trees and shrubs. Mating occurs in the spring (May into July) (Eide and Miller 2008). Two cubs are typically born in January or February in the den and stay with their mother for two or three years. Sows with cubs are very protective and can be exceedingly dangerous when approached. The only predators of brown bears are other brown bears and humans. Population success is heavily dependent on the quality of late summer habitat and forage, which are critical for bears to store enough fat for hibernation.

Brown bear hunting is regulated by ADF&G and managed by GMU, but ADF&G does not conduct brown bear population surveys in the region. In 2001, ADF&G established an intensive management area in GMU 19D around McGrath (approximately 20 mile radius) to study the effects of predator control programs around McGrath and to provide more moose for human harvest. This area was renamed the Bear Control Area in 2009. Management goals in the rest of GMU 19 and 21A are less intensive.

In the Mine Site, ADF&G has estimated population levels of brown bears in GMU 19 on the basis of habitat quality and known bear densities in similar habitats (Peirce 2013). In GMU 19A, habitat quality is considered moderate and capable of supporting 20 bears per 1,000 square miles or 200 bears in GMU 19A. The Donlin Gold Project has not conducted any surveys specifically for brown bears, but they have been observed infrequently during avian surveys, most often near the Russian Mountains.

In the Transportation Corridor, brown bears in GMU 18 are concentrated in the Kilbuck Mountains southeast of Bethel and in uplands along the Yukon River. There are high densities in these high quality habitat areas but few brown bears live in other areas of GMU 18 (Perry 2013). The Donlin Gold Project's wildlife surveys along the Kuskokwim River did not observe brown bears (Jewett et al. 2010b). They have been observed infrequently during avian surveys, most often near the Russian Mountains.

In the Pipeline component, ADF&G considers brown bear habitat in GMU 19D to generally be of poor quality, capable of supporting 15 bears per 1,000 sq. mi., or 185 bears in GMU 19D. GMU 19C has a mix of good quality habitat (capable of supporting 50 bears per 1,000 sq. mi.) and moderate quality habitat and is considered capable of supporting 290 bears in GMU 19C. In GMU 16B, on the southern side of the Alaska Range, ADF&G conducted line transect surveys in 2007 and estimated brown bear densities of about 69 bears per 1,000 sq. mi., although densities were much higher in the southern and western sections of the GMU than the north and east sections. ADF&G also uses harvest data and reports from long-term residents to track population trends. Currently ADF&G estimates there are 625-1,250 brown bears in GMU 16B. The Board of Game and ADF&G have made several changes to hunting regulations in GMU 16B to increase the take of brown bears in an effort to reduce the population and foster higher moose survival, including a brown bear control program between the Beluga and McArthur rivers (Peltier 2013).

Caribou (*Rangifer tarandus*)

Caribou live in the Arctic and alpine tundra as well as forested habitats throughout Alaska. Many separate herds are recognized in Alaska, distinguished by their separate calving grounds, although animals from different herds often mix together on winter ranges. Caribou are primarily grazing animals, feeding on sedges, mushrooms, and herbaceous plants in summer and lichens in winter, although they also eat leaves from shrubby plants such as willows (Valkenburg and Arthur 2008). Caribou travel almost constantly to find food and to find the most favorable conditions for the season. Caribou breed in the fall and calves are born in late May and early June. Predation on newborn calves by brown bears, wolves, and golden eagles is common. Caribou often join in large "postcalving aggregations" to avoid predation and these large groups seek out cooler windblown ridges and coastal areas in the summer to minimize mosquito harassment and parasitic flies. In the fall they move to rich forage areas, often in smaller groups, where they build fat reserves for the winter. Deep snow requires a great deal of energy to walk through and buries food sources, so caribou try to find windblown or other low-snow areas to survive the winter.

Caribou are an important game animal in Alaska, especially in areas where their migration routes pass near subsistence communities. They are valued for their meat and hides and are also popular with non-resident trophy hunters. Hunting is managed through hunting seasons, sex and size limits, bag limits, and closure areas and limited permit hunts. In recent years, the state has implemented extensive predator control programs against wolves and bears in an effort to increase caribou available for human harvest. Hunting regulations vary considerably throughout the EIS Analysis Area.

In the Mine Site, the Mulchatna caribou herd occurs in GMU subunit 19A, but their range is typically south of the Mine Site. The latest Mulchatna herd census (2008 data) indicated at least 30,000 caribou, which is at the low range of the management goal for this herd (Woolington 2013). Bull to cow ratios have been lower than management goals, indicating an unfavorable social structure that could reduce population growth. The Beaver Mountain herd ranges to the north of the Mine Site, primarily within GMU 21A. This herd was most recently surveyed in 2011 and 2012 in conjunction with the Sunshine Mountain herd. The estimate for both herds was 1,000 to 1,250 caribou and the population appears to be stable or growing (Seavoy 2013a). Animals from either of these herds could be present in the mine area at various times. Incidental caribou observations have been made during Donlin Gold wildlife surveys but only small numbers have been observed; caribou tend to be infrequent migrants through the Mine Site.

In the Transportation Corridor, animals from the Mulchatna herd are the most likely to be found within the Transportation Corridor between Kuskokwim Bay and the Mine Site. As noted above, the Mulchatna herd tends to concentrate in areas well south of the Kuskokwim River, but small numbers of animals may occasionally appear. The Donlin Gold Project's wildlife surveys along the Kuskokwim River did not observe caribou (RWJ Consulting 2010b).

In the Pipeline component, in addition to the Mulchatna and Beaver Mountain herds to the south and north of the right-of-way (ROW) near the Mine Site, several other caribou herds are found along the pipeline route. In GMU 19D and 19C, the pipeline would cross the range of the Big River-Farewell herd, including part of the traditional winter range along the northern foothills of the Alaska Range. ADF&G has not conducted systematic population surveys of the Big River-Farewell herd since 2004, when it was estimated to have 750-1,500 caribou, but

incidental sightings during other wildlife surveys and reports from hunters have led ADF&G to believe the herd now numbers about 500 to 750 animals (Seavoy 2013a).

The pipeline route also passes near the range of the Rainy Pass herd as it crosses the Alaska Range. Information on the herd's abundance is limited and similar to the Big River-Farewell herd; the population was estimated at 1,500-2,000 animals in 2004 but has likely declined to 500 to 750 animals since that time (Seavoy 2013a). For both the Big River-Farewell herd and Rainy Pass herd, hunting success is well below management goals and habitat quality does not appear to be limiting population growth.

Donlin Gold has not conducted any standardized study of caribou along the pipeline route, but incidental observations of caribou have been made during other route alignment surveys (ARCADIS 2013a). The herd affiliations of these caribou could not be determined.

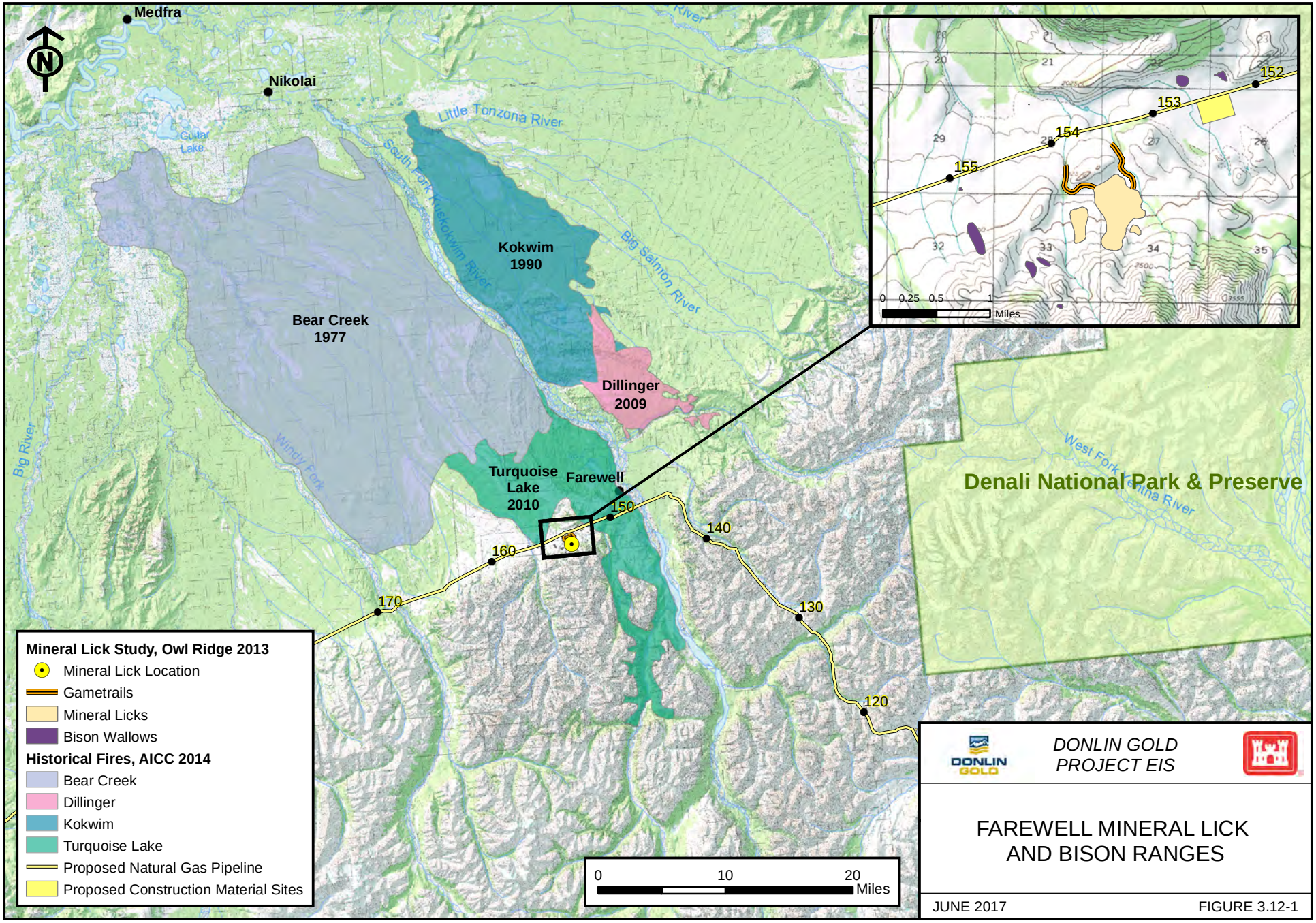
Dall Sheep (*Ovis dalli dalli*)

Dall sheep live in all major mountain ranges of Alaska, occupying alpine tundra and bare scree slopes with steep, rocky escape terrain nearby. They generally remain on high elevation slopes, but periodically cross mountain passes and gorges to reach preferred habitat (Olson 2008). Ewes disperse to have their lambs in spring but then soon join together in "ewe bands" for group protection from predators, including golden eagles, bears, and wolves. Rams travel in their own bands and generally do not mix with ewe bands except during the fall mating season or at mineral licks. Sheep are sensitive to disturbance from humans on the ground or in low flying aircraft and will flee to rugged escape terrain (Olson 2008).

Suitable habitat for Dall sheep does not exist in the Mine Site, the Transportation Corridor along the Kuskokwim River, or the Pipeline route outside of the Alaska Range. The pipeline route crosses the Alaska Range from approximately Milepost 50 through 180, and suitable habitat for Dall sheep is adjacent to the route between these mileposts. Sheep in this area are part of an ADF&G management subunit called the Alaska Range West population. ADF&G has not produced overall population estimates in this area but has conducted aerial surveys to track population trends on a density per mile basis and monitors sheep harvest through sealing requirements (Seavoy 2011a). The Alaska Range West population appears to have increased from 2008 to 2010, while harvest levels are below management objectives. The highest concentrations of Dall sheep are on the northwest side of the Alaska Range near Rainy Pass because snow depths are characteristically less than on the southeast side of the Range. The pipeline route also passes near a mineral lick southwest of Farewell Mountain. This lick is used by Dall sheep as well as bison, and the surrounding area has extensive game trails (ARCADIS 2013a).

Gray Wolf (*Canis lupus*)

Wolves occur throughout most of Alaska. They are highly adaptable to different habitats and prey on a wide variety of large and small mammals as well as fish and birds (Stephenson and Boertje 2008). Wolves are social animals and live in packs of 2 to 12 or more animals, which include young from one or more females. Breeding occurs in February and March, and four to seven wolf pups are born in May and early June. The pack remains near the den until mid-summer, when the pups are big enough to travel; packs may travel 10 to 30 miles a day in the winter in search of prey (Stephenson and Boertje 2008).


Medfra
Nikolai
Little Tonzona River
Guitar Lake
South Fork Kuskokwim River
Kokwim 1990
Bear Creek 1977
Big Salmon River
Dillinger 2009
Turquoise Lake 2010
Farewell
Windy Fork
Big River
West Fork Tatina River
Denali National Park & Preserve
150
140
160
170
130
120
152
153
154
155
0 0.25 0.5 1 Miles
0 10 20 Miles
Mineral Lick Study, Owl Ridge 2013
Mineral Lick Location
Gametrails
Mineral Licks
Bison Wallows
Historical Fires, AICC 2014
Bear Creek
Dillinger
Kokwim
Turquoise Lake
Proposed Natural Gas Pipeline
Proposed Construction Material Sites
DONLIN GOLD
DONLIN GOLD PROJECT EIS
FAREWELL MINERAL LICK AND BISON RANGES
JUNE 2017
FIGURE 3.12-1

Because they often prey on large mammals, which are also hunted by humans for food, wolves have often been subjected to intensive hunting and trapping efforts to reduce their numbers and thereby improve survival of game animals and support higher human harvests of game. The Board of Game has mandated the implementation of predator control programs and harvest goals to reduce populations of predators, including wolves, in some areas of the EIS Analysis Area, as described in the moose and bear sections above. In addition, wolves are often trapped by Alaska residents and prized for their fur. They are also frequently hunted as trophy animals, especially by non-resident hunters who employ local guide services.

In the Mine Site, ADF&G used a number of different data sources to estimate and track population trends of wolves in GMU 19A: aerial reconnaissance track surveys in the winters of 2006, 2008, and 2011, wolf surveys in adjacent GMU subunits, wolf research data, harvest records, and hunter/trapper interviews and questionnaires (Seavoy 2012b). ADF&G used this information to make a fall 2005 population estimate of 119-133 wolves (12-13 wolves per 1,000 sq. mi.) and a 2008 estimate of 80 wolves in GMU 19A (Seavoy 2012b).

Wolf tracks observed during numerous Donlin Gold aerial surveys indicate that wolves are common inhabitants of the Mine Site area, an impression backed by reports from local residents (ARCADIS 2013a). In addition, the Donlin Gold camp personnel have reported that a wolf pack was seen near the current exploration camp area on a number of occasions throughout the winters of 2008, 2010, and 2011 (ARCADIS 2013a).

In the Transportation Corridor, wolves appear to be increasing in GMU 18 along the Kuskokwim River in response to the increasing numbers of moose in the region (Jones 2009). ADF&G does not conduct wolf surveys in this area but relies on reports of residents and incidental sightings during other surveys to monitor wolf population trends. Based on that information during the 2008 to 2011 reporting period, ADF&G estimated the population at 200 to 350 animals (Jones 2012). Packs of wolves were observed along the Kuskokwim River close to Aniak and in the upland areas closer to the Mine Site during the Donlin Gold Project fall moose surveys (ARCADIS 2013a).

In the Pipeline component, ADF&G has conducted extensive surveys of wolves within the aerial wolf control focus area around McGrath in GMU 19D East, in part to track the effectiveness of predator control programs to improve moose populations. Data from these surveys and the other sources of information described for GMU 19A were used to make estimates of 91 wolves in the fall of 2005 (11 wolves per 1,000 sq. mi.) and 30 wolves in the fall of 2010 after predator control efforts (Seavoy 2012b). However, these estimates do not cover the southwestern part of GMU 19D through which the pipeline route would pass. ADF&G estimates that the areas adjacent to the southwestern part of GMU 19D (GMUs 19B and 19C) would likely have wolf densities slightly lower than or equal to the density of wolves in GMU 19D before predator control programs were implemented, about 15 to 20 wolves per 1,000 sq. mi.

In GMU 16B, wolf control programs have been implemented since 2003 with the management objective of reducing the population to 22 to 45 wolves. ADF&G estimated that the entire GMU 16 had a minimum of 120 to 140 wolves in 1999. Based on local hunter and trapper reports as well as reports from pilots participating in same-day aerial wolf control programs, the population has been reduced greatly as a result of those programs and has stabilized (Peltier 2012b).

Moose (*Alces alces*)

Moose are established throughout forested and shrubby areas of Alaska, especially in areas where fires occurred between 15 and 20 years before and browse production and cover is abundant (Rausch et al. 2008). Moose feed on sedges, horsetails (Equisetum spp.), pondweeds, and grasses in the spring; shallow pond vegetation and forbs in the summer; and willow (Salix spp.), birch (Betula spp.), and cottonwood (Populus spp.) twigs throughout the fall and winter. Moose breed in late September and October, with adult bulls going into "rut" and competing for cows. Cow moose usually begin breeding at 28 months, although some start as early as 16 months, and continue every year for the rest of their lives. Moose rarely live beyond 16 years of age. One or two calves (rarely three) are born in late May to early June. The bond between cow and calf continues for a year until just before the next calf is born, at which point the mother chases off her one-year-old. Some moose inhabit relatively small areas throughout their lives but most make seasonal migrations up to 60 miles between calving, rutting, and wintering areas. Natural predators of moose include wolves, brown bears, and black bears. In areas with roads, moose are often killed in accidents with cars, especially at night. Moose are attracted to the packed snow or cleared roadways for travel and roadside vegetation (Rausch et al. 2008).

In many areas of Alaska, moose are the most sought after big game animal and are valued for their meat as well as traditional sources of hides for clothing and other purposes. Hunting pressure is generally very high in areas near roads and rivers accessible by power boats. The State Board of Game and ADF&G manage hunting pressure through hunting seasons, sex and size limits as well as closure areas and limited permit hunts. In recent years, the state has implemented predator control programs against wolves and bears in an effort to increase moose available for human harvest. Hunting regulations vary considerably throughout the EIS Analysis Area.

The Mine Site is located in the north central part of GMU subunit 19A (Figure 3.12-2). In the Mine Site area, ADF&G considers moose abundance in the region to be well below the density that the habitat can support. Moose densities in GMU 19A ranged from 0.27 to 0.44 observable moose/square mile (sq. mi.) during ADF&G aerial surveys from 2005 to 2010, and 0.25 observable moose/sq. mi. (Holitna area) in 2011. These densities are lower than management goals for the region (0.75-0.93 moose/sq. mi.) (Seavoy 2012a). Indicators of population health (bull:cow ratio, calf:cow ratio, and calf survival) were mixed in different subsections and survey years, with indicators exceeding or meeting management goals only in certain areas in 2009 or 2010 (the last years for which data is publicly available). More aggressive predator control measures for bears were implemented in 2013 to help the moose population reach the intensive management objectives (Seavoy 2012a).

Aerial moose surveys in the Mine Site area conducted since 2006 (ARCADIS 2013a) found relatively low moose densities throughout the study area. Habitat types in the area are dominated by black spruce forest, alpine ridges, open tundra, and hills covered with thick alder that do not support high quality winter forage for moose.

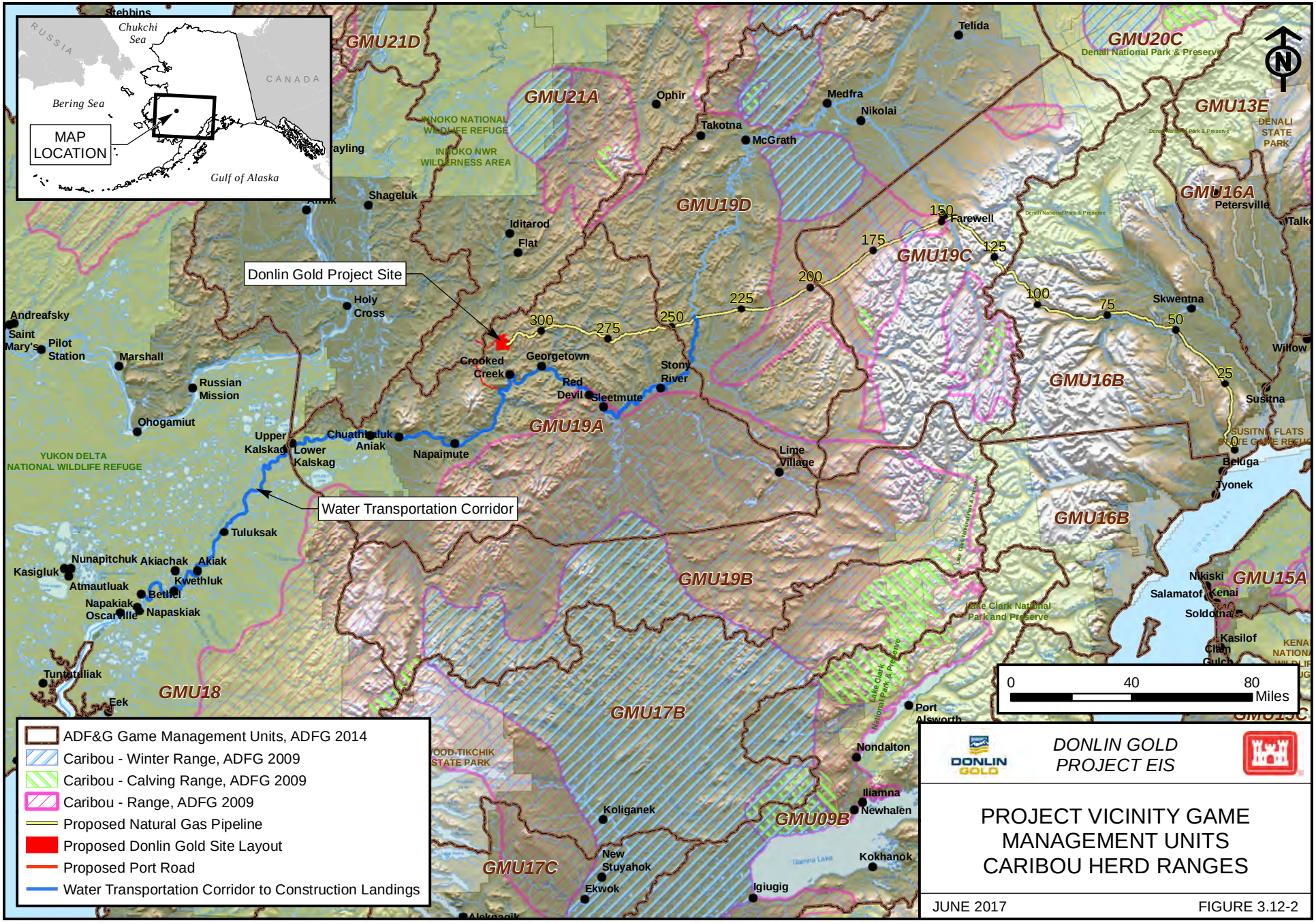
The Transportation Corridor between Kuskokwim Bay and the Mine Site occurs in GMU 18 and GMU subunit 19A. The moose population status in GMU 19A is described in the Mine Site section above. Much of GMU 18 consists of the Yukon Delta National Wildlife Refuge (YDNWR) to the north and the Togiak National Wildlife Refuge to the south. Moose began spreading into the Y-K Delta in the 1940s and the population along the Kuskokwim is still small; hunting pressure has limited the growth rate, although riparian habitat appears to be

available for expansion (Perry 2012). ADF&G aerial surveys indicate that moose densities increased in the Lower Kuskokwim area from 2004 to 2011, with the latter estimates at 0.8 moose per square mile. The population in this area appears to be growing primarily through continual immigration from surrounding areas (Perry 2012). Moose were consistently sighted during fall aerial surveys conducted by Donlin Gold contractors at the western base of the Russian Mountains, the hills west of the Owhat River, and the hills north of the Kuskokwim River (ARCADIS 2013a).

In the Pipeline component, the western portion of the pipeline route passes through GMUs 19A, 15F, 19D, and 19C, which are subject to intensive management efforts to provide high levels of moose harvest, including predator control programs on wolves and bears. Moose densities in GMU 19A are below management goals, as described above. ADF&G only conducts moose surveys in parts of GMU 19D and does not conduct systematic surveys in many of the areas the Pipeline would pass through. However, based on the similarity of habitats in these areas to the habitats in surveyed areas, ADF&G expects moose densities to be relatively low (i.e., around 0.5 moose per sq. mi.) (Seavoy 2012a). Population data for GMU 19C are limited, but moose densities are believed to be similar to what they were in the late 1980s and early 1990s. The Donlin Gold Project aerial moose survey in 2011 (ARCADIS 2013a) found relatively high densities of moose in areas around Farewell (GMU subunit 19C), while lower densities were observed to the west. The lowlands that dominate the northern edge of the Alaska Range have alternating patches of shrub, black and mixed spruce forest, with herbaceous patches larger and more numerous to the west. Moose in this area were most commonly observed in tall shrub habitat.

The eastern portion of the pipeline route crosses portions of GMU 16B east of the Alaska Range in the Cook Inlet drainage. The most recent ADF&G population estimate for GMU 16B (2008 to 2010 data) was 3,597 to 6,039 moose, which was below the management target of 6,500 to 7,500 moose in the area (Peltier 2012a). The bull to cow ratio varied from 39 to 78 bulls per 100 cows depending on year and area surveyed, compared to the target ratio of 20 to 25 bulls per 100 cows, which favors a recovering population. Twinning rates and other nutritional indexes suggest habitat quality is not limiting the population (Peltier 2012a). The population has not recovered since a severe winter die-off in 1999-2000 and has been impacted by relatively high predation from wolves and black bears, which are not subject to predator control programs in this area. Hunting regulations are intended to moderate hunting pressure to help the population recover.

The Donlin Gold Project conducted an aerial moose survey in 2011 and found that high densities of moose were observed along the southern portion and terminus of the Pipeline (ARCADIS 2013a). Other areas surveyed indicated low population densities of moose. The east side of the Alaska Range from the origin of the Pipeline near Beluga along the east-facing slopes of Little Mount Susitna, the west-facing slopes of Mount Susitna, and northeast along the Skwentna River, has large expanses of shrub-like habitat. At higher elevations, low shrub and herbaceous communities predominate while at lower elevations, low shrub communities prevail. The majority of moose in this area were observed in tall shrub habitat, followed by herbaceous and mixed forest.


MAP LOCATION
Chukchi Sea
Bering Sea
Gulf of Alaska
RUSSIA
CANADA
Donlin Gold Project Site
Water Transportation Corridor
GMU21D
GMU21A
GMU19D
GMU19C
GMU19A
GMU19B
GMU18
GMU17B
GMU17C
GMU16B
GMU16A
GMU20C
GMU13E
GMU15A
GMU09B
Denali National Park & Preserve
DENALI STATE PARK
INNOKO NATIONAL WILDLIFE REFUGE
INNOKO NWR WILDERNESS AREA
YUKON DELTA NATIONAL WILDLIFE REFUGE
Lake Clark National Park and Preserve
SUSITNA FLATS STATE GAME REFUGE
Stebbins
Shageluk
Anvik
Holy Cross
Iditarod
Flat
Ophir
Takotna
McGrath
Medfra
Nikolai
Telida
Farewell
Petersville
Skwentna
Willow
Susitna
Beluga
Tyonek
Andreafsky
Saint Mary's
Pilot Station
Marshall
Russian Mission
Ohogamiut
Crooked Creek
Georgetown
Red Devil
Sleetmute
Stony River
Upper Kalskag
Lower Kalskag
Chuathbaluk
Aniak
Napaimute
Lime Village
Tuluksak
Kasigluk
Nunapitchuk
Akiachak
Akiak
Kwethluk
Atmautluak
Bethel
Napakiak
Oscarville
Napaskiak
Tuntutuliak
Eek
Nondalton
Iliamna
Newhalen
Koliganek
New Stuyahok
Ekwok
Kokhanok
Igiugig
Port Alsworth
Nikiski
Kenai
Salamatof
Soldotna
Kasilof
Clam Gulch
150
175
125
200
225
100
75
50
25
0
300
275
250
0
40
80
Miles
ADF&G Game Management Units, ADFG 2014
Caribou - Winter Range, ADFG 2009
Caribou - Calving Range, ADFG 2009
Caribou - Range, ADFG 2009
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
Water Transportation Corridor to Construction Landings
DONLIN GOLD
DONLIN GOLD PROJECT EIS
PROJECT VICINITY GAME MANAGEMENT UNITS CARIBOU HERD RANGES
JUNE 2017
FIGURE 3.12-2

3.12.2.2.2 SMALL MAMMALS

Small mammal populations fluctuate due to natural factors such as weather, wildfire impacts on habitat, and prey population cycles. Some species are managed by ADF&G as "furbearers" that are trapped or hunted for hides, fur, or meat. Population information for these species is limited. Trapper animal harvests are a poor index of population trends because fur price is variable and current economy influences the number of people that attempt to trap every year; harvest levels are more indicative of trapper effort than the abundance of different species (Seavoy 2013b). Systematic population surveys are rarely conducted for any species, and available population trend information is derived from infrequent track surveys in fresh snow or trapper questionnaires. Trapper questionnaires have limitations as trap lines are usually in more accessible areas closer to population centers and may not reflect conditions in more remote areas. Trapping does provide a source of cash in remote communities, and furs are highly valued for traditional clothing (Perry 2010b).

Impacts from land development or other habitat changes are also difficult to assess. Table 3.12-1 lists species or species groups with their relative abundance, if known. Two of these species (indicated by shading) are on the BLM Alaska Sensitive Animal List.

Table 3.12-1: Small Mammal Status

Common Name	Scientific Name	General Habitat	Mine Site (GMU 19A[1])	Transportation Corridor (GMU 18)	Pipeline (GMU 19C, 19D, and 16B)
Coyote	*Canis latrans*	Diverse	Scarce	Scarce	Common to scarce
Red fox	*Vulpes vulpes*	Diverse	Common	Abundant	Common
Arctic fox	*Vulpes lagopus*	Tundra/grassland	Not present	Scarce	Not present
Canadian lynx	*Lynx canadensis*	Forests and shrubs	Common	Abundant	Common to scarce
American marten	*Martes americana*	Conifer and mixed forests	Common	Common	Common to uncommon
Kenai marten	*Martes americana kenaiensis*	Conifer and mixed forests	Absent	Absent	Potentially present
American mink	*Mustela vison*	Mixed forests	Scarce	Common	Common to scarce
Least weasel	*Mustela nivalis*	Diverse	Uncommon	Uncommon	Uncommon
Short-tailed weasel	*Mustela erminea*	Diverse	Common	Common	Common
River otter	*Lutra canadensis*	Riparian	Common	Common	Common
Wolverine	*Gulo gulo*	Diverse	Common	Common	Common to scarce
Beaver	*Castor canadensis*	Wetlands/riparian	Common	Abundant	Common
Muskrat	*Ondatra zibethicus*	Wetlands	Scarce	Scarce	Scarce

Table 3.12-1: Small Mammal Status

Common Name	Scientific Name	General Habitat	Mine Site (GMU 19A[1])	Transportation Corridor (GMU 18)	Pipeline (GMU 19C, 19D, and 16B)
Porcupine	*Erethizon dorsatum*	Conifer and mixed forests	Common	Scarce	Common
Red squirrel	*Tamiasciurus hudsonicus*	Forests	Abundant	Common	Abundant
Lemmings, shrews, and voles	*Dicrostonyx spp., Sorex spp., Microtus spp.*	Diverse	Common	Common	Abundant to common
Snowshoe hare	*Lepus americanus*	Forests and shrubs	Common	Abundant	Common
Alaskan hare	*Lepus othus*	Rocky slopes and upland tundra	Scarce	Scarce	Scarce

Notes:
Shading indicates species is on the BLM Alaska Sensitive Species List.
1 GMU 19A includes part of the Transportation Corridor area and Pipeline corridor.
Source: Relative abundance estimations for furbearers are from trapper questionnaires, 2011-2012 (ADF&G 2013c) and Walton et al 2013 (Kenai marten).

3.12.2.2.3 OTHER SPECIES

The wood frog (Lithobates sylvaticus), capable of surviving the frigid Arctic winter, hibernates in shallow bowl-shaped depressions under a layer of dead vegetation (duff), with snow cover providing additional insulation. Preferential breeding activity is in waters from about 1 to 7 feet deep (ABR 2014) where the water remains long enough for the tadpoles to mature and metamorphose. They are terrestrial and inhabit mixed forests, open meadows, muskeg, tundra, and even landscaped spaces in urban and suburban areas.

Wood frog range in Alaska includes most of southeast, southcentral, and interior Alaska (ACCS 2017d) with occurrences documented along the Susitna River, at Illiamna Lake, in Bethel, near Red Devil, at McGrath, around Farewell Lake, near Skwentna, and near Tyonek (ABR 2014, ACCS 2017d, PLP 2011). Wood frogs were not observed during any Donlin Gold biological studies. They have been observed at the Lyman property about two miles north of the open pit at the mine camp (Fernandez 2015b). ADF&G coordinated the Wood Frog Monitoring Project with the Alaska Center for Conservation Science (ACCS, formerly the Alaska Natural Heritage Program) to assess the current status of wood frogs in southcentral and interior Alaska, and to establish a baseline for future monitoring. At this time, the project is not active and information about state populations is too limited to analyze for impacts. No further analysis of wood frogs is presented in this document.

3.12.2.3 MARINE MAMMALS

Marine mammals analyzed in this document include pinnipeds (seals, sea lions, and walruses) and cetaceans (whales, dolphins, and porpoises) occurring within the marine and river portions of Kuskokwim Bay, the Kuskokwim River, and upper Cook Inlet. The eastern Bering Sea also supports several species that frequent areas adjacent to and including the Transportation

Corridor, the Dutch Harbor to Bethel barge corridor, and the Anchorage to Beluga barge corridor in Cook Inlet. Marine mammals are analyzed by "stock," a group of the same species in a common area than can interbreed.

Table 3.12-2 gives known general habitat areas for non ESA-listed pinniped and cetacean species. Habitat is discussed below for the marine and river portions of the Transportation Corridor. ESA-listed species including fin whales (Balaenoptera physalus), humpback whales (Megaptera novaeangliae), North Pacific right whales (Eubalaena japonica), the western stock of Steller sea lions (Eumetopias jubatus), and the Cook Inlet stock of beluga whales (Delphinapterus leucas) are discussed in Section 3.14, Threatened and Endangered Species.

Table 3.12-2: Marine Mammals (Non-ESA Listed) in or near EIS Analysis Area

Common Name	Scientific Name	Stock	Kuskokwim Bay and River	Dutch Harbor-Bethel Barge Corridor	Cook Inlet near Beluga Barge Landing
Harbor seal	*Phoca vitulina richardii*	Bristol Bay	X		
		Aleutian Islands		X	
		Cook Inlet/Shelikof			X[1]
Spotted seal	*Phoca largha*	Alaska	X		
Beluga whale	*Delphinapterus leucas*	Eastern Bering Sea	X	X	
Gray whale	*Eschrichtius robustus*	Eastern North Pacific		X	
Killer whale	*Orcinus orca*	Alaska Resident stock	X	X	
		Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock	X	X	X
Minke whale	*Balaenoptera acutorostrata*	Alaska		X	
Dall's porpoise	*Phocoenoides dalli*	Alaska		X	X
Harbor porpoise	*Phocoena phocoena*	Gulf of Alaska			X
		Bering Sea	X	X	

Notes: An X denotes presence in the area.

1 Although considered part of the range of the Cook Inlet/Shelikof Strait stock (Allen and Angliss 2013), all known haul out sites along western Cook Inlet included in abundance surveys are in central to lower Cook Inlet, the northern boundary of which is at West Foreland (Boveng et al. 2003, Montgomery et al. 2007), south of the EIS Analysis Area.

Source: ADF&G 2013a, 2013b; Coffing et al. 1999; MacDonald and Winfree 2008; RWJ Consulting 2008b, 2009, 2010b; Allen and Angliss 2015; Boveng et al. 2009; Coffing 1991; Juneau Empire 2008; Frost et al. 1992; Zerbini et al. 2007; Moore et al. 2002; Friday et al. 2013; Rugh et al. 1999.

3.12.2.3.1 PINNIPEDS

Based on surveys and subsistence harvest information from Quinhagak, Kwethluk, and Akiak, pinnipeds occurring in Kuskokwim Bay and up the Kuskokwim River include harbor seals (Phoca vitulina richardii), spotted seals (P. largha), ringed seals (P. hispida), bearded seals (Erignathus barbatus), Steller sea lions (Eumetopias jubatus), and Pacific walrus (Odobenus rosmarus divergens) (Coffing et al. 1999; MacDonald and Winfree 2008; RWJ Consulting 2010b; ADF&G 2013a, 2013b).

Harbor Seals (Bristol Bay Stock) and Spotted Seals (Alaska Stock)

Seals were the most common marine mammals observed in the Kuskokwim River during waterway transportation corridor wildlife surveys (RWJ Consulting Inc. 2010b). Harbor seals and spotted seals are closely related and often confused where their ranges overlap in the southern Bering Sea, including in northern Bristol Bay and Kuskokwim Bay (Quakenbush 1988). Observations recorded during surveys of the Kuskokwim River did not distinguish the species, which were noted as spotted / harbor seals (RWJ Consulting Inc. 2008c, 2009, 2010b).

In 2010, the NMFS and the Alaska Native Harbor Seal Commission defined 12 separate stocks of harbor seals in Alaska based largely on their genetic structure, along with population trends, movements, and traditional Alaska Native use areas, an increase over three previously recognized stocks. The Bristol Bay stock includes harbor seals seen in Kuskokwim Bay and the Kuskokwim River. The Alaska stock of spotted seals includes three Distinct Population Segments (DPSs) based on genetics, geography and breeding groups, of which the Bering DPS is considered in this document.

The National Marine Mammal Laboratory (Alaska Fisheries Science Center) conducts aerial surveys of harbor seals across their entire range in Alaska to get population estimates. The most recent survey of Bristol Bay in 2005 resulted in an estimated abundance of 18,577 harbor seals (Allen and Angliss 2015). Data from the NMFS aerial surveys suggest an increasing trend for this stock (NMFS unpublished data, cited in Allen and Angliss 2015). In general, site fidelity in harbor seals is considerable and long range movements are rare. However, some long distance movements of tagged harbor seals have been documented in Alaska (Lowry et al. 2001).

Extensive aerial surveys in April through May of 2012 and 2013 encompassed most of the spotted seal breeding area. Analysis of data from 2012 surveys resulted in a mean population estimate of 460,268 spotted seals (Allen and Angliss 2015). Population trend assessments are currently unavailable. Spotted seals are widely distributed on continental shelf areas of the Beaufort, Chukchi, southeastern East Siberian, Bering, and Okhotsk Seas, and south through the Sea of Japan and the northern Yellow Sea. Habitat use and distribution are closely linked to seasonal sea ice from November / December to March in the Bering Sea. The seals haul out on ice during the whelping, nursing, breeding, and molting periods (Heptner et al. 1976b). Spotted seals congregate on ice floes as the ice begins to disappear in late spring, during which time adults molt and pups are weaned. Adult spotted seals in the Bering Sea molt from late April or early May to mid-July (Boveng et al. 2009). In summer, seals move toward ice-free coastal waters (Heptner et al. 1976a). Spotted seals in the eastern Bering Sea use coastal haul-out sites from Kuskokwim Bay to the Bering Strait from May to July. Among the haul-outs used are sandbars near Nanvak Bay in northern Bristol Bay (Quakenbush 1988).

The largest haul-out in northern Bristol Bay closest to Kuskokwim Bay is Nanvak Bay, also the northernmost pupping area for harbor seals in Bristol Bay in an area where harbor and spotted seals and spotted seal ranges overlap. Both species appear to haul out there (MacDonald and Winfree 2008). In 2010, the highest count of harbor seals in Nanvak Bay was 400 in mid-September (Winfree 2010).

Seals, mostly spotted/harbor seals, were the most abundant marine mammal sighted on the Kuskokwim River during summer surveys in 2006-2009. Numbers of spotted/harbor seals sighted ranged from 11 in 2009 to 68 in 2007, with peak sightings in July-August (RWJ Consulting Inc. 2008c, 2009, 2010b). Harbor seals are also occasionally observed along the southern Kuskokwim Bay coast during spring and fall emperor goose aerial surveys. In early May 2009, 35 harbor seals were recorded near Chagvan Bay; 275 were recorded there in late-September that year (Dau and Mallek 2009; Mallek and Dau 2009).

Harbor seals feed opportunistically on a wide variety of fish and invertebrates (Iverson et al. 1997). Their diet varies seasonally, regionally, and most likely, annually. Common prey items include herring, pollock, salmon, cod, squid, and crustaceans (Iverson et al. 1997; Jemison 2001). Spotted seals are generalists and eat a varied array of fish, crustaceans, and cephalopods (Dehn et al. 2007). The fish commonly consumed are Pacific herring, smelt, Arctic cod, and saffron cod (Quakenbush et al. 2009).

Spotted seals are important for Alaskan subsistence hunters, primarily in the Bering Strait and Y-K regions. The mean annual subsistence harvest in north Bristol Bay from this stock over the five year period from 2004 through 2008 was 193 spotted seals per year (Allen and Angliss 2013). In the Kuskokwim region, spotted seals were reported harvested in Quinhagak, Akiak, and Kwethluk (Coffing et al. 1999; ADF&G 2013 a, 2013b).

3.12.2.3.2 CETACEANS

Sightings of cetaceans are rare in the upper Kuskokwim Bay and Kuskokwim River portions of the Transportation Corridor. Among those with reported sightings in these two areas are beluga whales (*Delphinapterus leucas*), harbor porpoises (*Phocoena phocoena*), and killer whales (*Orcinus orca*). These species also occur in the eastern Bering Sea, along with gray whales, minke whales, and Dall's porpoises.

Beluga Whale (Eastern Bering Sea Stock)

Five stocks of beluga whales are recognized in Alaska waters (Allen and Angliss 2013). The Eastern Bering Sea stock are found in Kuskokwim Bay, Kuskokwim River, and Bering Sea Transportation Corridors. Recent telemetry data indicate this stock is non-migratory with no evidence that members ever leave Bristol Bay (Citta et al. 2013). Systematic line transect surveys of the eastern Bering Sea in 2000 provided the most recent preliminary abundance estimate of 28,406 beluga whales (Allen and Angliss 2013). The Cook Inlet stock is discussed in Section 3.14, Threatened and Endangered Species.

Beluga whales were common in Kuskokwim Bay during summer until the 1950s when, for unknown reasons, they stopped using the area. Beluga whales were not reported there again until 1988 and 1989 when groups of 50-200 were seen (Frost et al. 1992). Groups of beluga whales were also reported in Kuskokwim Bay in July 1994. Although an estimated 500-1,000 were reported, only 8 were seen during an aerial survey (Frost et al. 2002).

Beluga whales have been documented upstream in the Kuskokwim River, although such occurrences are rare. In 1989 and 1990, beluga whales were spotted near Aniak (Coffing 1991). In August 2008, two beluga whales (presumably a cow and calf) were initially observed by a helicopter crew by the mouth of the Oskawalik River, about 10 miles below the village of Crooked Creek, then later verified adjacent to Red Devil (Juneau Empire 2008).

Gray Whale (Eastern North Pacific Stock)

Gray whales are the most coastal of all large whales and inhabit primarily inshore or shallow, offshore continental shelf waters (Jones and Swartz 2009). The two stocks of gray whales in the North Pacific are the eastern North Pacific stock that migrates along the coasts of eastern Siberia, North America (including Alaska), and Mexico, and the western North Pacific stock that migrates primarily between the South China Sea and the Okhotsk Sea (Carretta et al. 2015). Although individual whales from the western North Pacific stock may occasionally migrate to the eastern Pacific (Mate et al. 2011; Weller et al. 2012), the eastern North Pacific stock is the only one considered in this document. Gray whales primarily occur in the southeastern Bering Sea and in the vicinity of Unimak Pass and Unalaska Island during migration between high-latitude feeding areas and breeding lagoons in Mexico (Rugh et al. 1999). The southward migration out of the Chukchi Sea generally begins during October and November, passing through Unimak Pass in November and December. The northward migration usually begins in mid-February and continues through May, with whales entering the southern Bering Sea through Unimak Pass starting in April (Rice et al. 1984).

The eastern North Pacific gray whale population has been increasing over the past several decades. The most recent population estimate was 19,126 in 2006-2007 (Laake et al. 2009). Buckland and Breiwick (2002) estimated a population increase of 2.5 percent per year between 1967-1968 and 1995-1996, while Rugh et al. (2005) used more recent survey data to estimate a 1.9 percent rate of increase from 1967-1968 through 2001-2002. The steadily increasing population abundance warranted delisting of the eastern North Pacific gray whale stock in 1994, as it was no longer considered endangered or threatened under the ESA (Rugh et al. 1999).

Gray whales are suction-feeders and prey primarily on benthic amphipods, decapods, and other invertebrate species. Summer feeding range extends from California to the Arctic; most feeding occurs in the northern and western Bering and Chukchi seas.

Killer Whale (Alaska Resident Stock and Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock)

Killer whales are found in all oceans and most seas in coastal and temperate waters of high productivity (Forney and Wade 2006), ranging throughout the North Pacific and along the west coast of North America. Three recognized ecotypes (genetically distinct populations) of killer whales include resident, transient, and offshore, are distinguished by morphology (appearance), ecology (including prey), genetics, acoustics, and behavior (Ford and Fisher 1982; Baird and Stacey 1988; Hoelzel and Dover 1991; Baird et al. 1992; Hoelzel et al. 1998, 2002). Within these ecotypes are six stocks of killer whales in Alaska, of which four (Alaska Resident stock and the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock) are most likely to occur within the EIS Analysis Area. Members of the Alaska Resident stock have been photographically identified in Southeast Alaska, Prince William Sound, and western Alaska, with recently documented movements between the Bering Sea and Gulf of Alaska. Combining counts of

known 'resident' whales from these areas provides a minimum of 2,084 killer whales in the Alaska Resident stock (Allen and Angliss 2013). The minimum population estimate for the Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock is 552, based on photographic identification of individuals (Allen and Angliss 2013). Data are currently not available for determining trends in abundance.

The distribution and frequency of killer whales in Kuskokwim Bay is little studied and there are no documented cases of killer whales in the Kuskokwim River (Frost et al. 1992). There were multiple sightings of killer whales in Bristol Bay and Kuskokwim Bay in the summers of 1989 and 1990. In August 1989, a group of 35 killer whales were seen between the mouth of the Kuskokwim River and Quinhagak. One dead killer whale was in the same area in 1990; no live whales were seen that year. The 1989 sightings in Kuskokwim Bay were the first documented there (Frost et al. 1992). Resident killer whales were abundant around Unalaska Island during surveys in July and August of 2001-2003 (Zerbini et al. 2007).

Killer whales are apex marine predators with a diverse prey base. Transient killer whales are mammal-hunters whose prey includes various seal species. Residents are generally considered fish-eaters (Ford 2009). The killer whales observed in Kuskokwim Bay in 1989 were interacting with salmon, harbor seals, Steller sea lions, walruses, and beluga whales (Frost et al. 1992).

Minke Whale (Alaska Stock)

Minke whales are among the most common and numerous baleen whales found throughout the world. In the Northeast Pacific Ocean, they range from the Chukchi Sea south to Baja California (Perrin and Brownell 2009). Distribution in the southeastern Bering Sea is variable (Friday et al. 2013). The two stocks of North Pacific minke whales recognized in U.S. waters are the Alaska stock and the California/Washington/Oregon stock (Allen and Angliss 2013). The Alaska stock is considered in this document.

There are no abundance estimates for minke whales in the entire North Pacific or for the Alaska stock. Provisional estimates exist for minke whales in the central-eastern (810) and southeastern (1,003) Bering Sea (Moore et al. 2002). These numbers include only part of the stock's range, so cannot be extrapolated out to the entire stock. There are no data on abundance trends in Alaska waters (Allen and Angliss 2013).

Common prey in the North Pacific includes euphausiids (small marine crustaceans such as krill), anchovies, Pacific saury, walleye pollock, small fish, and squid (Perrin and Brownell 2009).

Dall's Porpoise (Alaska Stock)

Dall's porpoises, an oceanic species found along the continental shelf and in inland and coastal waters of the Gulf of Alaska and Bering Sea/Aleutian Islands areas, only occur in the North Pacific and adjacent seas. Dall's porpoise are probably the most widely distributed cetacean in temperate and subarctic regions of the North Pacific Ocean and Bering Sea.

Stock structure of eastern North Pacific Dall's porpoise populations is not well understood. The Alaska stock is currently the only stock of Dall's porpoise recognized in Alaska waters where it occurs in the Gulf of Alaska, Bering Sea, and Aleutian Islands areas. Estimated abundance for the Alaska stock was 83,400 porpoises (Allen and Angliss 2013). Dall's porpoises have poorly understood seasonal inshore-offshore and north-south movements (Jefferson 2009). They are

not common in Kuskokwim Bay or Kuskokwim River, but are common in deeper waters of the eastern Bering Sea (Moore et al. 2002; Friday et al. 2013).

Harbor Porpoise (Bering Sea Stock and Gulf of Alaska Stock)

Harbor porpoises in the eastern North Pacific range from Point Barrow and along the west coast of North America from Alaska to Point Conception, California (Gaskin 1984). They are primarily coastal and most commonly occur in waters less than 100 meters (328 feet) deep (Hobbs and Waite 2010). There are currently three stocks of harbor porpoise recognized in Alaska: the Southeast Alaska stock; the Gulf of Alaska stock; and the Bering Sea stock (Allen and Angliss 2013). The Bering Sea stock, found throughout the Aleutian Islands and all waters north of Unimak Pass, is most likely to occur in the project Transportation Corridor. The Gulf of Alaska stock ranges from Cape Suckling in Prince William Sound to Unimak Pass and may be found in upper Cook Inlet.

The most recent population estimate for the Bering Sea stock is 48,215, based on surveys of the Bristol Bay area in 1997 through 1999 (Hobbs and Waite 2010). The most recent abundance estimate of 31,046 porpoises for the Gulf of Alaska stock is based on surveys conducted in 1998 and is now considered unreliable (Allen and Angliss 2013).

Harbor porpoises are occasionally reported up the Kuskokwim River. A single porpoise observed by field teams near Tuntutuliak in 2008 was the only one seen in three years of observations (RWJ Consulting Inc. 2009). A dead harbor porpoise was found floating near the river bank in 2009 (RWJ Consulting Inc. 2010b).

Harbor porpoises often feed on bottom-dwelling fishes and small pelagic schooling fishes with high lipid content, such as herring and anchovy (Leatherwood et al. 1982; Bjørge and Tolley 2009).

3.12.2.4 BIRDS

The EIS Analysis Area contains exceptionally important bird habitat. The affected environment for birds includes all bird populations and habitat within 10 miles of all Project Components, including migration corridors in the vicinity and downgradient (downstream) areas of habitat due to their mobility. The Mine Site and Transportation Corridor areas overlapped in surveys as Mine Site and mine access roads (Angyaruaq [Jungjuk] and BTC mine access roads) habitats are similar; these project components are discussed together in this section. Landbirds, raptors, and waterbirds are discussed separately in this section. Detailed vegetation and wetland information is discussed in Section 3.10, Vegetation and Nonnative Invasive Species, and Section 3.11, Wetlands.

Project studies with an avian component conducted between 2004 and 2013 include:

- 2008 Spring Wildlife Study, Donlin Creek Project (2004, 2007 and 2008 nocturnal owl surveys) (ARCADIS 2008b);
- 2009 Wildlife Observations on the Kuskokwim River Final Report (waterway transportation corridor wildlife surveys 2006-2009, included avian observations) (RWJ Consulting Inc. 2010b);
- Final 2010 Avian Survey Comprehensive Data Analysis, Donlin Creek Project (ARCADIS 2011b);

- 2012 Avian Point Count and Raptor Survey (habitat-based point-count surveys and raptor nest surveys from 2007-2012) (ARCADIS 2012d);
- 2012 Aerial Raptor Survey, Donlin Gold Natural Gas Pipeline Study (habitat-based raptor nest survey from 2010-2011, included swan nest observations) (ARCADIS 2012e);
- Environmental Evaluation Document, Donlin Gold Project (initial baseline study to determine what avian species were present in and near the proposed project from 2004-2005) (ARCADIS 2013a); and
- Donlin Gold Waterfowl Surveys 2013 (stream-nesting waterbird survey in 2013) (Owl Ridge 2013b).

A comprehensive summary of project surveys is included in Appendix V, Table V-3.12-1. Additional bird field surveys will not be conducted prior to the permit decision as they are not necessary to assess impacts.

3.12.2.4.1 LANDBIRDS

Mine Site and Transportation Corridor

Breeding Bird Surveys

Avian surveys conducted in the Mine Site and mine access roads were habitat-based and designed to calculate relative abundance, species richness and diversity. Because the surveys were conducted after sunrise and into the afternoon/early evening hours (outside the recommended survey period), the numbers are likely to be biased low and potentially skewed toward higher numbers for species that are vocal later in the day. Similar habitat types were surveyed within the proposed facilities and reference areas (within a five-mile buffer) in order to collect baseline data for monitoring effects of Construction and Operations.

Species observed during breeding season are likely using the Mine Site as nesting habitat. Most observed species are migrants, arriving in the area in the spring and flying south in the fall. Cliff swallows have established nesting colonies on structures at the exploration camp, under the bridge over American Creek, and on machinery near Crooked Creek. Bank swallows, semipalmated plovers, and spotted sandpipers have colonized excavated areas near Crooked Creek. Savannah sparrows are found in open areas adjacent to the current runway (Placer Dome Technical Services Limited 2005 as cited in ARCADIS 2013a). A complete list of species observed between 2007-2012 in the Mine Site and along proposed access road corridors by habitat in descending order of abundance is in Appendix V, Table V-3.12-2 (Conifer, Shrub, and Broadleaf Forest Habitats) and Table V-3.12-3 (Wet and Dry Herbaceous and Mixed Forest Habitats) (ARCADIS 2012d). A list of the 40 bird species observed at 37 survey points within 0.5 miles of the BTC mine access road is in Table V-3.12-4.

Breeding Bird Surveys took place on the YDNWR between Aniak and Napaskiak as part of a landbird monitoring program of the lower Kuskokwim River initiated in 1998. The 10 most common landbirds observed during eight Breeding Bird Survey routes along the Kuskokwim River were: northern waterthrush (2.5/stop), fox sparrow (1.5/stop), bank swallow (1.4/stop), yellow warbler (1.4/stop), gray-checked thrush (1.2/stop), blackpoll warbler (1.1/stop), redpoll sp. (0.8/stop), Wilson's warbler (0.75/stop), varied thrush (0.74/stop), and alder flycatcher (0.71/stop). Species counts were 86 in 2000 and 89 in 2002. The most abundant and widespread

species observed was the northern waterthrush. The most common species (over 1 bird observed per 3-minute survey) were northern waterthrush, fox sparrow, bank swallow, gray-cheeked thrush, yellow warbler, and blackpoll warbler. Eight species of interest (gyrfalcon, gray-cheeked thrush, varied thrush, blackpoll warbler, golden-crowned sparrow, McKay's bunting, rusty blackbird, and hoary redpoll) were analyzed for abundance. Detection frequencies indicated four of the species (gray-cheeked thrush, varied thrush, blackpoll warbler, and rusty blackbird) could successfully be monitored by this type of survey (Harwood 2000, 2002). Many of these species breed at high densities here compared to other portions of their range (Cotter and Andres 2000).

Few landbird species remain in the Mine Site or Transportation Corridor year-round. Wintering species may include common redpoll, hoary redpoll, white-winged crossbill, black-capped chickadee, boreal chickadee, snow bunting, ruffed grouse, ptarmigan species, common raven, gray jay, three-toed woodpecker, and pine grosbeak. Additional species that breed in the region may migrate over the Mine Site during spring and/or fall migration, but are not known to stop over, such as greater white-fronted geese and tundra swans. Nesting duck species generally follow rivers to the coast, migrating south along coastal marine routes (Owl Ridge 2013b).

Avian survey data was used to calculate habitat-specific density estimates for the 18 most commonly observed species (those observed more than 75 times during the six years of surveys). Density estimates were calculated by multiplying the number of birds observed by the area surveyed (150-meter radius circular plot = 17.5 acres) (ARCADIS 2012e). To account for variability in species detectability (e.g., not all birds may be detected, habitats vary in density, some may be larger/sing louder), species-specific estimates of the effective area sampled were used (effective detection radius, or EDR) (see Matsuoka et al. 2012 for specific analysis methodology). Density varied from a high of 0.42 for common redpoll in shrub habitat to a low of 0.0014 for American pipit in herbaceous habitat. Table V-3.12-5 in Appendix V includes habitat-specific density estimates for all 18 species observed per habitat type.

Waterway Transportation Corridor Wildlife Surveys

Wildlife surveys conducted within the Transportation Corridor component, along waterway transportation corridors. Surveys were designed to count all wildlife observed, including avian species. Landbird species were identified at two locations (Fowler Island and Tuntutuliak) along the Kuskokwim River route (RWJ Consulting 2010b). The most frequently seen landbirds were finches and sparrows; species were not identified. A complete list is found in Table V-3.12-6 in Appendix V.

Pipeline

Bird density estimates in the Pipeline area were available from published studies done at several locations in the Pipeline area as no project-specific point count studies were conducted. Bird densities were estimated on unburned and recently burned sites at the Bear Creek and Farewell Burn areas located approximately 25 miles southeast of McGrath, between the western slopes of the Alaska Range and the South, Windy, and Middle forks of the Kuskokwim River (Hinkes and Engels 1989) in the vicinity of Milepost 150 of the Pipeline. Density estimates were available for 16 of the 18 most common species from the Mine Site and Transportation Corridor area study; see Table V-3.12-7 in Appendix V for a complete list. There is no bird density information available for the portion of the pipeline route within the Alaska Range and Cook

Inlet Basin ecoregions, therefore no estimates of density have been made. An inventory in upland habitats similar to Pipeline areas in Katmai and Lake Clark National Parks and Preserves identified 116 species, of which over 50 were landbirds. Golden-crowned sparrows were detected at one-and-one-half times the rate of any other species. Other commonly detected species were fox sparrow, American pipit, and redpoll species (Ruthrauff et al. 2007).

Although bird surveys were not conducted in the Pipeline area, existing information on bird species and density was judged to be sufficient to describe the type of impacts that could occur, and their intensity, duration, extent, and context, and to determine that the loss of habitat would not cause population-level declines in any species.

3.12.2.4.2 RAPTORS

Mine Site and Transportation Corridor

Breeding Bird Surveys and Aerial Raptor Nest Surveys

During the breeding bird survey, raptor species were observed in wet herbaceous habitats (one northern harrier, one osprey, and one merlin), in conifer forest habitats (one rough-legged hawk), in shrub habitats (one red-tailed hawk), and in broadleaf forest habitats (one Swainson's hawk) (ARCADIS 2012d). During the aerial raptor nest survey, the number of occupied nests ranged from 15 to 63 during the six years of surveys. Nests of 14 raptor species were identified. Cavity-nesting and forest-nesting raptors were recorded opportunistically as aerial surveys are generally less effective for detecting forest-dwelling raptor nests, (e.g., goshawk, cavity-nesting owls and boreal owls).

Total number of nests observed (not the number of nests in the area at any one time, as the number may include multiple counting of the same nest) by occupancy and by species are listed in Appendix V, Table V-3.12-8 and Table V-3.12-9. Nests were also noted adjacent to the proposed Angyaruaq (Jungjuk) mine access road and to the proposed BTC mine access road (Table V-3.12-10 and Table V-3.12-11 in Appendix V) (ARCADIS 2012e). No nests of the smaller cavity-nesting owl species were located. However, northern hawk owls (Surnia ulula) and boreal owls (Aegolius funereus) were observed during the point count survey and aerial raptor nest surveys after being flushed from forest thickets (ARCADIS 2011b). Figure 3.12-3 shows the locations of raptor nests identified during the most recent (2012) survey for the Mine Site and Transportation Corridor.

Bald eagles were the most abundant species observed during all survey years, followed closely by Harlan's red-tailed hawks, peregrine falcons and red-tailed hawks. Raptor nests were located in both living and dead spruce trees and cliffs or rocky outcrops. All occupied nests identified were located within 400 meters (0.25-mile) of a cliff, river, creek, or stream. These data support the conclusion that raptor species are using the Mine Site area for breeding.

Most of these species are migrants, present only during spring, summer, and early fall. Few raptor species remain in the Mine Site or Transportation Corridor area year-round. While no winter surveys have been conducted, raptors known to winter in the region include the gyrfalcon, northern hawk owl, boreal owl, great horned owl, great gray owl, and snowy owl. Camp personnel have frequently observed northern hawk owls during the winter (ARCADIS 2013a).

Waterway Transportation Corridor Wildlife Surveys

The two most common raptors incidentally observed during the waterway transportation corridor wildlife survey were the northern harrier (137 seen in 2009) and eagle (species not identified) with 35-40 annually. Raptor species less associated with aquatic habitats (hawks, falcons, and owls) were observed in smaller numbers (RWJ Consulting, Inc. 2010b). A complete list of raptor species observed is given in Table V-3.12-13 in Appendix V.

USFWS Surveys

Peregrine falcon nesting surveys conducted by BLM along the Kuskokwim River between McGrath and Aniak from 2000 to 2004 observed 20 pairs of peregrines occupying breeding territories, the highest since a historical recorded low in 1976, indicating that the breeding population may still be increasing (Seppi 2007). Other raptor species recorded during the 2000 to 2004 peregrine surveys included 15 pairs of rough-legged hawks that produced 25 young, one breeding pair of bald eagles, and one pair of breeding osprey (Seppi 2007).

Pipeline

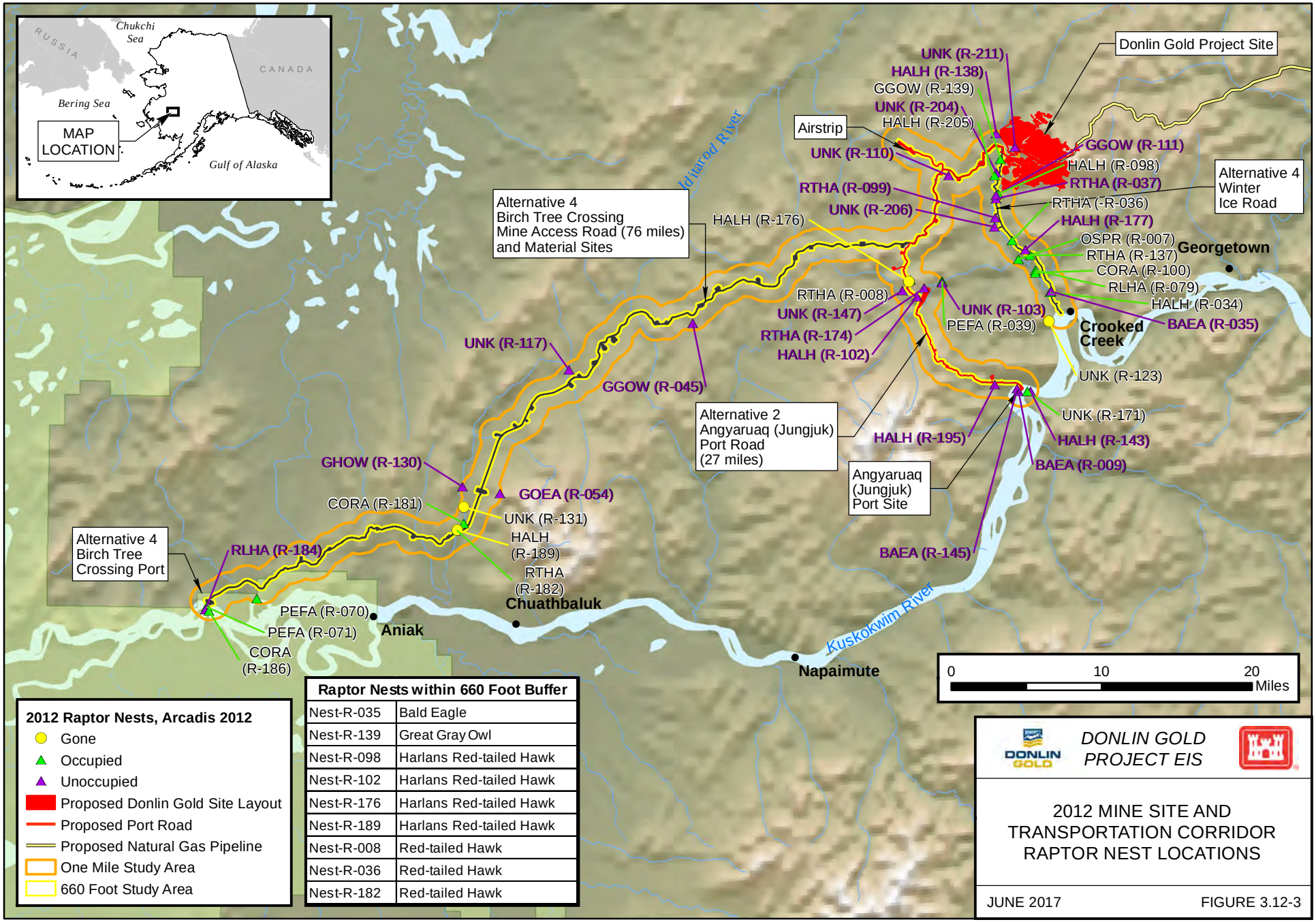
Aerial raptor surveys conducted by helicopter focused on suitable nesting habitats within one-mile on each side of the 316-mile Pipeline from late May to early June to coincide with raptor nesting activity in the region prior to vegetation leaf out. The survey was completed during the breeding season after the majority of species had finished courtship and were either incubating eggs or rearing young, allowing biologists to determine if nests were occupied or unoccupied. (ARCADIS 2012e). A complete list of nests is listed in Table V-3.12-11, Appendix V; abundance along the Pipeline route is shown in Table V-3.12-12.

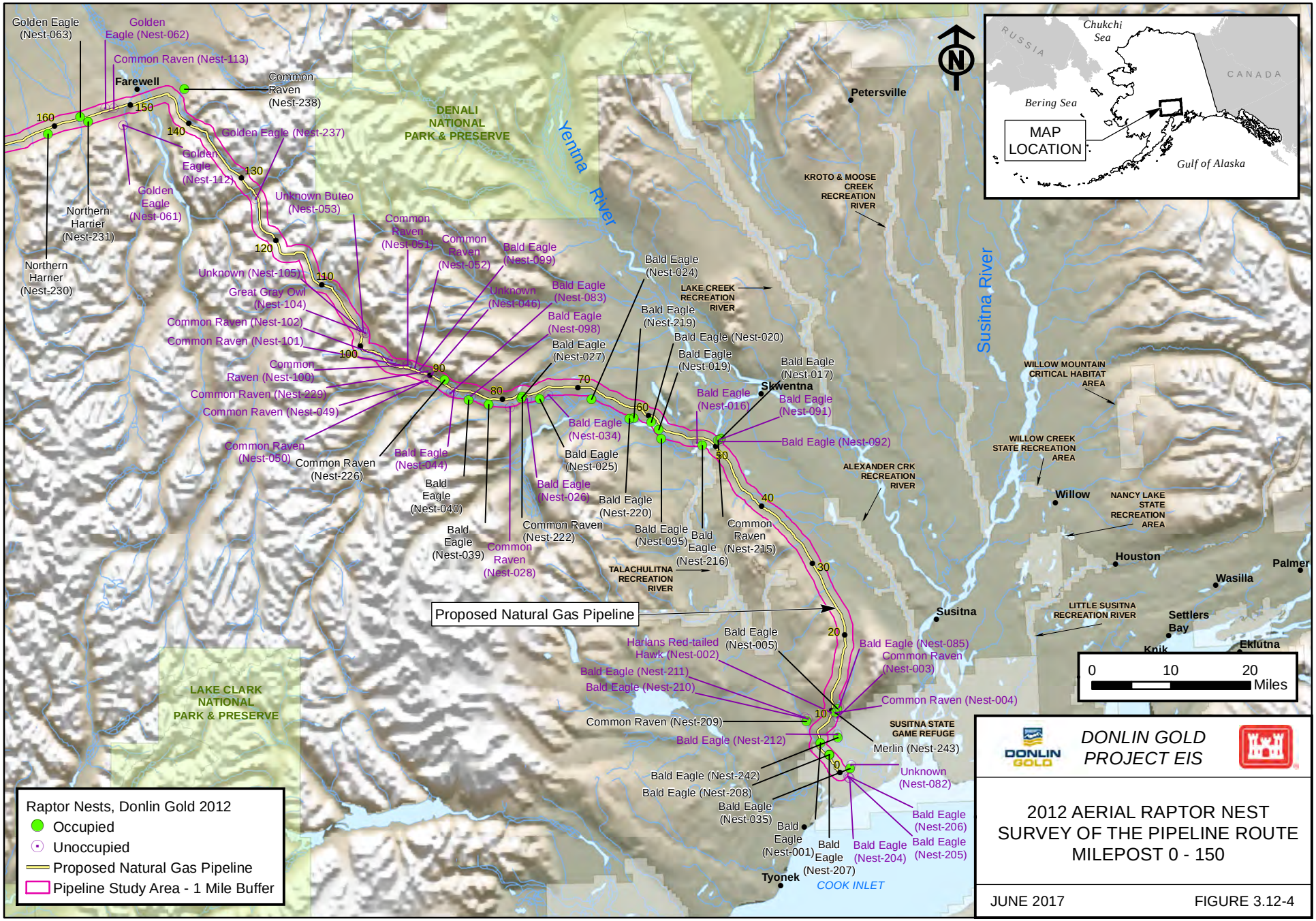
Raptor species generally select nesting sites that are relatively inaccessible and close to areas with a sufficient prey base to feed their young. Nests are commonly found in mature cottonwood, black spruce, and white spruce trees along riparian corridors. Cliff nest locations were common with 27 percent of all raptor nests located in 2011. All of the occupied raptor nests identified were within 800 m (0.5 mile) of a river, creek, or stream as mature trees and cliffs are often associated with riparian areas (ARCADIS 2012e). Figure 3.12-4 and Figure 3.13-5 show survey raptor nest locations in the Pipeline component.

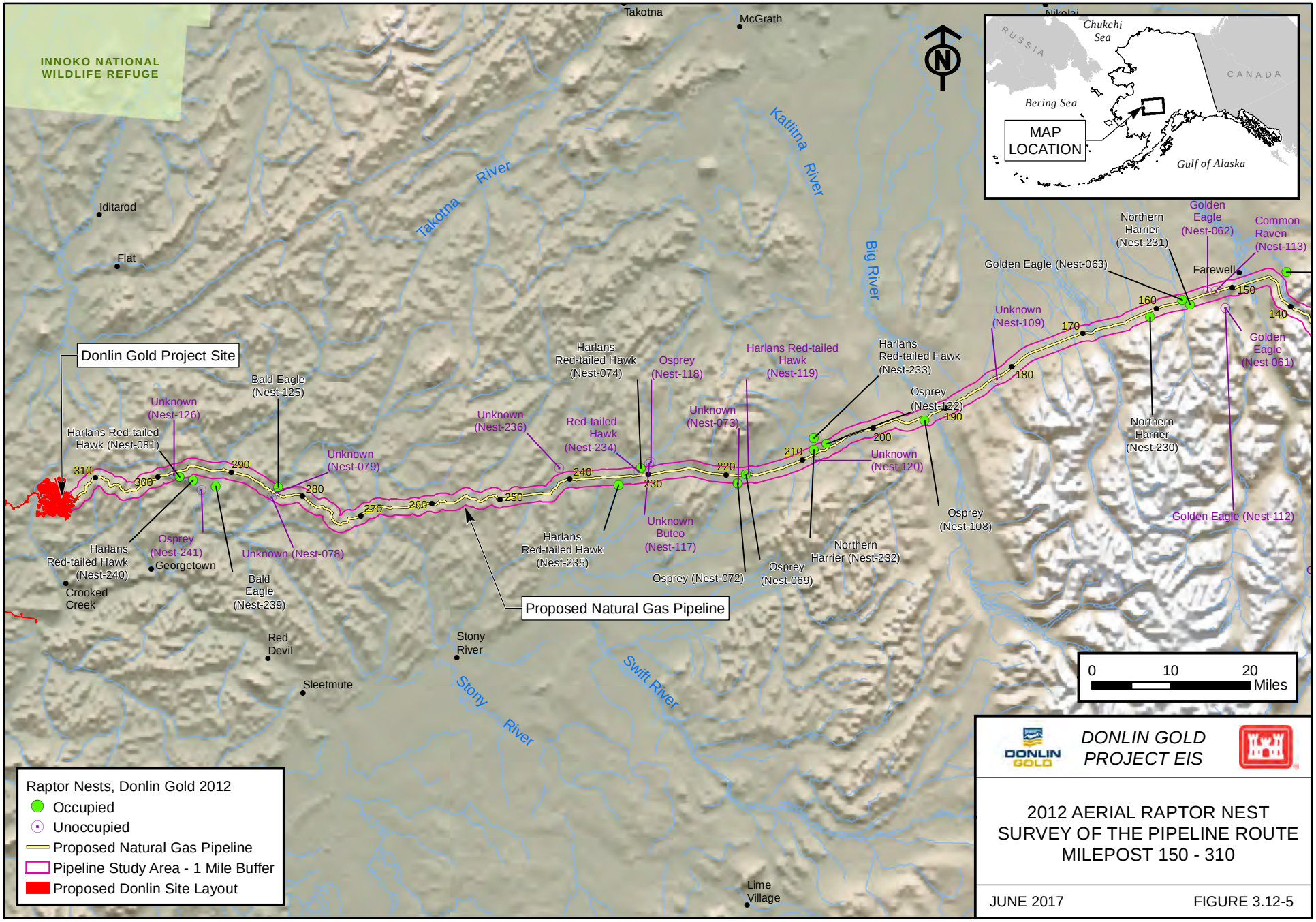
3.12.2.4.3 WATERBIRDS

Mine Site and Transportation Corridor

The Y-K Delta, long known for its abundance of waterbirds, was first established as a preserve and breeding ground for native birds in 1909 by President Theodore Roosevelt. A large portion of the global population of many waterfowl and shorebird species breed or migrate through the Y-K Delta with densities in wetlands of 416 shorebirds / km^2 (McCaffery et al. 2012), the highest recorded in North America (Bart and Johnston 2012). Other important populations include over one million ducks, half a million geese, and various raptors (USFWS 2014c). The area from the mouth of the Kuskokwim River north to the Seward Peninsula supports some of the highest local breeding densities of shorebirds in the world (Meltofte et al. 2007).


RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
Donlin Gold Project Site
Airstrip
Alternative 4 Birch Tree Crossing Mine Access Road (76 miles) and Material Sites
Alternative 4 Winter Ice Road
Alternative 2 Angyaruaq (Jungjuk) Port Road (27 miles)
Angyaruaq (Jungjuk) Port Site
Alternative 4 Birch Tree Crossing Port
Iditarod River
Kuskokwim River
Georgetown
Crooked Creek
Chuathbaluk
Aniak
Napaimute
UNK (R-211)
HALH (R-138)
GGOW (R-139)
UNK (R-204)
HALH (R-205)
UNK (R-110)
GGOW (R-111)
HALH (R-098)
RTHA (R-037)
RTHA (R-099)
RTHA (R-036)
UNK (R-206)
HALH (R-177)
HALH (R-176)
OSPR (R-007)
RTHA (R-137)
CORA (R-100)
RLHA (R-079)
HALH (R-034)
BAEA (R-035)
RTHA (R-008)
UNK (R-147)
RTHA (R-174)
HALH (R-102)
UNK (R-103)
PEFA (R-039)
UNK (R-117)
GGOW (R-045)
UNK (R-123)
UNK (R-171)
HALH (R-195)
HALH (R-143)
BAEA (R-009)
GHOW (R-130)
GOEA (R-054)
CORA (R-181)
UNK (R-131)
HALH (R-189)
RTHA (R-182)
RLHA (R-184)
BAEA (R-145)
PEFA (R-070)
PEFA (R-071)
CORA (R-186)
0
10
20
Miles
2012 Raptor Nests, Arcadis 2012
Gone
Occupied
Unoccupied
Proposed Donlin Gold Site Layout
Proposed Port Road
Proposed Natural Gas Pipeline
One Mile Study Area
660 Foot Study Area
Raptor Nests within 660 Foot Buffer
Nest-R-035 Bald Eagle
Nest-R-139 Great Gray Owl
Nest-R-098 Harlans Red-tailed Hawk
Nest-R-102 Harlans Red-tailed Hawk
Nest-R-176 Harlans Red-tailed Hawk
Nest-R-189 Harlans Red-tailed Hawk
Nest-R-008 Red-tailed Hawk
Nest-R-036 Red-tailed Hawk
Nest-R-182 Red-tailed Hawk
DONLIN GOLD
DONLIN GOLD PROJECT EIS
2012 MINE SITE AND TRANSPORTATION CORRIDOR RAPTOR NEST LOCATIONS
JUNE 2017
FIGURE 3.12-3


Golden Eagle (Nest-063)
Golden Eagle (Nest-062)
Common Raven (Nest-113)
Farewell
Common Raven (Nest-238)
Golden Eagle (Nest-237)
Golden Eagle (Nest-112)
Golden Eagle (Nest-061)
Northern Harrier (Nest-231)
Northern Harrier (Nest-230)
Unknown Buteo (Nest-053)
Unknown (Nest-105)
Great Gray Owl (Nest-104)
Common Raven (Nest-102)
Common Raven (Nest-101)
Common Raven (Nest-100)
Common Raven (Nest-229)
Common Raven (Nest-049)
Common Raven (Nest-050)
Common Raven (Nest-226)
Common Raven (Nest-051)
Common Raven (Nest-052)
Bald Eagle (Nest-099)
Unknown (Nest-046)
Bald Eagle (Nest-083)
Bald Eagle (Nest-098)
Bald Eagle (Nest-027)
Bald Eagle (Nest-034)
Bald Eagle (Nest-025)
Bald Eagle (Nest-044)
Bald Eagle (Nest-040)
Bald Eagle (Nest-039)
Bald Eagle (Nest-026)
Common Raven (Nest-222)
Common Raven (Nest-028)
Bald Eagle (Nest-024)
Bald Eagle (Nest-219)
Bald Eagle (Nest-020)
Bald Eagle (Nest-019)
Bald Eagle (Nest-017)
Bald Eagle (Nest-016)
Bald Eagle (Nest-091)
Bald Eagle (Nest-092)
Bald Eagle (Nest-220)
Bald Eagle (Nest-095)
Bald Eagle (Nest-216)
Common Raven (Nest-215)
Proposed Natural Gas Pipeline
Bald Eagle (Nest-005)
Harlans Red-tailed Hawk (Nest-002)
Bald Eagle (Nest-211)
Bald Eagle (Nest-210)
Bald Eagle (Nest-085)
Common Raven (Nest-003)
Common Raven (Nest-004)
Common Raven (Nest-209)
Bald Eagle (Nest-212)
Merlin (Nest-243)
Unknown (Nest-082)
Bald Eagle (Nest-242)
Bald Eagle (Nest-208)
Bald Eagle (Nest-035)
Bald Eagle (Nest-001)
Bald Eagle (Nest-207)
Bald Eagle (Nest-204)
Bald Eagle (Nest-206)
Bald Eagle (Nest-205)
DENALI NATIONAL PARK & PRESERVE
LAKE CLARK NATIONAL PARK & PRESERVE
Yentna River
Susitna River
KROTO & MOOSE CREEK RECREATION RIVER
LAKE CREEK RECREATION RIVER
ALEXANDER CRK RECREATION RIVER
TALACHULITNA RECREATION RIVER
WILLOW MOUNTAIN CRITICAL HABITAT AREA
WILLOW CREEK STATE RECREATION AREA
NANCY LAKE STATE RECREATION AREA
LITTLE SUSITNA RECREATION RIVER
SUSITNA STATE GAME REFUGE
Petersville
Skwentna
Willow
Houston
Palmer
Wasilla
Susitna
Settlers Bay
Knik
Eklutna
Tyonek
COOK INLET
Chukchi Sea
Bering Sea
RUSSIA
CANADA
Gulf of Alaska
MAP LOCATION
N
0 10 20 Miles
Raptor Nests, Donlin Gold 2012
Occupied
Unoccupied
Proposed Natural Gas Pipeline
Pipeline Study Area - 1 Mile Buffer
DONLIN GOLD
DONLIN GOLD PROJECT EIS
2012 AERIAL RAPTOR NEST SURVEY OF THE PIPELINE ROUTE MILEPOST 0 - 150
JUNE 2017
FIGURE 3.12-4


INNOKO NATIONAL WILDLIFE REFUGE
Takotna
McGrath
Nikolai
Iditarod
Flat
Takotna River
Kaltlina River
Big River
Swift River
Stony River
Red Devil
Sleetmute
Stony River
Lime Village
Donlin Gold Project Site
Proposed Natural Gas Pipeline
Harlans Red-tailed Hawk (Nest-081)
Unknown (Nest-126)
Bald Eagle (Nest-125)
Unknown (Nest-079)
Unknown (Nest-078)
Harlans Red-tailed Hawk (Nest-240)
Crooked Creek
Osprey (Nest-241)
Georgetown
Bald Eagle (Nest-239)
Unknown (Nest-236)
Harlans Red-tailed Hawk (Nest-074)
Red-tailed Hawk (Nest-234)
Osprey (Nest-118)
Harlans Red-tailed Hawk (Nest-235)
Unknown Buteo (Nest-117)
Osprey (Nest-072)
Unknown (Nest-073)
Harlans Red-tailed Hawk (Nest-119)
Osprey (Nest-069)
Harlans Red-tailed Hawk (Nest-233)
Unknown (Nest-120)
Northern Harrier (Nest-232)
Osprey (Nest-122)
Osprey (Nest-108)
Unknown (Nest-109)
Golden Eagle (Nest-063)
Northern Harrier (Nest-231)
Golden Eagle (Nest-062)
Common Raven (Nest-113)
Farewell
Golden Eagle (Nest-061)
Northern Harrier (Nest-230)
Golden Eagle (Nest-112)
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
N
0 10 20 Miles
Raptor Nests, Donlin Gold 2012
Occupied
Unoccupied
Proposed Natural Gas Pipeline
Pipeline Study Area - 1 Mile Buffer
Proposed Donlin Site Layout
DONLIN GOLD
DONLIN GOLD PROJECT EIS
2012 AERIAL RAPTOR NEST SURVEY OF THE PIPELINE ROUTE MILEPOST 150 - 310
JUNE 2017
FIGURE 3.12-5

The YDNWR is a Western Hemisphere Shorebird Reserve network site of hemispheric importance. Such a site provides staging, nesting, or breeding grounds for at least 500,000 shorebirds annually or at least 30 percent of the biogeographic population of any species. The YDNWR is also an East Asian Australasian Flyway Partnership Network Site for migratory waterbirds. Such a site supports at least 20,000 migratory waterbirds annually or appreciable numbers of an endangered or vulnerable population. The ADF&G has identified the mouth and lower region of the Kuskokwim River, including the YDNWR, as a "Most Environmentally Sensitive Area" due to the dense populations of waterfowl during the spring and fall seasons and the presence of anadromous lakes and streams (Cenaliulriit CRSA CMP 2006).

The SFSGR has large spring and fall concentrations of migrating waterfowl and shorebirds, including several thousand lesser sandhill cranes and over 8,000 swans. Spring migration of ducks, geese and swans number well in excess of 100,000 birds (ADF&G 2014c). This area has been designated as an Important Bird Area with total daily counts of waterfowl exceeding 36,000 birds during spring migration (National Audubon Society 2013, see Figure 3.12-6 for a depiction of Important Bird Areas). The site's principal importance is the rock sandpiper (*Calidris ptilocnemis ptilocnemis*), where virtually the entire population resides between early October and late April.

Low numbers of waterbirds are thought to nest in the Mine Site area; nests are expected in areas bordering the larger creeks and wetland habitat-type areas (i.e., Crooked Creek) (Placer Dome Technical Services Limited 2005). Higher numbers of waterbirds may occur where the proposed mine access roads cross Crooked Creek and Getmuna Creek, and in the vicinity of the Kuskokwim River. Harlequin ducks breed in many of the watersheds draining the Kuskokwim Mountains, as well as other suitable habitats. 164 pairs of harlequin ducks were documented during surveys on the Kisaralik, Kwethluk, and Eek rivers and their tributaries (McCaffery and Harwood 1994). Harlequin ducks were found nesting throughout the Kilbuk and Ahklun mountains and molting along the coast (Weir et al. 1982).

The proposed shipping route from Dutch Harbor through Bristol Bay to the mouth of Kuskokwim Bay is used year-round by many species of migratory birds, and crosses marine migration routes used by many species of waterfowl and seabirds (emperor goose, brant, Steller's eider (discussed in Section 3.14, Threatened and Endangered Species), common eider, king eider, black scoter, dunlin and western sandpiper). These areas are estimated to contain some 23 million marine birds of 30 species, with the Bering Sea supporting the greatest number of breeding seabirds, approximately 48 percent of all species documented in Alaska. The most abundant species are black-legged and red-legged kittiwakes, common and thick-billed murres, parakeet, crested, and least auklets, horned and tufted puffins, northern fulmar, pelagic cormorant, and glaucous-winged gull. Migration routes are generally along the coastline, although some species travel further inland during the spring migration. Birds known to winter along the route include pelagic cormorant, black-legged kittiwake, common and thick-billed murres, and tufted puffin, with wintering areas along the coasts of the southern Alaska Peninsula and Aleutian Islands. A large portion of the marine transportation route is mapped as a major summer concentration area for sooty and short-tailed shearwaters (Gill et al 1978).

Kuskokwim Bay is an important fall staging area for king eiders based on birds implanted with satellite transmitters (Oppel et al. 2008). King eiders undergoing wing molt were also located in Kuskokwim Bay (Phillips et al. 2006). Kuskokwim Shoals is an important staging and feeding area for waterfowl during spring and fall migration (Larned and Tiplady 1996).

Stream-Nesting Waterbird Surveys

Stream-nesting waterbird surveys were conducted along Crooked Creek, Getmuna Creek, Jungjuk Creek, and the Kuskokwim River to characterize breeding waterbird use in the vicinity of the Mine Site and Transportation Corridor on the Kuskokwim River between Crooked Creek and Bethel. Surveys were conducted in June 2013 to characterize breeding waterbird use in the stream drainages associated with the proposed mine and access road (Angyaruaq [Jungjuk Road]), and along the proposed supply barging route on the Kuskokwim River between Crooked Creek and Bethel. Waterfowl and shorebirds were observed in low numbers in the Mine Site during point count surveys; a list of species and access by location (Crooked, Getmuna, and Jungjuk creeks) are given in Table V-3.12-14 and Table V-3.12-15, Appendix V.

Results (Figure 3.12-7) and location (Figure 3.12-8) suggest only a few pairs of red-breasted mergansers, common mergansers, green-winged teal, mallards, and Canada or cackling geese may nest in the stream drainages associated with the Mine Site and mine access roads. No harlequin ducks were observed during any of the surveys. Only Crooked Creek and the lowest reaches of Getmuna Creek are wide enough to be suitable habitat, and Crooked Creek is dominated by silt substrate rather than the gravel and cobbles this species prefers (Crowley 1994). The survey also determined that the following drainages did not appear to be suitable breeding habitat for waterfowl: American Creek, Anaconda Creek, Crevice Creek, Quartz Gulch, Snow Gulch, Queen Gulch, Lewis Gulch, and Omega Gulch. These swift-flowing streams are less than 6 feet wide with densely vegetated and often steep riparian areas dominated by alder and black spruce. Quartz and Lewis Creeks, and Omega Gulch were dry at the time of the survey.

Nearly 1,110 birds of 26 species of waterfowl, waterbirds, shorebirds, and river associated raptors were observed on the Kuskokwim River (see Appendix V, Table V-3.12-16 for a complete list). Arctic terns and gulls (glaucous, glaucous-winged, and mew) were the most common birds recorded, especially along the lower half of the river closer to the coast. American wigeon, northern pintails, mallards, and greater white-fronted geese were the most common waterfowl, while spotted and other sandpipers were the most common shorebirds. Twenty bald eagles, ten osprey, and four peregrine falcons were also recorded. Most waterfowl, waterbirds, and shorebirds were found on gravel bars or at the heads of sand islands. Most eagles and osprey were located near the mouths of clear-water streams (Owl Ridge 2013b).

Waterway Transportation Corridor Survey

Waterbird species were identified during waterway transportation corridor wildlife surveys at two locations (Fowler Island and Tuntutuliak) along the Kuskokwim River route (RWJ Consulting 2010b) (Figure 3.12-9). Large bands of waterbirds were documented moving through the Kuskokwim River Delta on an annual basis between May and October for nesting, staging and migratory behavior (RWJ Consulting Inc. 2010b). Over 100 confirmed species of birds were recorded. The greatest numbers seen were geese, gulls, and ptarmigan species, representing more than half of the total number of birds observed. A complete list of waterbirds observed during this survey is included in Appendix V, Table V-3.12-17.

USFWS Surveys

The USFWS has conducted aerial breeding waterbird surveys of wetlands around Alaska for many years to provide abundance, distribution, and trend information for many species.

Surveys on the YDNWR near the Transportation Corridor and the Mine Site (Platte and Butler 1993; Platte 2003; Platte et al. 2012) found that waterbirds were widespread throughout the survey area (Figure 3.12-10).

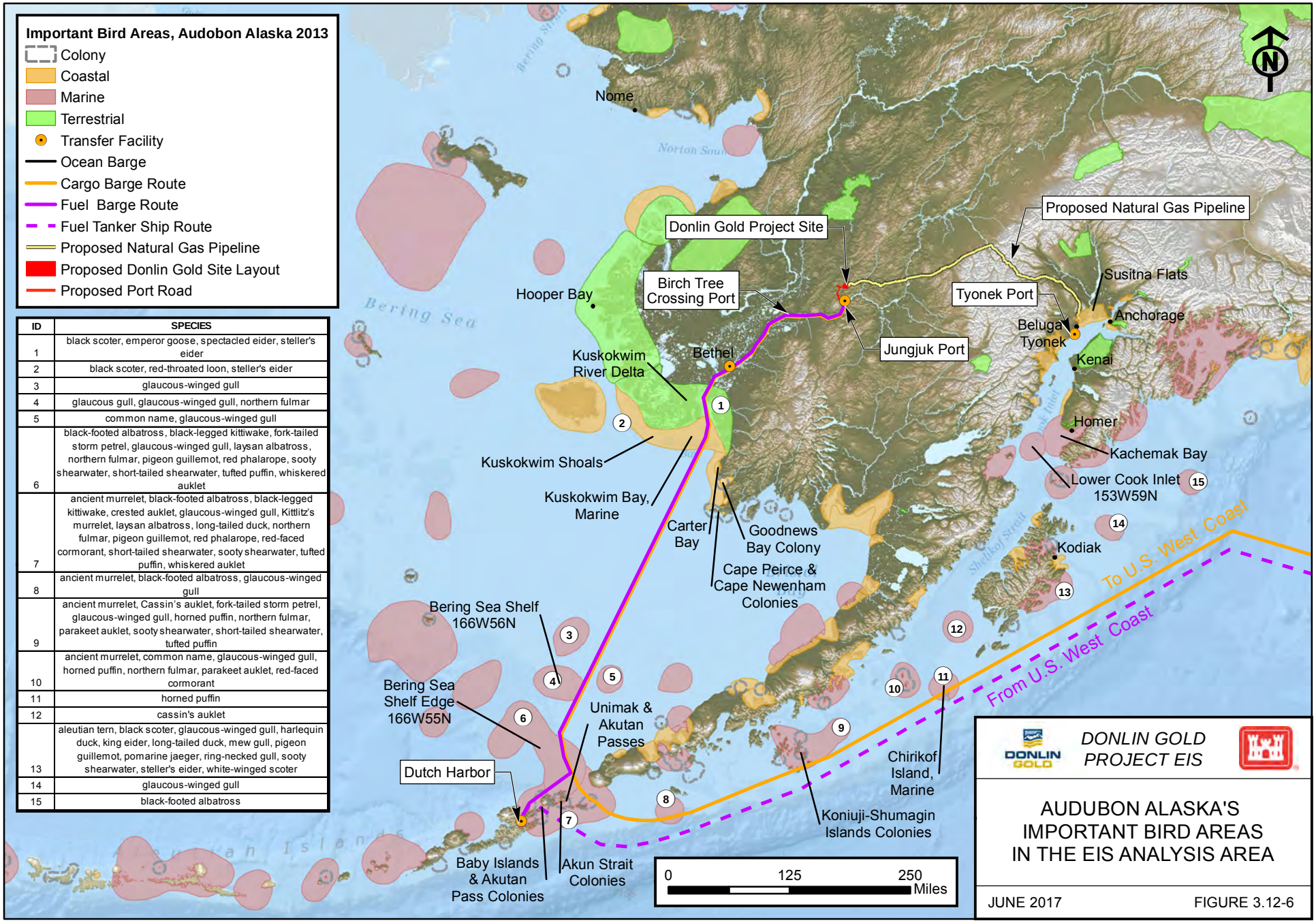
Pipeline

Much of the habitat found along the pipeline route west of the Alaska Range is not favorable to heavy use by waterbirds. However, habitats found on the east side of the Alaska Range within the Cook Inlet drainage are suitable for waterbird use. The SFSGR, which encompasses the first five miles of the pipeline corridor, contains habitat that is used by as many as 100,000 waterfowl during peak times of the year (ADF&G 2014c). Figure 3.12-11 shows kernel density distribution of bird sightings from aerial surveys on the Kenai Peninsula and Susitna lowlands conducted by the USFWS in 2003 and 2010 (Platte et al. 2012). Species documented on the SFSGR include mallards, northern pintails, Canada geese, tule white-fronted geese, lesser sandhill cranes, and swans. Phalaropes, dowitchers, godwits, whimbrels, snipes, yellowlegs, sandpipers, plovers, and dunlins are among the most abundant of shorebirds (Clausen et al. 1988).

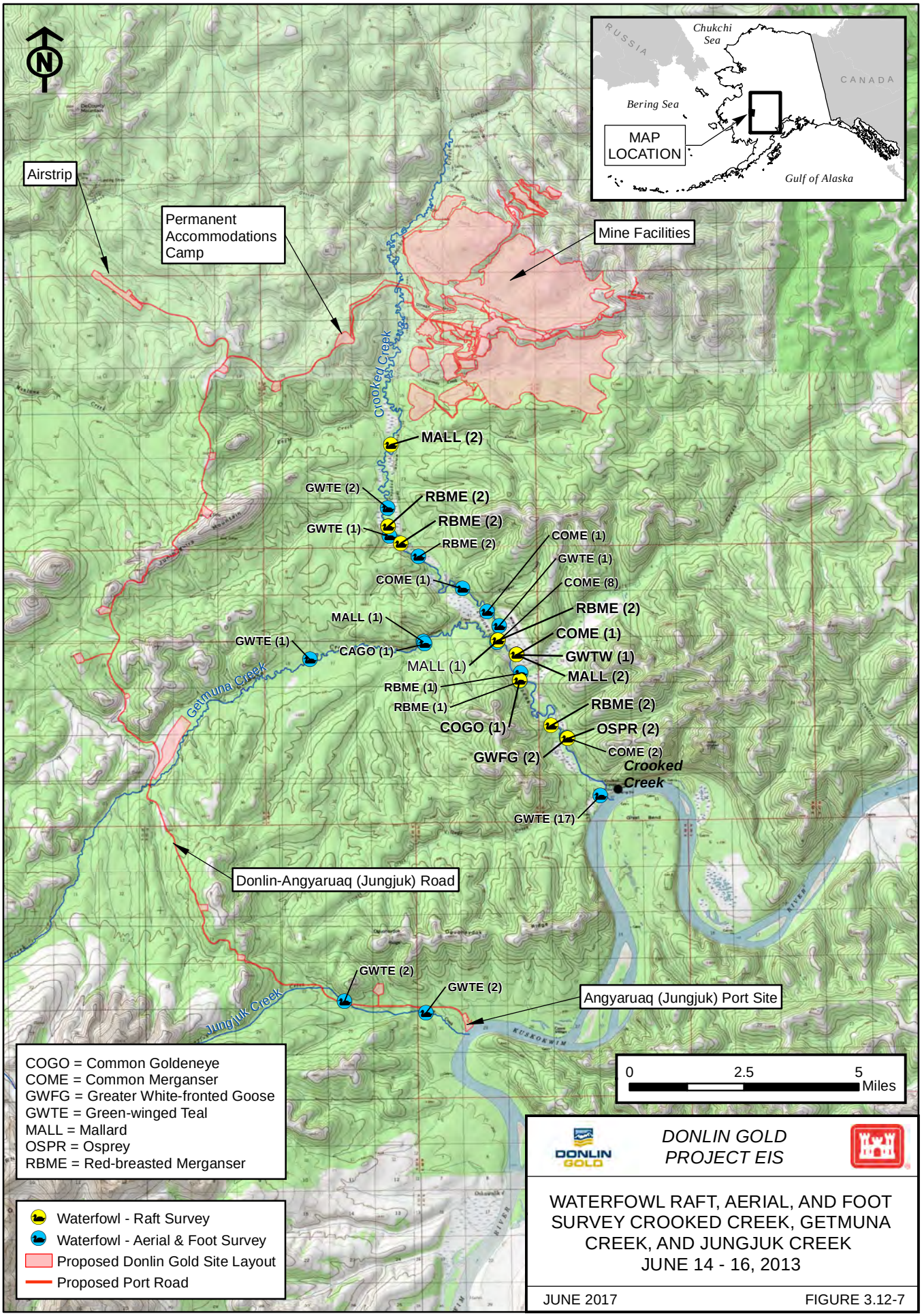
The aerial raptor survey (ARCADIS 2012e) along the pipeline corridor noted tundra and trumpeter swan nests as well. Figure 3.12-12 shows these locations, as well as locations of observations from USFWS data (USFWS 2005b).

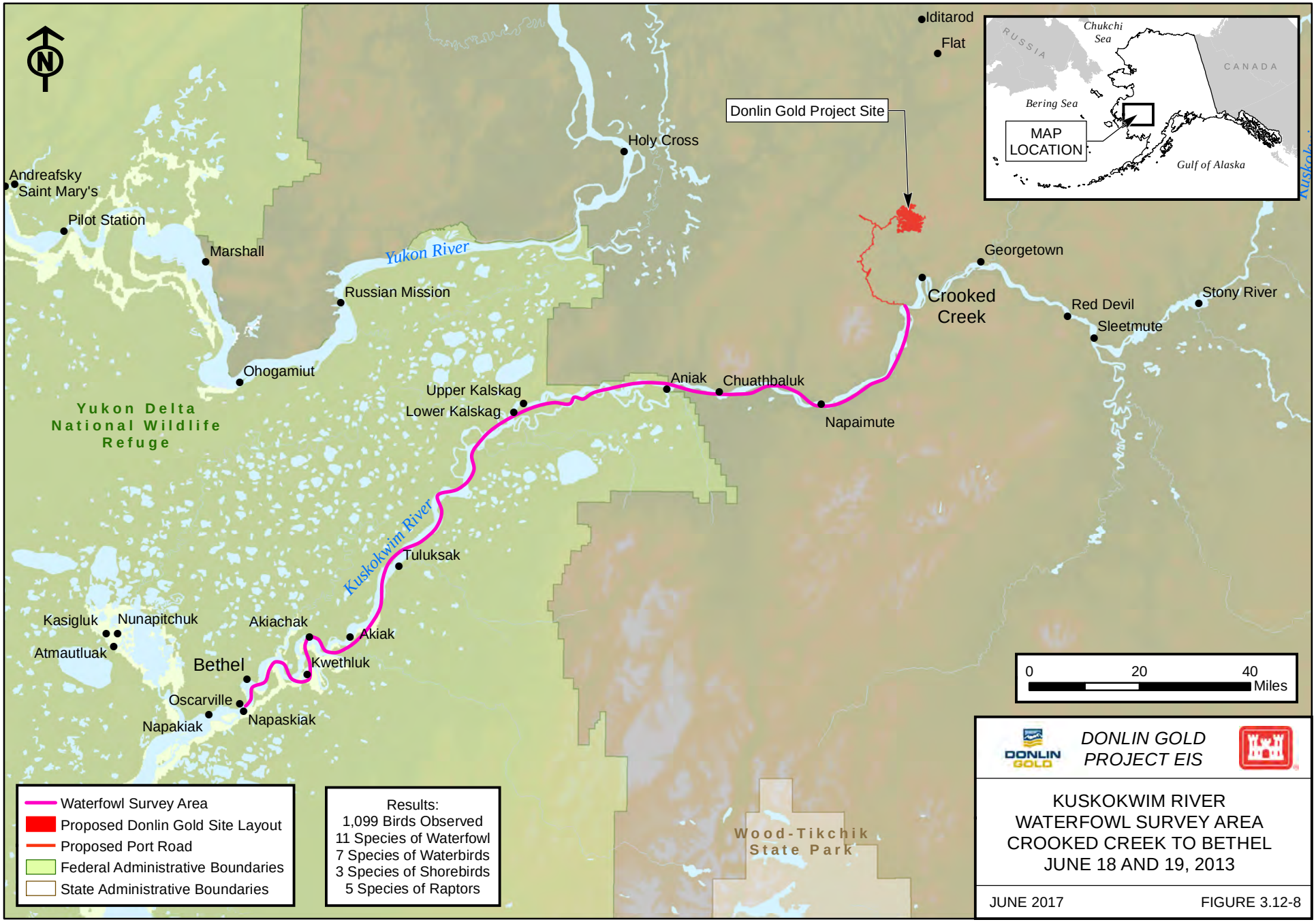
3.12.2.4.4 SPECIAL STATUS SPECIES

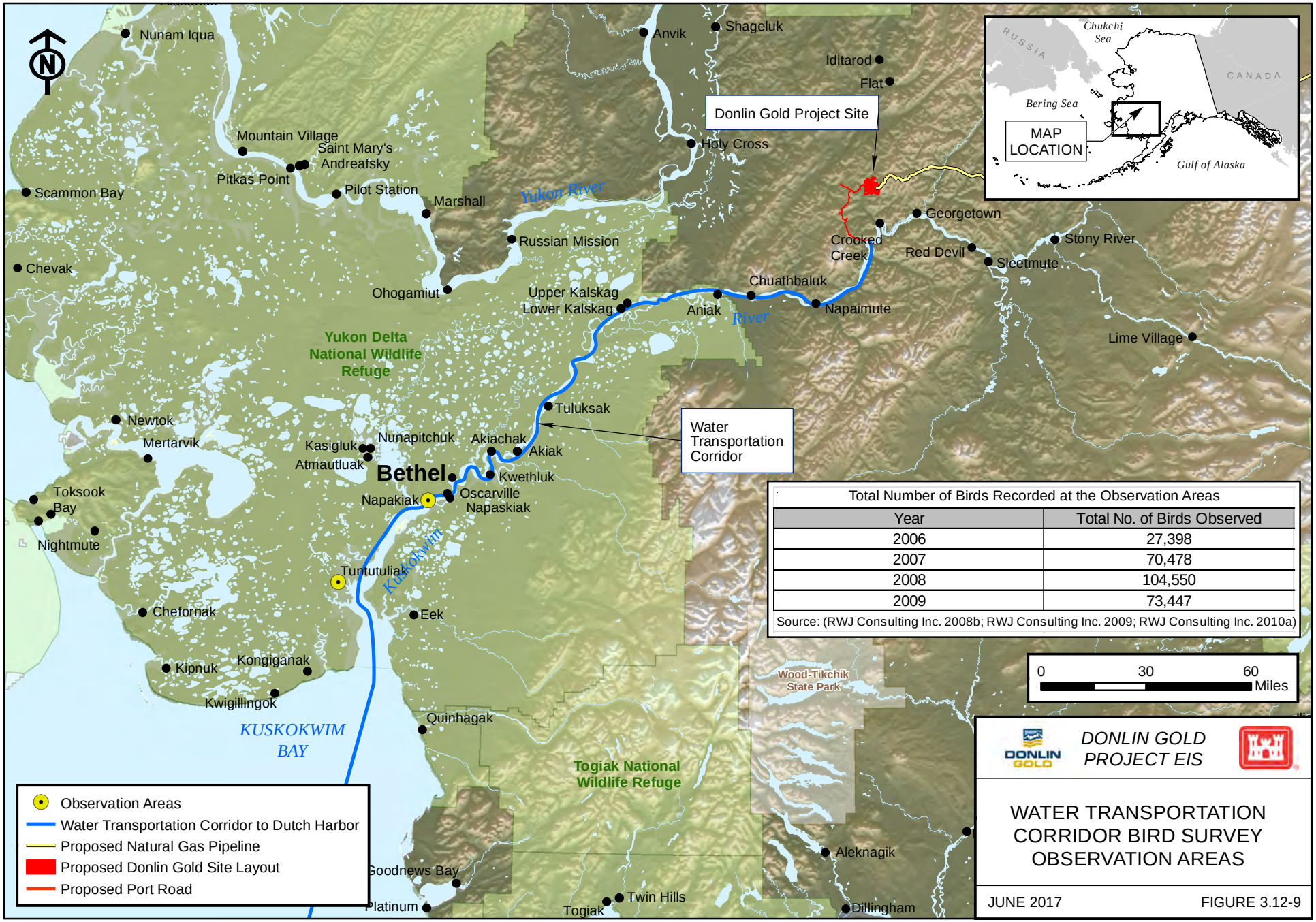
Thirty-one bird species that appear on at least one Alaska specific lists of bird species warranting special concern or conservation, including lists from the BLM, ADF&G, USGS, USFWS, and Audubon Alaska, have been observed or detected in or near the EIS Analysis Area (Appendix V, Table V-13.12-18). Data from the YDNWR breeding bird surveys indicates several species of special concern or conservation need are nesting in the area (Harwood 2000, 2002). Four species (black scoter, Hudsonian godwit, black turnstone, and rock sandpiper) occur in high numbers with a large portion of their global populations in the EIS Analysis Area. This designation does not include any special protections, although species may receive special attention or study.



ID	SPECIES
1	black scoter, emperor goose, spectacled eider, steller's eider
2	black scoter, red-throated loon, steller's eider
3	glaucous-winged gull
4	glaucous gull, glaucous-winged gull, northern fulmar
5	common name, glaucous-winged gull
6	black-footed albatross, black-legged kittiwake, fork-tailed storm petrel, glaucous-winged gull, laysan albatross, northern fulmar, pigeon guillemot, red phalarope, sooty shearwater, short-tailed shearwater, tufted puffin, whiskered auklet
7	ancient murrelet, black-footed albatross, black-legged kittiwake, crested auklet, glaucous-winged gull, Kittlitz's murrelet, laysan albatross, long-tailed duck, northern fulmar, pigeon guillemot, red phalarope, red-faced cormorant, short-tailed shearwater, sooty shearwater, tufted puffin, whiskered auklet
8	ancient murrelet, black-footed albatross, glaucous-winged gull
9	ancient murrelet, Cassin's auklet, fork-tailed storm petrel, glaucous-winged gull, horned puffin, northern fulmar, parakeet auklet, sooty shearwater, short-tailed shearwater, tufted puffin
10	ancient murrelet, common name, glaucous-winged gull, horned puffin, northern fulmar, parakeet auklet, red-faced cormorant
11	horned puffin
12	cassin's auklet
13	aleutian tern, black scoter, glaucous-winged gull, harlequin duck, king eider, long-tailed duck, mew gull, pigeon guillemot, pomarine jaeger, ring-necked gull, sooty shearwater, steller's eider, white-winged scoter
14	glaucous-winged gull
15	black-footed albatross


Airstrip
Permanent Accommodations Camp
Mine Facilities
Crooked Creek
Getmuna Creek
Jungjuk Creek
Donlin-Angyaruaq (Jungjuk) Road
Angyaruaq (Jungjuk) Port Site
MALL (2)
GWTE (2)
RBME (2)
GWTE (1)
RBME (2)
RBME (2)
COME (1)
GWTE (1)
COME (1)
COME (8)
RBME (2)
MALL (1)
COME (1)
GWTE (1)
CAGO (1)
GWTW (1)
MALL (1)
MALL (2)
RBME (1)
RBME (1)
RBME (2)
COGO (1)
OSPR (2)
COME (2)
GWFG (2)
Crooked Creek
GWTE (17)
GWTE (2)
GWTE (2)
COGO = Common Goldeneye
COME = Common Merganser
GWFG = Greater White-fronted Goose
GWTE = Green-winged Teal
MALL = Mallard
OSPR = Osprey
RBME = Red-breasted Merganser
Waterfowl - Raft Survey
Waterfowl - Aerial & Foot Survey
Proposed Donlin Gold Site Layout
Proposed Port Road
0
2.5
5
Miles
MAP LOCATION
Chukchi Sea
RUSSIA
CANADA
Bering Sea
Gulf of Alaska
DONLIN GOLD
DONLIN GOLD PROJECT EIS
WATERFOWL RAFT, AERIAL, AND FOOT SURVEY CROOKED CREEK, GETMUNA CREEK, AND JUNGJUK CREEK JUNE 14 - 16, 2013
JUNE 2017
FIGURE 3.12-7


Iditarod
Flat
Donlin Gold Project Site
Holy Cross
Andreafsky
Saint Mary's
Pilot Station
Marshall
Yukon River
Russian Mission
Ohogamiut
Yukon Delta
National Wildlife
Refuge
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Georgetown
Crooked
Creek
Red Devil
Sleetmute
Stony River
Kuskokwim River
Tuluksak
Kasigluk
Nunapitchuk
Atmautluak
Akiachak
Akiak
Bethel
Kwethluk
Oscarville
Napaskiak
Napakiak
Wood-Tikchik
State Park
Chukchi
Sea
RUSSIA
CANADA
Bering Sea
MAP
LOCATION
Gulf of Alaska
Waterfowl Survey Area
Proposed Donlin Gold Site Layout
Proposed Port Road
Federal Administrative Boundaries
State Administrative Boundaries
Results:
1,099 Birds Observed
11 Species of Waterfowl
7 Species of Waterbirds
3 Species of Shorebirds
5 Species of Raptors
0
20
40
Miles
DONLIN GOLD
DONLIN GOLD
PROJECT EIS
KUSKOKWIM RIVER
WATERFOWL SURVEY AREA
CROOKED CREEK TO BETHEL
JUNE 18 AND 19, 2013
JUNE 2017
FIGURE 3.12-8



Total Number of Birds Recorded at the Observation Areas

Year	Total No. of Birds Observed
2006	27,398
2007	70,478
2008	104,550
2009	73,447

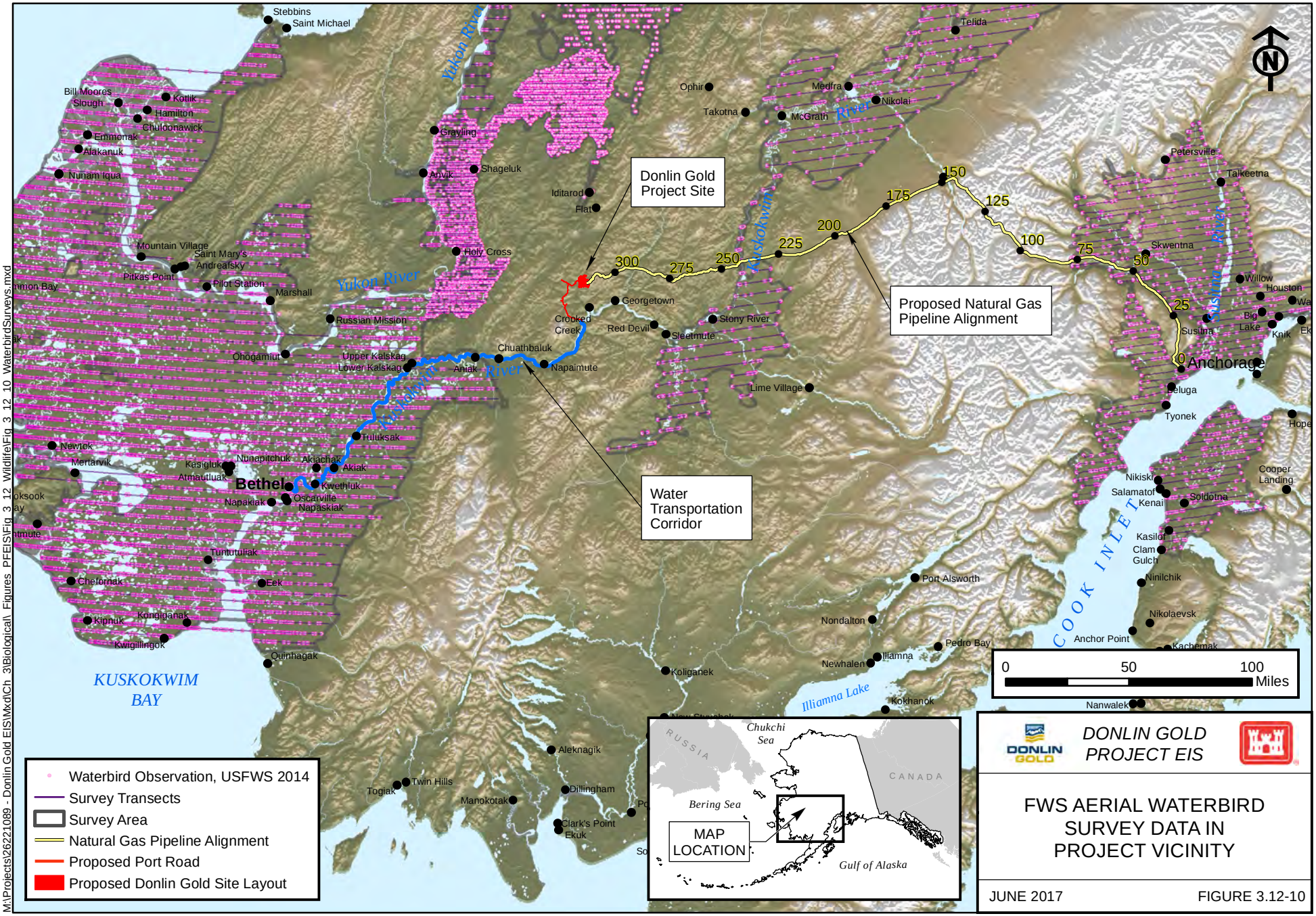
Source: (RWJ Consulting Inc. 2008b; RWJ Consulting Inc. 2009; RWJ Consulting Inc. 2010a)

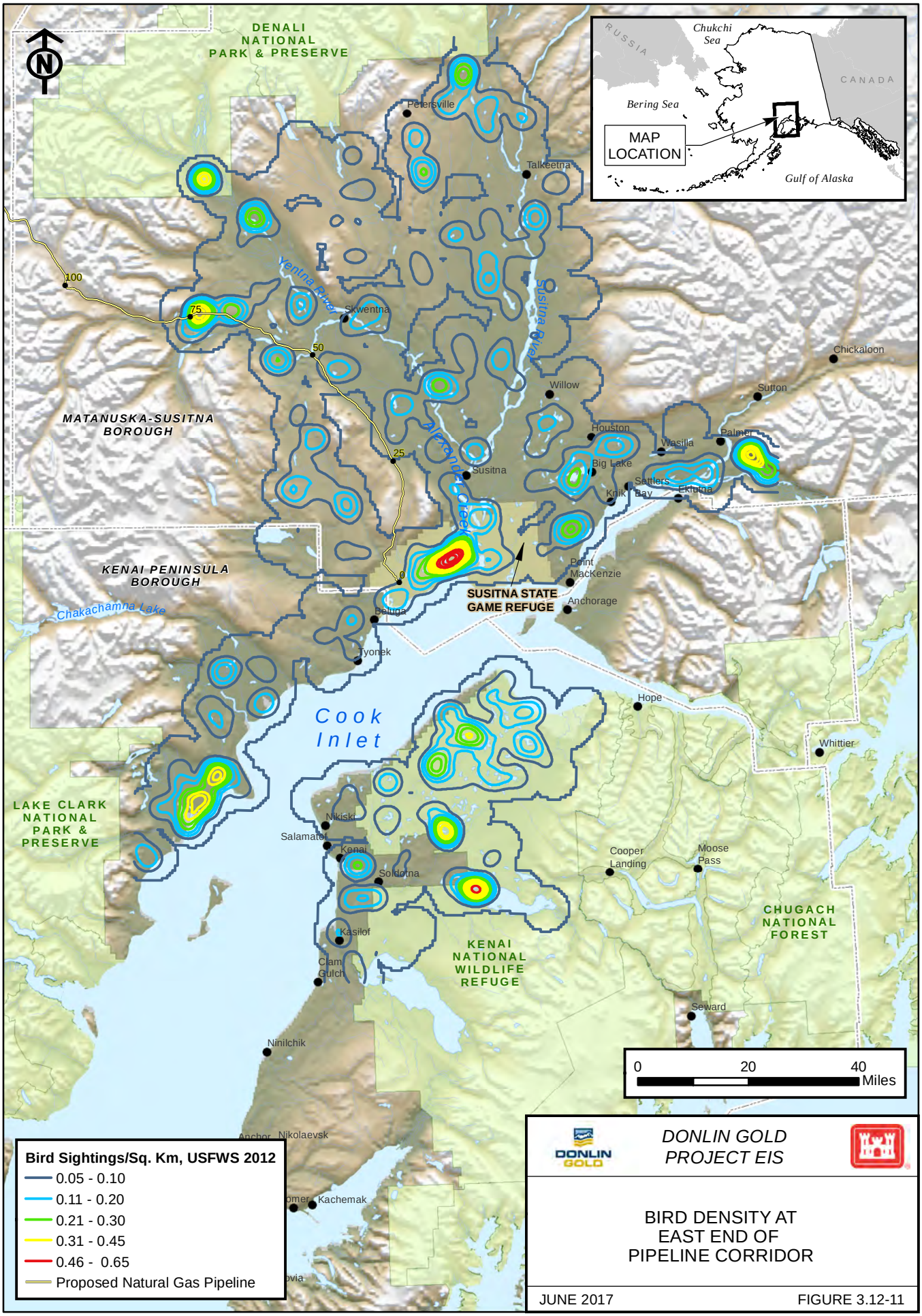
DONLIN GOLD

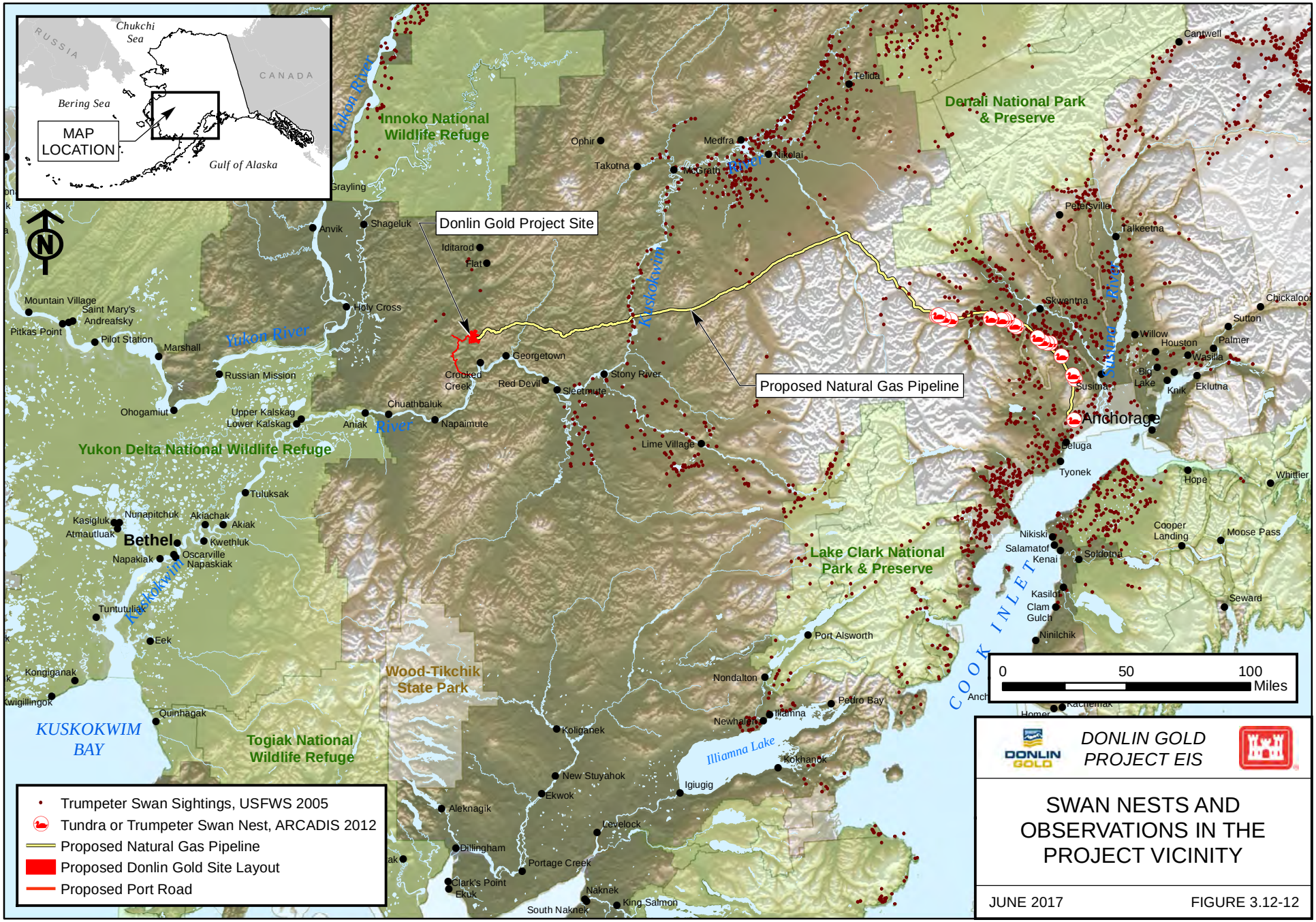
DONLIN GOLD PROJECT EIS

WATER TRANSPORTATION CORRIDOR BIRD SURVEY OBSERVATION AREAS

JUNE 2017 FIGURE 3.12-9


Donlin Gold Project Site
Proposed Natural Gas Pipeline Alignment
Water Transportation Corridor
Yukon River
Kuskokwim River
Stebbins
Saint Michael
Bill Moores Slough
Kotlik
Hamilton
Chuloonawick
Emmonak
Alakanuk
Nunam Iqua
Mountain Village
Saint Mary's
Andreafsky
Pitkas Point
Pilot Station
Marshall
Russian Mission
Ohogamiut
Newtok
Mertarvik
Kasigluk
Nunapitchuk
Akiachak
Akiak
Atmautluak
Bethel
Kwethluk
Napakiak
Oscarville
Napaskiak
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Kwigillingok
Quinhagak
KUSKOKWIM BAY
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Tuluksak
Holy Cross
Shageluk
Anvik
Grayling
Iditarod
Flat
Georgetown
Crooked Creek
Red Devil
Sleetmute
Stony River
Lime Village
Ophir
Takotna
McGrath
Medfra
Nikolai
Telida
Petersville
Talkeetna
Skwentna
Willow
Houston
Big Lake
Knik
Susitna
Anchorage
Beluga
Tyonek
Hope
Cooper Landing
Nikiski
Salamatof
Kenai
Soldotna
Kasilof
Clam Gulch
Ninilchik
Nikolaevsk
Anchor Point
Kachemak
Port Alsworth
Nondalton
Pedro Bay
Newhalen
Iliamna
Koliganek
Illiamna Lake
Kokhanok
Nanwalek
COOK INLET
Aleknagik
Twin Hills
Togiak
Manokotak
Dillingham
Clark's Point
Ekuk
150
175
125
200
100
225
75
250
50
300
275
25
0
50
100
Miles
Waterbird Observation, USFWS 2014
Survey Transects
Survey Area
Natural Gas Pipeline Alignment
Proposed Port Road
Proposed Donlin Gold Site Layout
RUSSIA
Chukchi Sea
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
DONLIN GOLD
DONLIN GOLD PROJECT EIS
FWS AERIAL WATERBIRD SURVEY DATA IN PROJECT VICINITY
JUNE 2017
FIGURE 3.12-10
M:\Projects\26221089 - Donlin Gold EIS\Mxd\Ch 3\Biological\ Figures PFEIS\Fig 3 12 WildlifeFig 3 12 10 WaterbirdSurveys.mxd


DENALI NATIONAL PARK & PRESERVE
MATANUSKA-SUSITNA BOROUGH
KENAI PENINSULA BOROUGH
LAKE CLARK NATIONAL PARK & PRESERVE
KENAI NATIONAL WILDLIFE REFUGE
CHUGACH NATIONAL FOREST
SUSITNA STATE GAME REFUGE
Cook Inlet
Chakachamna Lake
Alexander Creek
Susitna River
Petersville
Talkeetna
Skwentna
Willow
Houston
Wasilla
Palmer
Big Lake
Susitna
Settlers Bay
Knik
Eklutna
Chickaloon
Sutton
Point MacKenzie
Anchorage
Beluga
Tyonek
Hope
Whittier
Seward
Cooper Landing
Moose Pass
Nikiski
Salamatof
Kenai
Soldotna
Kasilof
Clam Gulch
Ninilchik
Nikolaevsk
Kachemak
100
75
50
25
0
0 20 40 Miles
MAP LOCATION
RUSSIA
Chukchi Sea
CANADA
Bering Sea
Gulf of Alaska
Bird Sightings/Sq. Km, USFWS 2012
0.05 - 0.10
0.11 - 0.20
0.21 - 0.30
0.31 - 0.45
0.46 - 0.65
Proposed Natural Gas Pipeline
DONLIN GOLD
DONLIN GOLD PROJECT EIS
BIRD DENSITY AT EAST END OF PIPELINE CORRIDOR
JUNE 2017
FIGURE 3.12-11


MAP LOCATION
Chukchi Sea
RUSSIA
CANADA
Bering Sea
Gulf of Alaska
Donlin Gold Project Site
Proposed Natural Gas Pipeline
Innoko National Wildlife Refuge
Yukon Delta National Wildlife Refuge
Togiak National Wildlife Refuge
Wood-Tikchik State Park
Denali National Park & Preserve
Lake Clark National Park & Preserve
Yukon River
Kuskokwim River
Susitna River
Illiamna Lake
KUSKOKWIM BAY
COOK INLET
Anchorage
Bethel
Grayling
Anvik
Shageluk
Iditarod
Flat
Ophir
Takotna
McGrath
Medfra
Nikolai
Telida
Cantwell
Petersville
Talkeetna
Skwentna
Sutton
Chickaloon
Willow
Houston
Palmer
Wasilla
Big Lake
Knik
Eklutna
Susitna
Beluga
Tyonek
Hope
Whittier
Cooper Landing
Moose Pass
Nikiski
Salamatof
Kenai
Soldotna
Kasilof
Clam Gulch
Seward
Ninilchik
Port Alsworth
Nondalton
Petro Bay
Iliamna
Newhalen
Kokhanok
Igiugig
Koliganek
New Stuyahok
Ekwok
Aleknagik
Dillingham
Levelock
Portage Creek
Clark's Point
Ekuk
Naknek
South Naknek
King Salmon
Lime Village
Stony River
Sleetmute
Red Devil
Crooked Creek
Georgetown
Holy Cross
Mountain Village
Saint Mary's
Andreafsky
Pitkas Point
Pilot Station
Marshall
Russian Mission
Ohogamiut
Upper Kalskag
Lower Kalskag
Aniak
Chuathbaluk
Napaimute
Tuluksak
Kasigluk
Nunapitchuk
Akiachak
Akiak
Atmautluak
Kwethluk
Napakiak
Oscarville
Napaskiak
Tuntutuliak
Eek
Kongiganak
Kwigillingok
Quinhagak
0
50
100
Miles
Trumpeter Swan Sightings, USFWS 2005
Tundra or Trumpeter Swan Nest, ARCADIS 2012
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
DONLIN GOLD PROJECT EIS
SWAN NESTS AND OBSERVATIONS IN THE PROJECT VICINITY
JUNE 2017
FIGURE 3.12-12

3.12.2.5 ENVIRONMENTAL CONTAMINATION

3.12.2.5.1 PIT LAKE ECOLOGICAL RISK ASSESSMENT (ERA)

An Ecological Risk Assessment (ERA) was prepared to analyze potential risk of wildlife exposure to contaminants in the pit lake. A risk assessment is used to characterize the nature and magnitude of health risks to ecological receptors from chemical contaminants and other stressors that may be present in the environment. The ERA consists of the following documents, included in Appendix S:

- Ecological Risk Assessment for the Proposed Future ACMA Pit Lake (ARCADIS 2013b), which reports the results of the pit lake ERA, based on a combination of water quality predictions, general literature, and studies of pit lakes elsewhere to predict exposure and effects of pit lake constituents to wildlife receptors. The ERA analyzes the pit lake infilling period (year 2 to year 52) and the mature pit lake stage (year 53 and beyond).
- Addendum to the ERA for the Proposed Donlin Pit Lake (ERM 2015), which evaluates aluminum and copper in the mature stage pit lake at year 99. The ERA Addendum analysis tiered off the 2013 ERA for the proposed pit lake. All applicable guidance and ERA protocols as described in detail in the 2013 ERA were followed in the ERA Addendum.
- Ecological Risk Assessment (ERA) for the Proposed Future ACMA Pit Critique (AECOM 2015f).

Both the ERA and ERA Addendum follow the Alaska Department of Environmental Conservation (ADEC) (ADEC 2015), EPA (EPA 1998b), and applicable BLM guidance regarding risk assessment approach and methods. The process includes the following components:

- A problem formulation (including the development of a conceptual site model). In the problem formulation step of an ERA, assessment endpoints (AEs), measurement endpoints (MEs), and analysis plan are developed. AEs identify the ecological values that should be protected. MEs are a means to measure potential ecological effects to AEs and determining whether any chemicals of potential concern (COPCs) pose potential risk to ecological receptors.
- An exposure assessment (including the evaluation of representative terrestrial or aquatic mammal or bird species).
- An effects analysis and a risk characterization which incorporates all exposure and toxicity assumptions.

Pit Lake Problem Formulation

Pit lake filling scenario: The period of pit lake infilling (year 2 to approximately year 52 after cessation of dewatering) is expected to be characterized by rapidly rising water levels, pit wall erosion and sloughing, and high steep walls surrounding the water that would limit access to the pit lake by wildlife but may allow access by birds. COPCs included antimony, arsenic, cadmium, chromium, cobalt, copper, lead, nickel, selenium, and zinc (ARCADIS 2013b).

Mature pit lake scenario: The period of pit lake maturity (year 53 and beyond) is expected to be characterized by lake level stabilization, and littoral and riparian areas along the edge of the pit

lake developing, which could attract a larger variety of wildlife for longer durations of time. COPCs included antimony, arsenic, selenium (ARCADIS 2013b), aluminum, and copper (ERM 2015). The ERA Addendum included aluminum and copper which were predicted to occur in concentrations above ecological water quality criteria based on water treatment system updates which resulted in surface water quality prediction revisions (Lorax 2015).

Ecological receptors (wildlife and bird species): Representative wildlife receptors chosen for quantitative evaluation in the ERA included: dark-eyed junco, mallard duck, and northern shrike for the pit lake filling scenario; with the addition of black bear, gray wolf, mink, snowshoe hare, and tundra vole for the mature pit lake scenario.

Analysis of reproduction, growth, and development of wildlife species that may use the pit lake and surrounding area was included. Chronic effects on representative species were evaluated. Acute effects were not evaluated since they would not accurately represent the long-term risks evaluated in the pit lake filling scenario and the mature pit lake scenario (ARCADIS 2013b, ERM 2015).

Pit Lake ERA Exposure Analysis

In the exposure analysis, exposure for wildlife was calculated based on a deterministic dose model developed by EPA. COPCs were identified by comparing concentrations at the pit filling and mature pit lake stages to screening level benchmarks, including ADEC water quality criteria. COPC concentrations were estimated directly for water and sediment and indirectly for food through use of bioaccumulation factors (BAFs). Literature-based values and some site-specific data were used to determine BAFs.

Toxicity reference values (TRVs): In the effects analysis, toxicity references values (TRVs) were derived for wildlife with which to compare the estimated dose. A range of TRVs was identified to characterize the potential range of effects, corresponding to no adverse effect levels (NOAELs) and low adverse effect levels (LOAELs). TRVs are receptor and COPC specific.

Hazard quotients (HQs): For each ecological receptor-COPC combination, upper and lower bound hazard quotients (HQs) were calculated to estimate likelihood of ecological risk. The HQ calculations are not measures of risk. They serve as a cautionary signal that potential hazards are present, and are indicators of whether further evaluation or natural resource management may be needed (ERM 2015). An HQ less than or equal to one indicates that adverse effects are not likely to occur, and thus can be considered to have negligible hazard. An upper-bound HQ is a plausible upper limit to the true probability that an individual would be impacted as a result of a given hazard (such as exposure to a toxic chemical).

A lower-bound HQ (NOAEL-HQ) and an upper-bound HQ (LOAEL-HQ), corresponding to ratios of dose to NOAEL-based TRVs and LOAEL-based TRVs, were calculated to characterize the potential range of effects for each ecological receptor (species) and COPC combination. A lower-bound HQ is a lower estimate of risks from a given exposure level, while an upper-bound HQ is an upper estimate of risks from a given exposure level.

Pit Lake ERA Effects Analysis and Risk Characterization

Table 3.12-3 shows lower- and upper-bound HQ values for each receptor for each COPC for both scenarios. For the pit lake filling scenario, lower- and upper-bound HQs were less than one

for all receptor-COPC combinations. For the mature pit lake scenario, results for receptor-COPC combinations were:

- Antimony: Lower-bound HQs (NOAEL-HQs) were less than or equal to one for mink, snowshoe hare, dark-eyed junco, mallard duck, and northern shrike. NOAEL-HQs were greater than one, but less than 10, for black bear, gray wolf, tundra vole, and American dipper. Upper-bound HQs (LOAEL-HQs) were less than one for all receptors.
- Arsenic: Lower-bound HQs (NOAEL-HQs) were less than or equal to one for black bear, gray wolf, snowshoe hare, dark-eyed junco, and northern shrike. NOAEL-HQs were greater than one, but less than 10, for mink, tundra vole, American dipper, and mallard duck. Upper-bound HQs (LOAEL-HQs) were less than one for all receptors.
- Selenium: Lower-bound HQs (NOAEL-HQs) were less than or equal to one for all receptors, and upper-bound HQs (LOAEL-HQs) were less than one for all receptors.
- Copper: Upper-bound HQs (LOAEL-HQs) were less than one for all receptors, and upper-bound HQs (LOAEL-HQs) were less than one for all receptors.
- Aluminum: Lower-bound HQs (NOAEL-HQs) were slightly greater than one for the mallard duck and tundra vole. Upper bound HQs (LOAEL-HQs) were less than one for all receptors.

Pit lake ERA model assumptions: The ERA analysis (ARCADIS 2013b) included a number of model assumptions discussed in a critique of the ERA by AECOM (AECOM 2015f). The assumptions include:

- Assumes that wildlife ingest water in the open pit lake 100% of the time, resulting in an Area Use Factor (AUF) of 1.0 (in other words, the model assumes that wildlife are exposed to the open pit lake every day for their entire life);
- Assumes the pit lake never freezes;
- Assumes species do not migrate, and are around the pit lake all year, which is unfrozen;
- Assumes all habitat around the pit lake is appropriate habitat with food / forage sources (no poor quality, steep, inaccessible habitat assumed);
- Applies whole rock concentration data from boreholes to estimate future sediment concentrations;
- Assumes no adjacency of other suitable, more productive natural water bodies in the vicinity of the pit lake;
- Conservative assumptions regarding dietary fractions of pit lake items; and
- Assumes 100 percent bioavailability of ingested sediments and food.

Table 3.12-3: Lower- and Upper-Bound Hazard Quotients (HQs) for ERA Scenarios by Receptor and COPC

	Pit Lake Filling Scenario									
	Antimony		Arsenic		Copper		Selenium		Cadmium	
Receptor	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ
American dipper	0.24	0.024	0.046	0.011	0.00072	0.00055	0.06	0.04	0.00028	0.00002
dark-eyed junco	0.26	0.026	0.05	0.011	0.00078	0.0006	0.065	0.044	0.00031	0.000022
mallard duck	0.022	0.0022	0.0042	0.00097	0.000066	0.000051	0.0055	0.0037	0.000026	0.0000019
northern shrike	0.22	0.022	0.042	0.0096	0.00065	0.00051	0.055	0.037	0.00026	0.000019
	Chromium		Cobalt		Lead		Nickel		Zinc	
Receptor	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ
American dipper	0.0082	0.0016	0.012	0.006	0.012	0.006	0.00066	0.00048	0.0012	0.00012
dark-eyed junco	0.0089	0.0017	0.013	0.0066	0.013	0.0066	0.00072	0.00052	0.0014	0.00014
mallard duck	0.00075	0.00015	0.0011	0.00056	0.0011	0.00055	0.00006	0.000044	0.0019	0.00014
northern shrike	0.0075	0.0014	0.011	0.0055	0.011	0.0055	0.0006	0.00043	0.0011	0.00011
	Mature Pit Lake Scenario									
	Antimony		Arsenic		Copper		Selenium		Aluminum	
Receptor	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ	NOAEL-HQ	LOAEL-HQ
black bear	**1.4**	0.14	0.47	0.047	0.00012	0.000084	0.14	0.082	0.0052	0.001
gray wolf	**1.2**	0.12	0.4	0.04	0.0001	0.000072	0.12	0.07	0.0058	0.000012
mink	0.96	0.096	**2.9**	0.29	0.016	0.011	0.17	0.1	0.086	0.17
snowshoe hare	0.063	0.0063	0.87	0.58	0.017	0.0047	0.22	0.11	0.081	0.016
tundra vole	**5.2**	0.52	**8.4**	0.84	0.0056	0.0039	0.45	0.27	**3.9**	0.79
American dipper	**1.6**	0.16	**3.5**	0.81	0.58	0.44	0.55	0.37	0.44	0.087
dark-eyed junco	0.26	0.026	0.05	0.011	0.00039	0.00047	0.065	0.044	0.00031	0.031
mallard duck	0.58	0.058	**1.4**	0.33	0.098	0.076	0.12	0.078	**1.1**	0.23
northern shrike	0.5	0.05	0.4	0.093	0.0097	0.0075	0.073	0.049	0.046	0.0046

Notes:

Bolded values indicate HQ>1

Source: ARCADIS 2013b, ERM 2015

These assumptions of use, presence, model inputs, and exposure was interpreted to be overly conservative as the model did not consider migratory patterns of wildlife; poor habitat of steep rock adjacent to the pit lake; quality and quantity of food (forage) is limited in availability along the margins of the pit lake; the pit lake is expected to freeze up to seven months per year; and discounts the presence of natural water bodies in the vicinity of the pit lake that species may use for drinking, bathing, or preening (AECOM 2015f). The reason for incorporating conservative assumptions is to increase confidence that the risk predictions are not under-predicting risk to wildlife (ERA 2015).

Interpretation of results: An HQ of less than or equal to one indicates that adverse effects are not likely to occur, and thus can be considered to have negligible hazard. An HQ greater than one indicates that adverse effects are possible. HQs cannot be translated to a probability that adverse effects will occur. A HQ exceeding one does not necessarily mean that adverse effects will occur.

- Pit lake filling scenario: For the pit lake filling scenario, results showed that HQs were less than 1 for all receptor-COPC combinations, indicating risk is unlikely to wildlife exposed to the proposed pit lake during the pit lake development stage (ARCADIS 2013b).
- Mature pit lake scenario: Despite the conservative assumptions used for the risk characterization of the mature pit lake, NOAEL-HQs were below 1 for most receptors and just above 1 for others, and LOAEL-HQs were less than 1 for all receptor-COPC combinations. Sensitivity analysis showed that reductions in sediment concentrations and area uses, which are expected, would result in reductions in HQs below 1 for wildlife receptors. The interpretation of the HQ results for the mature pit lake scenario for antimony, arsenic, and selenium is that wildlife risk from chemical exposure in the ACMA pit lake water is unlikely (ARCADIS 2013b). For aluminum and copper, all upper bound HQs (i.e., LOAEL-HQs) are less than 1, indicating no adverse effects to wildlife receptors are predicted. Two lower bound HQs (NOAEL-HQs) were slightly greater than 1 for the mallard duck and tundra vole risk characterization of aluminum, indicating some uncertainty exists in no effect predictions for these receptors' exposure to aluminum. Upper bound HQs were less than 1 for these receptors, however, indicating no prediction of adverse risk to mallards or voles. Thus, the potential risk to wildlife from exposure to aluminum and copper concentrations in the proposed pit lake is regarded as low (ERM 2015).
- Pit lake ERA model limitations: The model assumptions were interpreted to contribute to overestimates of exposure and risk in the ERA in a critique of the ERA (AECOM 2015). For this ERA, the area use factor (AUF) was assumed equal to 1 (100 percent), meaning that receptors would spend all their time at the pit lake, and would not obtain food or water elsewhere. However, it is more likely that the value of area use would be less than 100 percent, given the amount of other water bodies in the vicinity with better. A more reasonable, yet conservative, AUF for the open pit lake may be in the range of 5 to 10 percent based on waterfowl migration survey data in project surveys (Owl Ridge 2013b, Owl Ridge 2014c).

Sediment concentrations would also likely be less than the concentrations assumed in the ERA, as erosion and deposition of unmineralized surface soil along the pit rim is expected. Overly

conservation assumptions regarding sediment concentrations also resulted in over-estimates of exposure via food ingestion (ARCADIS 2013b).

Waterfowl would be expected in the area of the proposed Donlin mine fewer than 7 days in the spring and in the fall; other wildlife used in the ERA also would be subject to migration patterns and could use other sources of water (ARCADIS 2013b, AECOM 2015f).

An AUF of 10 percent would reduce all of the calculated HQs for the identified COPCs and wildlife receptors by an order of magnitude to become less than 1.0, which is indicative of no risk to wildlife (AECOM 2015f). Additionally, no metals have HQs greater than 1.0 for the filling stage of the pit lake.

Another conservative assumption in the ERA is bioavailability of 100 percent for all metals in ingested water, sediment, and food. The bioavailability of metals in soil vary with soil conditions (e.g., pH, Eh, and organic content of the soil), and are typically less than 100 percent (AECOM 2015f). Also, once absorbed by a prey organism, many metals are sequestered into nonbioavailable forms in the prey tissues (ARCADIS 2013b).

3.12.2.5.2 PIT LAKE OVERTURN/MIXING SCENARIO

The potential for an overturn/mixing scenario where high concentrations of metals in lower levels of the pit lake rise to the surface was not included in the ERA (ARCADIS 2013b, ERM 2015) given the time period involved, as this scenario would potentially occur 99 or more years after operations cease. The uncertainty in applying ERA analysis in this timeframe in a wildlife or bird risk ecotoxicology context would be considered too high to include in project analysis.

However, this modeled scenario is presented in detail in Section 3.5, Surface Water Quality, as well as in Appendix H. Two specific points in time were the focus of this investigation: year 55 (50-50 mix of clean surface water and contaminated water at depth) and year 200 (100 percent of pit lake water is from the contaminated bottom depths). This worst-case scenario assumes that all clean surface water (rain, snow melt or treated water), has been removed from the pit lake. Metal concentrations for each of these scenarios and baseline are presented in Table H-15 in Appendix H. These concentrations are compared to Ambient Water Quality Criteria (ADEC 2008, EPA 2009, Suter and Tsao 1996) in Table 3.12-4 resulting in HQs that give an indication of potential risk for each metal.

As the results in Table 3.12-4 illustrate, there are potential risks from exposure to metals in the pit lake for both overturn/mixing scenarios (year 55 and year 200). However, there are a number of conservative assumptions associated with these modeled scenarios. As mentioned above and discussed in detail in Section 3.5, the hypothetical model assumes that clean surface water will be systematically removed during the Closure Phase until all surface water is completely absent from the pit lake, which is a worst-case scenario outside of the scope of analysis for wildlife impacts. Given the potential risks associated with an overturn/mixing scenario, alternative surface water removal plans would likely be implemented as part of adaptive management applied during the monitoring program for the project post-Closure.

Table 3.12-4: Comparison of Pit Lake Surface Water Quality Estimates at Closure Year 55, 56, and 99 to Water Quality Standards for Ecological Receptors

Analyte	Alaska CCC Standard or EPA Ambient Water Quality Criteria	Source and Notes	Baseline Estimates	Baseline HQ Results	Complete Mixing[2]		HQ Results		Pycnocline at Surface ~Year 200 Winter[3]	HQ Results ~Year 200 Winter
					Year 55 Winter Estimate	Year 56 Summer Estimate	Year 55 Winter	Year 56 Summer		
Aluminum	87	1a,b	310	4	31,900	12,700	367	146	110,000	1264
Antimony	30	1b	67	2	382	216	13	7	680	23
Arsenic	150	1b	112	0.7	2,440	1,060	16	7	5,200	35
Boron	400	1c	202	0.5	1,740	880	4	2	2,300	6
Cadmium	0.18	1a,b	0.24	1.3	0.54	0.4	3	2	0.67	4
Chromium	11	1b	4	0.4	9.7	7.5	0.9	0.7	9	0.8
Copper	6.2	1a,b	1.4	0.2	90	32	15	5	220	35
Lead	1.6	1a,b	2.3	1.4	91	38	57	24	240	150
Manganese	80	1b	128	2	5,770	2,350	72	29	11,000	138
Nickel	36	1a,b	11	0.3	153	70	4	2	350	10
Selenium	5	1b	20	4	128	70	26	14	250	50
Zinc	81	1a,b	13	0.2	745	304	9	4	2,100	26
Mercury	770	1b	25	0.03	183	100	0.2	0.1	270	0.4

Notes:
Values are for dissolved metals (except aluminum and selenium), and represent depths between 0 and 33 feet in lake. Shaded cells exceed screening criteria. The pH was not modeled, but estimated to be between 5 and 6, based on input pH values.
All values are in µg/L except mercury (ng/L).
Risk cannot be excluded for HQs > 1. These results are highlighted in grey.
Ambient Water Quality Criteria:
1 Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances. Amended through December 12, 2008. Criteria are expressed in terms of dissolved metal in the water column, except for aluminum and selenium, which are in terms of total recoverable metal.
1a Aquatic life for fresh water hardness-dependent criteria. A value of 65 mg/L as $CaCO_3$ was used for hardness, based on model predictions for calcium and magnesium (not shown). For aluminum, if pH≥7.0 and hardness ≥50, then 750 µg/L, otherwise, 87 µg/L.
1b Aquatic life for fresh water (chronic) criteria (EPA 2009).
1c Lowest chronic value for all aquatic organisms (Suter and Tsao 1996)
2 Complete mixing induced in Year 55. Overturn tends to restratify over time, as can be seen for Year 56. See Appendix H for more details.
3 Year based on linear extrapolation of pycnocline rise from Year 53 to Year 99 in Appendix H Figure 6. Concentrations are average values rounded to two significant figures for base-case hypolimnion waters (between 33 and 850 feet above bottom) in Year 99. See Appendix H for more details.
Source: Lorax 2012 (Table 4-2), PitMod_overturn 1012.xls, and PitMod_base case 1012.xls, supplied by Lorax

3.12.2.5.3 FUGITIVE DUST DEPOSITION

The potential risk to wildlife from fugitive dust released during the Construction and Operations Phase activities were analyzed in two ways:

- The impact of the dust produced at the Mine Site (consisting mostly of waste rock with a small amount of ore) getting into soils and plants; and
- The impact of metals released from the existing soil due to the project ground-disturbing activities.

Wildlife could be exposed to metals in dust through either or both of these routes during the Construction and Operations phases. Exposure could be through direct inhalation of dust or incidental ingestion of soil or food items. During the Closure Phase, wildlife may be affected by the presence of deposited mine site fugitive dust emissions in the soil. A complete analysis of metals (including antimony, arsenic, and mercury) in both the existing soil and the mine-produced dust is presented in Section 3.2, Soils. Additional information on mercury impacts is provided in Section 3.22, Human Health.

The dust produced at the mine site from all mine sources and phases is predicted to contain 86 percent waste rock and 14 percent ore (Environ 2014a, Environ 2015, Donlin Gold 2015d). To evaluate the potential for risk to wildlife from the addition of mine-produced dust, estimates of 95 percent UCL shallow soil concentrations at year 35 of the mine life (3.5 years Construction, 27.5 years Operations, and four years of reclamation during the Closure phase) resulting from particulate deposition are compared to the most recent lowest observed effect concentrations (LOECs) from Los Alamos National Laboratory (92014) (Table 3.12-5). The selected LOECs used in the comparison are the lowest of available LOECs protective of terrestrial plants, soil invertebrates, birds, and mammals. Estimates of 95 percent UCL concentrations in baseline soil also are compared to LOECs.

Table 3.12-5: Potential Risk from Metals (Baseline and Year 35)

Metal	LOEC[1] (mg/kg)	Baseline Soil (mg/kg)[2]	Soil in Year 35 (mg/kg)[2]	Baseline Exceeds LOEC?	End of Mine Life Exceeds LOEC?
Antimony	24	11.1	11.2[3]	No	No
Arsenic	24	169	172[3]	Yes	Yes
Mercury	0.13	0.415	0.461[3]	Yes	Yes

Notes:

1 Lowest of lowest observed effect concentrations (LOECs) protective of plants, soil invertebrates, birds, and mammals from LANL (2015).

2 Based on 95% UCL concentrations in shallow soil (Fernandez 2014a).
3 See Table 3.2-13 in the Section 3.2, Soils.

Metals released from the existing soil due to the project's ground disturbing activities may also affect wildlife. Table 3.12-5 shows that existing soil at the Mine Site, contain concentrations of arsenic and mercury exceeding their respective LOECs. Wildlife is currently exposed to these metals through ingestion of soil, water, and vegetation, as well as via airborne dust inhalation from natural causes such as burrowing activities and wind. Ground disturbing activities at the Mine Site would increase the risk of contaminated airborne dust inhalation and the spread of

dust to nearby soil, water, and vegetation. However, potential transport pathways such as wind generated dusts are typically considered minor contributors to overall site risk. More specifically, the inhalation of dust particles by ecological receptors is considered a minor pathway and rarely evaluated particularly when compared to exposure via the ingestion of food or prey items. As pointed out in Table 3.2-13 in Section 3.2, Soils, the modeled percentage of additional dust in soil in year 35 is less than one percent (0.55%).

The BLM (Ford 2004) has established ecological Risk Management Criteria (RMC) for ingestion by wildlife of metals in soil and sediments. RMCs are calculated for COPCs based on assumed exposure factors, along with species and chemical specific TRVs. The RMC may be applied as a benchmark concentration to which environmental concentrations may be compared in order to assist land managers in protecting humans and wildlife on BLM lands (Ford 2004). As long as wildlife are not exposed to soils/sediments with concentrations of metals exceeding the RMC, they are not expected to experience adverse toxic effects (Ford 2004). Suggested exceedances of the criteria may be interpreted as follows:

- Less than criteria: low risk
- 1-10 times the criteria: moderate risk
- 10-100 times the criteria: high risk
- >100 times the criteria: extremely high risk

Table 3.12-6 lists exceedance criteria for five representative wildlife and bird species. Because the BLM's criteria do not include large mammal species such as moose or caribou that are known to frequent the Mine Site, elk was used as a representative receptor for large mammals in this comparison, and deer mouse was used to represent small mammals. The table compares the amounts of arsenic or mercury in existing or baseline soil, the amounts that would be expected to be present in soil in year 35 of mine operations from fugitive dust emissions (based on analysis in Section 3.2, Soils), and a comparison of exceedance criteria from Baseline to Year 35 levels.

Table 3.12-6 shows that baseline arsenic concentration is 169 mg/kg, which is expected to increase to 172 mg/kg in Year 35, an increase of 3 mg/kg. Baseline mercury concentration is 0.415 mg/kg, which is expected to increase to 0.46 mg/kg, an increase of 0.045 mg/kg (see Section 3.2, Soils, for additional information on soil metal concentrations).

The project impacts would not be expected to increase risk as baseline concentrations compared to Year 35 concentrations do not cause a change in the level of the exceedance criteria in metal concentrations for the selected representative species.

3.12.2.6 CLIMATE CHANGE

Climate change affects multiple resources, and trends associated with climate change are projected to continue into the future. Current and future effects on wildlife are tied to changes in physical resources and vegetation. Section 3.26, Climate Change, discusses climate change trends and impacts to key resources in the physical and biological environments including atmosphere, water resources, permafrost, and vegetation.

Table 3.12-6: Soil Metal Concentrations[1] in Baseline versus Year 35 Soils Compared to BLM Wildlife Risk Management Criteria[2]

	Arsenic					Mercury				
Metal Concentrations in Baseline Soil (mg/kg)	169					0.415				
Metal Concentrations in Soil in Year 35 (mg/kg)	172					0.46				
Change from Baseline to Year 35 (mg/kg)	Increase of 3					Increase of 0.045				
	Exceedance Criteria	**Baseline Concentration Exceedance Comparison (169/Exceedance Criteria)**	**Risk Interpretation of Exceedance Criteria**	**Year 35 Concentration Exceedance Comparison (172/Exceedance Criteria)**	**Change in risk from Baseline to Year 35?**	**Exceedance Criteria**	**Baseline Concentration Exceedance Comparison (0.415/Exceedance Criteria)**	**Risk Interpretation of Exceedance Criteria**	**Year 35 Concentration Exceedance Comparison (0.46/Exceedance Criteria)**	**Change in risk from Baseline to Year 35?**
Elk	328	0.52	Less than criteria	0.52	no change	11	0.04	Less than criteria	0.04	no change
Deer Mouse	230	0.73	Less than criteria	0.75	no change	2	0.21	Less than criteria	0.23	no change
Mallard	116	1.46	1-10 times the criteria	1.48	no change	4	0.10	Less than criteria	0.12	no change
Canada Goose	61	2.77	1-10 times the criteria	2.82	no change	6	0.07	Less than criteria	0.08	no change
Trumpeter Swan	76	2.22	1-10 times the criteria	2.26	no change	7	0.06	Less than criteria	0.07	no change

Source:
1 Table 3.2-13 in Section 3.2, Soils
2 Table 4 in Ford 2004

3.12.3 ENVIRONMENTAL CONSEQUENCES

This section describes potential impacts to non-ESA listed wildlife species as a result of the project. Table 3.12-7 provides the impact methodology framework applied to assessing direct or indirect impacts to wildlife based on four factors of magnitude or intensity, duration, extent or scope, and context (40 CFR 1508.27, described in Section 3.0, Approach and Methodology).

Table 3.12-7: Impact Methodology for Effects on Wildlife

Type of Effect	Impact Factor	Assessment Criteria		
Behavioral Disturbance	Magnitude or Intensity	Changes in behavior due to project activity may not be noticeable; animals remain in the vicinity.	Noticeable change in behavior due to project activity that may affect reproduction or survival of individuals.	Acute or obvious/abrupt change in behavior due to project activity; life functions are disrupted; animal populations are reduced in the EIS Analysis Area.
	Duration	Behavior patterns altered infrequently, but not longer than the span of the Construction Phase and would be expected to return to pre-activity levels after actions causing impacts were to cease.	Behavior patterns altered for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease.	Change in behavior patterns would continue even if actions that caused the impacts were to cease; behavior not expected to return to previous patterns.
	Extent or Scope	Impacts limited to vicinity of the project footprint.	Affects resources within the Project Area.	Affects resources distant from the Project Area.
	Context	Affects common or ordinary resources.	Affects resources of biological, cultural, subsistence or other importance.	Affects resources protected by legislation, or the resource affected fills a unique ecosystem role within the locality or region.
Injury and Mortality	Magnitude or Intensity	No noticeable incidents of injury or mortality; population level effects not detectable.	Incidents of injury or mortality are detectable; populations remain within normal variation.	Incidents of mortality or injury create population-level effects.
	Duration	Events with potential for mortality or injury would occur for a brief, discrete period lasting up to the duration of the Construction Phase.	Events with potential for mortality or injury would continue throughout Operations for up to the life of the project.	Potential for mortality or injury would persist after actions that caused the disturbance ceased.
	Extent or Scope	Impacts limited to vicinity of the project footprint.	Impact would occur beyond a local area, potentially throughout the Project Area.	Affects populations distant from the Project Area.

Table 3.12-7: Impact Methodology for Effects on Wildlife

Type of Effect	Impact Factor	Assessment Criteria		
	Context	Affects common or ordinary resources.	Affects resources of biological, cultural, subsistence or other importance.	Affects resources protected by legislation, or the resource affected fills a unique ecosystem role within the locality or region.
Environmental Contamination[2]	Magnitude or Intensity	Changes in resource character or quantity may not be noticeable.	Noticeable changes in resource character and quantity.	Acute or obvious changes in resource character and quantity.
	Duration	Changes would not last longer than the Construction Phase and would be expected to return soon to pre-activity levels.	Resource would be impacted during Operations and up to the life of the mine, and may return to pre-activity levels once the impact-causing source is removed.	Resource would not ever be anticipated to return to previous character or levels.
	Extent or Scope	Impacts limited to vicinity of the project footprint.	Affects resources beyond a local area, potentially throughout the Project Area.	Affects populations distant from the Project Area.
	Context	Affects usual or ordinary resources in the EIS Analysis Area; resource is not depleted in the locality or protected by legislation.	Affects depleted resources within the locality or region or resources protected by legislation.	Resources protected by legislation and the portion of the resource affected fills a unique ecosystem role within the locality or region.
Habitat Alterations[1,2]	Magnitude or Intensity	Changes in resource character or quantity may not be noticeable; habitat generally does not change.	Noticeable changes in resource character and quantity; habitat may change by vegetation type change or other change.	Acute or obvious changes in resource character and quantity; habitat may be removed or otherwise lost or changed.
	Duration	Changes would not last longer than the Construction Phase and would be expected to return soon to pre-activity levels.	Resource would be reduced during Operations and up to the life of the mine, and may return to pre-activity levels through revegetation or reclamation, but vegetation composition may be different.	Resources would not be anticipated to return to previous character or levels, such as in the case of permanent vegetation removal.
	Extent or Scope	Impacts limited to vicinity of the project footprint.	Affects resources beyond a local area, potentially throughout the Project Area.	Affects populations distant from the Project Area.

Table 3.12-7: Impact Methodology for Effects on Wildlife

Type of Effect	Impact Factor	Assessment Criteria		
	Context	Affects usual or ordinary resources in the EIS Analysis Area; resource is not depleted in the locality or protected by legislation.	Affects depleted resources within the locality or region or resources protected by legislation.	Resources protected by legislation and the portion of the resource affected fills a unique ecosystem role within the locality or region.
Increased Hunting and Trapping Pressure	Magnitude or Intensity	Changes in amount of hunting and trapping may not be noticeable.	Noticeable changes in amount of hunting and trapping.	Acute or obvious changes in hunting and trapping.
	Duration	Access would cause changes during Construction, but activity would return to previous levels when construction activities were completed.	Access would cause long-term changes throughout the life of the project and into the Closure Phase.	Access would cause permanently changes resulting in changes to management.
	Extent or Scope	Impacts limited to vicinity of the project footprint.	Affects resources beyond a local area, potentially throughout the Project Area.	Affects populations distant from the Project Area.
	Context	Affects usual or ordinary resources in the EIS Analysis Area; resource is not depleted in the locality or protected by legislation.	Affects depleted resources within the locality or region or resources protected by legislation.	Resources protected by legislation and the portion of the resource affected fills a unique ecosystem role within the locality or region.

Notes:

1 Habitat alteration impacts from nonnative invasive species introduction or spread are discussed in Section 3.10, Vegetation and Nonnative Invasive Species.

2 Habitat alteration impacts that relate to habitat changes and/or injury or mortality through contamination from fuel or chemical spills are discussed in Section 3.24, Spills.

Effects are discussed per Alternative, per species group (terrestrial mammals, marine mammals, birds). These impacts, while discussed separately for clarity, may be experienced concurrently by wildlife, with the overall effect of reducing the value of the EIS Analysis Area as wildlife habitat.

NNIS species impacts are discussed in Section 3.10, Vegetation and Nonnative Species. Environmental contamination issues, including impacts from exposure to potentially toxic materials such as fuel or chemical spills, are discussed in Section 3.24, Spill Risk.

3.12.3.1 ALTERNATIVE 1 – NO ACTION

Impacts to terrestrial mammals and birds would continue from ongoing mineral exploration and from reclamation of existing exploration and related disturbance (camp, roads, and airstrip). No new impacts would be expected for marine mammals.

3.12.3.2 ALTERNATIVE 2 – DONLIN GOLD'S PROPOSED ACTION

The following is a general description of the sources or mechanisms of potential impacts to wildlife and birds. Details are described below under each project component.

Based on comments on the Draft EIS from agencies and the public, one route option has been included in Alternative 2 to address concerns due to pipeline crossings of the Iditarod National Historic Trail (INHT):

- The MP 84.8 to 112 North Option would realign this segment of the natural gas pipeline crossing to the north of the INHT before the Happy River crossing and remain on the north side of the Happy River Valley before rejoining the alignment near MP-112 where it enters the Three Mile Valley. The North Option alignment would be 26.5 miles in length, compared to the 27.2 mile length of the mainline Alternative 2 alignment it would replace, with one crossing of the INHT and only 0.1 mile that would be physically located in the INHT right-of-way (ROW). The average separation distance from the INHT would be 1 mile.

For each type of impact, the design features that would mitigate or reduce the impact are also described. The impacts assessed under each alternative are those that remain following implementation of the design features detailed in Chapter 2. Specific mitigation measures that agencies are considering to further reduce impacts, as reasonable and practicable, are also discussed in Chapter 5, along with an evaluation of their expected effectiveness.

3.12.3.2.1 TERRESTRIAL MAMMALS

Key issues with potential direct and indirect effects impacting terrestrial mammals were identified during agency and public scoping. These include:

- Behavioral disturbance, including:
  - Noise;
  - Barriers to movement;
  - Organic waste attraction; and
  - Increased barge traffic.
- Injury and mortality, including:
  - Vehicle collisions;
  - Injury or mortality resulting from contamination from pit lake or other mine site component attraction; and
  - Injury or mortality resulting from contamination from fuel or chemical spills (addressed in Section 3.24, Spill Risk).
- Habitat alteration or fragmentation, including:
  - Vegetation removal;
  - Habitat changes through contamination from fuel or chemical spills (addressed in Section 3.24, Spill Risk); and

  - NNIS introduction and spread (addressed in Section 3.10, Vegetation and Nonnative Species).

- Increased hunting and trapping pressure.

These impacts are described in further detail below under associated subheadings, unless otherwise noted as being addressed in other document sections. Impacts are discussed, where applicable, by project component (Mine Site, Transportation Corridor, or Pipeline). Impacts are also discussed, where applicable, per project phase (Construction, Operations, or Closure).

Behavioral Disturbance

Behavioral responses to disturbance can range from mild "alert" behavior to fleeing at top speed, depending on disturbance type, distance, species, season, or other variables. Disturbance from human noise and activity during Construction and Operations could cause terrestrial mammals to avoid areas. The size of the "avoidance zone" depends on the type of disturbance as well as species' behavior variables. Some species, like moose and squirrels, appear to habituate (adapt) to traffic and human habitations. Others, such as wolves and brown bears, do not. Some predictable facility noise and operations may allow easier habituation. For example, the pipeline compressor station or the water treatment plant are constant for long periods, having lower effects than erratic sources of noise or motion. The effective loss of habitat per species would fluctuate over time but could be larger than construction area footprints.

In addition to inhibiting normal movement patterns, high levels of disturbance could have effects that range from physiological reactions to stress, potential for injury and mortality from exposure to predators and sub-optimal habitats, injury and mortality for denning mammals and small mammals in sub-nivean (under snow) spaces during winter construction, and reduced survivability and/or reproductive success in unfamiliar territories. Some species are particularly sensitive at certain times of year (e.g., Dall sheep lambing in spring, bear and wolf denning in winter, and moose rutting in fall). Ground-based activities would be the primary concern for most species, but airplane and helicopter traffic could also be problematic for certain species. Dall sheep and caribou are known to react strongly to low-flying aircraft.

Donlin Gold would develop and implement a Wildlife Avoidance and Human Encounter/Interaction Plan to minimize the risk of adverse wildlife interactions with pipeline construction workers. These types of plans for large construction projects in Alaska generally include bear safety training programs for workers, bear guards for construction crews and camps where necessary, waste management plans and facilities to minimize attractants to wildlife in camp, prohibitions against feeding or harassing wildlife, and communication protocols to frequently remind workers of wildlife safety rules/procedures, reporting requirements, and the presence/ location of known animals that should be avoided. If the plan is implemented effectively, adverse interactions with wildlife during construction would likely be minimal.

Noise

Indirect habitat loss would occur due to behavioral disturbance of animals from blasting and noise from heavy machinery used to remove waste rock and construct the mine facilities. All mammals would likely leave the immediate area if they could and stay various distances away from the construction zones in order to avoid the loud, continuous sounds, periodic percussive

sounds, and presence of people and machinery that would disrupt their normal behaviors. The distance of this avoidance zone would depend on many variables but would add to the effective loss of habitat for every species. Species that do not usually habituate to human presence or tolerate loud sounds, such as brown bears and wolves, may avoid the area causing large effective losses of habitat near the Mine Site. In addition, the avoidance of construction activity could cause animals to travel long distances around the mine to reach preferred habitats, causing habitat fragmentation or abandonment of previously valuable habitats, which could reduce survival and reproductive success for some animals.

Blasting and massive removal of waste rock during mine construction activities could cause injury and mortality to small mammals that have limited abilities to move away or avoid heavy machinery. There is also the potential for injury or mortality from flying or falling rocks during blasting activities, although most animals would have moved away prior to blasting as a result of human presence and noise from machinery. Large mammals would likely abandon the area before blasting occurs but pre-blasting safety checks could presumably detect any large mammals that enter the safety zone and they could be herded out of harm's way.

Mine Site activities would involve disturbance of terrestrial mammals which would continue to be chronic and periodically intense throughout Operations, and the disturbance zone would expand as the mine grows to its maximum size. The Angyaruaq (Jungjuk) Port site would also be a source of chronic disturbance due to barge traffic, loading and unloading activities, and the physical presence of people and vehicles. The disturbance zone around the port site would likely be much smaller than the area around the Mine Site because of the lack of explosives and smaller vehicles. Living facilities at the mine and port sites would be subject to wildlife interaction plans to minimize the risk of attracting bears and other potentially adverse interactions with humans. Traffic on the mine access road during the Operations Phase would be subject to speed restrictions, which would reduce the risk of injury or mortality from collisions with animals, but would also be a chronic source of disturbance. Disturbance at the Angyaruaq (Jungjuk) Port site and along the mine access road would be concentrated during the open water season when barge traffic was present, with greatly reduced levels of human activity in the ice-up season.

During the Closure Phase, the Mine Site would be subject to periodic monitoring activities which would likely involve small numbers of people and vehicles for relatively brief periods of time. The potential disturbance of animals from these activities would be minimal and temporary in nature.

In the Transportation Corridor, construction of the Angyaruaq (Jungjuk) Port and storage facilities in Bethel would impact a small amount of terrestrial mammal habitat and cause disturbance of mammals. Behavioral disturbance would likely be greater during the Construction Phase than the Operations Phase but the number of animals affected would probably be small during either phase given the limited area affected. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

During the Construction Phase, construction of facilities for the Pipeline component would impact a small amount of terrestrial mammal habitat and cause disturbance of mammals. Behavioral disturbance from noise would be greatest during the Construction Phase. By the Operations Phase, construction would cease and noise would only occur intermittently. There

would be periodic required brushing along the pipeline route (see Vegetation Removal under Habitat Alteration). There would be low levels of noise emitted from the pipeline compressor station sited on the SFSGR (at Milepost [MP] 0.4) and periodic aircraft inspection overflights.

Barriers to Movement

Behavioral avoidance in the Mine Site and Transportation Corridor, including project related mine activity areas, mine access road vehicle traffic, Kuskokwim River barges, and active construction areas may function as a partial barrier to movement for some species or for particular sex and age-classes within species. Physical features of mine facilities, including steep cutbanks, holding ponds, material yards, or retaining walls, may prevent or limit animal movements through the area. Mine Site impacts would continue through all Project phases. Project-related disturbance along the Kuskokwim River in the Transportation Corridor would be seasonal so impacts on habitat use would primarily occur in the open water months during Construction and Operations.

For species with large home ranges or that travel seasonally between winter and summer ranges, such as bears, wolves, caribou, and Dall sheep, a barrier to movement could fragment and decrease the size of preferred habitat. Brown bears tend to avoid construction activities and road traffic more than black bears. Brown bears avoid roads regardless of traffic volume (McLellan and Shackleton 1988) and could abandon certain range areas rather than cross access roads or mine facilities. Wolves travel widely in pursuit of prey, using a variety of habitat type, so habitat loss may have less impact; however, wolves strongly avoid roadways and other areas with high levels of human activity (US Forest Service 2000; Person 2001) and may have a large avoidance zone around the Mine Site and access roads, disrupting their normal travel patterns and foraging success.

In the Pipeline component, the pipeline corridor would be constructed in segments (spreads) over 2-1/2 years, so the entire length of the pipeline corridor would not be impacted by construction activities at the same time. However, the construction spreads and support facilities would likely cause disturbance for most terrestrial mammals for several miles along the construction zone at any one time. Most animals would likely avoid the disturbance by leaving the area if they could, although some species of small mammals are limited in how far they can travel. The combination sequence of open trench, pipeline laid out on the ground, lines of construction equipment, and construction camp facilities could be effective barriers to wildlife movement primarily for small species with limited mobility in relation to all animal terrestrial species potentially affected. Although such barriers may only last a few weeks in any given location, construction traffic to and from the active work site would extend the disturbance. Species such as moose, caribou, sheep, and bison have seasonal movement patterns between different preferred habitats that could be disrupted, leading to reduced foraging success, survival, or reproductive success.

There would be two above-ground fault crossings along the pipeline, the Castle Mountain and Denali-Farewell faults. Each would be approximately 1,300 feet long. There would also be above-ground piping and associated valves at 16 remote mainline block valves (MLVs) located at no more than 20-mile intervals (see Chapter 2, Alternatives, for further details of construction specifics for the Pipeline component). During construction of the above-ground sections, impacts would be expected to be similar to those of construction of other sections of the pipeline. During Operations, the above-ground portions of the pipeline may cause terrestrial

wildlife to alter their movements to avoid the pipeline sections. Larger wildlife species such as moose or bear may avoid and walk around the above-ground sections. Small mammals would generally be expected to resume patterns of movement under the pipeline. Although there is limited literature and guidance available for assessing impacts of above-ground pipeline on large mammal movement, the limited length is not expected to impact movement as above-ground distances are similar to minimum suggested by the government of Alberta for caribou habitat (Government of Alberta 2014). After Closure, the above-ground sections of pipeline would be cut at fault crossings and hauled away for recycling, and would not be expected to have impacts different than the buried sections.

Pipeline impacts would be greatest during the Construction Phase, and would be limited during Operations, with no impacts after the Closure Phase as the pipeline would be closed and left in place.

Moose tend to move between higher elevations in the summer and lower elevations in the winter and bull moose move extensively during the rut in fall (September and October) as they search for estrous cows. Caribou move between calving grounds (May-June), insect relief areas (June-July), and seasonal foraging areas (fall and winter months). Bison move between their summer range in the foothills near the South Fork and Windy Fork of the Kuskokwim River, including the physiologically important mineral licks in the Farewell area, and their winter habitat north of the Pipeline in the Bear Creek Burn area. However, the seasonal ranges of the bison overlap and animals could occur along the pipeline route at all times of year. Dall sheep also move down from their alpine habitats to use the Farewell mineral licks during the summer and fall. The potential for disruption of these movement patterns and the associated impacts to vital life functions are of particular concern to local residents and others, as expressed during the EIS scoping period. The potential for disturbance of these important game species along the pipeline route appears to be of particular concern in the Alaska Range and foothills to the north of the mountains given their important habitat values for all of these species.

There is the potential to mitigate or minimize these types of disturbance effects through advanced planning of construction schedules and activities to avoid the most sensitive areas and times. However, there are logistical constraints in moving construction camps and equipment so the potential for adaptive management to avoid impacts to real-time animal movements through rapid changes in construction activities is limited.

The proposed construction schedule for Alternative 2 shows the northern part of the route through the Alaska Range (approximately Milepost 110 to Milepost 145) would be completed from May through August. Dall sheep would be having their lambs in May and June but would typically be at much higher elevations than the construction equipment. Movements of sheep across the valley could be inhibited in areas of active construction, although the effects would be short-term (days or a few weeks) in any one area. Caribou from the Rainy Pass herd could also be in the area at this time, although they typically range further to the west, and would likely avoid the active construction zone. Construction activity at the northern end of this section could inhibit or redirect some movements of bison and sheep near the Farewell mineral lick area.

The proposed construction schedule shows the segment along the northern foothills (approximately Milepost 145 to Milepost 195) would be actively worked from November through April. Most of the moose, caribou, and bison in the area would likely be further north in the lowlands during this period, although there could be areas with higher concentrations of

these species along the corridor in protected river/creek valleys. Use of the Farewell mineral lick area would likely be minimal at this time of year due to snow cover.

Donlin Gold plans to help educate people traveling through the area about safety protocols and requirements during the Construction Phase through its Public Outreach Plan. Donlin Gold intends to work with people to either allow controlled access through or within construction zones or provide alternate access. Appropriate notices, warning signs, and flagging would likely be used to promote public safety but barricades may also be used around dangerous areas such as open trenches. Physical barriers would also serve to protect wildlife from passing through dangerous areas, although the physical presence and noise of machinery and people may be effective for deterring wildlife.

During Pipeline Operations, modification of habitat along the ROW to maintain early successional stages would improve browsing conditions for some species, such as moose and herbivorous small mammals, but would result in long-term loss of forest/shrub habitat. The resulting narrow strip of low vegetation along the buried pipeline ROW would not act as a barrier to movement for any species, although crossing it may expose some of them to higher risk of predation.

Organic Waste Attraction

Both Construction and Operations Phase activities may attract some species. Black bears, brown bears, foxes, birds, ground squirrels, foxes, coyotes, squirrels, ravens, and other wildlife are known to be attracted to construction camps and other human habitations because of food and garbage without careful management. Donlin Gold would develop and implement a Wildlife Avoidance and Human Encounter/Interaction Plan to minimize the attractiveness of camps and other facilities and minimize the risk of adverse human-wildlife interactions. Black bear and brown bear attraction often brings them into conflict with humans and results in bears being shot in defense of life or property. This is often a problem for remote construction camps (McLellan 1989). Donlin Gold intends to conduct site-specific orientation for all employees and contractors to include briefings on wildlife interactions, including bear safety.

Increased Barge Traffic

The frequency of river barge traffic needed to support the construction of the port facilities, mine facilities, and pipeline would increase by an average of 89 barge roundtrips during the Construction Phase during the first two years of construction. Current estimates of baseline roundtrips per season are 68. The total number of barges during Construction would therefore be expected to be 157 (or 89 plus 68). During the Construction Phase, there would be 122 barge roundtrips per year, or a total of 186 (122 plus 68) (see detailed barge trip information in Chapter 2, Alternatives). During the Operations Phase, there would be 122 annual barge roundtrips, and the total number of barges would be expected to be 190 (122 plus 68). It is not expected that there would be more than one barge on the river at any time per the project barge plan and estimated turnaround time for roundtrips (see Appendix W for barge plans).

Barges and other vessel traffic used during the Construction Phase may disturb terrestrial mammals using habitat along the Kuskokwim River.

Comments during Donlin Gold Project scoping meetings included observations that existing barge traffic affects large terrestrial mammals, such as moose, along the Kuskokwim river

through a combination of noise and visual disturbance (see the Scoping Report in Appendix B). Residents have observed moose coming out into the open and crossing the river only after existing barge traffic has passed and the sounds and wakes have abated, a period which may last tens of minutes or more depending on the barge load and direction of travel. The observed avoidance behavior of moose along the river banks and in crossing the river discussed at the scoping meeting may extend to other species such as bears and caribou. Traditional Ecological Knowledge (TEK, also referred to as Indigenous Knowledge) also indicates that large terrestrial mammals tend to avoid areas of anthropogenic disturbance, such as barge passing.

There is limited published literature regarding terrestrial mammal response to barge noise in particular, although information is available on response of mammals to sounds, and on response of marine mammals to marine vessel sound and presence (Marine Stressors Committee 2017). The project area may contain a diverse array of anthropogenic sound sources, which may vary in time, frequency, and intensity. How animals perceive the sound stimuli often relates to animal response; for example, sounds that are sudden, unpredictable, and loud often generate startle responses that can be similar to those associated with predation risk (Francis and Barber 2013). Other sounds that animals perceive as originating from either predators or aggressive entities may cause a disturbance response similar to a response to predators or same-species competition (Frid and Dill 2002). It is not expected that barge traffic would generate frequent sudden, unpredictable, or loud noises.

Sounds that are frequent, continuous, or chronic may not be perceived as being threatening by an animal, but can affect animals by interfering with the ability to detect acoustic signals or cues (for example, calls from other members of the species, or sounds made by predators or prey (Marine Stressors Committee 2017, Francis and Barber 2013). There is evidence that the more overlap there is in bandwidth between anthropogenic sounds and animal-generated sounds, the greater a behavioral disturbance may be. Masking of sounds may reduce an animal's perception range or listening area (Barber et al. 2010). Given that barge noise would be expected to be continuous rather than sudden or unpredictable, it is possible that moose (or other terrestrial wildlife) behavior may be affected in that wildlife may not be able to perceive sounds or other cues due to a masking effect of barge noise. It is also possible that moose or other terrestrial wildlife may exhibit avoidance behavior due to perceiving barge noise or vibrations, or by observing a vessel traveling closer to occupied shoreline habitat. The avoidance behavior would be expected to be temporary, and normal behavior to resume after the barge has passed through the area of habitat.

In combination with existing river traffic, the increased frequency of disturbance due to barge and other vessel traffic during the Construction Phase may deter animals from using habitats and moving between different parts of their range during the open water season. This effect may be more pronounced in high traffic areas (e.g., around Bethel) and may be expected to be more pronounced in areas such as the Angyaruaq (Jungjuk) Port site which does not currently have levels of activity that would be expected to occur during Construction or Operations phases. This disturbance-related loss of habitat could have adverse effects on the animals, although it may also make it more difficult for them to be hunted from the river, which would benefit the animals even though it would be an adverse effect for subsistence or recreational hunters. Overall, given the low number of barges on the river at any given time and the existing barge and other river traffic, the incremental reductions in time for crossing would be small.

During Operations, the level of activity for barges would be similar to the frequency of river barges used during the Construction Phase with similar effects on terrestrial mammals. There is potential for some large animals such as moose to habituate to the noise and increased presence of barge traffic over time; however, animals like moose are unlikely to change their patterns of crossing the river in response to barges, and the increased frequency of barges may restrict moose crossing and change moose behavior during the shipping season.

Injury and Mortality

If animals are forced out of their familiar territories or have to alter their movement patterns, they may enter the territories of other animals that aggressively defend their area, with the potential for injury or mortality. They may also be more susceptible to predation through lack of experience with local cover and escape terrain. In extreme cases, disturbance can actually lead to mortality of the animal if it causes a mother to be separated from or abandon her young or if the animal is injured trying to flee.

Small spills of industrial fluids, such as glycol (antifreeze), could attract wildlife and cause harm to wildlife if ingested.

Vehicle Collisions

Moose often feed near roads even when vehicles are present and rest or travel along cleared roads during heavy snow conditions. They frequently cross roads even when vehicles are present, but they are often startled by traffic and bolt to one side or the other. This may cause cows to be temporarily separated from their calves and increases their risk of injury or mortality through vehicle collisions when the animals try to reunite. Although construction vehicles typically travel at relatively slow speeds that would reduce the risk of collisions, the potential for injury and mortality would exist during Construction and Operations at the Mine Site and Pipeline areas, especially at night or other periods of poor visibility and in the winter when animals may use the mine access road to escape deep snow. Donlin Gold proposes to control traffic on access roads for project-only purposes and to enforce slow speed limits (i.e., 35 miles per hour). The number of drivers, shifts, and other considerations that may affect the likelihood of collisions would be determined in accordance with all applicable state and federal requirements. While traffic controls would be implemented through signage and security patrols, there are too many variables to know how effective they might be in reducing the risk of vehicle collisions with animals. Other species may also cross roads and have the potential for injury and mortality due to collisions with project vehicles, including caribou and a variety of small mammals.

Mine access road construction would probably last one or two years at the beginning of the Construction Phase. Mine development traffic along the road would likely begin soon after it was completed. The number and frequency of vehicles on the road may be high as mine equipment and construction materials are delivered to the Angyaruaq (Jungjuk) Port site and transported on the road. Given speed restrictions and the noise of heavy equipment moving along the road, the risk of injury or mortality due to collisions with wildlife on the road would be low, but disturbance would be almost continual near the road (up to a few hundred yards for some species).

The expected frequency of mine access road traffic would be equivalent to one truck passing any given point on average every 5 to 10 minutes during a 10-hour period each day during the

shipping season. The risk of injury and mortality from collisions with vehicles would increase during twilight hours or if the trucking extends into the winter when daylight is limited, snow restricts visibility, and icy roads increase stopping times for trucks. Trucking is not expected to occur during the non-shipping season. During the shipping season, trucking would occur for 12 hours per day. During the shipping season, twilight or night driving hazards would be reduced due to the amount of daylight that occurs. Donlin Gold intends to prohibit public use of the access road for safety reasons during active shipping and trucking seasons, including use by local residents.

After the Closure Phase, the Angyaruaq (Jungjuk) Port site and all mine support facilities would be removed and the land would be re-contoured and reclaimed. The mine access road and mine camp airstrip would remain in place during the Closure Phase to support reclamation and monitoring activities at the Mine Site. Some supplies and fuel may need to be barged up to a landing at Angyaruaq (Jungjuk), but the main port facilities would be removed, and this would be just another barge stop much like existing village stops. The volume of materials moved would be a tiny fraction of the operational volume and would be similar to the baseline conditions. The types of effects associated with the road and traffic, including behavioral disturbance, habitat fragmentation, and potential for injury and mortality, would continue but would be greatly reduced due to the very low traffic.

Environmental Contamination

Potential risks to wildlife from exposure to metals in water at the pit lake are analyzed in the ERA and ERA Addendum (ARCADIS 2013b, ERM 2015, AECOM 2015) (see Section 3.12.2.5). Concentrations of COPCs did not present risk under chronic exposure scenarios, and therefore also are not expected to present any risk under acute scenarios. Terrestrial mammals could potentially be exposed to contaminated soil from fugitive dust emissions; however, RMC levels compared to baseline or Year 35 soils indicate that there is not expected to be risk to mammals for arsenic or mercury.

Terrestrial mammals could potentially be exposed to discharges and spills from vessels transporting fuel and cargo, as well as to fuel spilled at any of several transfer points, including barge to storage tank transfer or ocean barge to river barge transfer at the Bethel Port site, and river barge to storage tank transfer at the Angyaruaq (Jungjuk) Port site, or in the event of a stranded barge that requires lightening of fuel.

Section 3.24, Spill Risk, provides analysis of risks and potential impacts of spills from fuel barges and storage tanks along the marine and riverine transportation corridors, and from tanker trucks traveling to and from the Mine Site. The risk of catastrophic accidents is very small (likelihood of occurrence is low during the life of the project), although small accidents and spills could periodically occur. The severity of impacts would depend on the type of contaminant spilled, the volume and extent of the spill, time and location of a spill, and whether or not terrestrial mammals are present.

Habitat Alteration

Different vegetation types have different value, providing essential habitat function (such as food sources, shelter, or cover from predators) for all terrestrial mammals. Most of the vegetation that would be removed consists of boreal forest tree species (white or black spruce, quaking aspen and paper birch); shrubs (alders, willows, salmonberry, lingonberry, cranberry,

and blueberry); and ground cover species (herbaceous plants, sedges, and grasses). Details of acres of direct loss of vegetation types from construction activities are discussed in Section 3.10, Vegetation and Nonnative Invasive Species.

Vegetation Removal

Areas such as the pipeline corridor would experience vegetation removal, revegetation, and a gradual regrowth of vegetation except in areas subject to regular maintenance brushing during the Operations Phase, or areas with permanent changes in hydrology. Areas with planned revegetation or reclamation (such as the pipeline corridor or certain Mine Site areas after the Closure Phase) would include native ground cover to minimize erosion in the first year. Shrub and tree species would likely re-colonize many disturbed areas within a few years. Areas that are not permanently altered would likely be used by a variety of terrestrial mammals for different habitat functions as the revegetation and succession process continues. Section 3.10, Vegetation and Nonnative Invasive Species, includes details on revegetation practices and processes.

Adverse or beneficial changes are different for different species. For some species such as moose, snowshoe hares, and voles, forest clearing with successional regrowth may improve the habitat especially if disturbance areas are narrow (e.g., the pipeline corridor) and surrounding forests remain to provide cover. Localized areas may also experience vegetation changes related to changes in hydrology due to embankments or new drainage areas (see Section 3.10, Vegetation and Nonnative Invasive Species, and 3.11, Wetlands). Some species such as moose may be attracted to roadways and disturbed areas because of vegetation planted for erosion control, to avoid predators or deep snow, or as a movement corridor (US Forest Service 2000; Trombulak and Frissell 2000).

Some areas such as the pit lake would experience permanent habitat value changes for all species. This direct loss or modification of habitat is large, but relatively small compared to the amount of similar, common natural habitats within the EIS Analysis Area.

Construction activities at the Mine Site include vegetation clearing for the mine facilities, including waste rock and tailings storage areas. The areas of vegetation types expected to be lost to these clearing efforts are given in detail in Section 3.10, Vegetation and Nonnative Species. Essentially all of the terrestrial mammal species occurring in the Mine Site area use conifer and shrub habitat types for food, shelter, and other life functions at least part of the year. However, these types of habitats are common and extensive in this part of Alaska; the amount of habitat lost from clearing at the Mine Site would be relatively small by comparison.

Vegetation clearing would be avoided as much as possible in the spring and early summer to minimize terrestrial mammal habitat disturbances during the time of year when the young of most species are more susceptible to disturbance.

Some terrestrial mammals, such as bears, wolves, river otters, and marten, give birth in dens during the winter or early spring. Land clearing and other construction activities near den sites during these months could cause some direct mortality of adults and young if dens are inadvertently destroyed, with the potential for decreased reproductive success. Since bears tend to choose den sites at higher elevations than the Mine Site or pipeline corridor, the potential for den disturbance is much smaller for bears than for otters or marten. Other small mammals such as voles and shrews live under the snow in burrows but have limited capacities to move away

from construction equipment during the winter, making them more susceptible to predators and cold temperatures.

With re-vegetation and natural succession causing continual changes in the vegetation of the Mine Site, other than the mine pit, the value of the Mine Site as habitat for terrestrial mammals would likely improve and change over time. Moose and other mammals that prefer early successional vegetation are likely to return to the Mine Site after human activity is curtailed. As trees grow back, arboreal species such as squirrels and martens could also return. As the herbivore species return, predators such as brown bears and wolves could also start using the Mine Site area again. The Closure Phase could therefore include a gradual return to a state similar to the pre-mine conditions although the pit lake would constitute a permanent removal of some habitat for terrestrial mammals and could hinder movement for some species.

Mine access road construction would involve land clearing along the ROW and gravel pits needed for construction. Direct loss of habitat includes vegetation removal of 9,819.30 acres in the Mine Site and 1,093.4 acres in the Transportation Corridor of primarily evergreen forested vegetation types (6,950.8 acres in Mine Site, 602.4 acres in Transportation Corridor) and scrub shrub vegetation types (1,991.5 acres in the Mine Site, 317.6 acres in the Transportation Corridor) (see Tables 3.10-10 to 3.10-11, in Section 3.10, Vegetation and Nonnative Species). The North Option vegetation removal acres would be similar acres (see Table 3.10-13 in Section 3.10, Vegetation and Nonnative Invasive Species). Disturbance from land-clearing and construction equipment would likely displace and deter most terrestrial mammals from using nearby areas, thus increasing the effective loss of habitat. Land clearing would likely occur during the winter season and road construction would likely occur primarily during the non-winter months. Disturbance along the mine access road corridor would therefore extend throughout the year during the Construction Phase, although it would not impact the entire ROW at the same time.

In the Pipeline component, removal or modification of habitat types during the 3 to 4 year Construction Phase would be a small proportion of total habitat types impacted along the pipeline corridor (see Table 3.10-12, in Section 3.10, Vegetation and Nonnative Species, for specific acres and percent of Ecoregions impacted for each of the project components).

Along the pipeline route, vegetation removal would include 6,981.9 acres, mainly evergreen forested vegetation types, deciduous / mixed forested types, and scrub shrub vegetation types in the four ecoregions the Pipeline component crosses (see Table 3.10-18 for a comprehensive list of all vegetation removal acres for each Alternative in Section 3.10, Vegetation and Nonnative Invasive Species).

Riparian wildlife habitat could also be modified by erosion of the river bank due to barge wakes. The banks of the Kuskokwim River include many silty soil types that are susceptible to erosion. The river bank is a naturally dynamic environment, with water currents, wind-generated waves, and ice scouring all causing changing areas of erosion and deposition. Large wakes generated by current barge and small boat traffic have contributed to these natural processes that undercut and cause collapse of vegetated banks into the river. New barge traffic related to mine development would contribute incrementally to erosion rates on the river bank and would therefore contribute to riparian habitat modification. However, the projected increase in erosion rates due to mine-related river traffic is very small, with an estimated increase over current rates ranging from 0.21 acres per year downriver to 0.01 acres per year upriver. Erosion of riparian habitat may be an adverse effect for some species and beneficial for

other species that prefer disturbed landscapes with early successional plants. Erosion rates are discussed in detail in Section 3.11, Wetlands.

Nonnative Invasive Species

Accidental or intentional introduction of NNIS could potentially change composition, structure, or function of terrestrial or aquatic vegetation communities, which can impact wildlife habitat. Impacts from NNIS are addressed in Section 3.10, Vegetation and Nonnative Species.

Within the Transportation Corridor, introduction of the Norway rat (Rattus norvegicus) is a concern. Norway rats are a nonnative invasive terrestrial mammal species that have colonized numerous cities and islands in Alaska, including Dutch Harbor, Nome, and Fairbanks (ADF&G 2015c). Rats have a variety of adverse effects, including competition for food resources and the potential to spread parasites and diseases. Rats have had devastating effects on some islands, primarily by eating seabirds and disrupting their nesting efforts, as well as altering vegetation patterns and displacing other predators (AMNWR 2007). Rat invasions typically occur when rats living on marine vessels escape while the vessels are in port, or during shipwrecks.

Increased Hunting and Trapping Pressure

The possibility of increased hunting and trapping pressure exists for the area's wildlife due to two main factors: 1) improved public access to previously difficult-to-reach areas along construction roads and the pipeline corridor, and 2) the influx of workers and new residents attracted to the employment opportunities of the mine. Potential future wildlife management may include stricter hunting regulations in the EIS Analysis Area.

New mine employees and associated contractors would likely be well paid and could afford off-road vehicles, river boats, airplanes, and guide services to hunt on their off-duty hours. Donlin Gold intends to implement restrictions on the possession and use of firearms and other weapons at their worker camps and would prohibit their personnel from hunting, trapping, and fishing while they are working. These restrictions could minimize the impact of additional hunting and trapping pressure in the immediate vicinity of the camps and mine facilities.

Donlin Gold would need to hire thousands of people to work during the Construction Phase and hundreds for the Operations Phase, some of which would not be local residents. Section 3.18, Socioeconomics, provides data on estimated workforce during Construction and Operations, including a 50-60 percent local hire rate during Construction and Operations. During Construction, temporary, non-local workers are likely to commute from outside of the region so an influx of new residents to the local communities of the EIS Analysis Area is unlikely. However, during Operations, some may choose to live in nearby communities such as Bethel rather than traveling long distances when they are off-shift. This increase in the local human population could lead to increased hunting pressure for recreational and subsistence purposes, especially for popular big game species such as moose and caribou, and also potential increased trapping pressure on furbearers. The increased demand for wildlife resources could lead to changes in wildlife management policies to address this demand, including the potential for expanded predator control programs on state-managed lands that could affect the populations of wolves and both species of bears. Considering the relatively low populations of moose and caribou, the influx of new people and increased mobility could lead to increases in hunting and trapping pressure that could reduce local game populations and necessitate changes in wildlife management regulations.

Traditional use of the surrounding area for subsistence hunting, trapping, and berry picking could be inhibited potentially resulting in increases in game species and furbearer populations through reduced hunting and trapping pressure. However, access to these areas by traditional means and routes may not be affected unless the access requires crossing mine-restricted property.

Access to the Angyaruaq (Jungjuk) access road may remain restricted after the mine is closed. The road would remain in place due to the need for limited transportation of supplies for the Water Treatment Plant (WTP). Because there are currently few roads in the area it is likely that local residents may want to use the port and road to access subsistence resources, especially those who worked at the mine or port and have become knowledgeable about the area and live nearby. Increased access may increase hunting and trapping pressure in the Angyaruaq (Jungjuk) Port and mine access road area (depending on wildlife populations), although it may reduce hunting and trapping efforts elsewhere as people choose to go where access is easiest. After the Closure Phase, some of the people who moved to the area for work may seek to move elsewhere for new employment, thereby reducing the number of local residents trying to use wildlife resources. However, local communities like Bethel may retain more residents than under the status quo as a result of long-term employment at the mine and establishment of families within the communities.

In the Pipeline component, a concern during the Construction Phase is the potential for increased public access along the pipeline corridor and supply routes, which may lead to increased hunting and trapping pressure as well as increased disturbance of wildlife from snow machines and off-road vehicles (ORVs), as well as non-mechanized means of transport such as dog teams, horses, and hiking. Potential users include residents of rural communities as well as non-local Alaskans and out of state users. Donlin Gold is aware that certain areas of the pipeline ROW, especially in the Matanuska-Susitna Borough, are currently used on a regular basis by residents from nearby communities.

In areas that already contain well-used trails, such as the INHT (ADL 222930/RST-199), the presence of temporary construction ROWs and access roads are unlikely to attract new users or increase current uses. In fact, the noise and disruption of construction activities in remote areas may decrease the inclination of people to travel through the area. However, in areas that currently do not have established or well-used trails, such as the area north of the Alaska Range between Farewell and the Mine Site, the post-construction ROWs may improve current options for access in all seasons.

Guided hunting and recreational wilderness travel businesses (e.g., river rafters) may develop new business opportunities that take advantage of the pipeline ROW for key access points. Donlin Gold would clearly mark the ROW where it would cross existing trails and may build berms or other barriers to discourage travel on the ROW. However, such efforts are not expected to prevent all use of the ROW and new trail systems may grow out from the ROW as previously remote areas receive more use.

Given the relative scarcity of popular big game animals near established communities and convenient trails, the expansion of access to new hunting grounds may increase use of the area for hunting and trapping purposes. Many areas through which the pipeline ROW passes on the north side of the Alaska Range are early successional vegetation habitats important to moose and other species. These areas are preferred habitat and would likely be targeted by new hunters. Although construction workers would be prohibited from having firearms or hunting

while on duty, their exposure to potentially new hunting areas along the ROW could eventually lead to increased hunting pressure in these areas following their project employment or during their off-shift time. This may occur after construction activities have moved out of an area but potentially even during construction. The increase in access and hunting pressure could affect population trends for popular game species such as moose, caribou, and Dall sheep, particularly in certain areas where ORV use is or becomes practical.

After the pipeline is closed, vegetation brushing would no longer occur; natural revegetation would be expected to allow regrowth to vegetation communities similar to those of adjacent vegetation types through natural succession. Some areas of the ROW may have become well-used as trail access to different locations; it is possible that long-time trail users may clear sections of the ROW as needed to maintain local trails. Given the long life of the proposed project, use of the ROW for access to new hunting and trapping grounds would likely have become well-established and not likely to end just because the pipeline is decommissioned. This increased access and hunting pressure would have become the new status quo, with modifications to game management regulations to maintain sustainable populations as needed. Wildlife populations would continue to fluctuate for a variety of reasons, with ADF&G's management goal to regulate consumptive uses of wildlife resources and habitat characteristics for sustainability. The potential impacts of additional trail development off the pipeline corridor cannot be predicted at this time because, while trail development is reasonably foreseeable if the project is constructed, the location and extent of additional trails is unknown.

Donlin Gold would attempt to limit public use of new airstrips during construction of the pipeline corridor, but some public use may occur. Current hunting access in many areas is primarily by small aircraft that land on gravel bars, tundra, or lakes. Some hunting parties currently land at the existing airstrip at Farewell with ORVs and hunt in the surrounding area. The availability of new landing strips during construction could allow the expansion of hunting pressure and other recreational uses in nearby areas that were previously difficult to access. After the Construction Phase, the new airstrips along the pipeline corridor would be made non-functional by excavating berms and/or trenches across the strip. This technique has been demonstrated to prevent continued use of temporary airstrips (Donlin Gold 2016c).

Summary of Terrestrial Mammal Impacts for Alternative 2

Applying the methodology defined in Table 3.12-7 to the information and data presented in this section, Alternative 2 has potential direct and indirect impacts on terrestrial mammals. Table 3.12-8 provides a summary of impacts by the four assessment factors.

Table 3.12-8: Summary Impacts[1] of Alternative 2 on Terrestrial Mammals by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Mine Site:				
Behavioral disturbance (noise, barriers to movement, organic waste attraction)	In some locations, changes in behavior due to project activity may not be noticeable; animals would be expected to remain in the vicinity. In other locations within the project footprint or adjacent to project activity, there may be noticeable changes in behavior that may affect reproduction or survival of individuals.	Behavior would be expected to be altered for several years during Construction and Operations and would be expected to return to pre-activity levels in the after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (noise).	Impacts would occur within the Project Area, mainly around areas of project activity within the project footprint, but behavior patterns could cause changes in movement within the Project Area.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.
Risk of injury or mortality (vehicle collisions, environmental contamination)	While injury or mortality may occur, population level effects are not expected to be detectable. There is unlikely to be a noticeable change in animal population character or quantity.	In some locations, risk would be expected to be higher for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (vehicle use of roads). In some locations, risk would be permanent such as the pit lake and would need to be addressed by appropriate mitigation and design.	Impacts are expected to be limited to vicinity of the project footprint, but it is possible that individuals may be impacted throughout the Project Area due in the case of environmental contamination to a species that is mobile.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.

Table 3.12-8: Summary Impacts[1] of Alternative 2 on Terrestrial Mammals by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Habitat alteration (vegetation removal)	In some locations, there may be noticeable changes in resource character and quantity; habitat may change by vegetation type change or other change due to removal followed by reclamation or natural revegetation. In other locations, there may be acute or obvious changes in resource character and quantity; habitat may be removed or otherwise lost or changed, such as in the case of the pit lake, which would experience permanent vegetation removal.	In some locations, resources would be reduced during Construction and up to the life of the mine, and may return to pre-activity levels through revegetation or reclamation, but vegetation composition may be different. In other locations, resources would not be anticipated to return to previous character or levels, such as in the case of permanent vegetation removal. In some locations, reclamation activities would begin during Operations.	In most locations, impacts would be local within the project footprint. There may be some vegetation type changes within the Project Area.	Habitats impacted are those common to the region; vegetation types are not expected to be depleted in the locality, and are not protected by legislation.
Increased hunting and trapping pressure	Changes in amount of hunting and trapping are not expected to be noticeable due to controlled access during Construction and Operations.	Impacts may be experienced for the life of the project, through Construction and Operations, but may extend past Closure as access may be possible.	Impacts would be expected to limited to vicinity of the project footprint with new access areas, but could be experienced within the Project Area if wildlife populations are impacted.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.
Transportation Corridor:				
Behavioral disturbance (noise, barriers to movement, increased barge traffic)	In some locations, changes in behavior due to project activity may not be noticeable; animals would be expected to remain in the vicinity. In other locations within the project footprint or adjacent to project activity, there may be noticeable changes in behavior that may affect reproduction or survival of individuals.	Behavior would be expected to be altered for several years during Construction and Operations and would be expected to return to pre-activity levels in the after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (noise, barge traffic).	Impacts would occur within the Project Area, mainly around areas of project activity within the project footprint, but behavior patterns could cause changes in movement within the Project Area.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.

Table 3.12-8: Summary Impacts[1] of Alternative 2 on Terrestrial Mammals by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Risk of injury or mortality (vehicle collisions)	While injury or mortality may occur, population level effects are not expected to be detectable. There is unlikely to be a noticeable change in animal population character or quantity.	In some locations, risk would be expected to be higher for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (vehicle use of roads).	Impacts are expected to be limited to vicinity of the project footprint, but populations may be impacted within the Project Area.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.
Habitat alteration (vegetation removal)	In some locations, there may be noticeable changes in resource character and quantity; habitat may change by vegetation type change or other change due to removal followed by reclamation or natural revegetation. In other locations, there may be acute or obvious changes in resource character and quantity; habitat may be removed or otherwise lost or changed, such as in the case of mine access roads, which would experience permanent vegetation removal.	In some locations, resource would be reduced during Operations and up to the life of the mine, and may return to pre-activity levels through revegetation or reclamation, but vegetation composition may be different. In other locations, resources would not be anticipated to return to previous character or levels, such as in the case of permanent vegetation removal.	In most locations, impacts would be local within the project footprint. There may be some vegetation type changes within the Project Area.	Habitats impacted are those common to the region; vegetation types are not expected to be depleted in the locality, and are not protected by legislation.
Increased hunting and trapping pressure	Changes in amount of hunting and trapping are not expected to be noticeable due to controlled access during Construction and Operations.	Impacts may be experienced for the life of the project, through Construction and Operations, but may extend past Closure as access may be possible.	Impacts would be expected to limited to vicinity of the project footprint with new access areas (around roads and port sites) but could be experienced within the Project Area if wildlife populations are impacted.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.

Table 3.12-8: Summary Impacts[1] of Alternative 2 on Terrestrial Mammals by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Pipeline:				
Behavioral disturbance (noise, barriers to movement, increased barge traffic)	In some locations, changes in behavior due to project activity may not be noticeable; animals would be expected to remain in the vicinity. In other locations within the project footprint or adjacent to project activity, there may be noticeable changes in behavior that may affect reproduction or survival of individuals.	Behavior would be expected to be altered for several years during Construction and Operations and would be expected to return to pre-activity levels in the after actions causing impacts were to cease. In the Pipeline, impacts would occur mainly during Construction, but there would be intermittent impacts during corridor vegetation brushing or other activities. Some impacts would be seasonal or intermittent (noise, increased barge traffic during Construction in Cook Inlet).	Impacts would occur within the Project Area, mainly around areas of project activity within the project footprint, but behavior patterns could cause changes in movement within the Project Area.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.

Table 3.12-8: Summary Impacts[1] of Alternative 2 on Terrestrial Mammals by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	Duration	Extent or Scope	Context
Risk of injury or mortality (vehicle/construction equipment collisions)	While injury or mortality may occur, population level effects are not expected to be detectable. There is unlikely to be a noticeable change in animal population character or quantity. Denning and burrowing species may be impacted more during Construction on the pipeline corridor.	In some locations, risk would be expected to be higher for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease. For the Pipeline, impacts would be expected to be higher during Construction as this is when most of the impact-causing activity would occur. Some impacts would be seasonal or intermittent, as some construction would take place at different times of the year in different locations; vegetation brushing would also occur intermittently.	Impacts are expected to be limited to vicinity of the project footprint.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.

Table 3.12-8: Summary Impacts[1] of Alternative 2 on Terrestrial Mammals by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Habitat alteration (vegetation removal)	In some locations, there may be noticeable changes in resource character and quantity; habitat may change by vegetation type change or other change due to removal followed by reclamation or natural revegetation. In other locations, there may be acute or obvious changes in resource character and quantity; habitat may be removed or otherwise lost or changed.	In some locations, resources would be reduced during Construction and up to the life of the mine, and may return to pre-activity levels through revegetation or reclamation, but vegetation composition may be different. In other locations, resources would not be anticipated to return to previous character or levels, such as in the case of permanent vegetation removal in limited locations within the Pipeline component. In some locations, reclamation activities would begin during Operations. Vegetation would be subject to periodic brushing during Operations along the pipeline corridor per PHMSA requirements.	In most locations, impacts would be local within the project footprint, although given the length of the construction footprint for the Pipeline component, impacts would be regional within the Project Area.	Habitats impacted are those common to the region; vegetation types are not expected to be depleted in the locality, and are not protected by legislation.
Increased hunting and trapping pressure	Changes in amount of hunting and trapping may be noticeable during Construction and Operations due to increased access along the length of the pipeline corridor.	Impacts may be experienced for the life of the project, through Construction and Operations, but may extend past Closure as access may be possible and may need to be addressed by adaptive game management approaches.	Impacts would be expected to limited be regional with new access areas possible along the length of the pipeline corridor which may connect existing trails or access points.	Impacted species are expected to be those common to the region, with some species such as moose being important game species, and some species such as small mammals being important furbearing species for trapping.

Notes:

1 The expected impacts account for impact reducing design features proposed by Donlin Gold and Standard Permit Conditions and BMPs that would be required. It does not account for additional mitigation measures being considered.

Mitigation and Monitoring for Alternative 2

Effects determinations take into account impact reducing design features (Table 5.2-1 in Chapter 5, Impact Avoidance, Minimization, and Mitigation) proposed by Donlin Gold and also the Standard Permit Conditions and BMPs (Section 5.3) that would be implemented.

Design features important in reducing impacts to terrestrial mammals include:

- In final design, site infrastructure, material sites, and roads would avoid ground disturbing activity in wetland areas whenever practicable; and
- Development and implementation of a Mine Site wildlife protection plan (which may include elements typical to such plans as Avian Protection Plans) to identify measures to prevent birds or wildlife from accessing the TSF, the pit lake, or other mine waters.

Standard Permit Conditions and BMPs important in reducing impacts to terrestrial mammals include:

- Monitoring of water withdrawals to ensure permitted limits are not exceeded;
- Development and implementation of a Wildlife Avoidance and Human Encounter / Interaction Plan;
- Implementation of Storm Water Pollution Prevention Plans (SWPPPs) and Erosion and Sediment Control Plans (ESCPs); and
- Development and maintenance of Oil Discharge Prevention and Contingency Plans (ODPCPs), Spill Prevention, Control, and Countermeasure (SPCC) Plans, and Facility Response (FRP) Plans.

Additional measures are being considered by the Corps and Cooperating agencies and are further assessed in Chapter 5, Impact Avoidance, Minimization, and Mitigation (Section 5.5 and Section 5.7). Examples of additional measures being considered that are applicable to this resource include:

- Where practicable and in compliance with FAA and safety requirements, establish appropriate minimum flight altitudes to minimize impacts to wildlife when animals are present in the vicinity of the work (both >1,000 feet and > 1,500 have been specified for other projects in Alaska); and
- Where appropriate, employ seasonal timing restrictions on blasting, as stipulated by resource agencies, to reduce noise related effects of blasting during sensitive subsistence hunting activities (e.g., fall moose hunting).

3.12.3.2.2 MARINE MAMMALS

Key issues with potential direct and indirect effects impacting marine mammals were identified during agency and public scoping. These include:

- Behavioral disturbance, including:
    - Noise; and
    - Increased barge traffic.

- Injury and mortality, including:
    - Vessel strikes; and
    - Injury or mortality resulting from contamination from fuel or chemical spills (addressed in Section 3.24, Spill Risk).
- Habitat alteration, including:
    - Habitat changes through contamination from fuel or chemical spills (addressed in Section 3.24, Spill Risk).

These impacts are described in further detail below under associated subheadings, unless otherwise noted as being addressed in other document sections. Impacts are discussed, where applicable, by project component (Mine Site, Transportation Corridor, or Pipeline). Impacts are also discussed, where applicable, per project phase (Construction, Operations, or Closure).

Project Components most likely to impact marine mammals are the marine and riverine portions of the Transportation Corridor, and barging and nearshore activity in upper Cook Inlet. Effects of barge trips south of Dutch Harbor or Cook Inlet are not analyzed because they are a small fraction of the typical shipping traffic to and from the Dutch Harbor vicinity and are within the range of variability of that shipping background. At the Mine Site, any direct or indirect effects on marine mammals incurred during all project phases would be due to transportation of fuel and materials via barges or construction at the port sites (discussed under Transportation Corridor). In the Pipeline component, impacts would be from transporting pipe and supplies via barges in the Kuskokwim River Transportation Corridor and in upper Cook Inlet (Beluga barge landing) and be similar to those for Transportation Corridor.

Behavioral Disturbance

During the Construction Phase, construction of specific Transportation Corridor facilities (i.e., at the Bethel cargo terminal, fuel terminal, and tank farm, and the Angyaruaq [Jungjuk] Port site), and shipping and offloading cargo and fuel, may impact marine mammals. During the Operations Phase, noise and barge traffic would continue along with other project activity that may impact marine mammals. During the Closure Phase, with the lower activity level and shorter time period, potential effects on marine mammals would likely include limited behavioral disturbance. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

Noise

The three types of potential impacts of noise on marine mammals are non-auditory injury, auditory injury, and behavioral (e.g., avoidance, changes in foraging or social behavior) (Richardson et al. 1995; Southall et al. 2007). Behavioral impacts from vessel traffic noise and dock and port construction noise are most likely. In-water noise from vessels, sonar, construction, or other sources could interfere with or mask marine mammal communication or cause deflection from or avoidance of an area (Würsig et al. 2000; David 2006; Clark et al. 2009; Tougaard et al. 2009; Norman 2011). Injury from noise is not likely, as sound levels are all expected to be well below injury thresholds.

Marine mammals are known to react to vessel activity and noise. Whales react less dramatically to the noise from slow-moving vessels than to faster and/or erratic vessel movements and engine noises. Some species tolerate slow-moving vessels within several hundred yards, especially if there are no sudden changes in direction or engine speed (Wartzok et al. 1989; Richardson et al. 1995; Heide-Jorgensen et al. 2003). Behavioral responses to vessels vary by vessel size, speed, distance, and whale species, but may include avoidance, such as swimming away from the vessel, or changes in diving and surfacing behavior (Finley et al. 1984; Norman 2011). Pinnipeds are sensitive both to sound in air and in water and may be susceptible to loud noise when they are in the water or hauled out on land (Kastek et al. 2005). Most available information on reactions of pinnipeds to boats concern pinnipeds hauled out on land or ice. Human caused disturbances of hauled-out seals usually result in flushing animals into the water (Suryan and Harvey 1999; Jansen et al. 2006). Harbor seals are more dependent on haulouts during pupping (early June through early July at Nanvak Bay) and molting (late August and early September at Nanvak Bay), leaving them more vulnerable to disturbance at those times. Harbor seals flushed from haulouts in Nanvak Bay have been known to alter haulout patterns for up to a day after disturbance (MacDonald and Winfree 2008). In places where boat traffic is heavy, seals may habituate to vessel disturbance (Bonner 1982; Jansen et al. 2006). The relatively low occurrence of marine mammals and lack of observed pinniped haulout sites in the Kuskokwim River, the mouth of the river, and in upper Cook Inlet suggests minimal likelihood of disturbance from vessel noise.

Dock construction at the port sites would involve pile driving (sheet pile). The high amplitude noise from pile driving activities may mask marine mammal vocalizations or cause deflection or avoidance of an area (Würsig et al. 2000; David 2006; Tougaard et al. 2009). Studies of large-scale offshore pile driving suggest audibility by harbor seals depends on propagation conditions and background noise, but could be up to great distances from the sound source (Kastelein et al. 2013). Noise would likely result in some amount of displacement or avoidance of the area by marine mammals during pile driving and dock construction activities (Kendall 2010; Dahne et al. 2013). Seal occurrence frequency in either port area is relatively low and harbor porpoise, beluga whale, and killer whale sightings are rare, limiting the likelihood that individuals would be disturbed by construction noise.

The increased barge traffic in the Kuskokwim River would increase underwater noise levels and the potential for behavioral disturbance of individual marine mammals in the area, such as short-term disturbance or temporary displacement as the barge passes by. The frequency of occurrence of pinnipeds in the lower Kuskokwim River (11-68 sightings of harbor/ spotted seals per year, 2007-2009 [RWJ Consulting Inc. 2010b]) is both variable and oftentimes low, minimizing the likelihood of repeated co-occurrence with barge traffic. Harbor porpoises and beluga whales are rare in the Kuskokwim River, and killer whales have never been seen in the river, although they are occasionally sighted in Kuskokwim Bay, so the likelihood of disturbance is low.

During the Closure Phase, impacts would be from transportation of fuel and materials via barges, and dismantling of the barge landing at the Angyaruaq (Jungjuk) Port site. Noise generated during removal of the barge landing would likely be of lower amplitude than during dock construction and of shorter duration.

Increased Barge Traffic

Potential effects on seals and cetaceans during the Construction Phase may include temporary, short-term displacement during construction at the Bethel Port site and behavioral disturbance or displacement caused by vessel traffic delivering fuel and cargo transport to Bethel and upriver to the Angyaruaq (Jungjuk) Port site. Although gray whales occur in the eastern Bering Sea, they are generally only there during migration prior to and after the proposed shipping season, so they are unlikely to be encountered or impacted by vessel traffic between Dutch Harbor and Bethel. Other cetaceans along the Bering Sea barge corridor (minke whales, killer whales, harbor porpoises, Dall's porpoises) could be encountered during cargo and fuel transport and could experience temporary displacement or avoidance as ships pass by. Some species such as Dall's porpoise often approach fast moving vessels to ride the bow wave. The nearest major harbor seal haulout and pupping area is in Nanvak Bay in northern Bristol Bay and outside of the EIS Analysis Area, so disturbance of sensitive habitat and life stages is very unlikely. Seals in the Kuskokwim River are generally in small groups of one to two animals and in the water resting, traveling, or foraging, and are less susceptible to disturbance than seals hauled out on land. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

During Operations, shipping activity would occur during the ice-free season from about June 1 to October 1. The number of vessels and frequency of operation during this project component would differ slightly from the Construction Phase, but the potential effects would be similar. The number and frequency of barge trips hauling materials down river would also be lower than during either the Construction or Operations phases.

Injury and Mortality

Vessel Strikes

Collisions between marine mammals and ships occur worldwide, with vessel speed being a key determinant of the frequency and severity of ship strikes. The potential for vessel collisions with marine mammals increases with ship speeds of 15 knots and greater (Laist et al. 2001; Vanderlaan and Taggart 2007). The potential for vessel strikes in the Kuskokwim River and at the mouth of the river would be minimized by the relatively slow speed at which tugs and barges are expected to travel in that portion of the Project Area. River barges for cargo travelling to or from the Bethel Port are expected to average 4 knots upriver while loaded and 10 knots downriver when empty. Similarly, the average speed of fuel barges would be 3.5 knots while loaded and travelling upriver and 10 knots downriver and empty. The transit speed of the fuel and cargo tugs and barges travelling between Dutch Harbor and the mouth of the Kuskokwim River is 10 knots (or slower) and, thus, below the speed threshold above which the potential for, and severity of, collisions increase.

Given the slow speed at which the barges would travel and the engine noise, marine mammals would likely anticipate approaching vessels with adequate time to move out of harm's way and avoid collisions.

Environmental Contamination

Marine mammals could potentially be exposed to discharges and spills from vessels transporting fuel and cargo, as well as to fuel spilled at any of several transfer points, including barge to storage tank transfer or ocean barge to river barge transfer at the Bethel Port site, and river barge to storage tank transfer at the Angyaruaq (Jungjuk) Port site, or in the event of a stranded barge that requires lightening of fuel.

Section 3.24, Spill Risk, provides analysis of risks and potential impacts of spills from fuel barges and storage tanks along the marine and riverine transportation corridors. The risk of catastrophic accidents is very small (likelihood of occurrence is low during the life of the project), although small accidents and spills could periodically occur. The severity of impacts would depend on the type of contaminant spilled, the volume and extent of the spill, time and location of a spill, and whether or not marine mammals are present.

Summary of Marine Mammal Impacts for Alternative 2

Applying the methodology defined in Table 3.12-7 to the information and data presented in this section, Alternative 2 has potential direct and indirect impacts on marine mammals. Table 3.12-9 provides a summary of impacts by the four assessment factors.

Table 3.12-9: Summary Impacts[1] of Alternative 2 on Marine Mammals by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Mine Site: No impacts are expected because marine mammals do not occur in the area.				
Transportation Corridor:				
Behavioral disturbance (noise, increased barge traffic)	Changes in behavior due to project activity may not be noticeable; animals would be expected to remain in the vicinity although specific movement patterns may change in response to passing barges or construction noise.	Behavior would be expected to be altered for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (noise, barge traffic).	Impacts would occur mainly around areas of project activity within the project footprint, but behavior patterns could cause changes in movement within the EIS Analysis Area.	Any impacted marine mammal species are protected under the MMPA.
Risk of injury or mortality (vessel strikes)	While injury or mortality may occur, population level effects are not expected to be detectable. There is unlikely to be a noticeable change in animal population character or quantity.	In some locations, risk would be expected to be higher for several years and would return to pre-activity levels in the long-term (from the Construction Phase through the life of the mine) after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (barging season).	Impacts are expected to be limited to vicinity of project activities.	Any impacted marine mammal species are protected under the MMPA.
Pipeline:				
Behavioral disturbance (noise, increased barge traffic)	Changes in behavior due to project activity may not be noticeable; animals would be expected to remain in the vicinity although specific movement patterns may change in response to passing barges or construction noise.	Behavior would be expected to be altered during the Construction Phase then return to pre-activity levels after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (noise due to construction, barge traffic).	Impacts would occur mainly around areas of project activity within the project footprint, but behavior patterns could cause changes in movement within the EIS Analysis Area.	Any impacted marine mammal species are protected under the MMPA.

Table 3.12-9: Summary Impacts[1] of Alternative 2 on Marine Mammals by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	Duration	Extent or Scope	Context
Risk of injury or mortality (vessel strikes)	While injury or mortality may occur, population level effects are not expected to be detectable. There is unlikely to be a noticeable change in animal population character or quantity.	Risk would be expected during the Construction Phase when barging takes place in Cook Inlet for project activities. Impacts would be seasonal or intermittent during barging season.	Impacts are expected to be limited to vicinity of project activities.	Any impacted marine mammal species are protected under the MMPA.

Notes:

1 The expected impacts account for impact reducing design features proposed by Donlin Gold and Standard Permit Conditions and BMPs that would be required. It does not account for additional mitigation measures being considered.

Mitigation and Monitoring for Alternative 2

Effects determinations take into account impact reducing design features (Table 5.2-1 in Chapter 5, Impact Avoidance, Minimization, and Mitigation) proposed by Donlin Gold and also the Standard Permit Conditions and BMPs (Section 5.3) that would be implemented.

Design features important for reducing impacts to marine mammals include:

- Ocean fuel barges would be double hulled and have multiple isolated compartments for transporting fuel to reduce the risk of a spill;
- Barges would maintain speeds less than 10 knots (18.5 km/hr) and reduce speeds to 5 knots (9.3 km/hr) when approaching marine mammals to minimize the risk of vessel strikes; and
- The project design includes a natural gas pipeline to decrease the amount of barging to transport diesel fuel. The design decision to use a natural gas pipeline instead of barging 110 Mgal of diesel per year was in response to community concern about barge traffic levels.

Standard Permit Conditions and BMPs important in reducing impacts to terrestrial mammals include:

- Implementation of SWPPPs and ESCPs; and
- Development and maintenance of ODPCPs, SPCC Plans, and FRPs.

Additional measures are being considered by the Corps and cooperating agencies and are further assessed in Chapter 5, Impact Avoidance, Minimization, and Mitigation (Section 5.5 and Section 5.7). Examples of additional measures being considered that are applicable to this resource include:

- For marine barging in the Bearing Sea - implement measures to minimize the risk of spills, including: avoiding operation of watercraft in fall and winter and in the presence of sea ice to the extent practicable; using double-hull tanks for fuel transport to reduce

tank rupture risk; and using fully-operated vessel navigation systems composed of radar, chartplotter, sonar, marine communications systems, and satellite navigation receivers, as well as automatic identification system (AIS) for vessel tracking.

3.12.3.2.3 BIRDS

Key issues with potential direct and indirect effects impacting birds were identified during agency and public scoping. These include:

- Behavioral disturbance, including:
  - Noise;
  - Organic waste attraction; and
  - Increased barge traffic.
- Injury and mortality, including:
  - Vehicle collisions;
  - Powerline collisions;
  - Injury or mortality resulting from contamination from pit lake or other mine site component attraction; and
  - Injury or mortality resulting from contamination from fuel or chemical spills (addressed in Section 3.24, Spill Risk)
- Habitat alteration or fragmentation, including:
  - Vegetation removal;
  - Nest site loss or disturbance;
  - NNIS introduction and spread (addressed in Section 3.10, Vegetation and Nonnative Species); and
  - Habitat changes through contamination from fuel or chemical spills (addressed in Section 3.24, Spill Risk).

These impacts are described in further detail below under associated subheadings, unless otherwise noted as being addressed in other document sections. Impacts are discussed, where applicable, by project component (Mine Site, Transportation Corridor, or Pipeline). Impacts are also discussed, where applicable, per project phase (Construction, Operations, or Closure).

Birds at the Mine Site could be affected by habitat loss due to vegetation removal; noise; potential environmental contamination from the tailings pond; and collisions with vehicles, equipment, or structures.

Behavioral Disturbance

Noise

Blasting would occur daily at the Mine Site and as needed at several material sites. Noise would increase above current levels during Construction and Operations. Loud noises from short-term events such as blasting are known to startle nearby birds and may cause them to leave the area

and can even lead to nest abandonment. The tug- and barge-related noise on the Kuskokwim River would be transient. Aircraft, vehicle, and heavy equipment noise would occur at the Mine Site. There would be no noise emissions along the pipeline route during the Operations Phase with the exception of low levels of noise emitted from the pipeline compressor station sited on the SFSGR and periodic aircraft inspection overflights.

During the Closure Phase, water would be pumped from the pit lake for treatment and discharge to Crooked Creek. Noise from the pumps, power plant, and other facilities may have impacts.

Bird use of otherwise suitable habitat may be reduced due to sensitivity to noise. The degree of disturbance varies among individuals, species, and time of year. Noise can change the composition of avian communities in favor of more noise-tolerant species, thus reducing nesting species richness, although not necessarily density. Predatory birds might avoid noise because it masks their calls or makes it harder to locate prey, thus making nests in noisier areas safer from predators (Francis et al. 2009).

Some birds may habituate to noise from steady-state sources, such as equipment and the pipeline compressor station sited on the SFSGR, and such noise alone generally does not result in substantive changes in normal wildlife activities. In areas with regular but non-threatening noise, birds may habituate and show little response. Because mining-related activities have occurred in and around the Mine Site area for several decades, birds may already be habituated to human-related disturbances. Birds would likely disperse from the local area during loud noises associated with construction activities. Migrants may avoid the project vicinity during noisy periods rather than stopping over during migration.

Noise impacts on bald or golden eagle nests would be analyzed for compliance with the BGEPA following the pre-construction raptor survey. If eagle nests are identified in the vicinity of the Mine Site or material sites where blasting may occur, an Eagle Act Permit may be required.

Blasting would occur at material sites during the Construction Phase. Noise impacts from trucks and equipment would occur.

Blasting may be necessary at material sites at Pass Creek and Kusko West. Blasting and construction noise may cause individual birds to be displaced from suitable habitat. However, habitat types in the areas surrounding the pipeline are similar and likely suitable for relocation. There would be no noise emissions along the pipeline during the Operations Phase with the exception of low levels of noise emitted from the pipeline compressor station sited on the SFSGR and inspection overflights.

Organic Waste Attraction

Birds would be attracted to any organic wastes not properly disposed of. Populations of scavenging birds such as gulls, ravens, bald eagles, jays, and magpies would increase, leading to potential increased nest predation on other bird species. Although all wastes would be managed to avoid attracting scavengers (as required by regulations), no management program achieves 100 percent control. Organic waste attraction could potentially cause an increase in predators.

Increased Barge Traffic

Increased barge traffic could affect birds through visual or noise disturbance, alteration of habitat through bank erosion or habitat use by barge wakes, risk of collisions, and risk of fuel or other hazardous materials spills that could degrade important bird habitat. Barges may have three classes of impacts: direct impact on offspring survival due to brood scattering; reduction in foraging behavior and an increase in energetically costly behavior; and a loss of suitable habitat (Kaiser and Fritzell 1984; Korschgen et al. 1985; Berry 1988; Bamford et al. 1990; Keller 1991; Mikola et al. 1994; Agness 2006).

Although nesting takes place primarily above the waterline, birds near the barge route would be subject to both visual and noise disturbance from increased barge traffic. Disturbances of nesting birds may cause abandonment of the nest, disruption of the pair bond, reduction in clutch size, increased egg mortality, abandonment of the nesting area, and increased predation of the nest. Disturbances during brood-rearing may cause exhaustion of young and an increase in losses from predation (Korschgen and Dahlgren 1992). Noise and movement of barges may disturb birds foraging or nesting along the shores. Disturbances during critical times of the nesting cycle eventually cause birds to nest elsewhere or not to nest at all (Korschgen and Dahlgren 1992). Noise generated by the barge would be audible to shore-based receptors for a maximum estimated time of 1.04 hours per occurrence (ARCADIS 2013a). Lights from barges may attract birds causing them to collide with the barge. Prop wash can re-suspend bottom sediments in shallow waters, which could affect aquatic invertebrates and other potential food organisms, although affected areas in the river are not used for feeding by large numbers of birds.

Habituation of birds to disturbance is possible (Stolen 2003). Waterbird responses to vessel traffic may be dependent on species, biological cycle (e.g., breeding, migrating, stopover, wintering), and/or vessel attributes (e.g., vessel type, size, and speed). When vessels are very close to the occupied habitat, the response is likely to be greater, especially if the vessel approaches rapidly. Waterbirds in the Kuskokwim River may be habituated to vessel traffic, and an additional one or two tugs and barges passing per day may or may not have impacts. Foraging habitat within the river would be affected more as birds would expend more energy to avoid collisions and may avoid the portions of the river with the highest traffic levels. Human disturbance compels waterfowl to change food habits, feed only at night, lose weight, or desert the feeding area. Waterfowl respond both to loud noises and rapid movements, such as boats powered by outboard motors, and to visible features (Korschgen and Dahlgren 1992).

Bank erosion, already occurring naturally along the river (see Figures 3.5-14 and 3.5-15), would be slightly increased by the waves caused by the project-related barges. As described in Section 3.5, Surface Water Hydrology, a study of channel migration on the Kuskokwim River (BGC 2007c) reported a baseline rate of erosion between 1950 and 2001 of 10-15 feet/year of shoreline. The shoreline habitat is not lost, but rather moved as the eroded material is deposited further downstream. The barge traffic would contribute incrementally to this natural process. To put this contribution in context, a comparison was made of the barge-generated wave energies to the tractive forces of the river itself (BGC 2016). The results show that the energy of the barge waves would range from to 1 to 3 percent of the energy of the river itself (BGC 2016). Shoreline erosion could affect species nesting close to the riverbanks (see Appendix V, Table V-3.12-19) through direct loss of habitat and destruction of nests, as well as those foraging in this habitat

due to potential impacts on prey species. Erosion could also affect fish species birds prey on (Dorava and Moore 1997).

Barge traffic would mainly impact waterbirds using the Kuskokwim River; their wakes could cause a noticeable change in behavior and may affect reproduction if nests are affected by erosion or large waves.

Injury and Mortality

Vehicle Collisions

Vehicle collision mortality of wildlife is well documented. Roadway width and length, vehicle speed, terrain and habitat, and traffic density can influence mortality rates, although study conclusions vary (Erritzoe et al. 2003). Vehicle collision mortality would be minimized along project roads through enforcement of low speed limits. Mortality rates for avian species may be expected to decline over time due to a postulated 'learning effect,' whereby birds acclimate to the presence of the road and develop behaviors to avoid collisions (e.g., flying higher when crossing the road to avoid vehicles) (Havlin 1987). Birds have been shown to change flight initiation distances in response to vehicles according to road speed limit (a known factor affecting killing rates on roads) rather than car speed, suggesting that birds are able to associate road sections with speed limits as a way to assess collision risk (Legagneux and Ducatez 2013).

Hundreds of millions of birds die each year in collisions with manmade structures, including glass windows and buildings, communication towers, and wind turbines (American Bird Conservancy 2013). Lighting, atmospheric conditions, and the number and size of windows are contributing factors. The scale of mine facilities may cause most avian species to avoid the area, reducing structure collision mortality. Camp facilities would be located away from the mine infrastructure, creating a potential for avian mortality from collisions with structures and towers. Some species may be attracted to the facility lights, especially during times of poor visibility such as during bad weather conditions. Down-shielded lights would be used to reduce the potential for collisions.

Bird collisions with aircraft have been well documented and appear to be increasing (FAA 2013). Contributing factors are larger populations of large birds near some airports, more air traffic, and higher use of quieter aircraft, such as turbofan-powered. Waterfowl, gulls, and raptors were groups with the most numerous and most damaging strikes. Species with high numbers of strikes in Alaska (FAA 2013) include bald eagle, Canada goose, American golden-plover, bank swallow, and ducks, all found in the Project Area. The American golden-plover is considered a Species of Conservation Need due to a declining population.

Project-related aircraft operation would be highest during the Construction Phase, with an expected 1,187 helicopter flights per year for the Pipeline and three fixed-wing aircraft flights / day / spread. During the Operations Phase, flight numbers would decrease for both the Pipeline and Mine Site, but would remain above current levels. The increased amount of air traffic would pose a collision risk to all bird species, as well as a safety hazard to the pilots and passengers. The degree of risk would be related to the location and timing of the flights with respect to key habitats and flight pathways. The number of birds affected is expected to be small because the interaction opportunities are relatively small. None of the 31 bird Species of Conservation Need known to occur in the EIS Analysis Area are expected to be at serious risk of population-level effects from these impacts.

Collisions could occur with vehicles or equipment during the Construction or Operations Phases. Collision impacts are not expected to be numerous enough to create population-level effects.

Powerline Collisions

All planned above-ground power lines potentially pose a collision threat primarily to raptors, waterfowl, and ptarmigan but could cause deaths among smaller species. The threat degree would be related to size and design of the structures, the line (wire) profile, and the location of the power line with respect to key habitats and flight pathways. Overhead power line design would be in accordance with BMPs for avian protection and relevant state and federal guidelines, reducing the potential for adverse impacts. If the power lines are constructed without adequate protections, raptors interacting could be electrocuted. Raptors are attracted to power lines, especially in areas without other tall perches. They use power poles and towers as perches from which to establish territorial boundaries, hunt, rest, find shade, feed, and sun themselves. Power line structures are also used by many species as nesting substrates.

Planned electrical lines include approximately 2.4 miles of line extending from the mine site facilities to the permanent camp. The airport and the port site would have independent electrical generating capabilities. Given the abundance of suitable perching habitat available to raptors, the risk of raptor interaction with powerlines would be reduced. Activity levels at these locations would serve as a deterrent for raptor and eagle use of the area near the powerlines.

Environmental Contamination

The project would create new areas of standing water that may attract birds including the Contact Water Dam (CWD) ponds, freshwater storage impoundments, the surface of the tailings pond, and the pit lake. Environmental contamination by contact with water in these locations is possible. The tailings pond and CWD ponds would present throughout the Operations Phase, and the pit lake would be present from the Closure Phase onward. Species may be attracted to water features during migration.

Birds may be affected by direct contact by drinking the water, or by eating contaminated plants or invertebrates that may be present. Primary exposure for birds would be from drinking or bathing in the water during any brief stopovers during migration. Post-bath preening could cause ingestion of water and contaminants present on the feathers. Birds are not likely to remain long in open water areas despite earlier thaw or later freezing due to the lack of food resources. Waterfowl and shorebirds may stay longer if there is no open water elsewhere in the spring. In these instances, all water and any food would come from the contaminated impoundments. The daily exposure was calculated through the ERA and ERA Addendums (Appendix S, see Section 3.12.2.5), which concluded that the concentrations of evaluated chemicals did not present a risk to birds under chronic exposure scenarios. Landbirds are not expected to bathe in most of the open water areas as the waterbodies are designed to be too deep for wading birds.

The estimated water concentrations of antimony, arsenic, and selenium are expected to be higher in the TSF than in the pit lake. The TSF, which would be an active component of the mine during the Operations Phase, would not be an attractive or exclusive source of water for birds and mammals. Mining activities would result in fluctuating water levels, changing metals concentrations, and active deposition of tailings. Also, there would be little opportunity for

growth of vegetation or invertebrates along the margins of the TSF because it would be a lined facility and water levels would fluctuate. During the Operations Phase, tailings would be added continuously and water would be pumped out of the TSF for reuse.

Considering representative exposure assumptions, the lack of attractive habitat features, and chronic intense disturbance from mining equipment, birds are not expected to be at risk from ingestion of water from the TSF or from ingestion of food and sediment from this location. Based on the calculations and discussion of exposure in the ERA and ERA Addendums, no birds would be expected to be at risk from ingestion of water during the filling stage of the pit lake or from ingestion of surface water, sediment, or food from the mature pit lake.

The water quality of the Lower CWD Pond is expected to be highly variable because of varying inputs and withdrawals. At the upper end of the range, toxic constituents would be at higher concentrations than in the TSF. For the Lower CWD Pond, much like the TSF, the lack of attractive food sources or other habitat features, chronic intense disturbance from mining equipment, and the availability of other nearby water sources would minimize the risk of bird exposure to water from the Lower CWD Pond. In consideration of representative exposure assumptions (e.g., 10 percent exposure factor), birds would not be expected to be at risk from ingestion of water, food, or sediment from the Lower CWD Pond.

The Upper CWD Pond is expected to have less variability and better water quality than the Lower CWD Pond because its primary source of water is natural runoff from undisturbed land and it would only receive water from the Lower CWD Pond under certain conditions. Given the expected short-term exposure, birds are not expected to be at risk from arsenic or other metals in the water. However, the surrounding habitat is more attractive than adjacent to the Lower CWD Pond, so exposure could be long enough for a few individual birds to be at risk.

Operations Phase activities would mobilize mercury in dust and in other airborne forms (even with stringent control measures), and the levels in soil would increase slightly (see Section 3.12.2.5.2, Environmental Contamination, for details; see Section 3.2, Soils, for a detailed discussion on soil metal increase).

Mercury in the form of methylmercury can bioaccumulate (accumulate in animal tissues) and biomagnify (increase in concentration up a food chain) making top-of-food chain organisms (e.g., birds that eat fish, animals that eat birds that eat fish) at greatest risk. See Section 3.2, Soils, for information on baseline mercury levels and mercury methylation in the project area; see Section 3.22, Human Health, for discussion on biological risks from mercury. Information on consumption of fish or wildlife within a human health context is discussed in Section 3.22, Human Health.

The Crooked Creek drainage is the area with greatest predicted mercury increases, and the levels of mercury measured in fish tissue there are well below the EPA criterion for human fish consumption (see Section 3.7, Water Quality). While the mercury methylation process is complex, factors that would increase it, such as increases in wetland area or depletion of oxygen in waters, or increases in populations of large resident fish, are not likely to increase with mining operations. Therefore, it is unlikely that top-of-food chain organisms like bald eagles would be adversely affected by increases in mercury from mine operations.

Habitat Alteration

Vegetation Removal

Long-term habitat loss would occur as the existing vegetation is removed and replaced with buildings, roads, runways, and other mine and project components. For some Project Components the amount of habitat temporarily disturbed during the Construction Phase and then revegetated would be larger than the long-term footprint of the facilities. Habitat loss would directly impact bird species whose home ranges fall within disturbance area as well as (to a lesser extent) those migrating through the area. Potential nest trees, such as black and white spruce and cottonwood, are abundant. The number of unoccupied nests observed during the raptor surveys indicates abundance in habitat; an average of 73 per year were observed during the 6 years of surveys at the Mine Site, and 22 per year observed during the three years of surveys along the pipeline route. Loss of habitat used during migration could affect bird populations beyond the Project Area as migrants would be forced to use other areas to rest and forage. The effect would be much smaller than the effect on breeding, because migrants use the habitat briefly and don't depend on it to feed their young.

Avian response to habitat fragmentation is species-specific. Some species avoid edge habitat for reasons such as microclimate or increased predation. Some avian species prefer early successional habitats; and habitat availability for these species may increase as a result of fragmentation. Avian species that avoid edge habitat would lose more habitat than just that contained in the Project Area where new edges are created because they would lose the area cleared plus the adjacent habitat that is too close to the new edge. Habitat not directly lost during the Construction Phase may still become less suitable for some birds for other reasons. Groundwater pumping and dewatering of streams and wetlands in the vicinity of the mine may alter bird habitat by changing vegetation composition.

To estimate bird number potentially affected by habitat loss or alteration, density estimates were multiplied by acres affected for each alternative. The number of pairs affected is a maximum number that describe the effects during the first breeding season, not pairs "lost" annually during the Operations Phase. Most birds affected by the habitat loss, even those known to have high nest site fidelity, would likely move to similar habitat in the surrounding area. It is unknown whether or not adjacent habitat is currently at carrying capacity (full to the point of not being able to support more individuals). If the adjacent habitat is full, the intensity of the impact would be high because displaced individuals may not be able to find suitable habitat elsewhere, or would be adversely affected by having to travel long distances to relocate. If the adjacent habitat is not full, then the intensity of the impact to displaced individuals would be lower.

There is an abundance of similar habitat in surrounding area (see Section 3.10, Vegetation and Nonnative Invasive Species). After the Closure Phase the area would be reclaimed including re-contouring roadways and reseeding disturbed areas with native seeds as described in the Reclamation and Closure Plan. These areas are expected to revegetate; however, they may not have the same vegetation composition, habitat, or avian species as they did prior to disturbance. Some disturbed areas such as the monitoring access and the pit lake itself would not be revegetated. The estimated number of breeding bird pairs potentially affected by habitat loss or alteration at the Mine Site and Transportation Corridor is listed in Appendix V, Table V-3.12-20. These numbers were calculated by multiplying estimated densities by the amount of each

habitat loss for species with density information calculated during breeding bird surveys at the Mine Site. Because the surveys were conducted outside the recommended survey period, the numbers may be biased low; therefore the actual numbers of nesting pairs affected may be higher than the estimate. However, the data is judged to be sufficient to determine that the loss of nesting habitat would not cause population-level declines in any species.

Birds in the Transportation Corridor area could be affected by direct habitat loss due to vegetation removal along the 30-mile long road and port site, noise, risk of environmental contamination from fuel spills, and collisions with vehicles or equipment. Avian species in impacted areas would be displaced to nearby similar habitat. After the Closure Phase the area would be reclaimed including re-contouring roadways and reseeding disturbed areas with native seeds. These areas are expected to revegetate; however, they would not have the same plant composition, habitat, or avian species as they did prior to disturbance. A total of 8 raptor nests were found within 1 mile of the proposed Angyaruaq (Jungjuk) Port site.

Landbird density estimates (Hinkes and Engels 1989) indicates species that may be affected by the habitat loss (see Appendix V, Table V-3.12-21; this table includes only those species for which density information was available and as such does not include all bird species or groups potentially affected). Because the Hinkes and Engels (1989) study was conducted in the Tanana-Kuskokwim River ecoregion, the estimates in Table V-3.12-21 in Appendix V are limited to densities in the portion of the pipeline corridor within that ecoregion.

Direct loss of avian habitat would occur within the construction footprint of the pipeline. Along the pipeline route, vegetation removal would include 6,981.9 acres, mainly evergreen forested vegetation types, deciduous / mixed forested types, and scrub shrub vegetation types in the four ecoregions the Pipeline component crosses (see Table 3.10-12 in Section 3.10, Vegetation and Nonnative Invasive Species, and Table 3.10-18 for a comprehensive list of all vegetation removal acres for each Alternative). During Construction and Operations, impacts to some avian species can be expected from habitat fragmentation, with impacts most pronounced during the Construction Phase when the corridor is fully cleared to install the pipeline. Impacts would lessen over time as the corridor would be revegetated, thus minimizing the edge effect and habitat fragmentation-related effects. The habitat surrounding the pipeline, but not necessarily within the cleared ROW, is considered suitable for any species displaced. After the Closure Phase, the pipeline would be abandoned in place and all above-ground facilities removed, except gravel pads, which would be left in place. Cleared land would be contoured to restore appropriate grades and revegetated.

Nonnative Invasive Species

Accidental or intentional introduction of NNIS could potentially change composition, structure, or function of terrestrial or aquatic vegetation communities, which can impact bird habitat. Impacts from NNIS are addressed in Section 3.10, Vegetation and Nonnative Species.

Nest Site Loss or Disturbance

Nest sites may be lost either directly through habitat loss due to construction, or indirectly through disturbance or degradation to adjacent habitat. While vegetation clearing during Construction would avoid the bird nesting period to mitigate take of migratory birds, loss of traditionally used nest sites could occur. Adjacent habitat may also become unsuitable for nesting due to the increased noise and human presence, or changes in vegetation types,

predator abundance, or hydrology. Some species, such as swallows, sparrows, semipalmated plovers, and spotted sandpipers may be attracted to altered habitat. Amount and suitability of nesting habitat would be reduced for most bird species. The number of nests lost or disturbed would be highest during the Construction Phase and would diminish as birds become accustomed to the new activities and learn to avoid them. Due to the abundance of conifer and deciduous forest habitats, it is unlikely that nesting habitat, including large trees, is a limiting factor in bird populations.

Raptor nest surveys documented 13 raptor species nesting in the vicinity of the Mine Site (see Appendix V, Table V-3.12-8). Raptor nest surveys would be conducted by Donlin Gold during the spring prior to start of construction. Donlin Gold would follow the recommendations provided by USFWS regarding timing of these surveys. If occupied nests are found close to areas of proposed activity, the activity would be scheduled to occur outside the nesting season if feasible. If not feasible, USFWS would be consulted to assist in determining measures necessary to avoid impacts to nesting raptors. It is expected that if construction occurs in suitable habitat before the onset of the breeding season, the construction disturbance would cause the raptors to seek alternate nest sites. Raptors returning to nest sites that have been removed during the non-breeding season may fail to nest that season, but are likely to move to adjacent similar habitat fairly quickly. Eagles and their nests are protected under the BGEPA; any impacts to these species may require consultation with the USFWS and an Eagle Act Permit.

Raptor nest surveys documented five raptor species classified as state or federal species of conservation concern nesting in the vicinity of the pipeline. If construction occurs in suitable habitat before the onset of the breeding season, the disturbance would cause the raptors to seek alternate nest sites.

Swans (either tundra or trumpeter, identification was uncertain) were observed nesting in the vicinity of the pipeline, mainly close to the eastern end near the Susitna River. Trumpeter swans have also been documented nesting near the Kuskokwim River crossing. If these nest sites are abandoned, displaced birds would likely move to adjacent suitable habitat where they might have to compete with other swans. Other waterbirds nesting in the wetlands affected by Pipeline component Construction or Operations Phases could also be displaced.

Summary of Terrestrial Bird Impacts for Alternative 2

Applying the methodology defined in Table 3.12-7 to the information and data presented in this section, Alternative 2 has potential direct and indirect impacts on birds. Table 3.12-10 provides a summary of impacts by the four assessment factors.

Table 3.12-10: Summary Impacts[1] of Alternative 2 on Terrestrial Birds by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Mine Site:				
Behavioral disturbance (noise, organic waste attraction)	In some locations, changes in behavior due to project activity may not be noticeable; animals would be expected to remain in the vicinity. In other locations within the project footprint or adjacent to project activity, there may be noticeable changes in behavior that may affect reproduction or survival of individuals.	Behavior would be expected to be altered for several years during Construction and Operations and would be expected to return to pre-activity levels in the after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (noise).	Impacts would occur within the Project Area, mainly around areas of project activity within the project footprint, but behavior patterns could cause changes in movement within the Project Area.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.
Risk of injury or mortality (vehicle collisions, powerline collisions, environmental contamination)	While injury or mortality may occur, population level effects are not expected to be detectable. There is unlikely to be a noticeable change in animal population character or quantity.	In some locations, risk would be expected to be higher for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (vehicle use of roads). In some locations, risk would be permanent such as the pit lake and would need to be addressed by appropriate mitigation and design.	Impacts are expected to be limited to vicinity of the project footprint, but it is possible that individuals may be impacted throughout the EIS Analysis Area in the case of environmental contamination to a species that is mobile.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.

Table 3.12-10: Summary Impacts[1] of Alternative 2 on Terrestrial Birds by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Habitat alteration (vegetation removal, nest site loss or disturbance)	In some locations, there may be noticeable changes in resource character and quantity; habitat may change by vegetation type change or other change due to removal followed by reclamation or natural revegetation. In other locations, there may be acute or obvious changes in resource character and quantity; habitat may be removed or otherwise lost or changed, such as in the case of the pit lake, which would experience permanent vegetation removal.	In some locations, resources would be reduced during Construction and up to the life of the mine, and may return to pre-activity levels through revegetation or reclamation, but vegetation composition may be different. In other locations, resources would not be anticipated to return to previous character or levels, such as in the case of permanent vegetation removal. In some locations, reclamation activities would begin during Operations.	In most locations, impacts would be local within the project footprint. There may be some vegetation type changes within the Project Area.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.
Transportation Corridor:				
Behavioral disturbance (noise, barriers to movement, increased barge traffic)	In some locations, changes in behavior due to project activity may not be noticeable; animals would be expected to remain in the vicinity. In other locations within the project footprint or adjacent to project activity, there may be noticeable changes in behavior that may affect reproduction or survival of individuals.	Behavior would be expected to be altered for several years during Construction and Operations and would be expected to return to pre-activity levels in the after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (noise).	Impacts would occur within the Project Area, mainly around areas of project activity within the project footprint, but behavior patterns could cause changes in movement within the EIS Analysis Area.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.

Table 3.12-10: Summary Impacts[1] of Alternative 2 on Terrestrial Birds by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Risk of injury or mortality (vehicle collisions, powerline collisions)	While injury or mortality may occur, population level effects are not expected to be detectable. There is unlikely to be a noticeable change in animal population character or quantity.	In some locations, risk would be expected to be higher for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease. Some impacts would be seasonal or intermittent (vehicle use of roads). In some locations, risk would be permanent such as the pit lake and would need to be addressed by appropriate mitigation and design.	Impacts are expected to be limited to vicinity of the project footprint, but it is possible that individuals may be impacted throughout the Project Area due in the case of environmental contamination to a species that is mobile.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.
Habitat alteration (vegetation removal, nest site loss or disturbance)	In some locations, there may be noticeable changes in resource character and quantity; habitat may change by vegetation type change or other change due to removal followed by reclamation or natural revegetation. In other locations, there may be acute or obvious changes in resource character and quantity; habitat may be removed or otherwise lost or changed, such as in the case of the pit lake, which would experience permanent vegetation removal.	In some locations, resources would be reduced during Construction and up to the life of the mine, and may return to pre-activity levels through revegetation or reclamation, but vegetation composition may be different. In other locations, resources would not be anticipated to return to previous character or levels, such as in the case of permanent vegetation removal. In some locations, reclamation activities would begin during Operations.	In most locations, impacts would be local within the project footprint. There may be some vegetation type changes within the Project Area.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.
Pipeline:				

Table 3.12-10: Summary Impacts[1] of Alternative 2 on Terrestrial Birds by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	**Duration**	**Extent or Scope**	**Context**
Behavioral disturbance (noise, increased barge traffic)	In some locations, changes in behavior due to project activity may not be noticeable; animals would be expected to remain in the vicinity. In other locations within the project footprint or adjacent to project activity, there may be noticeable changes in behavior that may affect reproduction or survival of individuals.	Behavior would be expected to be altered for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease. In the Pipeline, impacts would occur mainly during Construction, but there would be intermittent impacts during corridor vegetation brushing or other activities. Some impacts would be seasonal or intermittent (noise, increased barge traffic during Construction in Cook Inlet).	Impacts would occur within the Project Area, mainly around areas of project activity within the project footprint, but behavior patterns could cause changes in movement within the Project Area.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.
Risk of injury or mortality (vehicle collisions, powerline collisions)	While injury or mortality may occur, population level effects are not expected to be detectable. There is unlikely to be a noticeable change in animal population character or quantity. Denning and burrowing species may be impacted more during Construction on the pipeline corridor.	In some locations, risk would be expected to be higher for several years and would return to pre-activity levels in the long-term (from the end of the Construction Phase through the life of the mine) after actions causing impacts were to cease. For the Pipeline, impacts would be expected to be higher during Construction as this is when most of the impact-causing activity would occur. Some impacts would be seasonal or intermittent, as some construction would take place at different times of the year in different locations; vegetation brushing would also occur intermittently.	Impacts are expected to be limited to vicinity of the project footprint.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.

Table 3.12-10: Summary Impacts[1] of Alternative 2 on Terrestrial Birds by Project Component

Impacts	Assessment Criteria			
	Magnitude or Intensity	Duration	Extent or Scope	Context
Habitat alteration (vegetation removal, nest site loss or disturbance)	In some locations, there may be noticeable changes in resource character and quantity; habitat may change by vegetation type change or other change due to removal followed by reclamation or natural revegetation. In other locations, there may be acute or obvious changes in resource character and quantity; habitat may be removed or otherwise lost or changed.	In some locations, resources would be reduced during Construction and up to the life of the mine, and may return to pre-activity levels through revegetation or reclamation, but vegetation composition may be different. In other locations, resources would not be anticipated to return to previous character or levels, such as in the case of permanent vegetation removal in limited locations within the Pipeline component. In some locations, reclamation activities would begin during Operations. Vegetation would be subject to periodic brushing during Operations along the pipeline corridor per PHMSA requirements.	In most locations, impacts would be local within the project footprint, although given the length of the construction footprint for the Pipeline component, impacts would be regional within the Project Area.	Impacted species are expected to be those common to the region, except for those species considered to be species of special concern or conservation need. Bald and golden eagles have protections under the BGEPA. Migratory birds have protections under the MBTA.

Notes:

1 The expected impacts account for impact reducing design features proposed by Donlin Gold and Standard Permit Conditions and BMPs that would be required. It does not account for additional mitigation measures being considered.

Mitigation and Monitoring for Alternative 2

Effects determinations take into account impact reducing design features (Table 5.2-1 in Chapter 5, Impact Avoidance, Minimization, and Mitigation) proposed by Donlin Gold and also the Standard Permit Conditions and BMPs (Section 5.3) that would be implemented.

Design features important in reducing impacts to birds include:

- Raptor nest surveys would be conducted during the spring prior to start of construction. If occupied nests are found close to areas of proposed activity, the activity would be scheduled to occur outside the nesting season if feasible. If not feasible, the USFWS would be consulted to assist in determining measures necessary to avoid or minimize impacts to nesting raptors;
- Where practicable, fully shielded light fixtures would be used to reduce potential light attraction to migratory birds;
- Incorporate BMPs and design guidelines for avian protection from electrocution on above-ground powerlines. An example is the "Suggested Practices of Avian Protection on Power Lines: The State of the Art in 2006" (APLIC 2012); and
- The project design includes routing transmission lines in proximity to roads, where possible, to reduce additional vegetation impacts. Develop a Mine Site wildlife protection plan (which may include elements typical to such plans as Avian Protection Plans) to identify measures to prevent birds or wildlife from accessing the TSF, the pit lake, or other mine waters (in consultation with ADF&G and USFWS).

Standard Permit Conditions and BMPs important in reducing impacts to birds include:

- Monitoring of water withdrawals to ensure permitted limits are not exceeded;
- Development and implementation of a Wildlife Avoidance and Human Encounter / Interaction Plan;
- BMPs to minimize impacts to avian species during Construction and Operations;
- Implementation of SWPPPs and ESCPs;
- Development and maintenance of ODPCPs, SPCC Plans, and FRPs; and
- Development and implementation of an ISPMP.

Additional measures are being considered by the Corps and Cooperating agencies and are further assessed in Chapter 5, Impact Avoidance, Minimization, and Mitigation (Section 5.5 and Section 5.7). Examples of additional measures being considered that are applicable to this resource include:

- Apply measures to reduce the initial clearing requirements for the ROW, on a site - specific basis;
- Minimize vegetation clearing during bird nesting season; and
- To the extent practicable, bury all transmission lines to reduce potential impacts to visual resources and birds from overhead lines.

3.12.3.2.4 CLIMATE CHANGE SUMMARY FOR ALTERNATIVE 2

Predicted overall increases in temperatures and precipitation and changes in the patterns of their distribution (Walsh et al. 2005; Chapin et al. 2006, 2010; McGuire 2015) have the potential to influence the projected effects of the Donlin Gold Project on vegetation and wetlands and likewise on wildlife habitat. An overall warming/drying trend would tend to convert some wetlands to uplands and tend to increase the cover of shrubs and trees in previously open areas. Warming may also increase the thawing of permafrost over time. In project components like the Pipeline, increased thawing might lead to more open water areas. See Section 3.26, Climate Change, for further details on climate change and resources.

For terrestrial wildlife and birds, a combination of more open water and more nearby upland or forested areas may benefit species like the wood frog and waterfowl. An increase of fires due to drying might benefit species like bison and possibly caribou that use early successional habitat areas, but be a detriment to species that rely on forested cover. Habitat important for moose would be affected, but effects are uncertain. Warming conditions may lead to increases in infectious disease in wildlife, or conditions that favor the release of persistent environmental pollutants that can affect the immune system and favor an increased disease rate (Bradley et al. 2005). For marine mammals, changes in marine productivity could negatively affect food webs. Impacts of climate change to marine mammals are extremely complex and poorly understood at this time.

3.12.3.3 ALTERNATIVE 3A – REDUCED DIESEL BARGING: LNG-POWERED HAUL TRUCKS

During Construction, Alternative 3A would greatly reduce the amount of diesel fuel needed to operate the mine and would therefore reduce the need for barge-support facilities and diesel storage tanks in Bethel and the Angyaruaq (Jungjuk) Port site compared to Alternative 2. However, a reduced need for diesel fuel delivery would not greatly reduce the need for port facility and mine access road construction to address the overall material supply and transportation needs for the mine. The scale of port construction could be less than under Alternative 2 and could take less time to complete, but the incremental reduction in construction activity at Bethel and the Angyaruaq (Jungjuk) Port site would likely lead to minimal reductions in potential impacts to terrestrial mammals compared to those described under Alternative 2. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

During the Operations Phase, Alternative 3A would reduce the number of fuel barge trips on the Kuskokwim River and fuel truck trips along the mine access road compared to Alternative 2. Cargo barge trips would be the same as Alternative 2. The potential impacts of barge traffic on terrestrial mammals would be similar in types of impacts to Alternative 2. However, given the reduced number of barges and the infrequency of terrestrial mammals crossing the river during open-water season, the potential for barge interactions with swimming mammals would be rare and even less frequent than under Alternative 2.

Barge traffic under Alternative 3A would contribute incrementally to erosion of river bank habitats through their associated wakes but such losses would be less than was described for Alternative 2. The increase over current erosion rates of riparian wetland habitats from mine-

related barges was estimated to range from 0.21-acre per year downriver to 0.02-acre per year upriver under Alternative 2 conditions (see Section 3.11.4.2.2, Wetlands). This increase in erosion would be very small relative to the amount of baseline erosion expected from both natural causes and existing vessel traffic and the abundance of similar riparian habitat along the Kuskokwim River.

During the Construction Phase, the decreased diesel fuel use under this alternative would likely not require the increased storage capacity at either Dutch Harbor or Bethel that was proposed under Alternative 2. Diesel storage capacity at the Angyaruaq (Jungjuk) Port site would also be reduced. Reduced or eliminated need for storage would mean reduced or eliminated construction needs at these ports and reduced potential for construction-related disturbance of marine mammals.

During the Operations Phase, Alternative 3A differs from Alternative 2 by a decrease in the number of ocean and river fuel barge trips. Specifically, the number of oceangoing fuel barges between Dutch Harbor and Bethel would decrease from 14 to 5 and the river fuel barge trips between Bethel and the Angyaruaq (Jungjuk) Port site would decrease from 58 trips per season to 19 trips. The combined fuel and cargo river barge trips would, therefore, decrease from 122 trips per season to 83 trips. Fewer fuel barge trips would decrease the potential for vessel disturbance of marine mammals in the Kuskokwim River and in the Dutch Harbor to Bethel barge corridor. The number of cargo trips would be the same as under Alternative 2.

Terrestrial Mammals

Fewer fuel barge trips reduces the risk of disturbance to riparian mammals such as river otters, beaver, and muskrats. Fewer fuel truck trips along the mine access road reduces the risk of wildlife/vehicle collisions and the chance that the road would become a barrier to wildlife movement.

Marine Mammals

Reducing the number of fuel barge trips reduces, but does not eliminate, the potential for adverse impacts to marine mammals. The chance of barges affecting marine mammals through behavioral disturbance or risk of injury or mortality from collision with vessels would be reduced.

Birds

Reducing the number of fuel barge trips reduces, but does not eliminate, the potential for adverse impacts to birds. The chance of barges affecting birds through behavioral disturbance or risk of injury or mortality from collision with vessels would be reduced.

3.12.3.4 ALTERNATIVE 3B – REDUCED DIESEL BARGING: DIESEL PIPELINE

Under Alternative 3B, an 18-inch diameter diesel pipeline would be constructed from Cook Inlet to the Mine Site, instead of a natural gas pipeline, to eliminate diesel barging on the Kuskokwim River. The diesel Pipeline would be located in the same corridor proposed for the natural gas Pipeline under Alternative 2, with an additional segment between Tyonek and the start of the proposed corridor for the natural gas line. The diesel Pipeline would extend 334 miles from Cook Inlet to the Donlin Mine. The diesel Pipeline would require a 19-mile extension

from the proposed terminus of the natural gas Pipeline, south to Tyonek. This additional segment would cross the Beluga River.

This alternative would require either construction of a new dock facility in Tyonek or expansion of the existing Tyonek North Foreland Barge Facility. A new tanker berth system would be needed at Tyonek to accommodate the tide, ice, and seismic conditions and provide adequate depth for continuous 24-hour operation. A barge landing at Tyonek sufficient for most tidal stages would be required to support the construction and operations of the facilities. Tanks sufficient for storing one month's fuel consumption, approximately 10-million gallons, would be installed at each end of the Pipeline.

Two options to Alternative 3B have been added based on Draft EIS comments from agencies and the public:

- Port MacKenzie Option: The Port MacKenzie Option would utilize the existing Port MacKenzie facility to receive and unload diesel tankers instead of the Tyonek facility considered under Alternative 3B. A pumping station and tank farm of similar size to the Tyonek conceptual design would be provided at Port MacKenzie. A pipeline would extend northwest from Port MacKenzie, route around the Susitna Flats State Game Refuge, cross the Little Susitna and Susitna rivers, and connect with the Alternative 3B alignment at approximately MP 28. In this option, there would be no improvements to the existing Tyonek dock; a pumping station and tank farm would not be constructed near Tyonek; and the pipeline from the Tyonek tank farm considered under Alternative 3B to MP 28 would not be constructed.
- Collocated Natural Gas and Diesel Pipeline Option: The Collocated Natural Gas and Diesel Pipeline Option (Collocated Pipeline Option) would add the 14-inch-diameter natural gas pipeline proposed under Alternative 2 to Alternative 3B. Under this option, the power plant would operate primarily on natural gas instead of diesel as proposed under Alternative 3B. The diesel pipeline would deliver the diesel that would be supplied using river barges under Alternative 2 and because it would not be supplying the power plant, could be reduced to an 8-inch-diameter pipeline. The two pipelines would be constructed in a single trench that would be slightly wider than proposed under either Alternative 2 or Alternative 3B and the work space would be five feet wider. The permanent pipeline ROW would be approximately two feet wider. This option could be configured with either the Tyonek or Port MacKenzie dock options.

Terrestrial Mammals

Alternative 3B would not require the construction of large diesel storage tanks and transfer facilities at Bethel and the Angyaruaq (Jungjuk) Port site, although smaller diesel storage tanks would likely be needed to service port vehicles. The port facilities would still be constructed, and the mine access road would be the same as under Alternative 2. The transport of equipment and supplies for construction on the Kuskokwim River would otherwise be the same as Alternative 2. Alternative 3B would require improvements to the Tyonek North Foreland Barge Facility to accommodate vessels in excess of 30,000 gross tons and construction of fuel unloading facilities capable of accommodating the proposed volume of diesel fuel. The dock would need to be extended an additional 1,500 feet, and piles would need to be driven to support it. Dredging would not be required, as the dock would be extended out to the desired water depth.

During the Operations Phase, Alternative 3B would eliminate the need to barge diesel fuel from Bethel to the Angyaruaq (Jungjuk) Port site and to transport diesel in fuel trucks along the mine access road. River barges and transport trucks would still be required to deliver consumable materials and other supplies to the Mine Site but the elimination of diesel transport would reduce the number of river barge trips on the Kuskokwim River to about half the number required under Alternative 2. A similar reduction of truck traffic on the access road could be expected under Alternative 3B. The effects of operating the transportation system on terrestrial mammals would therefore be about half of what they could be under Alternative 2. The potential for injury and mortality of animals due to collisions with vehicles would be less than under Alternative 2 and would be considered minimal given slow vehicle speeds and light traffic.

Pipeline construction under Alternative 3B would involve the same basic construction techniques and schedule as Alternative 2 and would occur along the same route with the addition of a 19-mile segment from Tyonek to Beluga under Alternative 3B. The diesel pipeline of Alternative 3B would be incrementally larger than the natural gas pipeline proposed under Alternative 2 and would require the installation of additional check valves and other structures to help prevent fuel spills and to limit fuel release in the case of a catastrophic pipeline rupture. However, the main types of effects on terrestrial mammals from pipeline construction would be loss/modification of habitat and disturbance from all the heavy machinery needed to clear the ROW, dig the trench, and install the pipeline. Construction of a diesel pipeline under Alternative 3B would have the same scope of direct effects on wildlife as described for the natural gas pipeline under Alternative 2. The 19-mile stretch of pipeline from Tyonek would impact an additional 473.5 acres compared to Alternative 2 of primarily evergreen or deciduous/mixed forested and scrub shrub vegetation types (see Table 3.10-15, in Section 3.10, Vegetation and Nonnative Invasive Species) plus any additional work sites or material pits that may be needed to build that stretch of the pipeline. The rest of the pipeline would have the same impacts on wildlife habitat as described under Alternative 2. The Port MacKenzie Option would impact an additional 452.8 acres compared to Alternative 2, in similar habitats as the Tyonek area, while the Collocated Pipeline Option would impact an additional 684.6 acres in similar habitats along the pipeline construction route (see Table 3.10-18 for a comprehensive list of all vegetation removal acres for each Alternative in Section 3.10, Vegetation and Nonnative Invasive Species).

During the Operations Phase, the potential for environmental damage from a diesel pipeline rupture would be much greater than the risk from a natural gas pipeline rupture, so pipeline monitoring and spill prevention measures could require the maintenance of helicopter pads and airstrips at various points along the diesel pipeline route as well as additional access roads under Alternative 3B. Long-term facilities may or may not be kept from public use; project use of them would be much less than during the Construction Phase. Such facilities are assumed to add to the potential impacts to terrestrial mammals described for Alternative 2 from increased access of hunters, trappers, and other recreational users to areas along the pipeline route that are currently difficult to access, especially areas north of the Alaska Range between Farewell and the Mine Site. Improved access along the pipeline route for travel with ORVs, snowmachines, and non-motorized modes of transport could lead to increases in hunting and trapping pressure, which could cause changes in population trends for important game species and require changes in game management regulations. New access patterns and ancillary (side) trail systems would likely be established from the pipeline corridor, impacting several GMUs.

Because a diesel pipeline would have more serious issues with potential spills and cleanup than a natural gas pipeline, more ground-level access points would need to be maintained relative to the natural gas pipeline alternatives to address potential pipeline ruptures, which could lead to greater indirect effects to wildlife from improved hunter access.

Two diesel pipeline sections at fault crossings would need to remain on the surface rather than being buried. These above-ground sections may have to be protected by fencing or be elevated to reduce the potential for vandalism. These sections are expected to be no more than a few hundred feet in length and could inhibit some mammals from traveling through the area and may contribute to habitat fragmentation for some species.

Closure activities for a diesel pipeline would be similar to those described for a natural gas pipeline under Alternative 2 but could be greater due to a larger number of airstrips and long-term roads. Decommissioning would involve use of a limited amount of heavy machinery in some areas along the pipeline route with associated wildlife and habitat disturbance effects, but impacts would be considerably less than during the Construction Phase because many stretches of pipeline would be cleaned and abandoned in place. The pipeline corridor could continue to provide improved access to ORVs and non-motorized modes of transport even after the Closure Phase. Potential impacts on important terrestrial mammal populations from hunting and trapping pressure could extend beyond the Closure Phase.

For the Port MacKenzie Option, the different route would have similar impacts to terrestrial mammals as those described for Alternative 3B. The Collocated Natural Gas and Diesel Pipeline Option would have similar impacts to those described for Alternative 3B, although the wider corridor may slightly increase impacts, especially to small mammals or denning or burrowing species.

Marine Mammals

At the Mine Site, there would be additional diesel storage tanks, requiring more construction and higher potential for spills.

During Construction, impacts in the Transportation Corridor for cargo shipments, such as docks in Bethel and Angyaruaq (Jungjuk) Port site would be the same as under Alternative 2. The diesel storage capacity in Dutch Harbor, Bethel, and at Angyaruaq (Jungjuk) Port site would not, however, be required for Alternative 3B. Specific to Alternative 3B would be required improvements to the Tyonek North Foreland Barge Facility to accommodate vessels in excess of 30,000 gross tons and construction of fuel unloading facilities capable of accommodating the proposed volume of diesel fuel. The dock would need to be extended an additional 1,500 feet, including driving piles to support it. Dredging would not be required, as the dock would be extended out to the desired water depth. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

During the Operations Phase, Alternative 3B would decrease peak annual barge traffic on the Kuskokwim River between Bethel and the Angyaruaq (Jungjuk) Port site to 64 trips for cargo transit only and eliminate oceangoing fuel barging between Dutch Harbor and Bethel. Cargo transport between marine terminals and Bethel would be similar to Alternative 2, with 16 round trips per season during the Construction Phase and 12 during the Operations Phase. Under

Alternative 3B, there would be 12 round trips per season to transport fuel from either marine terminals in the Pacific Northwest or from the Tesoro Refinery in Nikiski to Tyonek. Halving the amount of barge traffic on the Kuskokwim River would decrease the likelihood of potential interactions with marine mammals in the river. Additional vessel traffic into Tyonek would increase the potential for disturbance or collisions as described under Alternative 2, Transportation Corridor. Some behavioral modifications may occur, but are not likely to exceed short-term avoidance.

Pipeline Construction at the existing dock at the Tyonek North Foreland Facility would involve extension to deeper water. The diesel pipeline would also require a 19-mile extension from the proposed end of the natural gas pipeline to Tyonek, which would cross the Beluga River. Most potential impacts from construction would result from the dock extension and vessel traffic from materials transport. Effects would be similar to that described under Alternative 2, possible temporary behavioral disturbance. For the Port MacKenzie Option, the different route would have similar impacts to non-ESA listed marine mammals as those described for Alternative 3B. The Collocated Natural Gas and Diesel Pipeline Option would have the same impacts as Alternative 2.

Birds

Diesel barging would be eliminated on the Kuskokwim River after the Construction Phase. Both river and ocean cargo barges would still be necessary for cargo, but total barge traffic would be reduced. The reduction in fuel barge traffic on the Kuskokwim River would reduce barge-related impacts to birds in those areas. However, the addition of a diesel fuel barge from either of the Northwest marine terminals or Nikiski to Tyonek and expansion of the facilities at Tyonek could cause the same types of barge-related impacts to birds in Cook Inlet.

The location of the diesel pipeline would remain the same as the natural gas pipeline in Alternative 2. The diesel pipeline would require a 19-mile extension from the proposed terminus of the natural gas pipeline, south to Tyonek. The additional segment would cross the Beluga River and adjacent wetlands. In addition, this alternative would require extension of the existing Tyonek North Foreland Barge Facility to reach greater depth. The changes in habitat may impact different amounts and species of breeding birds, with impacts in addition to those described under Alternative 2. For the Port MacKenzie Option, the different route may impact breeding pairs along this alternative route, with impacts similar to those described in Alternative 3B. The Collocated Natural Gas and Diesel Pipeline would have similar impacts to those described under Alternative 2, although the wider corridor may slightly increase impacts.

3.12.3.5 ALTERNATIVE 4 – BTC PORT

Terrestrial Mammals

Construction of a new port site at BTC and the mine access road from that site would have the same general impacts as Alternative 2. The BTC Port site and road has similar types of riparian/boreal forest habitats as the Angyaruaq (Jungjuk) Port site and mine access road, so the potential loss/modification of wildlife habitat would be similar (but more acres at BTC). 697.7 more acres of primarily shrub and evergreen forest habitat types would be impacted (see Table 3.10-13, in Section 3.10, Vegetation and Nonnative Invasive Species; see Table 3.10-18 for a comprehensive list of all vegetation removal acres for each Alternative). The amount of habitat

permanently lost to the port site and access road would be more than twice the amount in Alternative 2, but would be a long, narrow clearing and the overall habitat loss would be considered small relative to the amount of similar habitat in the surrounding area. Land clearing and road construction work from the BTC Port site would either take longer to build or require larger construction crews than a road from the Angyaruaq (Jungjuk) Port site. The temporary winter access road up Crooked Creek would allow construction crews to be working from both ends of the road. Impacts would include disturbance from land clearing equipment, gravel mining, and heavy machinery used for hauling, placing, and leveling the road surface and building the port. The effects would be the same types as with Alternative 2, but the extent would be larger.

During the Operations Phase, Alternative 4 offers a tradeoff of effects relative to alternatives using the Angyaruaq (Jungjuk) Port site: potential impacts to terrestrial wildlife from barge traffic and the risk of fuel spills in the Kuskokwim River are reduced while potential impacts from mine access road vehicles and fuel spills on the road are increased. Both port site and mine access road options would have disturbance, habitat loss/modification, and potential injury and mortality impacts on wildlife but such effects would occur in different locations and to different extents. Impacts to wildlife due to disturbance during the operation of the BTC Port site would be small and periodic. The mine access road from the BTC Port site would be longer than from the Angyaruaq (Jungjuk) Port site and would therefore require more trucks on the road to deliver the same amount of goods. The number of vehicles traveling between the port and Mine Site would be about double the number required if the port site was at Angyaruaq (Jungjuk). The trucks would pass a given point about every 5 to 10 minutes over a 14 hour period each day through the shipping season. The risk of vehicle collisions would also be about double that of Alternative 2. Given the slow speeds of mine-related vehicles and the relatively small number of vehicle transits per day, collisions with large mammals would likely be rare. On a gold mine haul road in the state of Washington with similar speed restrictions, monitoring found only about 1 deer per year was found dead (along with 1 bird and 3 small mammals), and part of those were killed by personal vehicles, not the haul trucks (Golder 2015).

Both alternatives would have the potential to affect the ability of local residents to use the areas around the access road for traditional hunting (as well as other subsistence activities such as fishing and berry picking). The road from the BTC Port site would cross the Owhat River watershed, which is an important area for subsistence (see Section 3.21, Subsistence). Donlin Gold intends to prohibit public use of the access road for safety reasons, including use by local residents. Traditional use of the surrounding area for subsistence hunting, trapping, and berry picking could be inhibited, potentially resulting in localized increases in game species and furbearer populations through reduced hunting and trapping pressure. However, access to these areas by traditional means and routes may not be affected unless the access requires crossing mine-restricted property. Another related issue is the potential for traffic on the road to disturb wildlife and change their distribution or movement patterns through avoidance of the road and its associated noise and traffic.

Alternative 4 would shift the location of potential impacts on terrestrial mammals relative to the Angyaruaq (Jungjuk) Port site. Impacts during the Operations phase would be generally similar, while the extent would be larger.

During and after Closure, barge traffic and truck traffic on the mine access road would be greatly reduced but would continue for monitoring and facility maintenance as needed. Even

though the port facilities would be removed, the mine access road would likely be accessible by river boat and 4-wheelers (ATVs), which are common modes of transportation for hunters. The access road would therefore likely make it easier for local residents or other hunters to access wildlife habitat along the mine access road and Mine Site and the resulting increase in hunting pressure could lead to decreased local populations of popular game species. Game management regulations are intended to maintain sustainable populations within larger management areas and are not often designed to address localized depletions of game. Hunting pressure in a given area may decline if hunter success rates are poor but may still be enough to keep local game populations depressed.

Marine Mammals

Impacts on marine mammals upstream of the BTC port site would be eliminated.

Birds

While there are fewer river miles between Bethel and BTC, impacts from Transportation Corridor would be offset by a longer road to the Mine Site. Because the haul distance would be longer, additional cargo and fuel tanker trucks would be procured for transporting these materials to the Mine Site. However, the shorter barge distance shortens the round trip time and fewer barge miles would be required.

The change in the location of the river port would eliminate project-related barge traffic on approximately 60 miles of the Kuskokwim River between the BTC Port site and the Angyaruaq (Jungjuk) Port site. This would eliminate any barge-related effects on birds in that stretch of the river.

The longer port road would cause additional habitat loss through vegetation removal along the road, and has the potential to increase the risk of bird / vehicles collision due to the longer road length at 76 miles, compared to 30 miles in Alternative 2. Trucking hours or season would not change. A total of 16 raptor nests compared to 14 would be impacted. The changes in habitat may impact breeding bird pairs (see Appendix V, Table V-3.12-22 for details) with impacts of habitat loss or alteration at the Mine Site and transportation areas combined.

3.12.3.6 ALTERNATIVE 5A – DRY STACK TAILINGS

Terrestrial Mammals

At the Mine Site, the operating pond would be lined, so it would not be likely to have vegetation or invertebrates around its perimeter. The seepage collection system and water management would prevent contaminated water from reaching creeks downgradient. Given the facility design, monitoring requirements, and emergency response requirements under any permitted mine facility, the potential impacts of exposure of wildlife to contaminated water sources downstream from the Mine Site would be expected to be similar to those described under Alternative 2. The potential for wildlife to be exposed to contaminated water sources would be slightly reduced compared to Alternative 2.

The dry stack methodology is expected to require more diesel fuel used by heavy machinery to haul and compact tailings and reagents used in the dry stack process, thus increasing the volume of barge and trucking along the Transportation Corridor by seven barges on average

per year during Operations. The higher amount of transportation activity may cause slightly more frequent disturbance of terrestrial mammals along the Kuskokwim River and the mine access road, but impacts would be similar to Alternative 2. The additional seven barge trips could also incrementally raise the risk of fuel spills, chemical spills, and vehicle accidents, both in the Kuskokwim River and along the road corridor.

Marine Mammals

The impact on marine mammals under Alternative 5A would be the same as described under Alternative 2.

Birds

The footprint of the Mine Site TSF would be increased to 2,463.0 acres for the Unlined Option (71.6 acre increase), and increased to 2,753.5 acres for the Lined Option (362.1 acre increase), compared to 2,391.4 acres in Alternative 2. Increasing the amount of bird habitat affected. The changes in habitat may impact breeding bird pairs (see Table 3.10-19 in Section 3.10, Vegetation and Nonnative Invasive Species, and Appendix V, Table V-3.12-23 for details; see Table 3.10-18 for a comprehensive list of all vegetation removal acres for each Alternative). The remaining amount of open water at the Mine Site (pit lake, CWDs) would be reduced by roughly half compared to Alternative 2. This reduction in open water would reduce the risk of birds being attracted to the Mine Site and being adversely affected by ingesting contaminated water.

3.12.3.7 ALTERNATIVE 6A – MODIFIED NATURAL GAS ALIGNMENT: DALZELL GORGE ROUTE

Terrestrial Mammals

For most species of terrestrial mammals, there is not enough information on the relative abundance of animals in the different areas to distinguish between the alternative alignments of the Pipeline. Two species with information to assess effects are caribou and bison.

The Dalzell Gorge alignment would traverse through or near more of the Rainy Pass caribou herd range than the alignment under Alternative 2. Both alignments would pass through about the same amount of the Big River-Farewell herd range north of the Alaska Range. Both alignments pass through the Farewell bison herd's core range and pass less than one mile from the important mineral lick areas. The Alternative 6A alignment drops down to the South Fork of the Kuskokwim River valley as it flows north out of the Alaska Range. This area could be used more frequently by caribou and bison in non-winter months relative to the Alternative 2 alignment to the east. Highest effects for either species would likely occur during the Construction Phase.

The proposed construction schedule is different than the proposed schedule for Alternative 2 for the section of the pipeline through the northern half of the Alaska Range. The spread along the South Fork River north to the Farewell mineral lick area would be completed from November through March. Most of the moose, caribou, and bison in the area would likely be further north in the lowlands during this period, although there could be areas with higher concentrations of these species in protected areas. Use of the Farewell mineral lick area would likely be minimal at this time of year due to snow cover. Those relatively few animals that were

nearby when construction activities occurred would likely be subject to high levels of noise and disturbance that would cause them to leave the area.

The southern stretch of this alignment in the mountains would be constructed during the summer, as would the similar stretch under Alternative 2, so the effects on Dall sheep and other higher elevation species would be similar.

Marine Mammals

The impact on marine mammals under Alternative 5A would be the same as described under Alternative 2.

Birds

Along the pipeline route, more conifer forest, deciduous/mixed forest, and land cover vegetation would be impacted; amount of shrub and herbaceous vegetation impacted is less. Change in habitat types affected may mean different bird species may be affected. 12.4 fewer acres of vegetation would be impacted (see Table 3.10-18 for a comprehensive list of all vegetation removal acres for each Alternative in Section 3.10, Vegetation and Nonnative Invasive Species). The changes in habitat may impact different amounts and species of breeding birds.

3.12.3.8 ALTERNATIVES IMPACT COMPARISON

Table 3.12-11 compares impacts between alternatives on terrestrial mammals; Table 3.12-12 compares impacts to marine mammals, and Table 3.12-13 compares impacts to birds. The summary impacts are similar among action alternatives. That does not mean that all the alternatives would affect wildlife equally.

For terrestrial wildlife and birds, the main differences between alternatives are in the amount of vegetation removed, the number of river and ocean barge trips during the barging season, the length of the barge route, the length of mine access roads, the volume of trucking during the trucking season, the length and route of the pipeline corridor, or the use of dry stack tailings methodology. For marine mammals, the main differences are in the number of river and ocean barge trips during the barging season and the length of the barge route.

Table 3.12-11: Comparison by Alternative for Terrestrial Mammals*

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative- 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Impact Causing Project Components						
Vegetation removal, construction activities, project activities, and infrastructure	17,894.6 total acres of habitat loss before reclamation, primarily evergreen forest or scrub shrub (17,832.2 acres, North Option [62 less acres]). Angyaruaq (Jungjuk) port site construction. 30-mile mine access road from port. Mine facilities construction. Road and facilities maintenance may require brushing of above-ground vegetation during Operations. 316-mile natural gas pipeline and ancillary facilities construction (North Option – less than one mile shorter) Pipeline corridor brushing of above-ground vegetation during Operations in 50' ROW. Summary: Vegetation will be removed, in some locations permanently, impacting habitat.	Differences: Fewer diesel trucks and trips. Additional LNG Plant and storage tanks, reduced onsite diesel storage. Summary: Same amount of vegetation removal, but fewer impacts from diesel transportation and storage.	Differences: 18,368.1 acres of habitat loss before reclamation, similar composition to Alternative 2. Tyonek port site construction; 19-mile pipeline extension construction. 334-mile diesel pipeline and ancillary facilities construction. *Port MacKenzie Option:* Port improvements, alternative diesel pipeline route reconnecting at MP 28. 18,447.4 acres of habitat loss. *Collocated Pipeline Option:* Wider ROW. 18,579.2 acres of habitat loss. Summary: More impacts due to more acres of vegetation removal compared to Alternative 2.	Differences: 18,995.8 acres of habitat loss before reclamation, similar composition to Alternative 2. BTC port site construction. 76-mile mine access road. Summary: More impacts due to more acres of vegetation removal compared to Alternative 2.	Differences: *Unlined Option:* 17,966.2 total acres of habitat removal, similar composition to Alternative 2. *Lined Option:* 19,256.7 total acres of habitat removal, similar composition to Alternative 2. Dry stack methodology reduces open water areas. Summary: More vegetation removal and habitat loss in the Mine Site compared to Alternative 2, but less open water would be present as a potential attractant in the Mine Site because of the DST facility during Operations.	Differences: 17,882.2 acres of habitat loss before reclamation, similar composition to Alternative 2. 313-mile natural gas pipeline. Summary: Similar amount of vegetation removal compared to Alternative 2.
River barge trips (Transportation Corridor)	Construction - 89 trips/year (50 cargo, 19 fuel, 20 during first two years to staging above Devil's Elbow) Operations - 122 trips/year (64 cargo and 58 fuel) Summary: Noise disturbance is possible.	Differences: Operations - 83 trips/year (64 cargo, 19 fuel) Summary: Fewer barge trips lower noise impacts.	Differences: Operations - 64 trips/year (cargo) Summary: Least amount of barge trips lowers noise impacts.	Same number of trips as Alternative 2, but river barges would only go as far as BTC port. Summary: Shorter barge route lowers noise impacts.	Differences: Operations - 129 trips/year (71 cargo, 58 fuel) Summary: Similar impacts as Alternative 2.	Same as Alternative 2.
Ocean barge trips (Transportation Corridor)	Construction - 30 trips/year to Bethel (16 cargo, 14 fuel) Operations - 26 trips/year to Bethel (12 cargo, 14 fuel) Summary: Noise disturbance is possible.	Differences: Operations - 5 trips/year per year to Bethel (all fuel) Summary: Fewer barge trips lower noise impacts.	Differences: Operations - no barge trips (fuel or cargo) Summary: Least amount of barge trips lowers noise impacts.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

Table 3.12-11: Comparison by Alternative for Terrestrial Mammals*

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative- 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Ocean barge trips (Pipeline component)	Construction - 20 ocean barges during the first year from Anchorage to Beluga Landing. Summary: Noise disturbance is possible.	Same as Alternative 2.	Differences: Operations - 12 trips/year (fuel) compared to none in Alternative 2 (but no barge trips during Construction from Anchorage to Beluga Landing). Summary: More barge trips during Operations raises potential for noise impacts. No barges during Construction reduces impacts.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Direct or Indirect Impacts - Mine Site						
Behavioral disturbance (noise, barriers to movement, organic waste attraction)	Noise disturbance and displacement from project activities is possible during Construction and Operations, depending on species sensitivity. During Operations, impacts may be seasonal during the operating season. Organic waste attraction is possible.	Fewer diesel trucks and trips during Operations may reduce noise and displacement impacts.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Risk of injury or mortality (vehicle collisions, environmental contamination)	Risk of injury or mortality is possible due to vehicle collisions during the barging and trucking season during Construction and Operations. Environmental contamination is possible at mine site features including the pit lake (Operations and after Closure), and the TSF and CWD ponds (Operations).	Fewer fuel trucks and reduced onsite diesel storage during Operations lowers potential for vehicle collisions, and lowers risk of environmental contamination.	Fewer fuel trucks during Operations lowers potential for vehicle collisions, and lowers risk of environmental contamination.	Same as Alternative 2.	Dry stack methodology reduces open water present in Mine Site and lines ponds reducing habitat during Operations, lowering risk of environmental contamination.	Same as Alternative 2.
Habitat alteration (vegetation removal)	Vegetation will be removed during Construction, in some locations permanently, which may alter or reduce wildlife habitat. Some locations may experience a change in vegetation type during Operations and Closure (through reclamation or natural revegetation).	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Differences: In the TSF, the Unlined Option would have 2463 acres of vegetation removed (71.6 more than Alternative 2); the Lined Option would have 2753.5 acres removed (362.5 more compared to Alternative 2).	Same as Alternative 2.
Increased hunting and trapping pressure	Access will be controlled during the Construction and Operations Phases, but there may be impacts to wildlife from increased hunting and trapping pressure.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Direct or Indirect Impacts - Transportation Corridor						
Behavioral disturbance (noise, barriers to movement, increased barge traffic)	Noise disturbance and displacement from project activities is possible, primarily during Construction and Operations during the barging and trucking season. Disturbance level depends on species sensitivity.	Fewer diesel trucks and trips and fewer river and ocean barge trips during Operations may reduce noise and displacement impacts.	Fewer diesel trucks and trips and fewest river and ocean barge trips during Operations may reduce noise and displacement impacts.	Shorter barge route during Construction and Operations may reduce impacts from barging; longer road may increase impacts.	Similar to Alternative 2.	Same as Alternative 2.

Table 3.12-11: Comparison by Alternative for Terrestrial Mammals*

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative- 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Risk of injury or mortality (vehicle collisions)	Risk of injury or mortality is possible during Construction and Operations during the trucking season.	Fewer fuel trucks during Operations lowers potential for vehicle collisions.	Fewer fuel trucks during Operations lowers potential for vehicle collisions.	Longer road increases potential for vehicle collisions.	Same as Alternative 2.	Same as Alternative 2.
Habitat alteration (vegetation removal)	Vegetation will be removed during Construction, in some locations permanently, which may alter or reduce wildlife habitat. Some locations may experience a change in vegetation type during Operations and Closure (through reclamation or natural revegetation).	Same as Alternative 2.	Same as Alternative 2.	<u>Differences:</u> 1791.1 acres of vegetation removal (697.7 acres more than Alternative 2).	Same as Alternative 2.	Same as Alternative 2.
Increased hunting and trapping pressure	Access will be controlled during the Construction and Operations Phases, but there may be impacts to wildlife from increased hunting and trapping pressure.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Direct or Indirect Impacts - Pipeline						
Behavioral disturbance (noise, barriers to movement, increased barge traffic)	Noise disturbance and displacement from project activities (mine operations, vehicles, barges, infrastructure, human noise) is possible, primarily during Construction and Operations. Disturbance level depends on species sensitivity.	Same as Alternative 2.	Similar to Alternative 2, although there may be increased impacts due to longer pipeline route and more complicated construction, and more access roads built to access the pipeline corridor.	Same as Alternative 2	Same as Alternative 2	Similar to Alternative 2.
Risk of injury or mortality (vehicle collisions)	Risk of injury is possible due to vehicle collisions mostly during the Construction Phase.	Same as Alternative 2.	Similar to Alternative 2, although there may be increased impacts due to longer pipeline route and more complicated construction, and more access roads built to access the pipeline corridor.	Same as Alternative 2	Same as Alternative 2	Similar to Alternative 2, although there is the possibility of more impacts to caribou and bison due to the route.
Habitat alteration (vegetation removal)	Vegetation will be removed during Construction, in some locations permanently, which may alter or reduce wildlife habitat. Some locations may experience a change in vegetation type during Operations and Closure (through reclamation or natural revegetation). Vegetation brushing will occur during Operations in a 50' ROW per PHMSA regulations, resulting in early-successional stage vegetation in the corridor periodically.	Same as Alternative 2.	7455.4 acres of vegetation removal (473.5 more than Alternative 2). For the Port MacKenzie Option, 7434.7 acres of vegetation removal (452.8 acres more than Alternative 2, 20.7 acres less than Alternative 3B). For the Collocated Pipeline Option, 7666.5 acres of vegetation removal (684.6 acres more than Alternative 2, 211.1 acres more than Alternative 3B).	Same as Alternative 2.	Same as Alternative 2.	<u>Differences:</u> 6969.5 acres of vegetation removal (12.5 acres less than Alternative 2).
Increased hunting and trapping pressure	Access will be controlled during the Construction and Operations Phases, but there may be impacts to wildlife from increased hunting and trapping pressure along the entire pipeline corridor route, given the current use, expected increase in access, and proximity to current recreationally used features and areas such as the Iditarod National Historic Trail.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

Notes: * The No Action Alternative would have no new impacts on terrestrial wildlife.

Table 3.12-12: Comparison by Alternative for Marine Mammals*

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Impact Causing Project Component						
River barge trips (Transportation Corridor)	Construction - 89 trips/year (50 cargo, 19 fuel, 20 during first two years to staging above Devil's Elbow). Operations - 122 trips/year (64 cargo and 58 fuel). Summary: Noise disturbance and vessel strike are possible.	Differences: Operations - 83 trips/year (64 cargo, 19 fuel). Summary: Fewer barge trips lowers noise and vessel strike potential.	Differences: Operations - 64 trips/year (cargo) . Summary: Least amount of barge trips lowers noise and vessel strike potential.	Same number of trips as Alternative 2, but river barges would only go as far as BTC port. Summary: Shorter barge route lowers noise disturbance and vessel strike potential.	Differences: Operations - 129 trips/year (71 cargo, 58 fuel). Summary: Similar impacts as Alternative 2.	Same as Alternative 2.
Ocean barge trips (Transportation Corridor)	Construction - 30 trips/year to Bethel (16 cargo, 14 fuel). Operations - 26 trips/year to Bethel (12 cargo, 14 fuel). Summary: Noise disturbance and vessel strike are possible.	Differences: Operations - 5 trips/year per year to Bethel (all fuel). Summary: Less barge trips lowers noise and vessel strike potential.	Differences: Operations - no barge trips (fuel or cargo). Summary: Least amount of barge trips lowers noise and vessel strike potential.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Ocean barge trips (Pipeline component)	Construction - 20 ocean barges during the first year from Anchorage to Beluga Landing. Summary: Noise disturbance and vessel strike are possible.	Same as Alternative 2.	Differences: Operations - 12 trips/year (fuel) compared to none in Alternative 2 (but no barge trips during Construction from Anchorage to Beluga Landing). Summary: More barge trips during Operations raises potential for noise impacts. No barges during Construction reduces impacts.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Direct or Indirect Impacts - Transportation Corridor						
Behavioral disturbance (noise, increased barge traffic)	Noise disturbance and displacement from barging is possible, primarily during Construction and Operations during the barging season. Disturbance level depends on species sensitivity.	Fewer river and ocean barge trips during Operations may reduce noise and displacement impacts.	Fewest river and ocean barge trips during Operations may reduce noise and displacement impacts.	Shorter barge route during Construction and Operations may reduce impacts from barging.	Similar to Alternative 2.	Same as Alternative 2.
Risk of injury or mortality (vessel strikes)	Risk of injury or mortality from vessel strikes is possible during Construction and Operations during the barging season.	Fewer river and ocean barge trips during Operations may reduce risk of injury or mortality.	Fewest river and ocean barge trips during Operations may reduce risk of injury or mortality.	Shorter barge route during Construction and Operations may reduce risk of injury or mortality.	Similar to Alternative 2.	Same as Alternative 2.
Direct or Indirect Impacts - Pipeline						
Behavioral disturbance (noise, increased barge traffic)	Noise disturbance and displacement from barging is possible during Construction during the barging season.	Same as Alternative 2.	More barge trips during Operations raises potential for disturbance.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Risk of injury or mortality (vessel strikes)	Risk of injury or mortality from vessel strikes is possible during Construction during the barging season.	Same as Alternative 2.	More barge trips during Operations raises risk of injury or mortality from vessel strike.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

Notes: * The No Action Alternative would have no new impacts on marine mammals. Marine mammals do not occur at the Mine Site component.

Table 3.12-13: Comparison by Alternative for Birds*

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Impact Causing Project Components						
Vegetation removal, construction activities, project activities, and infrastructure	17,894.6 total acres of habitat loss before reclamation, primarily evergreen forest or scrub shrub (17,832.2 acres, North Option [62 less acres]). Angyaruaq (Jungjuk) port site construction. 30-mile mine access road from port. Mine facilities construction. Road and facilities maintenance may require brushing of above-ground vegetation during Operations. 316-mile natural gas pipeline and ancillary facilities construction (North Option – less than one mile shorter). Pipeline corridor brushing of above-ground vegetation during Operations in 50' ROW. Summary: Vegetation will be removed, in some locations permanently, impacting habitat.	Differences: Fewer diesel trucks and trips. Additional LNG Plant and storage tanks, reduced onsite diesel storage. Summary: Same amount of vegetation removal, but fewer impacts from diesel transportation and storage.	Differences: 18,368.1 acres of habitat loss before reclamation, similar composition to Alternative 2. Tyonek port site construction; 19-mile pipeline extension construction. 334-mile diesel pipeline and ancillary facilities construction. *Port MacKenzie Option:* Port improvements, alternative diesel pipeline route reconnecting at MP 28. 18,447.4 acres of habitat loss. *Collocated Pipeline Option:* Wider ROW. 18,579.2 acres of habitat loss. Summary: More impacts due to more acres of vegetation removal compared to Alternative 2.	Differences: 18,995.8 acres of habitat loss before reclamation, similar composition to Alternative 2. BTC port site construction. 76-mile mine access road. Summary: More impacts due to more acres of vegetation removal compared to Alternative 2.	Differences: *Unlined Option:* 17,966.2 total acres of habitat removal, similar composition to Alternative 2. *Lined Option:* 19,256.7 total acres of habitat removal, similar composition to Alternative 2. Dry stack methodology reduces open water areas. Summary: More vegetation removal and habitat loss in the Mine Site compared to Alternative 2, but less open water would be present as a potential attractant in the Mine Site because of the DST facility during Operations.	Differences: 17,882.2 acres of habitat loss before reclamation, similar composition to Alternative 2. 313-mile natural gas pipeline. Summary: Similar amount of vegetation removal compared to Alternative 2.
River barge trips (Transportation Corridor)	Construction - 89 trips/year (50 cargo, 19 fuel, 20 during first two years to staging above Devil's Elbow). Operations - 122 trips/year (64 cargo and 58 fuel). Summary: Noise disturbance is possible.	Differences: Operations - 83 trips/year (64 cargo, 19 fuel). Summary: Fewer barge trips lower noise impacts.	Differences: Operations - 64 trips/year (cargo). Summary: Least amount of barge trips lowers noise impacts.	Same number of trips as Alternative 2, but river barges would only go as far as BTC port. Summary: Shorter barge route lowers noise impact potential.	Differences: Operations - 129 trips/year (71 cargo, 58 fuel) Summary: Similar impacts as Alternative 2.	Same as Alternative 2.
Ocean barge trips (Transportation Corridor)	Construction - 30 trips/year to Bethel (16 cargo, 14 fuel) Operations - 26 trips/year to Bethel (12 cargo, 14 fuel). Summary: Noise disturbance is possible.	Differences: Operations - 5 trips/year per year to Bethel (all fuel) during Operations (17 total compared to 26 total in Alternative 2). Summary: Fewer barge trips lower noise impacts.	Differences: Operations - no fuel barge trips compared to 14 in Alternative 2, for a total of 12 barge trips/year. Summary: Least amount of barge trips lowers noise impacts.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

Table 3.12-13: Comparison by Alternative for Birds*

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Ocean barge trips (Pipeline component)	Construction - 20 ocean barges during the first year from Anchorage to Beluga Landing. Summary: Noise disturbance is possible.	Differences: Construction – no pipe/equipment barges between Anchorage and Beluga Landing. Summary: No barges during Construction reduces impacts.	Differences: Construction – no pipe/equipment barges between Anchorage and Beluga Landing. Operations - 12 trips/year (fuel) Summary: More barge trips during Operations raises potential for noise impacts. No barges during Construction reduces impacts.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Direct or Indirect Impacts - Mine Site						
Behavioral disturbance (noise, barriers to movement, organic waste attraction)	Noise disturbance and displacement from project activities is possible during Construction and Operations, depending on species sensitivity. During Operations, impacts may be seasonal during the operating season. Organic waste attraction is possible.	Fewer diesel trucks and trips during Operations may reduce noise and displacement impacts.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Risk of injury or mortality (vehicle collisions, environmental contamination)	Risk of injury or mortality is possible due to vehicle collisions during the barging and trucking season during Construction and Operations. Environmental contamination is possible at mine site features including the pit lake (Operations and after Closure), and the TSF and CWD ponds (Operations).	Fewer fuel trucks and reduced onsite diesel storage during Operations lowers potential for vehicle collisions, and lowers risk of environmental contamination.	Fewer fuel trucks during Operations lowers potential for vehicle collisions, and lowers risk of environmental contamination.	Same as Alternative 2.	Dry stack methodology reduces open water present in Mine Site and lines ponds reducing habitat during Operations, lowering risk of environmental contamination.	Same as Alternative 2.
Habitat alteration (vegetation removal, nest site loss or disturbance)	Vegetation will be removed during Construction, in some locations permanently, which may alter or reduce or disturb wildlife habitat and nest sites. Some locations may experience a change in vegetation type during Operations and Closure (through reclamation or natural revegetation).	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Differences: In the TSF, the Unlined Option would have 2463 acres of vegetation removed (71.6 more than Alternative 2); the Lined Option would have 2753.5 acres removed (362.5 more compared to Alternative 2).	Same as Alternative 2.
Direct or Indirect Impacts - Transportation Corridor						
Behavioral disturbance (noise, barriers to movement, increased barge traffic)	Noise disturbance and displacement from project activities is possible, primarily during Construction and Operations during the barging and trucking season. Disturbance level depends on species sensitivity.	Fewer diesel trucks and trips and fewer river and ocean barge trips during Operations may reduce noise and displacement impacts.	Fewer diesel trucks and trips and fewest river and ocean barge trips during Operations may reduce noise and displacement impacts.	Shorter barge route during Construction and Operations may reduce impacts from barging; longer road may increase impacts.	Similar to Alternative 2.	Same as Alternative 2.
Risk of injury or mortality (vehicle collisions, powerline collisions)	Risk of injury or mortality is possible during Construction and Operations during the trucking season.	Fewer fuel trucks during Operations lowers potential for vehicle collisions.	Fewer fuel trucks during Operations lowers potential for vehicle collisions.	Longer road increases potential for vehicle collisions.	Same as Alternative 2.	Same as Alternative 2.

Table 3.12-13: Comparison by Alternative for Birds*

	Alternative 2 – Proposed Action	Alternative 3A – LNG-Powered Haul Trucks	Alternative 3B – Diesel Pipeline	Alternative 4 – BTC Port	Alternative 5A – Dry Stack Tailings	Alternative 6A – Dalzell Gorge Route
Habitat alteration (vegetation removal, nest site loss or disturbance)	Vegetation will be removed during Construction, in some locations permanently, which may alter or reduce wildlife habitat. Some locations may experience a change in vegetation type during Operations and Closure (through reclamation or natural revegetation).	Same as Alternative 2.	Same as Alternative 2.	Differences: 1791.1 acres of vegetation removal (697.7 acres more than Alternative 2).	Same as Alternative 2.	Same as Alternative 2.
Direct or Indirect Impacts - Pipeline						
Behavioral disturbance (noise, increased barge traffic)	Noise disturbance and displacement from project activities (mine operations, vehicles, barges, infrastructure, human noise) is possible, primarily during Construction and Operations. Disturbance level depends on species sensitivity.	Same as Alternative 2.	Similar to Alternative 2, although there may be increased impacts due to longer pipeline route and more complicated construction, and more access roads built to access the pipeline corridor.	Same as Alternative 2	Same as Alternative 2	Similar to Alternative 2.
Behavioral Risk of injury or mortality (vehicle collisions, powerline collisions)	Risk of injury is possible due to vehicle collisions mostly during the Construction Phase.	Same as Alternative 2.	Similar to Alternative 2, although there may be increased impacts due to longer pipeline route and more complicated construction, and more access roads built to access the pipeline corridor.	Same as Alternative 2	Same as Alternative 2	Similar to Alternative 2, although there is the possibility of more impacts to caribou and bison due to the route.
Habitat alteration (vegetation removal, nest site loss or disturbance)	Vegetation will be removed during Construction, in some locations permanently, which may alter or reduce wildlife habitat. Some locations may experience a change in vegetation type during Operations and Closure (through reclamation or natural revegetation). Vegetation brushing will occur during Operations in a 50' ROW per PHMSA regulations, resulting in early-successional stage vegetation in the corridor periodically.	Same as Alternative 2.	7455.4 acres of vegetation removal (473.5 more than Alternative 2). For the Port MacKenzie Option, 7434.7 acres of vegetation removal (452.8 acres more than Alternative 2, 20.7 acres less than Alternative 3B). For the Collocated Pipeline Option, 7666.5 acres of vegetation removal (684.6 acres more than Alternative 2, 211.1 acres more than Alternative 3B). If the Collocated Pipeline Option was configured with Port MacKenzie, 8083.1 acres of vegetation removal (1101.2 acres more than Alternative 2, 627.7 acres more than Alternative 648.4 acres more than the Port MacKenzie Option alone, and 416.6 acres more than the Collocated Pipeline Option alone.	Same as Alternative 2.	Same as Alternative 2.	Differences: 6969.5 acres of vegetation removal (12.5 acres less than Alternative 2).

Notes: *The No Action Alternative would have no new impacts on birds.