3.23 WILDLIFE VALUES

This section provides a description of the birds, terrestrial, and marine mammals that are known or have a potential to occur in the project area. Federally listed threatened or endangered species (TES) are discussed separately in Section 3.25, Threatened and Endangered Species. This section is organized based on the species present in or near the various components of the project alternatives (including their variants).

The Environmental Impact Statement (EIS) analysis area for wildlife varies depending on the species and project component because of differences in species biology and in potential impacts from different project components. Table 3.23-1 shows the analysis area per species group and project component. The analysis area is where wildlife species may experience both permanent and temporary impacts from the project. Project components had differently sized buffers placed around them to approximate the area that would experience impacts caused by the various project activities. The analysis area is not meant to encompass the home range of all species in the area; it is meant to provide an estimate of the area where wildlife would experience project-related impacts as they move through, feed, stage, migrate, nest, den, etc., in the area.

For the mine site, a 10-mile-radius buffer was applied as the analysis area to encompass impacts such as noise from project activities (including blasting), light pollution, fugitive dust, loss and alteration of habitat, and other impacts. For the transportation and natural gas pipeline corridor and port, a 3-mile-radius buffer was applied for raptors and terrestrial mammals due to their large home ranges and potential impacts from noise, and loss of nesting, denning, and foraging locations. Waterbirds, landbirds, and shorebirds had a 1-mile-radius buffer due to their smaller home range sizes.

All project components and alternatives in the marine environment of Cook Inlet and beyond have the same analysis area. The analysis area includes all activities associated with pipeline construction, operations, maintenance/repair, and monitoring, as well as potential project-related vessel and aircraft routes. Specifically for marine mammals, the analysis area includes marine waters crossed by concentrate bulk carriers traveling from Cook Inlet through Shelikof Strait and the Aleutian Islands, and marine line haul barges from Cook Inlet to West Coast ports traveling either through the Pacific Ocean or near the coast through the Gulf of Alaska and southeastern Alaska. The shipping lanes are approximately 6.4 nautical miles wide (7.4 miles), and include the area of ensonification from vessels during all project activities. The shipping lanes are defined in PLP 2020-RFI-163, and buffered to include an area of ensonification. The analysis area is the same for non-TES and TES of marine mammals; specific details for how the analysis area in the marine environment was determined are provided in Section 4.25, Threatened and Endangered Species.

The analysis area in Cook Inlet includes a vessel corridor from Nikiski south to Kamishak Bay and most of the western portion of lower Cook Inlet. The analysis area encompasses Kamishak Bay and includes all marine components during all phases of the project (construction, operations, and closure). This includes installation of the natural gas pipeline, projected flight paths in and out of the airstrip at Amakdedori, and project-related vessel traffic between the port and lightering locations. The analysis area excludes eastern lower Cook Inlet where there are well-established shipping lanes for existing non-project-related vessel traffic (Nuka and Pearson 2015). The analysis area does not change regardless of the alternative or variants considered and encompasses the extent of potential project-related impacts that are reasonably expected to occur. Many wildlife species have a much larger range than the analysis area; however, this section focuses on species that have the potential to be present in the area during project construction, operations, and closure.

Table 3.23-1: EIS Analysis Area per Species/Group and Project Component

Species Group	Mine Site	Transportation and Natural Gas Pipeline Corridor	Port	Lightering Locations
Raptors	10-mile radius	3-mile radius	3-mile radius	1-mile radius
Waterbirds[1]	10-mile radius	1-mile radius	1-mile radius	1-mile radius
Landbirds and Shorebirds	10-mile radius	1-mile radius	1-mile radius	1-mile radius
Terrestrial Mammals	10-mile radius	3-mile radius	3-mile radius	None
Marine Mammals	None	The western portion of lower Cook Inlet south to Cape Douglas plus three shipping routes (6.4 nautical miles [7.4 miles] in width) from the mouth of lower Cook Inlet south and west out to the edge of the exclusive economic zone. For harbor seals in Iliamna Lake, a 1-mile buffer around the ferry and natural gas pipeline routes was selected as the analysis area.		

Note:

[1] Because waterbirds occur both in the terrestrial environment and the marine environment, the analysis area for waterbirds in Cook Inlet encompasses the same area as the analysis area for marine mammals: Kamishak Bay south to Cape Douglas.

Biological surveys conducted to document baseline conditions for the project often covered a much larger area than the analysis area to understand the regional wildlife populations at the time of project-specific surveys. However, impacts from the project are only considered for species that occur in the analysis area. The various survey areas for different species are described in their respective sections below. Project components that are geographically similar across all alternatives (such as the mine site and portions of the transportation and natural gas pipeline corridor) are only discussed once, under Alternative 1a. Components that are unique to the different alternatives are discussed separately.

Most of the baseline wildlife data for the project were collected in 2004 and 2005, with additional data collected for various species and project components in subsequent years. The data for a proposed port at Amakdedori were collected in 2018 and 2019. Although baseline conditions in the vicinity of the mine site have not changed drastically due to human development activities, it is recognized that habitats are not static, and change over time. The wildlife baseline data are considered representative of the habitat and species that occur in the analysis area.

3.23.1 Alternative 1a

3.23.1.1 Mine Site

Birds

The bird species present in the analysis area include those that are protected under the Migratory Bird Treaty Act of 1918 (MBTA) (16 United States Code [USC] 703-712) and the Bald and Golden Eagle Protection Act (16 USC 668-668c). In addition, multiple agencies as well as non-profit organizations have created Alaska-specific lists of bird species of conservation concern with small or vulnerable population sizes in Alaska, restricted geographic ranges (including breeding and wintering), and decreasing population trends, among other reasons. Bird species of conservation concern are species listed on at least one of the following three lists: the US Fish and Wildlife Service's (USFWS) Birds of Conservation Concern in Bird Conservation Regions BCR 2 (western Alaska) and BCR 4 (northwestern interior forest US portion only) (USFWS 2008a), the Alaska Department of Fish and Game's (ADF&G) Wildlife Action Plan (listed as a species of greatest conservation need in southwest Alaska) (ADF&G 2015a), and Audubon Alaska's WatchList 2017-Red List of Declining Populations (Warnock 2017). Bird species of conservation concern do not receive the same level of protection as those listed under the federal Endangered Species Act (ESA), but are protected by the MBTA. Bird species of conservation concern are not specifically detailed herein but are recognized as occurring in the EIS analysis area. Avian species present in the mine site are divided into groups that include raptors, waterbirds, landbirds, and shorebirds.

Historical bird surveys around the mine site include cliff-nesting raptor surveys (detailed in ABR 2011a), reconnaissance avian surveys of the mine site and surrounding areas, including waterfowl surveys on the Kvichak and Naknek rivers (Smith 1991), and landbird and shorebird studies from the Iliamna Lake region (Williamson and Peyton 1962). These historical studies cannot be directly compared to the surveys conducted for the project due to differences in survey methods, timing of surveys, habitat surveyed, and geographical extent (ABR 2011a). Therefore, historical survey data are of limited use, and generally not used for the analysis in this section. More recently, Brna and Verbrugge (2013) reviewed the mammalian and avian resources of the Nushagak River and Kvichak River watersheds; these data are included where appropriate.

Avian surveys for the mine site were conducted primarily from 2004 through 2005 (with a few surveys in 2006) by ABR. The full details of the survey methods and results are provided in the Pebble Project Environmental Baseline Document (EBD) 2004 through 2008, Chapter 16, Wildlife and Habitat Bristol Bay Drainages (ABR 2011a). Lists of all bird species and their conservation status detected in the area referred to as the mine survey area are provided in the Pebble Limited Partnership (PLP) EBDs (ABR 2011a-e). The methods and results are summarized for the specific project components, where applicable.

Habitat mapping and habitat-value assessments were conducted across the mine survey area in 2004 and 2005 in an effort to better understand the biological conditions present and how they relate to avian abundance and distribution. Wildlife habitats in the mine survey area were mapped to provide a baseline inventory of the availability of wildlife habitats for use by various wildlife species (ABR 2011a). The mine survey area was defined as an area comprising 184 square miles, centered on the mine footprint. The area is primarily composed of alpine and unforested upland habitats on glacial moraine deposits, with three prominent river corridors in the area (North Fork Koktuli [NFK] River, South Fork Koktuli [SFK] River, and Upper Talarik Creek [UTC]). Field data on the vegetation, physiography, landforms, and surface forms were applied to assess the potential use of the mapped habitat by avian species, as detailed in ABR 2011a. Habitat use for each species was qualitatively categorized into one of four value classes (high, moderate, low, or negligible) primarily based on avian survey data specific to the mine survey area, and habitat-use information from scientific literature (ABR 2011a). Twenty-five wildlife habitat types were mapped in the mine survey area, with Upland Moist Dwarf Scrub and Alpine Moist Dwarf Scrub representing over 52 percent of the mine survey area wildlife habitat types. The complete list of all avian habitat types, their plant-species composition, and their value as avian habitat are detailed in ABR 2011a. Avian habitat mapping is useful for understanding the locations where various avian species are likely to occur, and how impacts from the project are anticipated to affect the vegetation communities used by birds.

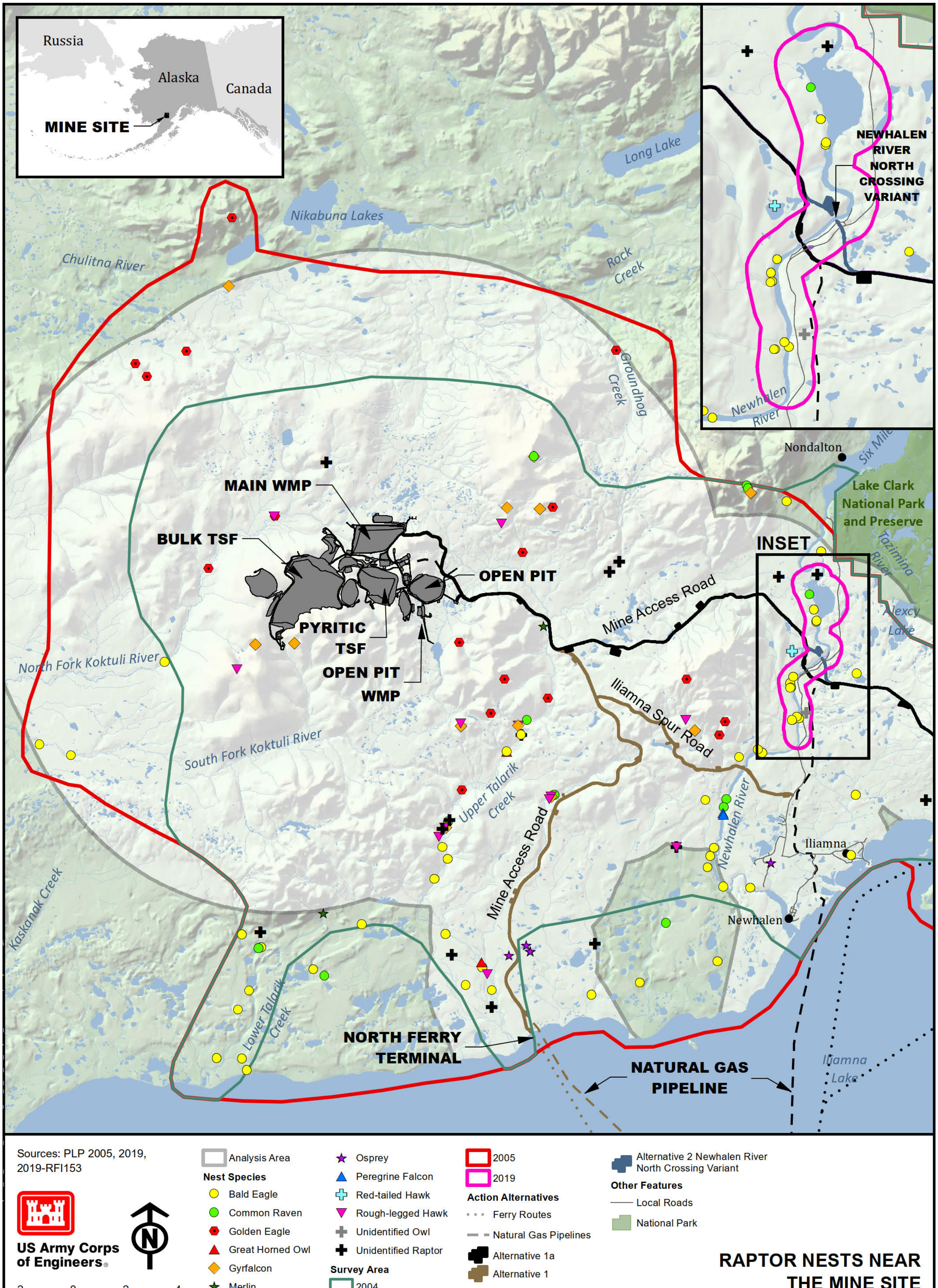
The following sections provide an overview of survey methods and results for the three categories of birds (raptors, waterbirds, and landbirds/shorebirds) that breed, stage, winter, and migrate throughout the mine survey area. The mine survey area covered a larger area than the EIS analysis area.

Raptors

Methods—Historical raptor survey data were reviewed to understand the level of field effort by previous studies; however, ABR data from 2004 and 2005 are more recent and comprehensive. Aerial-based raptor studies were conducted from April to May 2004 and May to August 2005 to collect baseline data on the distribution, abundance, nesting status, and habitat use of large tree and cliff-dwelling birds of prey (and large corvids), which included bald eagles (*Haliaeetus leucocephalus*), golden eagles (*Aquila chrysaetos*), gyrfalcon (*Falco rusticolus*), peregrine falcon (*Falco peregrinus*), rough-legged hawk (*Buteo lagopus*), northern goshawk (*Accipiter gentilis*), osprey (*Pandion haliaetus*), great horned owl (*Bubo virginianus*), and common raven (*Corvus corax*). These aerial surveys are not able to detect ground-nesting raptor species such as northern harrier (*Circus hudsonius*) and short-eared owl (*Asio flammeus*). Additional fall and winter bald eagle surveys were conducted in 2005 and 2006 to gather information on wintering bald eagles.

Surveys were conducted across the mine survey area that included all suitable cliff habitat and woodland tracts that could provide nesting platforms for large cliff and tree-nesting raptors. The area surveyed for raptors encompassed the analysis area. The 2004 survey area was slightly smaller than the 2005 survey area, which is shown on Figure 3.23-1. The 2005 survey area was broader, extending from the Chulitna River to the north of the mine site; south to Iliamna Lake; west almost to the confluence of the NFK and SFK; and east to beyond the Newhalen River. Detailed survey methods are discussed in ABR 2011a, and followed the Draft Environmental Baseline Studies, proposed 2004 and 2005 study plans (NDM 2004, 2005).

The first helicopter survey was conducted prior to the leaf-out of deciduous trees to identify tree-nesting species, such as northern goshawk and bald eagle. The second survey for each year was timed to coincide with peak nesting for cliff-nesting raptors, such as golden eagle, gyrfalcon, peregrine falcon, and rough-legged hawk. Because these species nest at slightly different times, which can vary from year to year, surveys were timed to coincide with the time when most cliff-nesting raptors would have active nests. One survey was conducted in late June through early July to determine the success of early nesting species such as gyrfalcons and golden eagles. A second survey was conducted in early August to determine nesting success and productivity for some late-hatching species (such as rough-legged hawk) where brooding adults obscured views of the nest in the early July survey (ABR 2011a). A nest was considered successful if at least one live nestling was observed at approximately 80 percent of the average age of first flight for the species. Productivity was determined as the number of young per occupied nest or the total number of pairs, and the number of young per successful nest or pair (ABR 2011a). Wintering bald eagle surveys were conducted in February and November 2005 and November 2006 to determine bald eagle winter use of the mine survey area.



RAPTOR NESTS NEAR THE MINE SITE

PEBBLE PROJECT EIS

FIGURE 3.23-1

Results—No raptor nests were found directly in the mine site footprint based on ABR surveys (ABR 2011a). The mine site footprint itself lacks cliffs, large trees, and other structures that could support nesting raptors. The habitat is primarily open rocky tundra surrounded by rolling hills. Habitat for most tree-nesting raptors is limited in the EIS analysis area to trees along UTC and its tributaries, as well as the lower reaches of the Koktuli River. More extensive woodlands (spruce-dominated) occur in the area between Iliamna Lake, the UTC, and lower Talarik Creek. Habitat for cliff-nesting species is limited to isolated cliffs, and bluffs along riparian areas. This includes hills between the NFK and Upper SFK rivers, the eastern side of Koktuli Mountain, the eastern and southern slopes of Groundhog Mountain, and along UTC.

Of the 19 raptor species (12 day-active raptors and seven species of owl) that may occur in the mine survey area and surrounding areas, 10 species were recorded during aerial surveys. A complete list of the detected raptor species, along with their breeding status, nest abundance, and nest productivity, is provided in ABR 2011a. The most commonly detected nesting raptors were bald eagle (with the closest nest more than 4 miles from the mine site footprint in the NFK), golden eagle, rough-legged hawk, and gyrfalcon (Figure 3.23-1). Not all of the nests detected were active or occupied at the time of survey, and the number of active raptor territories varied depending on prey availability. The nesting success (percentage of total nests that contained at least one live nestling at approximately 80 percent of the average age of first flight for the species during the productivity surveys) ranged from 67 percent for rough-legged hawk and golden eagle, to 71 and 80 percent for bald eagle and gyrfalcon, respectively (ABR 2011a). Merlin (*Falco columbarius*), osprey, and great horned owls were detected nesting in the mine survey area in low abundance; no peregrine falcon or northern goshawk nests were detected during surveys. In addition, suitable nesting habitat exists for the northern harrier and short-eared owl. However, both of these are ground-nesting species; therefore, it is difficult to find their nests via aerial surveys and no nests of these species were detected. Therefore, aerial surveys are limited in their ability to detect nests for all raptor species. Furthermore, raptor species exhibit variation in nest timing, nesting areas, and density in relation to prey species abundance. Although the mine site footprint lacks suitable habitat for tree- and cliff-nesting raptors, there is potential habitat for ground-nesting raptors, especially around wetland and marsh areas.

Bald eagle nests were found primarily along the lower NFK and SFK rivers, UTC, and lower Talarik Creek along the Newhalen River, and generally were not in close proximity to the mine site (Figure 3.23-1). Cliff-nesting raptors such as golden eagles, gyrfalcons, and rough-legged hawks nested on cliffs closer to the mine site along the NFK, SFK, and UTC drainages, including Groundhog Mountain and the mountains east of Frying Pan Lake (Figure 3.23-1). The closest gyrfalcon and golden eagle nests to any component of the mine site were approximately 0.4 mile (near the bulk tailings storage cell south embankment sediment pond), and 0.8 mile away (near Frying Pan Lake water treatment plant discharge-south), respectively. Overall, two gyrfalcon nests were less than a mile from the mine site (south of the bulk tailings storage cell), and four golden eagle nests were observed in a large area between 0.8 mile to 2.5 miles from the mine site. Several rough-legged hawk nests were also in the vicinity and ranged from 1.7 to 2.5 miles from the mine site.

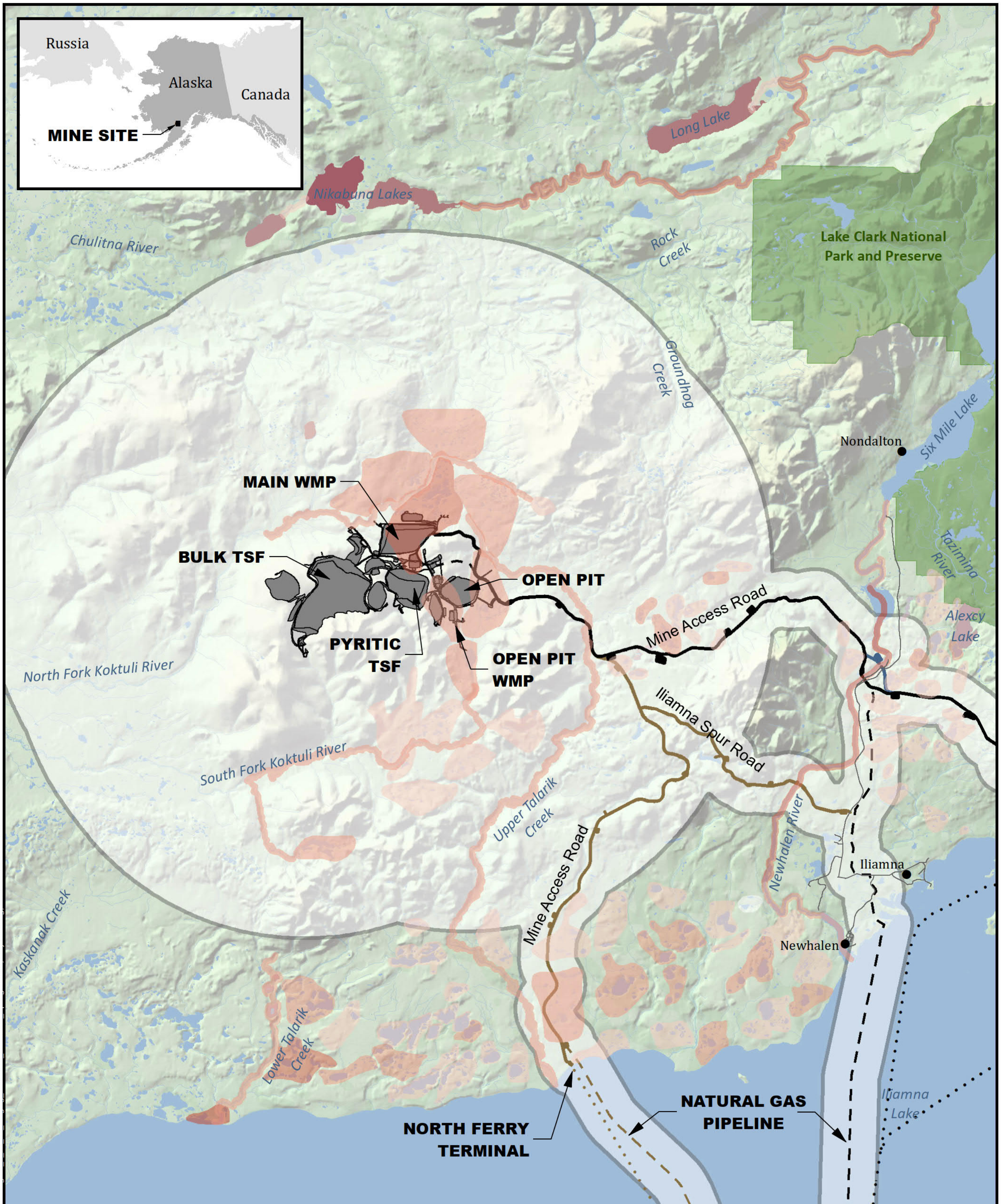
In summary, aerial raptor surveys in 2004 and 2005 documented nesting in the main river valleys and adjacent cliffs in the EIS analysis area. Although no raptors were detected nesting directly in the mine site a (due to a lack of nesting structures, such as trees or cliffs), the habitat is suitable for foraging for a variety of raptor species that nest in the vicinity, including golden eagles, gyrfalcons, and rough-legged hawks, as well as northern harriers and short-eared owls.

Waterbirds

The Iliamna Lake region serves as a migration route for many species of waterbirds (swans, geese, ducks, loons, and gulls) moving to and from the breeding grounds in western and northern Alaska (Platte and Butler 1995). The USFWS conducts aerial-based waterbird surveys annually each spring and summer as part of the North American Waterfowl Breeding Pair Survey (USFWS 2012a). In the late 1980s, the survey effort was expanded to include additional wetlands to improve population estimates and map the distribution of several species. This expanded breeding pair survey area included the wetlands around the mine site (labeled the Bristol Bay lowlands) (Platte and Butler 1995). A series of maps (USFWS 2012d) depicting the abundance and distribution of various waterbird species was created, and generally correlate with the distribution of waterbird species found during baseline surveys for the project. Although these data are useful for understanding historical distributions of waterbird species around the mine site, the baseline data presented below are more thorough and include ground-based surveys to document breeding success.

Waterbird species that use the mine survey area for breeding or staging include tundra swan (*Cygnus columbianus*), common loon (*Gavia immer*), harlequin duck (*Histrionicus histrionicus*), surf scoter (*Melanitta perspicillata*), black scoter (*Melanitta americana*), long-tailed duck (*Clangula hyemalis*), and a variety of dabbling and diving ducks (Williamson and Peyton 1962). Surveys were conducted in the mine survey area from April to October 2004, in 2005, and in September 2006 using helicopters, fixed-wing aircraft, and ground personnel to document the distribution, abundance, species composition, and habitat use of waterbird species during the breeding season (pre-nesting, nesting, molting, and brood-rearing) and during spring/fall migration. Waterbirds observed included species of geese, swans, ducks, loons, grebes, cormorants, cranes, gulls, terns, and jaegers. The complete details of the methods used for these various surveys are outlined in the EBDs, proposed 2004 and 2005 study plans (NDM 2004, 2005), and are summarized below.

Methods—The mine survey area for waterbirds in 2004 and 2005 encompassed the mine site facilities plus a large buffer encompassing adjacent wetlands (Figure 3.23-2 and Figure 3.23-3). The mine survey area included the majority of the EIS analysis area. Field work was conducted from April to October 2004, April to October 2005, and September 2006. Fixed-wing aircraft were used to conduct waterbird migration surveys every 7 to 10 days during spring and fall migration in 2004 and 2005. Waterfowl breeding population surveys were conducted using fixed-wing aircraft in June 2004 and May 2005. Swan nesting surveys were conducted in the mine survey area in June 2005 and May 2005, and productivity surveys were conducted in September 2006 using aircraft. Harlequin duck pre-nesting and brood-rearing surveys were conducted by helicopter in the mine survey area in May, July, and August 2004 and 2005. Species of loons were recorded incidentally as part of the spring and fall migration surveys and the waterbird brood-rearing surveys. A helicopter survey for nesting gulls was conducted in June 2005 in the mine survey area. Ground surveys for brood-rearing waterbirds were conducted in July 2004 and 2005 and included a search of wetlands, ponds, and lakes in selected locations in the mine survey area. Finally, surveys for flocks of molting waterbirds were conducted in the mine survey area in July and August 2005. The complete details of the survey data, flight paths, data recorded, and timing of surveys are detailed in ABR 2011a.



Sources: PLP 2005, 2019-RFI153

Analysis Area

Maximal Number of Birds

- 0
- 1-25
- 26-100
- 101-250
- 251-500
- 501-1000

Action Alternatives

- Ferry Routes
- Natural Gas Pipelines
- Alternative 1a
- Alternative 1
- Alternative 2 Newhalen River North Crossing Variant

Other Features

- Local Roads
- National Park

US Army Corps of Engineers®

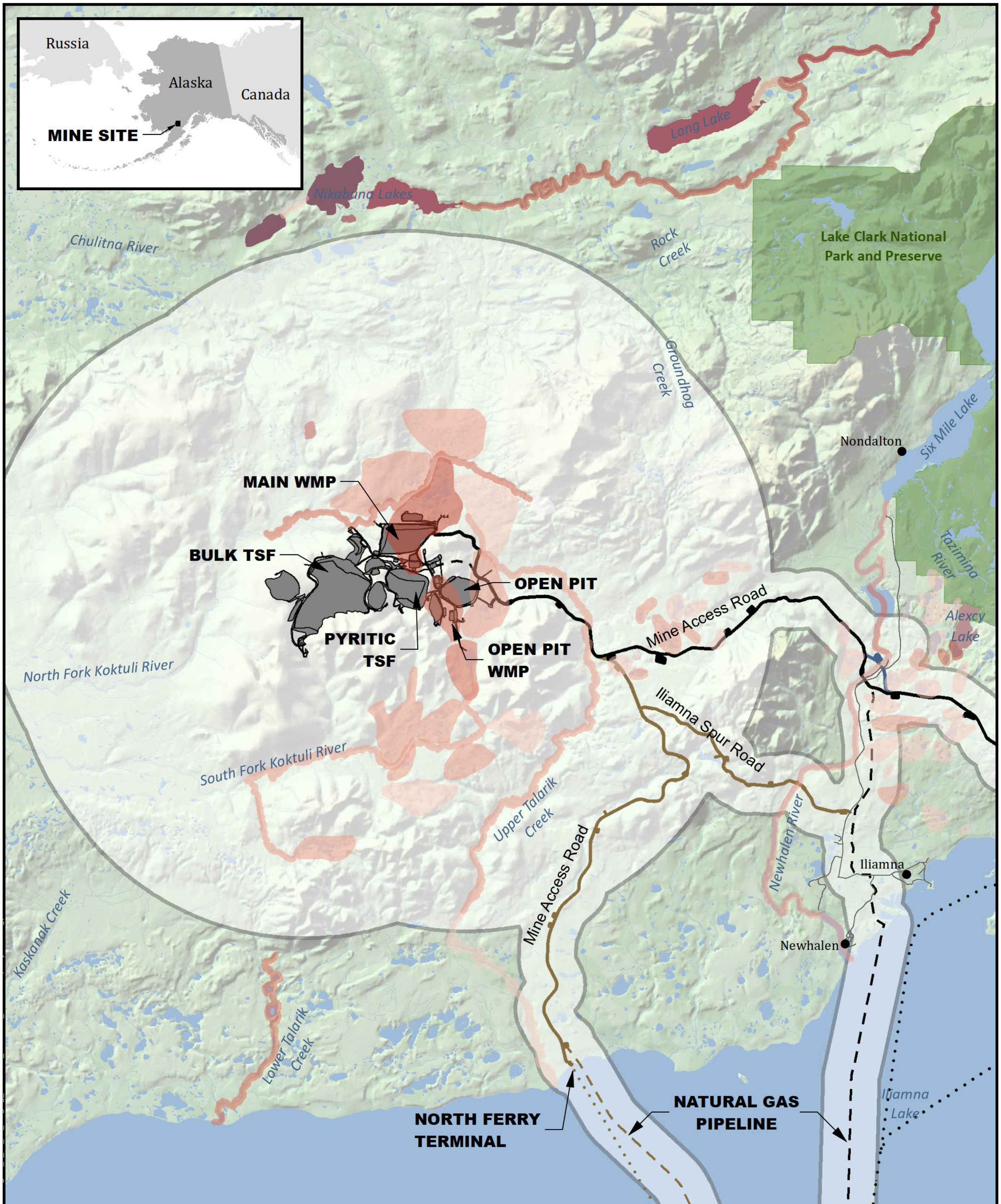
2 0 2 4

Miles

WATERBIRD STAGING NEAR THE MINE SITE, SPRING 2005

PEBBLE PROJECT EIS

FIGURE 3.23-2



Sources: PLP 2005, 2019-RFI153

Analysis Area

Maximal Number of Birds
- 0
- 1-25
- 26-100
- 101-250
- 251-500
- 501-1000
- 1001-2000

Action Alternatives
- Ferry Routes
- Natural Gas Pipelines
- Alternative 1a
- Alternative 1
- Alternative 2 Newhalen River North Crossing Variant

Other Features
- Local Roads
- National Park

US Army Corps of Engineers®

2 0 2 4
Miles

WATERBIRD STAGING NEAR THE MINE SITE, FALL 2005

PEBBLE PROJECT EIS

FIGURE 3.23-3

Results—Thirty-seven species of waterbirds were observed, with 21 confirmed to breed in the mine survey area due to the presence of a brood. A complete list of the waterbird species detected in the mine survey area is not included here but is detailed in ABR (2011a). Waterbirds used lakes and rivers throughout the mine survey area for staging during spring and fall migration, with swans and dabbling ducks (*Anas* sp.) arriving in late-April to early May. Many of these birds likely nested in the area. Diving duck species arrived in mid- to late-May and staged on rivers and lakes. Some of these birds likely nested in the area, while small flocks (up to approximately 60 birds) were observed resting and feeding on lakes before continuing their northward migration. During fall migration, both dabbling and diving ducks were observed in the larger lakes of the mine survey area in flocks of between 60 and 120 birds. Concentrations of birds in both spring and fall were noted in the northern half of the mine survey area from Frying Pan Lake north to lakes in the NFK River basin. In the mine survey area, UTC was the most heavily used creek by dabbling and diving ducks.

Nikabuna and Long lakes, and the outlets of UTC and lower Talarik Creek are important migratory stopover locations for large flocks of waterfowl. In late April, hundreds of swans, greater white-fronted geese (*Anser albifrons*), Canada geese (*Branta canadensis*), and dabbling and diving ducks staged on these lakes (Figure 3.23-2). Between August and mid-October, thousands of ducks (2,000 to 5,000 birds) staged around the Nikabuna and Long lakes, with hundreds of swans starting in early October (Figure 3.23-3). The outlets of UTC and lower Talarik Creek at Iliamna Lake are important staging locations for swans, ducks, and gulls during spring and fall migration.

Tundra swans were common breeding birds in the mine survey area in 2004 and 2005, with about half of the 14 nests (from 2004) and 15 nests (from 2005) found around the lakes in the NFK River drainage (Figure 3.23-4). Many swans returned to their same territories and nest sites in 2005 (ABR 2011a). Swan productivity surveys in late-September 2006 found one brood in the survey area, and in previous years (2004, 2005), swan broods remained in the mine survey area into mid-October (ABR 2011a).

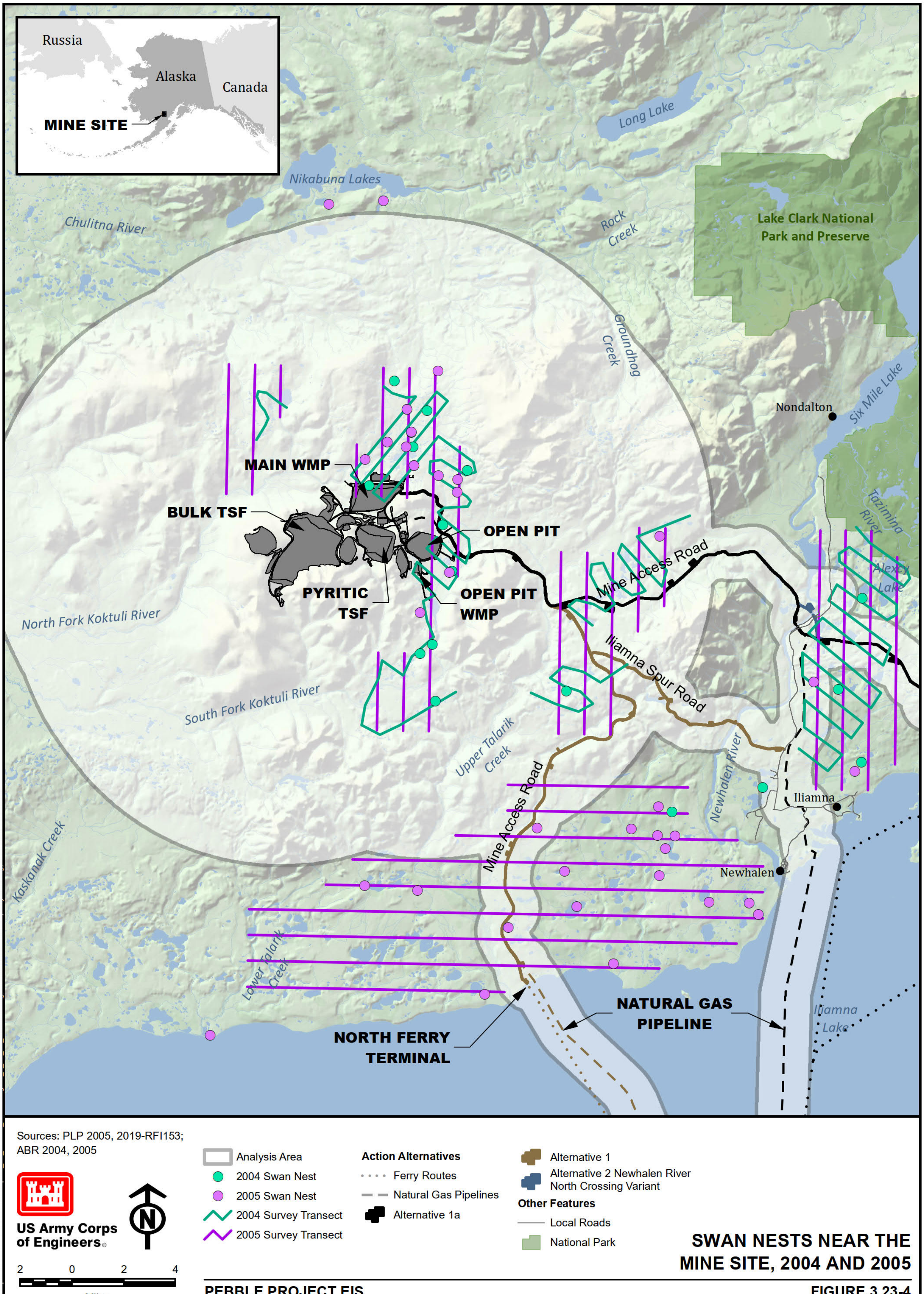
Harlequin ducks were common breeders in the UTC, followed by the NFK and the SFK rivers. The highest numbers of broods counted by drainage were seven broods each on UTC and the NFK River, and three broods on the SFK River, totaling 71 young in 17 broods (ABR 2011a).

Common loons nested in the mine survey area in 2004 and 2005 on Big Wiggly Lake and on lakes east of UTC in 2004. One Pacific loon (*Gavia pacifica*) nest was found in the northern part of the NFK River drainage in 2005.

Small groups of nesting mew gulls (*Larus canus*) were found north of Frying Pan Lake (six nests) and in the NFK River drainage. A single Bonaparte's gull (*Chroicocephalus philadelphia*) brood was seen near Big Wiggly Lake in 2004.

Eighteen species of waterbird broods were recorded in the mine survey area, with brood-rearing groups on 33 percent of the sampled lakes in 2004 (69 broods), and 26 percent in 2005 (168 broods). American wigeon, northern pintail, and scaup were the most common species observed on lakes, with red-breasted merganser (*Mergus serrator*), green-winged teal (*Anas crecca*), and mallard broods more commonly seen on rivers. Most broods were found in lowland lakes in the central part of the NFK River drainage, in Frying Pan Lake, and in lakes in the floodplain of the lower SFK River drainage.

During the summer waterbird molting period (late July through August), small flocks of ducks and numerous brood-rearing groups were observed in the mine survey area. Flocks of 35 to 60 birds were observed on Big Wiggly Lake, Frying Pan Lake, and other large lakes adjacent to the NFK and SFK rivers. Species of scaup were the most commonly observed duck, followed by green-winged teal and northern pintail.



SWAN NESTS NEAR THE MINE SITE, 2004 AND 2005

PEBBLE PROJECT EIS

FIGURE 3.23-4

The mine survey area includes lowland lakes and rivers that support habitat for staging, migrating, and breeding waterbirds. The highest numbers of waterbirds pass through in late May on their northern migration, and in mid-August during fall migration. Nikabuna and Long lakes support large numbers of migrating waterbirds (primarily ducks). These lakes are more than 12 miles north of the mine survey area and occur outside of the EIS analysis area. The NFK River supported the greatest numbers of waterbird broods observed on ponds and lakes in the mine survey area. The UTC supported the greatest number of waterfowl broods observed on rivers; scaup species were the most numerous waterbirds observed during summer molt surveys.

Landbirds and Shorebirds

Project baseline studies conducted in 2004 and 2005 are the most comprehensive source of data for landbirds and shorebirds in the mine survey area. Various avifaunal studies have been conducted in the broader region around the analysis area; however, none of these studies were conducted directly in the mine site (ABR 2011a). The breeding landbird and shorebird survey area encompassed the mine site facilities plus a large surrounding buffer, including the majority of the analysis area. In 2004, the survey area was 97 square miles and 113 square miles in 2005. Surveys for breeding landbirds and shorebirds were conducted in June 2004, and May and June 2005 to document the landbird and shorebird species present in the mine survey area, their abundance, and the use of mapped habitats to provide data for the wildlife habitat mapping.

Landbirds were defined as passerines or songbirds (including species of ptarmigan, corvids, flycatchers, larks and pipits, swallows, kinglets, thrushes, warblers, sparrows and allies, and finches) and did not include any species of raptors, waterbirds, or waterfowl. Shorebirds consisted of species of plovers, sandpipers, and their allies.

Methods—Surveys for breeding landbirds and shorebirds were conducted following the EBD proposed 2004 and 2005 study plans (NDM 2004, 2005). Surveys used variable circular-plot point-count methods (Buckland et al. 2001; Ralph et al. 1995), which are designed primarily to detect singing male passerines defending their territories, and to inventory breeding shorebirds. Prior to fieldwork, aerial photography was used to allocate point-count locations (based on prominent photo signatures), with adequate spatial representation to sample the variety of habitats in the mine survey area and ensure point counts were at least 1,640 feet apart. Ten-minute point-count surveys were conducted between 4:30 AM and 4:00 PM (with most conducted between 5:00 AM and 2:00 PM); point-count locations were accessed by helicopter and on foot. One biologist conducted each point count, and point counts were only conducted once at each location. Surveys were conducted in June 2004 and at the end of May and throughout June 2005 to coincide with the peak breeding period for landbirds in southwestern Alaska. Point-count locations were chosen to adequately determine the species and average occurrence of birds using specific habitat types (vegetation communities) that could be correlated to the wildlife habitat mapping.

Results—In 2004, 166 point-count locations recorded 1,794 individual birds across the survey area. In 2005, 227 point-count locations recorded 2,636 birds across the same survey area. In 2005, eight additional point-counts were conducted in the UTC drainage to the east of the survey area. In 2004 and 2005, 28 landbird species and 14 shorebird species were detected, including birds incidentally detected (ABR 2011a). Point-count data were used to estimate a mean of 10.2 landbirds and 1.1 shorebirds per point-count when data from 2004 and 2005 were combined. The following nine landbirds were the most frequently detected species in the mine survey area: savannah sparrow (*Passerculus sandwichensis*), golden-crowned sparrow (*Zonotrichia atricapilla*), Wilson's warbler (*Cardellina pusilla*), orange-crowned warbler (*Vermivora celata*), common redpoll (*Acanthis flammea*), American tree sparrow (*Spizella arborea*), gray-cheeked thrush (*Catharus minimus*), fox sparrow (*Passerella iliaca*), and yellow warbler (*Setophaga* *petechia*). Of these species, the savannah sparrow, golden-crowned sparrow, and Wilson's warbler were the most common, constituting approximately 37 percent of the point-count observations in both years. Species of larks, pipits, and swallows were less common; ptarmigan, flycatchers, corvids, and kinglets were rarely recorded.

No particular shorebird species was considered an abundant breeder (ABR 2011a). Six of the 14 species were considered common breeders: greater yellowlegs (*Tringa melanoleuca*), Wilson's snipe (*Gallinago delicata*), least sandpiper (*Calidris minutilla*), black-bellied plover (*Pluvialis squatarola*), whimbrel (*Numenius phaeopus*), and American golden-plover (*Pluvialis dominica*).

Landbirds were recorded in 15 of the 19 wildlife-habitat types, and shorebirds were recorded in 12 wildlife-habitat types. The most productive breeding habitats in terms of bird abundance were Lowland Low and Tall Willow Scrub, Riverine Tall Alder or Willow Scrub, and Upland Moist Tall Willow Scrub. More than nine birds were observed per point count in these habitats. Most landbirds regularly used tall and low scrub habitats; most shorebirds were found in open habitats, including bogs, meadows, dwarf scrub types, and barren habitats.

Of the landbird and shorebird species that nested in the mine survey area, gray-cheeked thrush and blackpoll warbler (*Setophaga striata*) preferred to breed in dense, tall-scrub habitats, including willows and alders (along riverine alder-willow thickets), with a thick understory of low shrubs. Breeding shorebirds such as surfbird (*Aphriza virgata*) and American golden-plover used high-elevation alpine habitats for nesting, including barren and dwarf-scrub-dominated types. The other shorebird species, such as whimbrel, Hudsonian godwit (*Limosa haemastica*), lesser yellowlegs (*Tringa flavipes*), and short-billed dowitcher (*Limnodromus griseus*), used open, wet, lowland and riverine habitats such as meadows, scrub-bogs, and marshes.

Species of greatest conservation need (ADF&G 2015a) that were observed (and were recorded as nesting or presumed to nest) in the mine survey area include gray-cheeked thrush, blackpoll warbler, American golden-plover, whimbrel, Hudsonian godwit, surfbird, and short-billed dowitcher (ABR 2011a). Detailed information on the specific habitat types and their approximate abundance per habitat type is included in ABR 2011a. Gray-cheeked thrush (116 were documented in 2004 and 251 in 2005) were considered common in tall-scrub habitats in upland, lowland, and riverine areas of the mine survey area. Blackpoll warbler were also considered common in the mine survey area (18 were documented in 2004, and 34 in 2005) primarily in riverine tall alder or willow scrub. American golden-plovers were considered common in the mine survey area (16 were recorded in 2004, and 14 in 2005) and were documented in alpine moist dwarf scrub, upland moist dwarf scrub, upland dry dwarf shrub-lichen scrub, and lowland ericaceous scrub bog. Whimbrel were also considered common in the mine survey area (18 were recorded in 2004, and 40 in 2005) and they were found in lowland ericaceous scrub-bog and lowland wet graminoid-shrub meadow. Hudsonian godwit were considered uncommon in the mine survey area (four were recorded in 2004, and two in 2005) and were found in lowland ericaceous scrub-bog and lowland wet graminoid-shrub meadow, and only in the wetlands north of Frying Pan Lake. Surfbirds were considered uncommon in the mine survey area (two were recorded in 2004, and eight in 2005) and were only found in alpine moist dwarf scrub. Short-billed dowitchers were considered uncommon in the mine survey area (six were recorded in 2004, and nine in 2005) and were only found in lowland wet graminoid-shrub meadow.

Terrestrial Mammals

Historical terrestrial mammal surveys have been conducted in the area surrounding the mine site, including population and inventory studies by the ADF&G (ADF&G 1985; Butler 2006, 2007a, b, 2008; Woolington 2006, 2007a, b, 2009). Smith (1991) conducted a broad reconnaissance survey to document the wildlife species present in the area around the mine site. Under an agreement with Cominco Alaska Exploration, ADF&G surveys focused on the area around the Pebble deposit in the early 1990s. Additional studies and analyses in recent years have been conducted as part of broad-scale species inventories by the National Park Service (NPS) and the USFWS (Brna and Verbrugge 2013; Cook and MacDonald 2004a, b).

Mine site facilities are in the far eastern corner of Game Management Unit (GMU) 17B. Terrestrial mammal surveys for the mine site were conducted from 2004 through 2010 by ABR for a variety of species. The full details of the survey methods and results are provided in the PLP EBD 2004 through 2008, Chapter 16, Wildlife and Habitat Bristol Bay Drainages (ABR 2011a). The methods and results are summarized for the specific project components.

To quantify the suitability of vegetation communities in the mine site as wildlife habitat, habitat mapping and habitat-value assessments were conducted across the mine survey area in 2004 and 2005. Wildlife habitats were mapped in the mine survey area to provide a baseline inventory of the availability of wildlife habitats for use by wildlife; specifically for a selected set of mammal species (ABR 2011a). The mine survey area for terrestrial mammals was defined as an area comprising 184 square miles, centered on the mine site footprint, and encompassed the majority of the EIS analysis area. The mine survey area is primarily composed of alpine and unforested upland habitats on glacial moraine deposits, with three prominent river corridors in the area (NFK and SFK rivers and UTC). Field data on the vegetation, physiography, landforms, and surface forms were used to assess the use of the mapped habitat by 13 mammal species (see Section 16 in ABR 2011a). Habitat use for each species in each mapped habitat type was qualitatively categorized into one of four value classes (i.e., high, moderate, low, or negligible value), based primarily on wildlife survey data specific to the mine survey area, and habitat-use information from scientific literature (ABR 2011a). The complete list of all 25 wildlife habitat types, their plant-species composition, and their value as wildlife habitat is provided in Appendix 16.1C in ABR 2011a.

The following sections detail the specific survey methods and results for mammals that breed and migrate throughout the mine survey area. Data from these surveys were applied to wildlife habitat mapping to understand the value of the wildlife habitat in the mine survey area.

Large Mammals

Aerial strip-transect surveys were conducted from April to November 2004, March through December 2005, May through July and December 2006, June and July 2007, May 2009, and April 2010 to document the large mammal species present in the mine survey area. A general bear (*Ursus* spp.) survey in 2009 and moose (*Alces alces*) survey in 2010 were designed to estimate the density of those species, while additional aerial surveys were intended to gather distribution, relative abundance, and general patterns of use of the EIS analysis area. Specifically, ABR conducted the following surveys and analyses:

- Detailed analysis of ADF&G's radio telemetry data for the Mulchatna caribou (*Rangifer tarandus*) herd
- Aerial strip-transect surveys in the mine survey area during late winter, caribou calving, caribou post-calving, caribou rut/fall migration, and early winter
- Aerial line-transect surveys to estimate the density of bears in the Iliamna Lake region
- Aerial surveys of brown bears (*Ursus arctos*) along salmon-spawning streams and an examination of brown bear and gray wolf (*Canis lupus*) dens in and around the mine survey area

- Aerial quadrant surveys to estimate the moose population in the mine and transportation corridor survey area
- Aerial survey of beaver (*Castor canadensis*) colonies throughout the mine survey area

Analysis of ADF&G's radio telemetry data for the Mulchatna caribou herd involved a detailed fixed-kernel analysis (a statistical method using spatial data for a defined area to estimate the relative density of use of that area by a species) of 29 years of radio transmitter and satellite collar data. The data included 12,198 locations of radio-collared caribou representing a range of age and sex classes across the years. The fixed-kernel distributions for radio-collared caribou locations were analyzed using geographic information system software, with the output mapping represented by use distribution contours of different-intensity colors (Rodgers et al. 2007). The high-density contour encompassed 50 percent of all collar locations; the moderate-density contour enclosed 75 percent of all collar locations, and the low-density contour enclosed 95 percent of all locations.

There are limitations using radio-collared data to interpolate the range of habitat use of the Mulchatna caribou herd in the mine site and surrounding area. Radio telemetry data have been collected through a collaborative effort by various state and federal agencies. Most of the data are from very high-frequency radio transmitters tracked by agency biologists with additional data from satellite collars. Additional data were gathered by direct observations of non-collared caribou during radio-tracking flights. For the analysis, the VHF-collar sample comprised 468 caribou (373 females and 95 males) that were collared from March 1981 through October 2009. The satellite-collared caribou represent a much smaller sample size of 34 caribou; most were females that were collared over several years ranging from 1990 to 2009 (ABR 2011a). Caribou were collared by state and federal agency biologists; therefore, caribou selected for collaring were not related to documenting use of the mine site. Instead, the caribou were collared for inventory and survey studies (e.g., photo census, captures, parturition surveys, and fall composition surveys). By collaring select individuals, agency biologists were able to track down caribou in various core groups, which can be followed year after year. Their goals were not to document caribou's seasonal use, migration, or distribution in the mine site. The data analyzed are not necessarily representative of the entire Mulchatna caribou herd, nor does the data reflect the complete distribution of the herd during their peak population in the mid-1990s; the data reflect only a subset of the entire herd. ABR conducted a variety of wildlife surveys recording caribou to provide a sample of caribou use of the mine site to augment the data.

A series of aerial strip-transect surveys was flown to coincide with seasonal timing to detect late-winter moose and caribou distribution, spring bear locations, caribou and moose calving, caribou post-calving, bear locations along salmon streams, caribou rut, and early winter moose and caribou distribution. Surveys involved a fixed-wing aircraft flying at low altitude along established transects, with two observers in the aircraft. The complete details of the methods for each survey type, including type of aircraft, count method, sampling method (e.g., quadrate or line/strip transects), and other pertinent details are provided in ABR 2011a. Five strip-transects of the study area were flown in 2004 (April, May, July, October, and November), seven in 2005 (March, two in May, June, July, October, and December), four in 2006 (May, June, July, and December), and two in 2007 (June and July). The seasonal timing was selected to correspond with specific life stages for various wildlife as detailed in the following sections.

Caribou

Caribou inhabit the Arctic and alpine tundra, as well as forested habitats throughout Alaska. At the time of Smith's reconnaissance survey in 1991, during early exploration of the area, the mine site analysis area was in a calving and wintering area for the Mulchatna herd, and the valley containing the deposit was in a known migration route. Between 1981 and 1988, the population of the Mulchatna caribou herd ranged from 20,000 to 60,000 caribou; from 1991 to 1993, the population expanded to 90,000 to 150,000 animals; and from 1994 to 1996, the population was 180,000 to 200,000 animals (Demma 2011). During the 1990s, the Mulchatna caribou herd shifted their traditional calving grounds to the west and north. By 2008, population size decreased to around 30,000 animals (Woolington 2009); in 2012 and 2013, there were 22,809 and 18,308 caribou estimated, respectively (Barten 2015). A survey on July 2, 2014 estimated 26,275 caribou in the Mulchatna herd (Butler 2015). The 2015 population estimate was 30,736, and the 2016 population estimate was 27,242 caribou. The most recent survey from July 2019 estimated the Mulchatna caribou herd at a severely depressed population of 13,500 individuals (ADF&G 2019e).

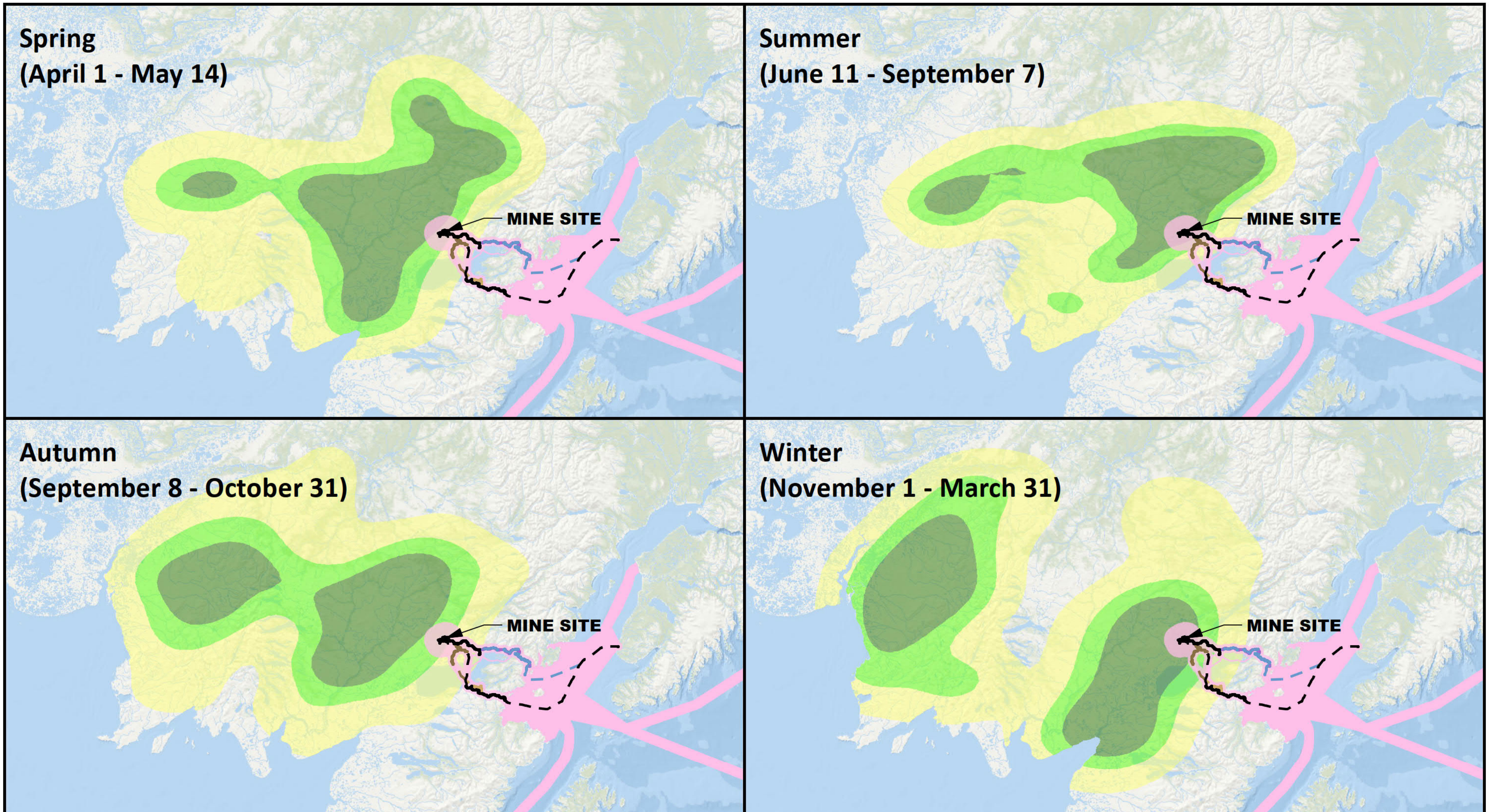
The cause of the decline in the Mulchatna caribou herd from historically higher numbers in the 1980-1990s is not fully understood. However, based on traditional knowledge of local elders in the region, one potential reason for the decline was that the population grew so large that the caribou herd had limited food, which led to an epidemic of hoof rot (*Sphaerophorus necrophorus*) and the herd shifted their range northward (Van Lanen 2018). Both scientific observations and traditional knowledge support the observation that the larger population of the Mulchatna caribou herd in the 1980s and 1990s led to competition for food among caribou, resulting in overuse of core areas in the eastern portion of their range and a shift west and north (Van Lanen et al. 2018). Overuse of habitat and habitat degradation can result in competition for food resources, which can lead to increased dispersal of large caribou groups into smaller herds. When local habitats deteriorate from overgrazing, caribou can adapt by expanding their range into new areas. Therefore, the carrying capacity of an area exists under a variety of highly dynamic variables across space and time that are connected to herd size and caribou dispersal across the landscape (Van Lanen et al. 2018). Overuse of habitat and habitat degradation demonstrated that the winter carrying capacity in many of the traditional wintering areas was being surpassed. These areas included significant portions of the Mulchatna caribou herd winter range north and west of Iliamna Lake. The area has shown signs of overuse, including trampled and heavily grazed tundra vegetation. As caribou moved west into new habitat, the eastern portions of the Mulchatna herd range have exhibited signs of habitat recovery and an increase in the number of caribou (Van Lanen et al. 2018). According to local knowledge recorded by Van Lanen et al. (2018), the mine site is in and adjacent to areas where caribou overgrazed lichens during the 1990s; regrowth has occurred since 2010.

Analysis of telemetry data indicated that between 1993 and 2004, use of the mine area by the Mulchatna caribou herd occurred primarily during the post-calving collection period, and to a lesser extent during the rut (Woolington 2003). Fixed-kernel analysis of the radio-collar data indicate that across 29 years of data, collared individuals in the Mulchatna caribou herd occurred in moderate to high densities throughout the mine survey area during spring, low density during calving, high density during summer and winter, and moderate density during autumn (Figure 3.23-5). Despite population declines since the 1990s, the herd has continued to use a vast area, including the mine site. Based on a radio-collared subset of the Mulchatna herd, the area west and northwest of the mine site facilities (as compared to south or east) shows higher use than the mine site footprint itself. However; these data do not necessarily reflect the distribution of the entire herd but represent the core of the herd (since radio-collaring efforts often target the core of the herd) (Figure 3.23-5). Collared individuals represent only a portion of the total herd and based on the limitations of some collared data (particularly VHF data), large movements may be missed, and the observed distribution of collared caribou depends on the timing of aerial surveys. The 29 years of data span the timeframe that the Mulchatna caribou herd increased rapidly, peaked, and then declined. The Mulchatna herd continues to use a vast area despite its currently low population; it is possible that large groups of caribou may occasionally occur in the mine site, especially during the post-calving period (ABR 2011a).

Aerial transect surveys of the mine survey area in 2004, 2006, and 2007 confirmed the Mulchatna herd telemetry analysis that the greatest numbers of caribou were found in the mine survey area during the summer post-calving period, when large groups may move through the area (Figure 3.23-6). Figure 3.23-6 shows a compilation of caribou groups that were detected during aerial radio-telemetry surveys from 1981 to 2010; therefore, there are overlapping polygons representing different caribou group sizes. This figure shows that the greatest numbers of caribou that were documented in the general area around the mine site occurred in late-June 1996 and July 1997. In a June 29 and 30, 1996 survey, totals of approximately 100,000 caribou (which represented about half of the Mulchatna caribou herd at the time) were recorded north of the mine site in the Nikabuna Lakes area and to the west in the drainage of the NFK River (ABR 2011a). During the post-calving period, caribou groups occurred in alpine or open upland habitats such as ridge tops, snow beds, and other habitats that served as insect relief (ABR 2011a). Based on the habitat mapping conducted by ABR (2011a), moderate-value habitats (barren, dwarf-and low-scrub, meadow, scrub-bog, marsh, and forested habitats) were common and widespread throughout the mine study area.

Incidental observations of caribou during other biological surveys for the project revealed small groups of caribou scattered throughout the mine survey area in June 2004 and 2005. During post-calving surveys in July 2004, close to 10,000 caribou were observed in the mine survey area moving southwest (ABR 2011a). Figure 3.23-6 shows historical caribou trails, which occur primarily to the west of the mine site. Historical caribou trails often follow local topographical lines. Currently, the mine site does not appear to be used as a major calving area (Figure 3.23-7) but may be used by the herd during the post-calving summer period. Figure 3.23-7 depicts the density of calving areas from 1981 to 2010 based on radio-collar data. It is important to note that the data on Figure 3.23-5 through Figure 3.23-7 represent a time when the Mulchatna caribou herd was at much higher numbers than the current depressed population estimate of 13,500 animals (ADF&G 2019e).

Although the collared caribou individuals indicated that core portions of the herd occur primarily to the north and west of the mine site, the herd is at a reduced population level. Caribou range widely, can shift calving areas and foraging areas, and can experience vast population fluctuations. Surveys indicate that the area around the mine site has been used by large numbers of caribou in the past, when the population was higher. Currently, small groups of caribou likely associated with the Mulchatna caribou herd occur in the general vicinity of the mine site throughout the year based on surveys from 2004 and 2005 (ABR 2011a). Observations from local residents near the eastern part of the Mulchatna caribou herd range indicate that foraging habitat conditions are improving in formerly overgrazed areas (Van Lanen et al. 2018).



Sources: PLP 2020-RFI168; 2019-RFI153; PLP 2005

*Note that there are limitations when using radio-collared data to interpret the range of habitat use of the Mulchatna Caribou Herd in the mine site and surrounding area. Caribou were collared by various wildlife agencies for inventory and survey studies (e.g., photo census, captures, parturition surveys, and fall composition surveys) that were unrelated to the project. By collaring select individuals, agency biologists were able to track down caribou in various core groups that could be followed year after year. Their goals were not to document caribou seasonal use, migration, or distribution in the mine site; data that were analyzed are not necessarily representative of the entire Mulchatna caribou herd nor do they reflect the complete distribution of the herd during their peak population in the mid-1990s. Rather, the data reflect only a subset of the entire herd.

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25 0 25 50 75 100
Miles

Analysis Area

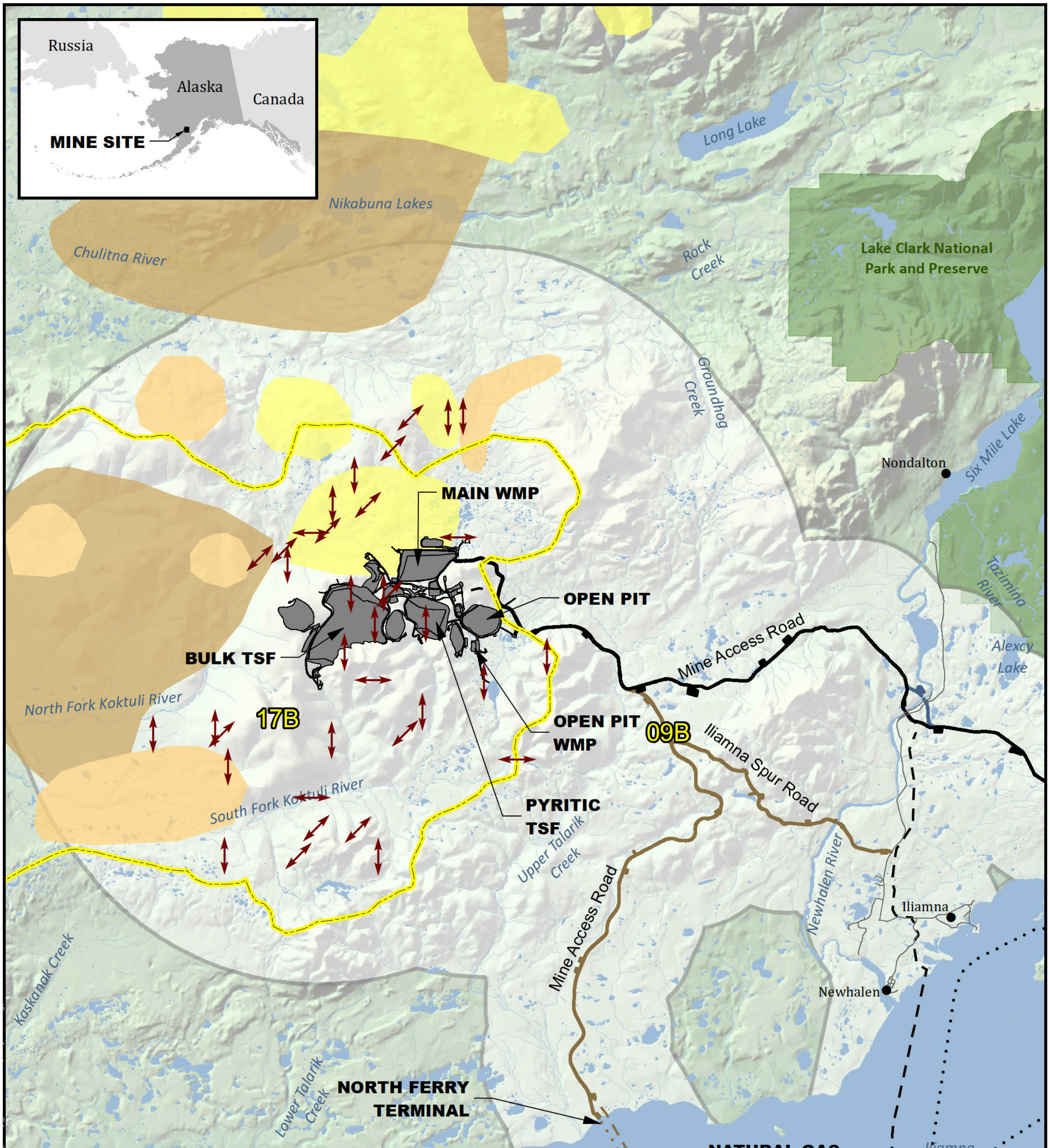
Areas of Concentrated Use
- High Density
- Medium Density
- Low Density

Action Alternatives
- Natural Gas Pipelines
- Alternative 1a
- Alternative 1
- Alternative 1 Kokhanok East Ferry Terminal Variant
- Alternative 2
- Alternative 3

MULCHATNA CARIBOU HERD SEASONAL RANGE USE, 1981 TO 2010

PEBBLE PROJECT EIS

FIGURE 3.23-5



* Note that there are limitations when using radio-collared data to interpret the range of habitat use of the Mulchatna Caribou Herd in the mine site and surrounding area. Caribou were collared by various wildlife agencies for inventory and survey studies (e.g., photo census, captures, parturition surveys, and fall composition surveys) that were unrelated to the project. By collaring select individuals, agency biologists were able to track down caribou in various core groups that could be followed year after year. Their goals were not to document caribou seasonal use, migration, or distribution in the mine site; data that were analyzed are not necessarily representative of the entire Mulchatna caribou herd nor do they reflect the complete distribution of the herd during their peak population in the mid-1990s. Rather, the data reflect only a subset of the entire herd.

Sources: PLP 2005, 2019-RFI153
ABR 1999 - 2005,

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2 0 2 4
Miles

- Analysis
- Game Management Units

Caribou Group Size
- 7500 - 30000
- 30001 - 70000
- 70001 - 100000
- Caribou Trail

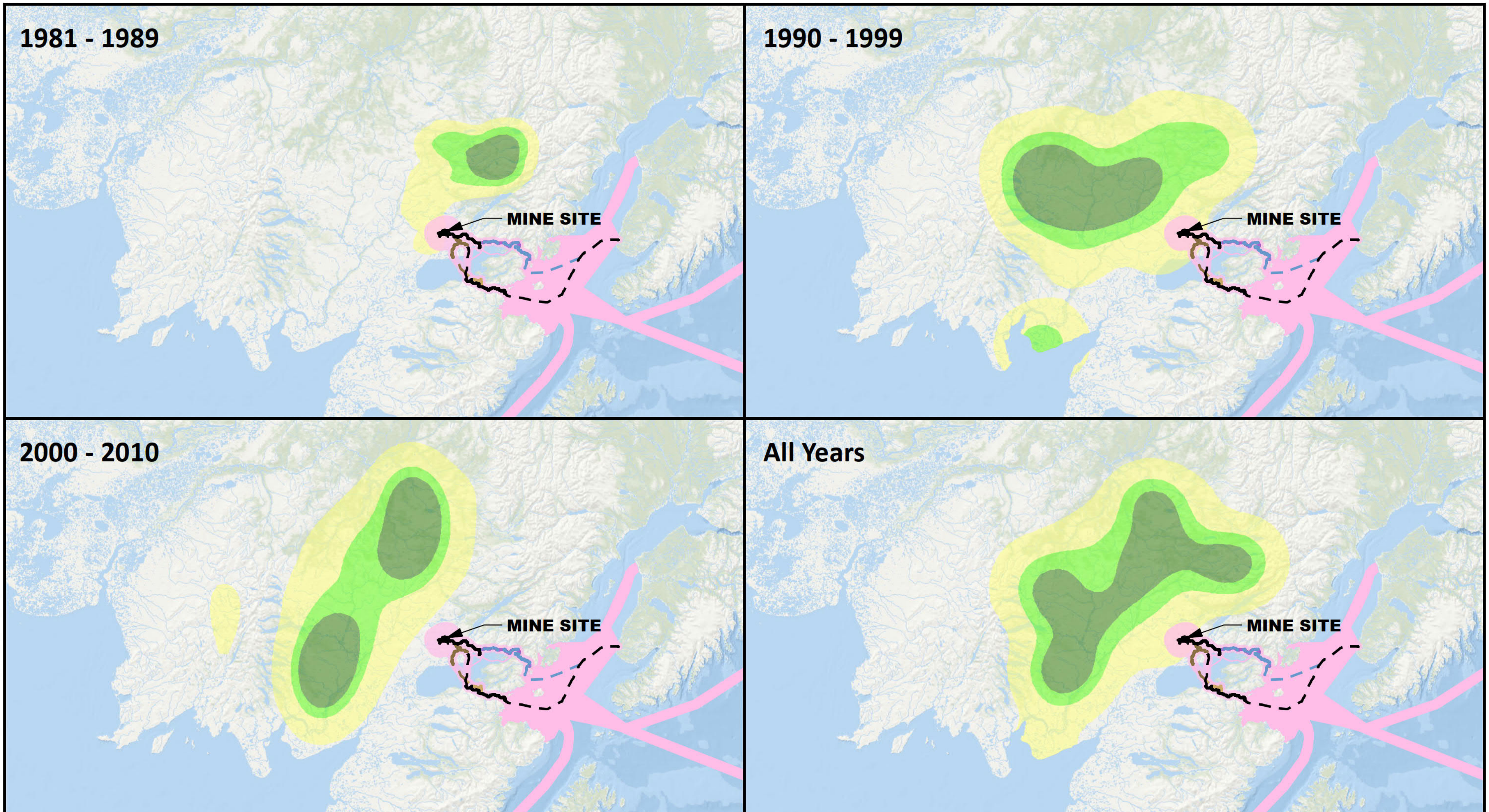
Action Alternatives
- Lightering Locations
- Ferry Routes
- Natural Gas Pipelines
- Alternative 1a
- Alternative 1
- Alternative 2 Newhalen River North Crossing Variant

Other Features
- Local Roads
- National Park

CARIBOU GROUPS RECORDED DURING RADIO-TELEMETRY SURVEYS NEAR THE MINE SITE, 1981-2010

PEBBLE PROJECT EIS

FIGURE 3.23-6



Sources: PLP 2005; PLP 2020-RFI168; PLP 2019-RFI153

*Note that there are limitations when using radio-collared data to interpret the range of habitat use of the Mulchatna Caribou Herd in the mine site and surrounding area. Caribou were collared by various wildlife agencies for inventory and survey studies (e.g., photo census, captures, parturition surveys, and fall composition surveys) that were unrelated to the project. By collaring select individuals, agency biologists were able to track down caribou in various core groups that could be followed year after year. Their goals were not to document caribou seasonal use, migration, or distribution in the mine site; data that were analyzed are not necessarily representative of the entire Mulchatna caribou herd nor do they reflect the complete distribution of the herd during their peak population in the mid-1990s. Rather, the data reflect only a subset of the entire herd.

US Army Corps of Engineers

25 0 25 50 75 100
Miles

Analysis

Areas of Concentrated Use

High Density

Medium Density

Low Density

Action Alternatives

Natural Gas Pipelines

Alternative 1a

Alternative 1

Alternative 1 Kokhanok East Ferry Terminal Variant

Alternative 2

Alternative 3

MULCHATNA CARIBOU HERD CALVING RANGE USE, 1981 TO 2010

Moose

A moose population survey in April 2010 estimated 33 moose in the 455-square-mile survey area, which corresponds to an estimated density of 0.07 moose per square mile (ABR 2011a). The survey area included a large portion of habitat along the northern shore of Iliamna Lake. The mine site appeared to have a low density of moose; however, the population of moose may be higher in the fall and early winter when moose use higher-elevation habitats. No moose were recorded directly in the mine site facilities footprint during the April 2010 survey, or during other surveys from 2004 through 2007. This observation is consistent with the habitat types and vegetation communities in the mine site, which are composed primarily of low-growing tundra plant species and are not the preferred habitat for moose. Moose were observed in UTC and the drainages surrounding the mine site footprint that contain preferred vegetative forage and cover.

Brown Bear

Brown bears are widespread and common in the Bristol Bay and Cook Inlet drainages on the Alaska Peninsula, primarily because of large salmon runs that provide an abundant source of protein. Brown bears are relatively common tundra inhabitants in the mine survey area (Figure 3.23-8) (ABR 2011a). Standardized surveys specifically for the mine site were conducted in 2009 by ABR and the ADF&G (Becker 2010). Aerial line-transect surveys flown in May 2009 used two similar analytical methods to determine the density of brown bears in the survey area surrounding the mine site, which included all of Iliamna Lake (which overlaps with the transportation corridor and natural gas pipeline corridor). One analytical method (double-count method) resulted in a population density of 47.7 brown bears per 386 square miles (Becker 2010), and the second method (plane model) resulted in 58.3 brown bears per 386 square miles (ABR 2011a). Using the double-count method, the mine survey area supported approximately 412 brown bears. As reported by Becker (2010), the estimate of 47.7 brown bears per 386 square miles is similar to brown bear population estimates for other nearby areas. Surveys north of the Iliamna survey area around Lake Clark National Park and Preserve in 1999 and 2000 (Becker 2003; Butler 2007a) yielded estimates of 38.6 brown bears per 386 square miles; to the south in GMU 9C (in spring 2005 and 2006), densities were estimated to be 78.4 brown bears per 386 square miles (Olson and Putera 2007). Overall, brown bears were not common in the mine site footprint itself, but were distributed throughout the mine survey area, primarily along streams and waterways.

Helicopter surveys of salmon-spawning streams around the mine site on August 18 and 19, 2004 recorded 16 brown bears mainly 9 to 18 miles south and southeast of the mine site. Dense vegetation along streams limited visibility; therefore, the number of bears reported is likely underestimated. The survey area included the NFK and SFK rivers and the mine survey area south to Iliamna Lake and east to the Newhalen River (ABR 2011a). More-recent surveys of bear use at select salmon-spawning streams from July to September 2012 used time-lapse remote-sensor wildlife cameras positioned at one location in UTC (Figure 3.23-8). Overall, low bear activity was recorded (0.03 percent of useable photographs contained bears), with most activity in the late afternoon in July and August. No bears were recorded during September. Bears spent little time fishing at the location visible to the camera (ABR 2015a).

Surveys of bear dens and incidentally detected brown bear dens (during other biological surveys) from 2004 through 2006 indicated that suitable denning habitat was common in the mine survey area; dens were generally found in low-elevation wooded sites and high-elevation scree slopes. Although brown bear dens were not found directly in the mine site footprint, there were several to the south and east of the mine site, including some less than a mile from the mine site, and less than 0.5 mile from the mine access road (Figure 3.23-8).

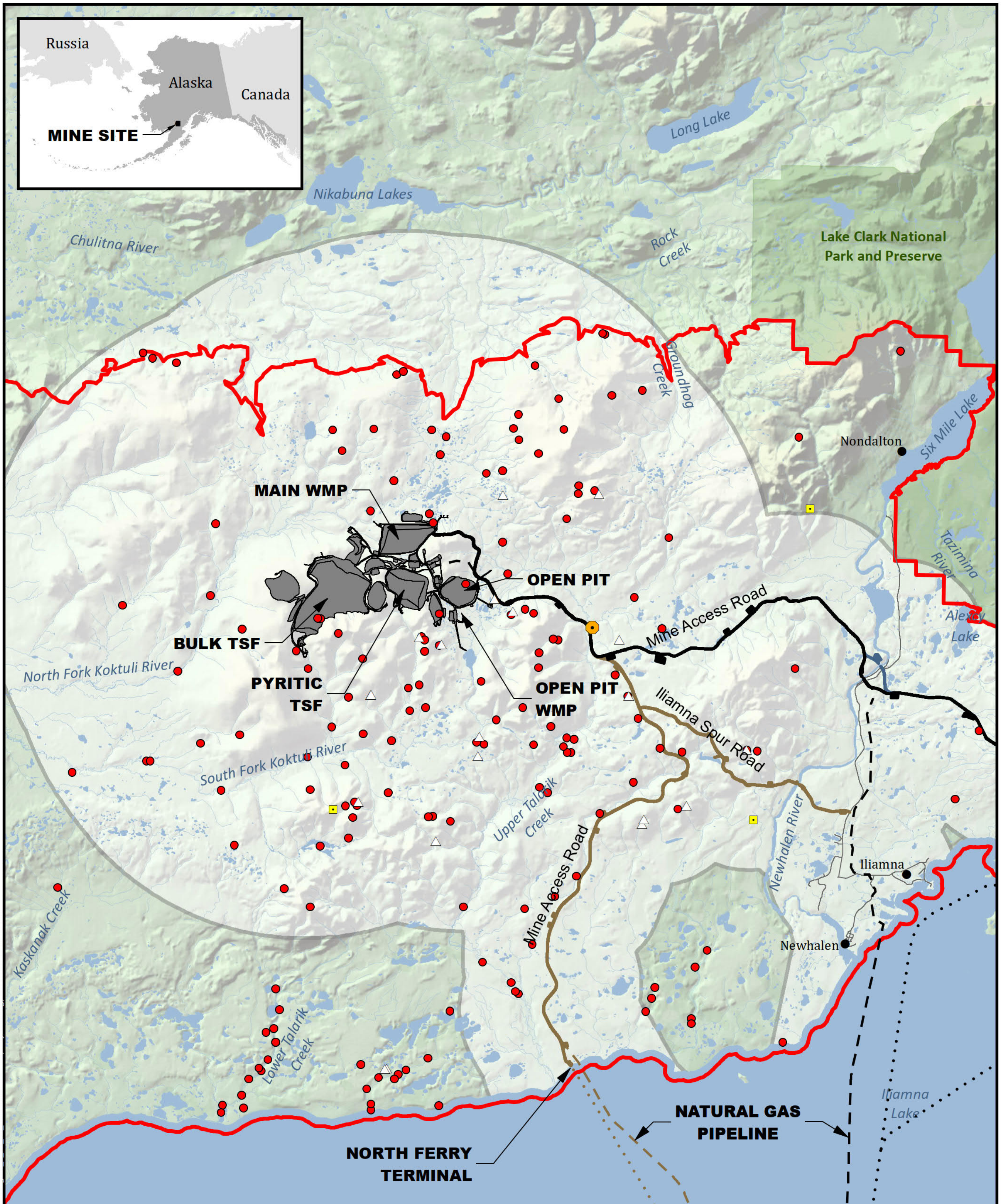
Black Bear

Black bears (*Ursus americanus*) are uncommon in forested areas near the mine site and tend to be more common on the eastern side of Iliamna Lake. Black bears were not observed in the mine survey area during project wildlife surveys from 2004 to 2007 (Figure 3.23-8). During regional surveys in May 2009, which encompassed the mine survey area and Iliamna Lake, black bears were found in more forested habitats (which are lacking in the mine survey area) on the eastern side of Iliamna Lake. During the survey that covered 1,004 12.4-mile transects, only 18 black bear groups were observed. Given the intensive survey effort and scarcity of black bear sightings, abundance estimates were not developed. Black bears were almost absent from the survey area in spring 2009 (Becker 2010).

Gray Wolf

Wolves are found and able to thrive in a wide variety of habitats. Their main prey in the northern Bristol Bay region include moose, caribou, and beaver (Woolington 2006), and salmon seasonally, among others. Although no project-specific surveys for wolves were conducted, several individual wolves were incidentally detected scattered across the mine site over multiple years, but no packs or groups of wolves were detected (ABR 2011a). Three wolf dens were found during bear den and other biological surveys (one in UTC, one at the base of Sharp Mountain, and one on the eastern side of the Newhalen River), but none appeared to be active (ABR 2011a).

Currently, the ADF&G has an intensive caribou management plan for the Mulchatna caribou herd involving wolf predation control (ADF&G 2014). The wolf control area is west and southwest of the analysis area. In 2017, the ADF&G conducted a study to map wolf pack territories in the intensive management area for the Mulchatna caribou herd using global positioning system (GPS) collars (ADF&G 2018r). Preliminary density estimates, based on 7 months of GPS data and observed seasonal pack sizes, resulted in spring and fall wolf densities of 2.2 and 3.0 wolves, respectively, per 386 square miles in the Mulchatna River and lower Nushagak River drainages (ADF&G 2018r).



Sources: PLP 2005, 2019-RFI153; ABR 2015a

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2 0 2 4
Miles

Analysis Area

Observations (2004 - 2009)

- Black Bear
- Brown Bear
- Brown Bear Den (2004 - 2006, 2010)
- May 2009 Bear Density Survey Area

Wildlife Camera Location

Action Alternatives

- Ferry Routes
- Natural Gas Pipelines
- Alternative 1a
- Alternative 1
- Alternative 2 Newhalen River North Crossing Variant

Other Features

- Local Roads
- National Park

BEAR OBSERVATIONS AND DENS NEAR THE MINE SITE

PEBBLE PROJECT EIS

FIGURE 3.23-8

Small Terrestrial Vertebrates

No project-specific surveys were conducted for small mammal species, but they were incidentally recorded during biological surveys in the analysis area. Some species are managed by the ADF&G as "furbearers," which are trapped or hunted for hides, fur, or meat. Population information for these species is limited to trapper questionnaires (Parr 2018); trapper questionnaires provide relative abundance information for the region based on perceptions and responses from relatively few trappers. Table 3.23-2 lists species with their relative abundance, if known, based on the limited information from trapper questionnaires for GMU 17, where the mine site facilities would be located, and for GMU 9, where the transportation corridor and natural gas pipeline corridor would be (west of Cook Inlet) (Parr 2018).

Table 3.23-2: Furbearer Species Status

Common Name	Scientific Name	General Habitat	Mine Site (GMU 17[1])	Transportation and Natural Gas Pipeline Corridors (west of Cook Inlet; GMU 9[1])
Coyote	*Canis latrans*	Diverse	Scarce	scarce
Red fox	*Vulpes*	Diverse	Abundant	abundant
Canadian lynx	*Lynx canadensis*	Forests and shrubs	Scarce	common
American marten	*Martes americana*	Conifer and mixed forests	Abundant	scarce
American mink	*Mustela vison*	Mixed forests	Common	common
Ermine	*Mustela erminea*	Diverse	common	common
River otter	*Lutra canadensis*	Riparian	abundant	common
Wolverine	*Gulo*	Diverse	common	scarce
Beaver	*Castor canadensis*	Wetlands/riparian	abundant	abundant
Muskrat	*Ondatra zibethicus*	Wetlands	common	common
Red squirrel	*Tamiasciurus hudsonicus*	Forests	common	abundant

Note:
GMU = Game Management Unit
[1]Source: Parr 2018

Of the fur-bearers listed above, only two coyotes were observed in the mine survey area; with red foxes more common and observed on numerous occasions. Two groups of river otters were detected in the mine survey area in 2005; two wolverines were incidentally detected in the mine survey area during avian surveys in 2004 and 2005. Aerial surveys for beaver colonies were conducted in October 2005, which recorded 113 active colonies in the mine survey area. Active colonies were also found along UTC, and in both NFK and SFK rivers, as well as isolated tundra ponds. The locations of these species in relation to the mine site are shown on figures in ABR 2011a.

There are additional mammal species that are not considered "furbearers," and are known to occur in the mine survey area, as detailed in ABR 2011a. These include hoary marmot (*Marmota caligata*), arctic ground squirrel (*Spermophilus parryii*), snowshoe hare (*Lepus americanus*), Alaska hare (*Lepus othus*), collared pika (*Ochotona collaris*), and various species of mice, lemmings, shrews, and voles. These species are generally common to abundant, depending on their population cycles.

Wood Frog

The wood frog is the most widely distributed amphibian in Alaska, ranging from the mainland of southeast Alaska north to the Brooks Range, and is the sole amphibian found north of Prince William Sound (ADF&G 2015b). Wood frogs breed virtually anywhere that has standing water for at least part of the summer, including ponds, bogs, marshes, temporary pools, tire tracks, or roadside ditches. However, specific studies have shown that the highest breeding activity is in waters from about 1 to 7 feet deep (ABR 2011a). Waterbodies must remain long enough for the tadpoles to mature and metamorphose. Another important habitat factor is vegetation nearby for hibernating (typically, forest vegetation with enough dead leaves covering the ground to form suitable hibernating sites).

The ADF&G has a wood frog monitoring program, with a goal of assessing the current status of wood frogs in Alaska (ADF&G 2018i). Wood frog studies were conducted in 2007 by ABR to determine their occupancy and distribution in the mine survey area and to describe the important habitat characteristics associated with breeding waterbodies. ABR conducted ground-based surveys in May 2007 sampling 119 randomly selected waterbodies (out of 1,668 potential waterbodies) for wood frogs. Surveys were conducted via passive listening for vocalizing male wood frogs from these pre-selected waterbodies at locations spaced around each waterbody. Surveys followed standard amphibian-calling survey protocols, with slight modifications in the time of day (USGS 2005). The sampling design involved a repeat survey for each waterbody (2 to 4 days apart) during peak breeding.

Wood frogs were detected at waterbodies throughout the mine survey area; the occupancy rate of wood frogs breeding in the mine survey area was estimated at approximately 50 percent (ABR 2011a). Near the mine site facilities, several waterbodies contained wood frogs. Deep waterbodies (i.e., greater than 5 feet deep) were 10 times more likely to be occupied by wood frogs than shallow waterbodies (i.e., less than 5 feet deep). Wood frogs seemed to prefer waterbodies with herbaceous, low-shrub shoreline and aquatic vegetation.

3.23.1.2 Transportation Corridor and Natural Gas Pipeline Corridor

Terrestrial wildlife resources along the transportation corridor and natural gas pipeline corridor from the mine site to the Kenai Peninsula in the analysis area are described below. Marine mammals found in the vicinity of the natural gas pipeline corridor through Cook Inlet are discussed under Amakdedori Port, below. The analysis area includes the transportation and natural gas pipeline corridor, plus a surrounding 1- or 3-mile buffer, depending on the resource. For most species, a 3-mile buffer was used (apart from waterbirds, and landbirds and shorebirds, where a 1-mile buffer was used).

As detailed in Chapter 2, Alternatives, the portion of the natural gas pipeline corridor that would be on the Kenai Peninsula would be trenched into the ground (via horizontal directional drilling), tie into an existing pipeline near Anchor Point, and connect to a compressor station constructed on private land. Wildlife resources in the area are representative of the wildlife in the region, including brown and black bears, moose, and smaller terrestrial wildlife. The area is currently bisected by the Sterling Highway, with several residences nearby.

Surveys were conducted by ABR in spring, summer, and fall 2018 along the port access road from the south ferry terminal to Amakdedori port. The survey methodologies and results are included below.

Birds

In general, many of the same species that were documented in the mine survey area also occur along the transportation corridor and natural gas pipeline corridor. The main difference is that portions of the corridor on the northern side of Iliamna Lake and south of the mine site tend to lack the high-elevation alpine tundra habitats that characterize the mine site, and the corridor includes a greater portion of lowland marsh, meadows, scrub, and boreal forest habitat types. This is reflected in a transition of avian species where obligate-tundra nesting species are less common, and species that prefer more scrub and forested habitat types are more common, as detailed in the following sections. However, the port access road is similar in habitat types and vegetation communities to the mine site, with similar bird species composition. Lists of all bird species detected in the transportation corridor and natural gas pipeline corridor, along with their conservation status, are in the PLP EBDs (ABR 2011a-e).

Raptors

There are multiple raptor nests in close proximity to the mine access road from the Eagle Bay ferry terminal to the mine site. Based on raptor surveys conducted in 2005, one bald eagle nest was located approximately 0.5 mile east of the Eagle Bay ferry terminal and 660 feet south of the access road. Near Roadhouse Mountain, four golden eagle nests were located approximately 1 mile from a material site. In addition to bald and golden eagle nests, the nests of a great-horned owl, red-tailed hawk, merlin, and several unidentified raptors were located less than a mile from the mine access road. On July 2, 2019, a raptor nest helicopter survey was conducted for the proposed bridge crossings over the Newhalen River (ABR 2019d). This area was surveyed in 2004 and 2005; historical nest locations were visited in 2019. The 2019 surveys included a 0.5-mile buffer around the proposed Newhalen River bridge crossings plus 3 miles up and down stream. Both historical raptor nest locations and new locations were surveyed. Several of the historical bald eagle nests observed during the 2004/2005 surveys were no longer detectable in 2019. No suitable golden eagle nesting habitat is present in the area around the Newhalen River bridge crossings because the habitat is primarily riparian with large spruce and cottonwood trees. The surveys in July 2019 documented four bald eagle nest structures but could not relocate six nest structures that had previously been recorded during 2004/2005 surveys (ABR 2019d). Of the four bald eagle nests that were along the Newhalen River, none were within 0.5 mile of the bridge locations. The closest nest was 0.9 mile south (downstream) of the southern bridge crossing (Figure 3.23-1) (ABR 20019d). The closest nest to the northern bridge crossing was approximately 1.4 miles upstream. Although additional nests were historically closer to the bridge crossings, six historical nests were not relocated during surveys in July 2019. This is possibly because habitat conditions such as dense leaf coverage prevented clearly seeing all nests; however, some of the historical nests and trees may have fallen down. Notes from surveys in 2004 and 2005 indicate that some of the historical nests were structurally compromised. It is possible that some trees and/or nests have collapsed since 2004 and 2005. Therefore, the closest known raptor nest to the Newhalen bridge crossings is a bald eagle nest 0.9 mile south of the southern crossing.

There were few raptor nests along the portion of the natural gas pipeline corridor from Iliamna north to the junction of the mine access road where it would cross the Newhalen River. Aside from bald eagle nests along the north shore of Iliamna Lake and along the Newhalen River, the only other raptor nest in the area was an unidentified large owl nest (ABR 2019d).

Project-specific raptor surveys were also conducted in summer 2018 for areas south of Iliamna Lake along the port access road. Bald eagles were the most commonly detected nesting raptor species, followed by golden eagles (Figure 3.23-9). Overall, there were few nests along the port access road due to a lack of large trees and limited cliff habitat. Several nests were observed on the northern and southern sides of Gibraltar Lake, with additional nests clustered along the coastal bluff around Cook Inlet. There were no bald or golden eagle nests near the area of the bridge over the Gibraltar River. There is little suitable bald and golden eagle nesting habitat within 0.5 mile of the Gibraltar River along its length from the outflow of Gibraltar Lake to Iliamna Lake (ABR 2019e). The closest nests were more than 4 miles from the bridge (Figure 3.23-9). Eagle nests were in close proximity to the port access road in areas east of the Gibraltar River. The closest golden eagle nest was approximately 0.2 mile north of the port access road, near one of the material sites. The nest was not active in 2018 but may be active in the future. The closest bald eagle nest was 0.3 mile north of the Kokhanok spur road and was active in 2018 (Figure 3.23-9). Overall, most raptor nests were more than 0.5 mile away from the port access road, but at least eight bald and golden eagle nests were within 1 mile of the road or a material site.

Waterbirds

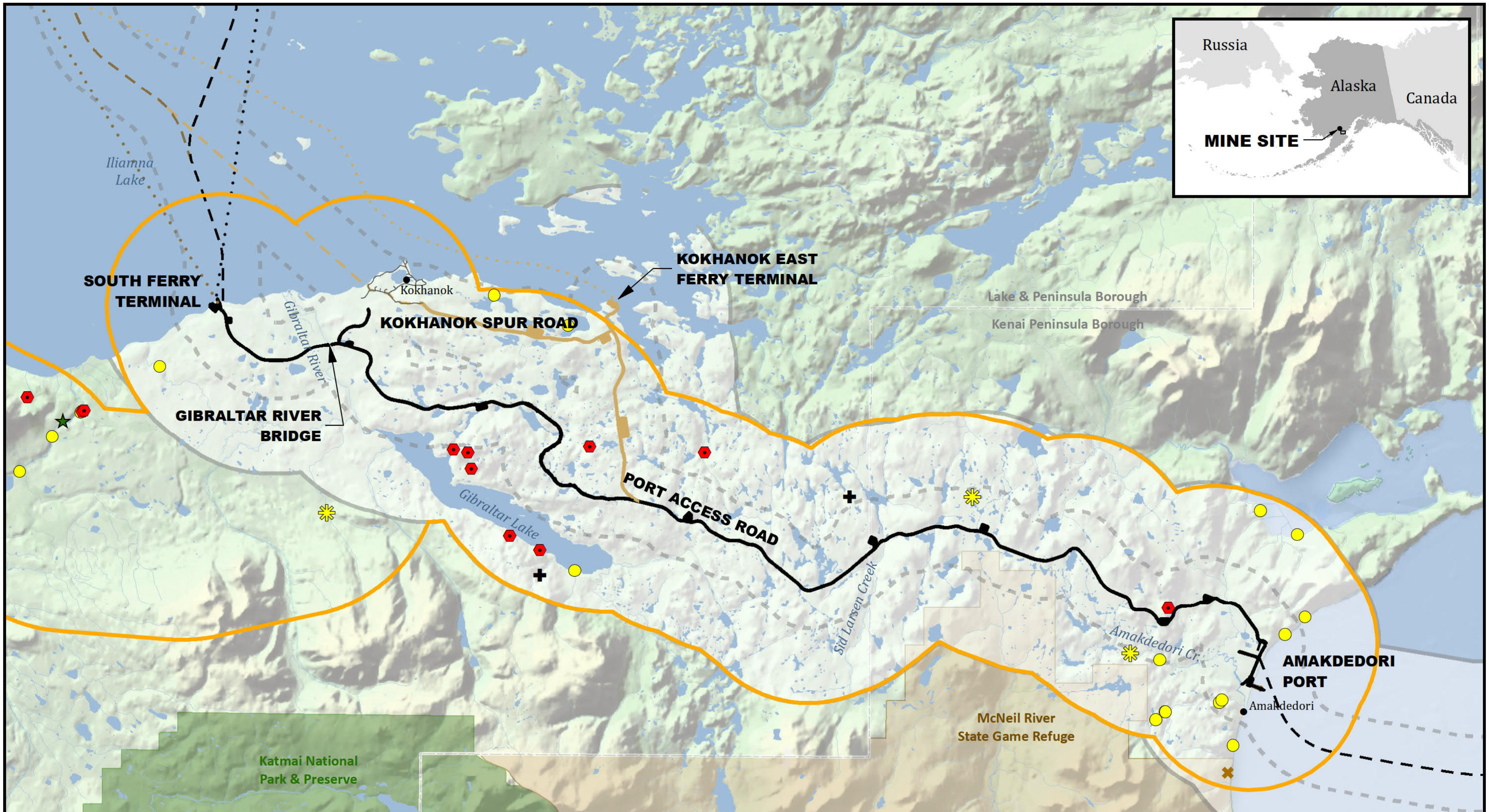
This section details the waterbirds present in the transportation and natural gas pipeline corridor for areas outside of the mine survey area (discussed above). This includes the area east of the mine survey area along the Newhalen River, the port access road, Kokhanok east spur road, and waterbirds present along the natural gas pipeline corridor through Cook Inlet. There is overlap between the waterbirds present at Amakdedori port (discussed in a subsequent section below) and the waterbirds along the natural gas pipeline corridor in Cook Inlet. Seabirds are a subsect of waterbirds, which are discussed in this section and include seabird colonies that occur around the natural gas pipeline and seabird colonies around the lightering locations.

For surveys conducted in 2004 and 2005, the timing of waterbird migration in spring and fall was similar to the mine survey area, with similar species detected. During spring, the highest concentrations of swans, geese, and ducks were found in broad lake-like area of the Newhalen River known as Three-mile Lake (Figure 3.23-2). During fall migration, concentrations of waterbirds occurred at many of the same locations as in spring (Figure 3.23-3). No groups of swans or geese were observed staging in the area during fall; only brood-rearing groups and adult swans as singles and pairs. Thousands of ducks and gulls were recorded during fall surveys, with duck abundance remaining high from mid-August to mid-October, and gull abundance peaking in mid- to late-September. The northern part of Iliamna Lake (near creek outflows) also supported large concentrations of staging and migrating waterbirds. Waterfowl breeding density was estimated at 31.6 birds per square mile in 2004, and 17.6 birds per square mile in 2005.

Waterbird data for the port access road were collected in spring (April and May) and fall (September and October) 2018 (ABR 2018g, 2018h). All waterbodies greater than 5 acres and selected rivers and streams in a 1-mile buffer around the port access road were surveyed, in addition to smaller waterbodies in the corridor (ABR 2018g, 2018h).

Surveys from the end of April and May 2018 in a 1-mile buffer of the port access road documented 598 birds of 17 species, with an additional seven unidentified species groups (e.g., loons, swans). The most common species with 50 or more individuals detected, in descending order of abundance, were: unidentified scaup, northern pintail, mallard, and red-breasted merganser.

Based on the early September and October 2018 surveys, approximately 647 waterbirds from at least 13 species (plus nine unidentified species groups) were detected in the surveyed area. The main species detected with 50 or more individuals, in descending order of abundance, were: glaucous-winged gull (*Larus glaucescens*), unidentified gull, mallard, and unidentified scaup (ABR 2018g, 2018h). Waterbirds were sparse directly along the port access road, because the area is at a high elevation with rocky ponds and little vegetation. Waterbirds were more common around rivers, streams, and waterbodies at lower elevations around Iliamna Lake and Cook Inlet.



Sources: PLP 2019-RFI153; ABR 2018

US Army Corps of Engineers

2 0 2 4

Miles

Raptor Analysis Area
Waterbirds Analysis Area
2018 Raptor Survey

Swan Nest
2018 Nest

Raptor Nest Species
Bald Eagle
Bald Eagle Nest Inhabited by Great Horned Owl
Common Raven
Golden Eagle
Merlin
Unidentified Eagle
Unidentified Raptor

Action Alternatives
Ferry Routes
Natural Gas Pipelines
Alternative 1a
Alternative 1
Alternative 1 Kokhanok East Ferry Terminal Variant

Other Features
Local Roads
Borough Boundary
State Game Refuge/Sanctuary
National Wildlife Refuge
National Park

RAPTOR AND SWAN NESTS NEAR THE PORT ACCESS ROAD AND AMAKDEDORI PORT

Waterbird data in Kamishak Bay and along the natural gas pipeline corridor were also incidentally collected during marine-based field surveys from March through July 2018 (ABR 2018b-f). No transects or systematic sampling techniques were used; therefore, density estimates were not determined. In a 3-mile radius of Amakdedori port, the main species detected (i.e., more than 50 individuals observed), in decreasing order of abundance, were: unidentified scoter, surf scoter, harlequin duck, glaucous-winged gull, and pigeon guillemot. The highest number of birds was typically recorded in June.

During ABR surveys in spring and summer 2018, low numbers of swans (species not identified) were identified along the port access road (Figure 3.23-9). There was at least one swan nest within 1 mile of the port access road, and an additional nest farther away. The species of swan was not identified, but both tundra and trumpeter swans occur in this area of the Alaska Peninsula. Historical trumpeter swan surveys from 2010 and 2015 documented similar densities of trumpeter swans (16 to 30 swans) in the survey area that overlaps with the port access road (Groves and Hodges 2013; Groves 2018). These 2 years show consistency in the number of swans estimated and indicate that the area has a moderate density of trumpeter swans near the southwestern limit of the species range in Alaska.

In 2004 and 2005, a few pairs of harlequin ducks were found along the Newhalen River during pre-nesting surveys, along with a few broods later in the season. During ABR surveys in 2018, several pairs of harlequin ducks were observed within 3 miles of the port access road in May; however, nesting was not confirmed.

In 2004 and 2005, several common loon broods were detected in lakes in the floodplain of the Newhalen River, with adult birds on several lakes in the vicinity. Broods were also found on large, deep lakes from early May to late September in 2004 and 2005. No Pacific or red-throated loon (*Gavia stellata*) nests or broods were observed. In 2018, common loons were rare along the port access road, observed primarily in Gibraltar Lake.

The transportation corridor and natural gas pipeline corridor north of Iliamna Lake do not overlap any areas where large concentrations of waterbirds breed or stage. The northern part of Iliamna Lake (near creek outflows) also supports large concentrations of staging and migrating waterbirds. Waterfowl breeding density was estimated at 31.6 birds per square mile in 2004, and 17.6 birds per square mile in 2005.

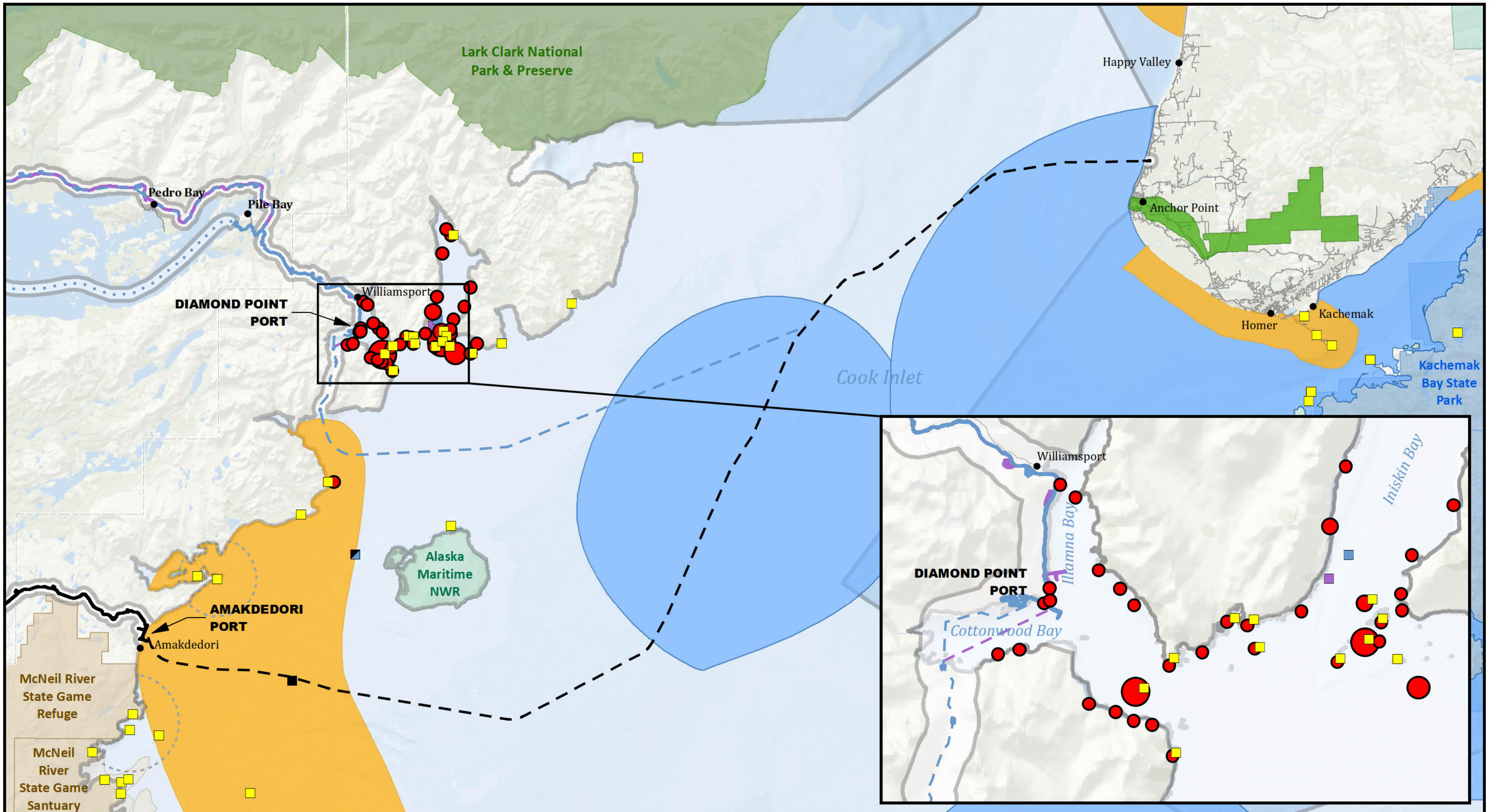
The natural gas pipeline corridor traverses lower Cook Inlet, which is an important nesting, wintering, molting, and migrating area for a variety of seabirds. The most recent seabird surveys were conducted by the Bureau of Ocean Energy Management from 2012 through 2016 to document the seasonality of seabird distribution in lower Cook Inlet (Renner et al. 2017). Surveys were conducted by boat traveling established transects at different times of the year across lower Cook Inlet. Overall, the total marine bird densities were high in winter, spring, and summer; half as abundant during the fall. Densities were higher on the eastern side of Cook Inlet, especially in the shallow waters close to shore. The most common species were: white-winged scoter (*Melanitta deglandi*); common murre (*Uria aalge*), observed year-round; black-legged kittiwake (*Rissa tridactyla*), observed in summer; red-necked phalarope (*Phalaropus lobatus*), observed in spring; and sooty shearwater (*Ardenna grisea*), observed in summer and fall. White-winged scoter was the most abundant marine bird across all seasons, with the highest numbers during winter. High concentrations were located north of Augustine Island near Ursus Cove in Kamishak Bay (Renner et al. 2017). Sooty shearwaters were the most abundant seabird during summer; however, they do not breed in Alaska. Short-tailed shearwaters were also observed, but in lower numbers. Both shearwater species are long-distance migrants that breed in the Southern Hemisphere and feeding during the northern summer. They are most abundant from August through November, and range widely from the Chukchi Sea south to the Gulf of Alaska (Kuletz and Labunski 2017). The highest densities of sooty shearwaters were on the eastern side of lower Cook Inlet, and red-necked phalaropes were concentrated on the southern side of Kachemak Bay (Renner et al. 2017). Both black-legged kittiwakes and common murres (which are the most abundant cliff-nesting seabird species in the area) were widespread, but more common on the eastern side of lower Cook Inlet, with a pronounced north-south difference between the two species. Black-legged kittiwakes were more abundant near the mouth of Cook Inlet, and common murres were more abundant on both sides of Kachemak Bay and north to Anchor Point. High densities of seabirds occur on the eastern side of lower Cook Inlet, which coincides with inflowing oceanic water from the Gulf of Alaska. Renner et al. (2017) confirmed that the predominant gradient in lower Cook Inlet in terms of avian abundance is east to west (with the eastern side having higher marine bird densities), rather than north to south.

There were no seabird colonies in a 1-mile buffer of the natural gas pipeline corridor in the EIS analysis area (Figure 3.23-10). Several seabird colonies along the western portion of lower Cook Inlet were located around Amakdedori port and are discussed in the port section below.

Additional waterbirds that occur in lower Cook Inlet include Kittlitz's murrelet (*Brachyramphus brevirostris*) and marbled murrelet (*Brachyramphus marmoratus*). These species occur throughout most of the length of the natural gas pipeline corridor, with a lower abundance along the western side of lower Cook Inlet (Piatt et al. 2007). The most recent at-sea surveys in lower Cook Inlet estimated a population of more than 29,000 marbled murrelets, which is roughly 4 percent of the world population of the species (Piatt et al. 2007). Lower Cook Inlet is one of the three main areas where marbled murrelets are concentrated during the breeding season. Marbled murrelets breed and winter in lower Cook Inlet, with the highest densities in early May. One marbled murrelet was detected in the EIS analysis area during surveys by ABR in 2018 in the area around Amakdedori port. Low numbers of marbled murrelets have been detected in Kamishak Bay during June 1993 surveys of lower Cook Inlet (Kuletz et al. 2011). Although no Kittlitz's murrelets have been detected in the area around Amakdedori port, based on ABR surveys in 2018, low numbers have been detected in the vicinity of the natural gas pipeline corridor in the analysis area (Kuletz et al. 2011). Kittlitz's murrelets are more abundant on the eastern side of Cook Inlet and around Douglas River Shoals. Surveys in 1993 indicated that a minimum of 2,950 (about 5 to 9 percent of the world population) of Kittlitz's murrelets occur in lower Cook Inlet (Kuletz et al. 2011).

Some seabird populations in lower Cook Inlet have experienced extreme fluctuations in productivity and mortality rates. Both common murres and black-legged kittiwakes have experienced population declines in the past several years. These trends are discussed below in detail under Climate Change.

The NPS conduced an aerial survey of known seabird colonies in the lower portion of Kamishak Bay, from the Kamishak Islands to Cape Douglas, on June 30, 2018 (Griffin 2018). NPS took photographs and counted the number of nests observed at four island locations in southern Kamishak Bay, including Kamishak Islands, Douglas River Islands, Shaw Island, and North Douglas Point. The main species detected included glaucous-winged gulls and unidentified cormorants and seabirds. The only nests recorded were those of glaucous-winged gulls on Kamishak and Douglas River islands (Griffin 2018).



Sources: PLP 2020-RFI168; PLP 2019-RFI153; N Pac. Seabird Portal accessed 2019

US Army Corps of Engineers

5 0 5 10

Miles

Analysis

Audubon Important Bird Area Type

- Coastal
- Colony
- Interior
- Marine
- Seabird Colonies

2012 Seabird Colony Size

- 1 - 20
- 21 - 50
- 51 - 100
- 350 - 374

Action Alternatives

- Lightering Locations
- Ferry Routes
- Natural Gas Pipelines
- Alternative 1a
- Alternative 2
- Alternative 3

Other Features

- Roads
- Borough Boundary
- National Park
- National Wildlife Refuge
- State Game Refuge/Sanctuary

SEABIRD COLONIES IN PROXIMITY TO THE EIS ANALYSIS AREA

PEBBLE PROJECT EIS

FIGURE 3.23-10

Landbirds and Shorebirds

Landbird and shorebird surveys were conducted in 2005 for the Alternative 2—North Road and Ferry with Downstream Dams transportation corridor; a portion of this corridor overlaps with Alternative 1a. The point-count survey methods for conducting landbird and shorebird surveys are detailed above. The survey area for the transportation corridor in 2005 was 2,000 feet wide and extended from the mine site along the northern side of Iliamna Lake to Cook Inlet. Multiple point-counts were conducted from the mine site to the Eagle Bay ferry terminal, primarily around the Newhalen River and along the southern edge of Roadhouse Mountain. The wildlife habitats east of the mine site in the transportation and natural gas pipeline corridors include a large percentage of Upland and Lowland Spruce and Moist Mixed Forest. These wildlife habitats support a slightly different assemblage of bird species that are more dependent on forested habitats. The majority of habitats along the mine access road were considered high-value habitats, based on the ABR habitat value rankings (ABR 2011a). The only portion of habitat that was not considered high-value avian habitat was east of the Newhalen River to the southwest corner of Roadhouse Mountain, which coincided with Upland Moist Dwarf Scrub. According to ABR surveys (2011a), 10 landbird species were considered abundant in the area, including: Wilson's warbler, orange-crowed warbler, Swainson's thrush (*Catharus ustulatus*), yellow-rumped warbler (*Setophaga coronata*), golden-crowned sparrow, dark-eyed junco (*Junco hyemalis*), ruby-crowned kinglet (*Regulus calendula*), American robin (*Turdus migratorius*), varied thrush (*Ixoreus naevius*), and hermit thrush (*Catharus guttatus*). Wilson's warbler, orange-crowned warbler, and Swainson's thrush were the most abundant. The two most frequently observed breeding shorebirds were greater yellowlegs and Wilson's snipe. Upland and Lowland Moist Mixed Forest, Upland and Lowland Spruce Forest, and Riverine Moist Mixed Forest supported the highest numbers of breeding landbird and shorebird species (see Section 3.26, Vegetation, for a description of vegetation types in the EIS analysis area).

The vegetation around the south ferry terminal and Kokhanok includes scattered sections of forest interspersed with low and tall shrubs. Avian species composition is similar to the northern side of Iliamna Lake. However, a large portion of the port access road south of Kokhanok consists of rocky terrain with low-growing tundra vegetation interspersed with small ponds. This habitat is similar and adjacent to the montane areas of Katmai National Park and Preserve. Both Katmai National Park and Preserve and the port access road are in the Alaska Peninsula ecoregion. From 2004 to 2006, the NPS conducted an inventory and monitoring program to document bird species in montane regions of Katmai National Park and Preserve and Lake Clark National Park and Preserve (Ruthrauff et al. 2007). From late May to early June 2004 through 2006, biologists conducted avian counts at sample plots across both park units. The most commonly detected species were golden-crowned sparrow, fox sparrow, and American pipit (*Anthus rubescens*). High-elevation sites (those most similar to the middle portion of the port access road) were composed of a high-percentage cover of dwarf shrub and bare ground habitat. This type of habitat supported species such as rock ptarmigan (*Lagopus muta*), American golden-plover, wandering tattler (*Tringa incana*), surfbird (*Aphriza virgata*), and snow bunting (*Plectrophenax nivalis*).

Species of greatest conservation need in Alaska (ADF&G 2015a) that were detected in the transportation corridor and natural gas pipeline corridor (and not in the mine site) include: black-backed woodpecker (*Picoides arcticus*), olive-sided flycatcher (*Contopus cooperi*), varied thrush, rusty blackbird (*Euphagus carolinus*), and solitary sandpiper (*Tringa solitaria*). These species, detected in low densities, are associated with coniferous-forested habitats, which are generally lacking in the mine survey area. A list of all species of greatest conservation need in Alaska that were detected in the transportation corridor and natural gas pipeline corridor are included in the PLP EBDs (ABR 2011a-e).

Two avian transect surveys were conducted along the port access road with one transect west of Amakdedori port and the other near Kokhanok in June 2018 (ABR 2018i, 2018j). Surveys followed the standardized point-count procedures developed for the statewide Alaska Landbird Monitoring Surveys and have been adopted for shorebirds (Handel and Cady 2004). The most commonly detected landbird species, in decreasing order of abundance, were: Wilson's warbler, golden-crowned sparrow, savannah sparrow, fox sparrow, orange-crowned warbler, common redpoll, hermit thrush, American robin, varied thrush, and yellow warbler. Three species of shorebirds were also detected in low numbers: semipalmated plover, greater yellowlegs, and least sandpiper (ABR 2018j). Overall, the seven most common species were an order of magnitude more abundant than the remaining landbird species, and shorebirds were much less abundant (ABR 2018j). Of the 10 most commonly detected landbird species, all except the American robin are considered either at-risk or stewardship species by the ADF&G (ADF&G 2015a).

Specific to the portion of the natural gas pipeline corridor and the compressor station on the Kenai Peninsula, the North American Breeding Bird Survey (BBS) includes one survey point along the Anchor River on the western side of the Sterling Highway; it was been monitored for 33 years, from 1983 to 2017 (no data for 1985 and 1988) (Pardieck et al. 2018). This location is south of the compressor station and north of the Anchor River Important Bird Area. Count data totaled across all 33 years indicate that the 10 most common species, listed in order or abundance, were: orange-crowned warbler, varied thrush, fox sparrow, American robin, hermit thrush, alder flycatcher, ruby-crowned kinglet, Wilson's warbler, golden-crowned sparrow, and yellow-rumped warbler. These 10 most common species are generally found in scrub and coniferous forest habitats, which are typical of the vegetation in this portion of the Kenai Peninsula.

The most commonly detected breeding shorebird species at the Anchor River BBS was the Wilson's snipe (Pardieck et al. 2018). Many other shorebird species migrate through and use the habitat around the Anchor River and adjacent intertidal zone during migration. The only shorebird species that remains in the area during winter is the rock sandpiper. Groups of rock sandpipers winter in Cook Inlet, especially along areas of exposed mudflats in upper Cook Inlet (Ruthrauff et al. 2013). Additional detailed information on rock sandpipers that winter in Cook Inlet is provided below.

Terrestrial Mammals

The transportation corridor and natural gas pipeline corridor, including the mine access road, and the northern two-thirds of the port access road, are in GMU 9B. The southern third of the port access road is in GMU 9A. The portion of the natural gas pipeline corridor on the Kenai Peninsula is in GMU 15C. Because the natural gas pipeline would connect below ground to existing infrastructure on the Kenai Peninsula (see figures in Chapter 2, Alternatives) and is less than 0.5 mile, a detailed discussion of terrestrial mammals on the Kenai Peninsula is not included in the EIS. The natural gas pipeline corridor on the Kenai Peninsula is also adjacent to single-family residences and is not near any stream, creek, or other area where wildlife may congregate. There are no caribou herds in the immediate vicinity; common terrestrial mammals on the Kenai Peninsula in this area include moose, bears, and smaller species.

Methods used for biological surveys for this portion of the transportation corridor and natural gas pipeline corridor are the same methods used for the mine survey area and are not repeated below. Only specific results that relate to the mine access road are analyzed.

General vegetation types along the transportation corridor and natural gas pipeline corridor consist of spruce forest and mixed-species forest. This change in vegetation from an open landscape in the mine site to a more closed, forest-dominated landscape in the corridor is reflected in the species type and abundance, as detailed in the following sections.

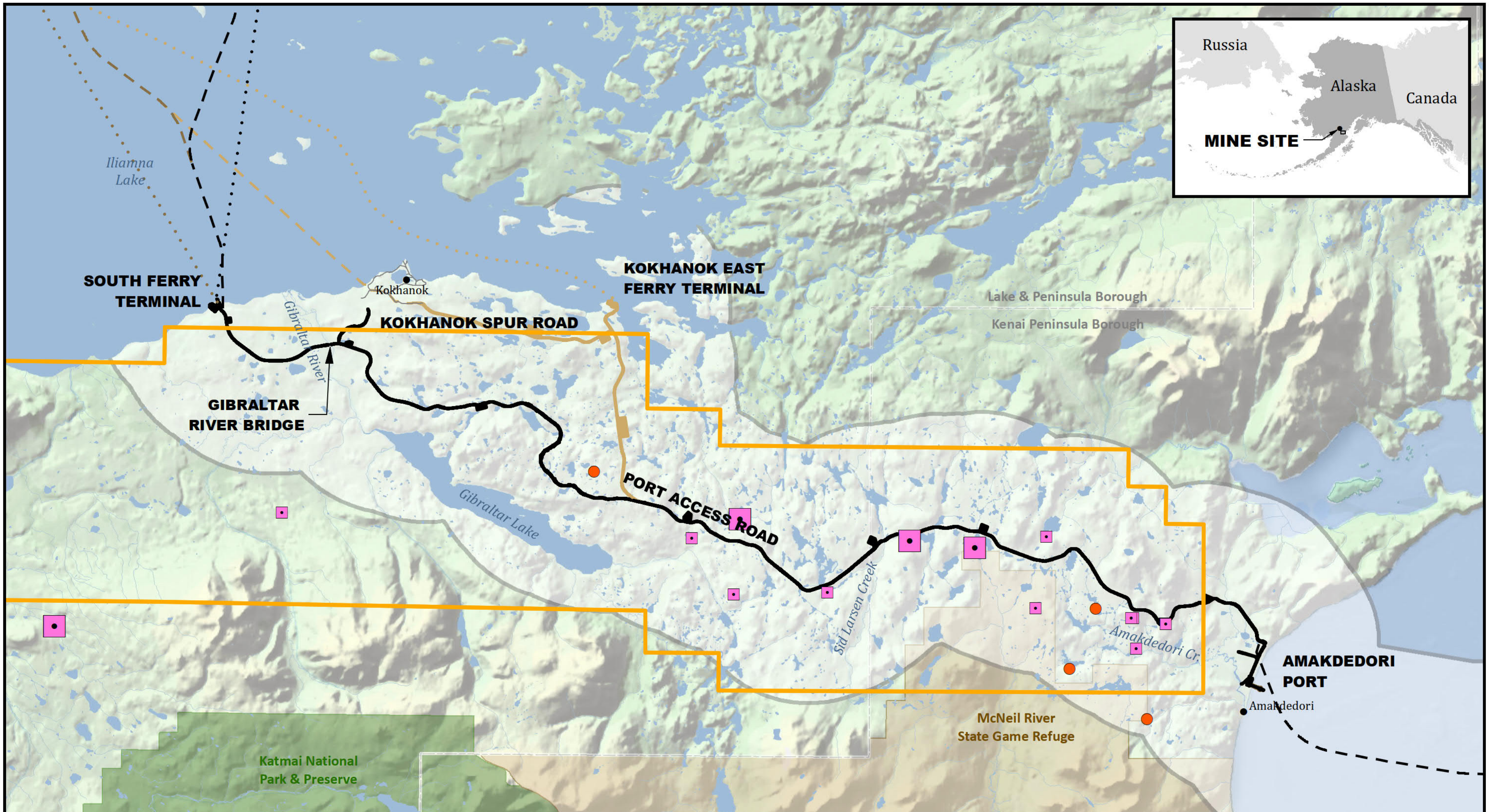
Large Mammals

Caribou were uncommon and rarely detected in the area around the transportation corridor and natural gas pipeline corridor (Figure 3.23-5). They tend to occur farther north and west; the 29 years of satellite telemetry data that were analyzed (described above) found few instances of caribou in the area that would be covered by the transportation corridor and natural gas pipeline corridor.

The Northern Alaska Peninsula caribou herd occurs in GMUs 9E and 9C, with the northern extent of their current range approximately 70 miles south of the transportation corridor and natural gas pipeline corridor around Naknek Lake (ADF&G 2015b). The population of the Northern Alaska Peninsula caribou herd is approximately 2,700 (ADF&G 2015b). Although there are no designated herds that regularly use the transportation corridor and natural gas pipeline corridor as part of their home range, isolated groups of caribou use the area. Some of these groups may be associated with the Mulchatna caribou herd. According to the ADF&G, localized herds inhabit parts of the transportation corridor and natural gas pipeline corridor, such as a herd in the area south and east of Kokhanok, in the higher country around Kukaklek and Nonvianuk lakes, and east to the Kamishak Bay coast (ADF&G 2018s). Aerial surveys of caribou were conducted during the end of May and early October 2018 along the port access road (ABR 2018m, 2018n). These surveys documented a few individual caribou (usually one or two caribou, with one group of four individuals) between Iliamna Lake and the port, but no large groups or congregations were detected (Figure 3.23-11). In addition, low numbers of caribou were incidentally recorded during other surveys along the port access road and are shown on Figure 3.23-11.

Brown bear density estimates from the bear population survey in May 2009 ranged from 47.7 to 58.3 brown bears per 386 square miles (Becker 2010). The area covered by the survey included the southern portion of GMU 9B, plus a small section of the eastern part of GMU 17B. All but one of the black bear sightings occurred east of Nondalton and north of Kokhanok. Therefore, black bears appeared to be more closely tied to forested environments, with brown bears occurring in more open terrain and around salmon streams during periods of salmon spawning. Specific to areas outside the transportation corridor and natural gas pipeline corridor, brown bears were concentrated around the northern portion of Katmai National Park and Preserve, south of Gibraltar Lake (Becker 2010) (Figure 3.23-12).

Surveys conducted by the NPS in May 2003 using an aerial line-transect double-count technique estimated that in GMU 9A, the brown bear density was 150 bears per 386 square miles, with a standard error of +/- 28 bears; for black bears, the density was 85 +/- 20 bears per 386 square miles. This corresponds to a population of 703 +/- 134 brown bears and 413 +/- 62 black bears in GMU 9A (Olson and Putera 2007). No surveys were conducted in 2003 to determine a density estimate for GMU 9B. The aerial surveys by Becker (2010) included GMU 9B; therefore, in conjunction with the NPS survey in 2003 (Olson and Putera 2007) for GMU 9A, the entire transportation corridor and natural gas pipeline corridor have been surveyed. More recent density estimates put the overall brown bear density in Unit 9 at approximately one bear per 3.5 square miles, with an extrapolated population size of 6,000 to 6,800 bears on lands that are open to bear hunting. The population at McNeil River State Game Sanctuary and national parks in Unit 9 are estimated to contain an additional 2,000 to 2,500 brown bears (Crowley and Peterson 2015). Overall, brown bears were more common along the coast and around the southern part of Iliamna Lake, with black bears more common to the east of Iliamna Lake and areas adjacent to Lake Clark National Park and Preserve.



Sources: PLP 2019-RFI153; ABR 2018

US Army Corps of Engineers

2 0 2 4
Miles

Analysis Area

Survey Observations

1 - 4 Caribou Observed

2018 Survey

Incidental Observations

1 - 4 Caribou Observed

2 - 8 Caribou Observed

Action Alternatives

Ferry Routes

Natural Gas Pipelines

Alternative 1a

Alternative 1

Alternative 1 Kokhanok East Ferry Terminal Variant

Other Features

Roads

Borough Boundary

State Game Refuge/Sanctuary

National Wildlife Refuge

National Park

CARIBOU OBSERVATIONS NEAR THE PORT ACCESS ROAD AND AMAKDEDORI PORT

PEBBLE PROJECT EIS

FIGURE 3.23-11

Sources: PLP 2018, 2019-RFI153; ABR 2018

* During bear den surveys in late- April and mid-May 2018, snow cover was largely gone or patchy in the survey area around the port access road. This limited the ability to detect bear dens; therefore, the resulting estimate is conservative and likely underrepresents the number of bear dens in the area.

US Army Corps of Engineers

2 0 2 4

Miles

Analysis Area

Observations (2004 - 2009)

- Black Bear
- Brown Bear
- May 2009 Bear Density Survey Area

2018 Study

- Brown Bear Salmon Stream
- Brown Bear Coastal
- Brown Bear Den
- Brown Bear Salmon Stream Transect
- Brown Bear Coastal Survey Transect
- Brown Bear Den Survey
- Brown Bear Salmon Survey

Action Alternatives

- Ferry Routes
- Natural Gas Pipelines
- Alternative 1a
- Alternative 1
- Alternative 1 Kokhanok East Ferry Terminal Variant

Other Features

- Roads
- Borough Boundary
- State Game Refuge/Sanctuary
- National Wildlife Refuge
- National Park

BEAR OBSERVATIONS AND DENS NEAR THE PORT ACCESS ROAD AND AMAKDEDORI PORT

PEBBLE PROJECT EIS

FIGURE 3.23-12

Although there are limited radio-collared bear data from the vicinity of the port access road, a map provided by Larry Aumiller in Dawson (2019) shows bears that were radio-collared at the mouth of the Douglas River had moved along the Katmai Coast, and followed rivers and streams through the Alaska Peninsula interior (out to Kukaklek Lake), and moved between McNeil River and Katmai National Park and Preserve. Bears moved between the coastal regions and interior areas following salmon streams. In addition, some bears that were tagged at McNeil were harvested at Gibraltar Lake, the Gibraltar River, and near Kokhanok. Furthermore, at least one bear considered a regular visitor at McNeil Falls was observed around Amakdedori. Therefore, bears that use McNeil River State Game Refuge and Sanctuary move across the landscape and use State of Alaska lands north of McNeil and throughout Katmai National Park and Preserve.

A series of three surveys for bears was conducted along the port access road in the spring and summer of 2018 (ABR 2018p, 2018k, 2018o). The first aerial surveys were conducted to locate bear dens within 0.6 mile of the port access road, and a separate corridor around the western end of Iliamna Lake. In total, the survey area was 151 square miles. Aerial surveys were flown from April 30 to May 1, 2018, and from May 13 to 16, 2018, to assess den emergence. Surveys were timed to occur when bears typically emerge from dens; adequate snow cover is important for locating dens. However, during surveys in 2018, snow was largely gone or patchy in the survey area, restricting the ability to locate some dens. Due to limited detectability, the number of dens found is likely an underestimate. Surveys located 64 bear dens throughout the survey area, but only a portion of these dens were in the survey area around the port access road. Specific to the port access road, dens were located in two main areas. Several dens were found from Gibraltar Lake west to Iliamna Lake; the remaining were clustered near Cook Inlet north of Amakdedori Creek (Figure 3.23-12). Surveys documented a concentration of brown bear dens on each side of the port access road and around Amakdedori port (Figure 3.23-12). Several of the dens were close to the port access road, with the closest approximately 300 feet north of the road (ABR 2018p). Results indicated that bear dens were found at lower elevations, steeper slopes, higher topographic positional indices, higher ruggedness, more north- and west-facing aspects, and more often in shrubs (ABR 2018p). This indicates that bears in the Iliamna area are more likely to den in shrubby areas with steep slopes. A model was created to estimate density using the relative probability of detecting a bear den based on resource selection function analysis. The model predicted that the 151-square-mile survey area had an estimated density of 164 dens per 386 square miles (ABR 2018p).

The second set of aerial surveys assessed the prevalence of bears using coastal sedge meadows or other areas along the coast of Cook Inlet from Ursus Head south to Chenik Head. These surveys were conducted on May 20, 28, and July 2, 2018 (ABR 2018k). One survey was attempted on June 18, 2019 but was cancelled due to poor weather (high winds and persistent fog). Because the June survey was missed, these surveys may have missed the peak nutritional time period for coastal sedge meadows, which occurs in June. Therefore, surveys may underestimate the total number of bears, or bear use of the coastal sedge meadows along Cook Inlet by Amakdedori and the port access road. Bear observations were widely dispersed and no concentration areas were observed (Figure 3.23-12). A few bears were detected around Ursus Cove and Bruin Bay, but only one brown bear was detected in the port access road analysis area on May 28, 2018. The bear was detected upstream along Amakdedori Creek.

The third set of surveys was focused on bear use of salmon streams. Three surveys were conducted during July 14 and 15, August 16 to 18, and September 7 and 8, 2018 (ABR 2018o). During each survey, all streams and rivers in the ADF&G anadromous waters catalog within 3 miles of the transportation corridor outside of the mine site were surveyed. Two replicate surveys of the entire area were flown on each trip (ABR 2018o). Specific to the port access road, during the July survey, bears congregated at the mouth of Amakdedori Creek, with a few individuals along streams near Gibraltar Lake. The July survey may not have occurred during peak salmon run timing, which typically occurs during the last half of July. During the August surveys, bears were primarily near the southern shore of Iliamna Lake, at the eastern end of Gibraltar Lake, fishing in the river flowing into Bruin Bay; a few bears were upstream in Amakdedori Creek. During September surveys, bears were concentrated around the stream flowing into Bruin Bay, at the eastern end of Gibraltar Lake, along the westerns shore of Iliamna Lake, and around Kokhanok. These surveys of brown bear activity in the area around the port access road illustrate bear use of Amakdedori Creek, Gibraltar Lake, and other anadromous streams in the area (Figure 3.23-12).

The moose density in the transportation corridor was estimated at 0.13 moose per square mile, based on data from the April 2010 aerial survey (ABR 2011a). Moose were more heavily concentrated in river drainages due to the presence of suitable forage. Per ADF&G, for GMU 9 and GMU 10, there are approximately 0.50 moose per square mile or less for most of the Alaska Peninsula due to limited habitat (Lill 2017). Generally, the habitat along the port access road is rocky substrate covered in low-growing tundra plant species. Therefore, moose densities are generally low along the port access road, with moose limited to river valleys and drainages with appropriate forage and cover. Surveys in summer 2018 documented very low numbers of moose along the port access road, primarily in drainages on the south side of Iliamna Lake.

Multiple beaver colonies were detected on the western side of the Newhalen River but were generally absent from the port access road area.

The transportation corridor and natural gas pipeline corridor contain more suitable caribou and brown bear habitat compared to habitat for moose and black bears. The port access road is in an area with abundant brown bears because it includes both coastal vegetation communities and salmon streams.

Small Terrestrial Vertebrates

Although no specific small mammal surveys were conducted for the project, Table 3.23-1 details the relative abundance of furbearers in GMU 9 based on the results of limited trapper questionnaires (based on individual perceptions and responses of relatively few trappers) from 2013 (Parr 2018). Many of the species have abundance indices similar to the mine site. Main differences include lynx, which are considered common, and American martins and wolverines, which are considered scarce in GMU 9. Additional non-furbearer small mammal species occur in the transportation and natural gas pipeline corridors, including Alaska hare and species of squirrels, mice, lemmings, voles, and others previously mentioned under the mine site.

Other mammal species were incidentally detected during surveys conducted by ABR and included red fox and river otter around the mouth of the Newhalen River (ABR 2011a). Coyote were detected along the southern side of Roadhouse Mountain, river otters were also detected on the eastern side of the Newhalen River on smaller tributaries, and multiple beaver colonies were detected on the western side of the Newhalen River along tributaries. Although no porcupine (*Erethizon dorsatum*) were recorded during ABR surveys (2011a), they are likely to occur along the forested portions of the transportation corridor and natural gas pipeline corridor. During surveys conducted in summer 2018, both red fox and wolverine were detected along the port access road.

Surveys for wood frogs were not conducted; however, the species is anticipated to occur throughout the region in freshwater ponds, lakes, streams, and adjacent wetland vegetation.

3.23.1.3 Amakdedori Port

Birds

Surveys in the vicinity of Amakdedori port were conducted in spring, summer, and fall 2018 by ABR, and include aerial surveys for nesting raptors, waterbird breeding observations, waterbird spring and fall observations, waterbird observations in Cook Inlet, and landbird and shorebird point-counts (ABR 2018g, h, i, j, and l).

Raptors

The area immediately adjacent to Amakdedori port is not suitable habitat for tree-nesting raptors due to a lack of large trees, including those to support bald eagle nests. Coastal bluffs to the north and south of the port support nesting bald eagles. These nests were approximately 0.6 and 0.7 mile north and south of the port, respectively (Figure 3.23-9). Both nests successfully raised one young eagle each in 2018 (ABR 2018l). Additional nearby nesting raptor species include golden eagles. A northern harrier and short-eared owl were observed in 2018 in the vicinity of Amakdedori port, and suitable nesting habitat is present. However, nests were not found because locating nests of ground-nesting species is difficult via aerial surveys.

Waterbirds

The terrestrial habitat around the Amakdedori port contains small waterbodies where waterbirds may breed and stage, although a large portion of the area is also upland habitat (see Section 3.22, Wetlands and Other Waters/Special Aquatic Sites, for additional information). The port location itself does not contain rocky outcrops, crags, or other features along the water's edge that may support nesting seabirds.

The marine portion of the Amakdedori port is in Kamishak Bay, a globally important bird area (IBA) along the Pacific Flyway (Figure 3.23-10). Kamishak Bay was designated by the National Audubon Society as an IBA due to large numbers (i.e., more than 9,000) of breeding glaucous-winged gulls (National Audubon Society 2013a; Smith et al. 2012). In Kamishak Bay, there are multiple-colony IBAs in the EIS analysis area. In particular, two colony IBAs, Amakdedulia Cove Colony and Contact Point Colony, are more than 6 miles from Amakdedori port (National Audubon Society 2014; Smith et al. 2012). Amakdedulia Cove is south of the port location in Kamishak Bay and supports 1 percent of a sub-species of double-crested cormorant (*Phalacrocorax auritus*), small numbers of glaucous-winged gulls, tufted puffins (*Fratercula cirrhata*), and large numbers (i.e., 272 birds per square mile) of seaducks (National Audubon Society 2013b). More than 7 miles north of the port location is Contact Point, which forms the southeastern border of Bruin Bay. A large seabird nesting colony exists here, and includes more than 1,000 seabirds of several species, including red-faced cormorants (*Phalacrocorax urile*), pelagic cormorants (*Phalacrocorax pelagicus*), common murres (*Uria aalge*), pigeon guillemots (*Cepphus columba*), tufted puffins, and horned puffins (*Fratercula corniculata*). Large numbers (i.e., 140 birds per square mile) of seaducks raft in the nearby waters (National Audubon Society 2013c). There are multiple other seabird colonies on the rocky islands along the western edge of Cook Inlet both north and south of Amakdedori port.

Kamishak Bay is an important molting and wintering location for a variety of waterbirds, including the federally threatened Steller's eider (*Polysticta stelleri*) (see Section 3.25, Threatened and Endangered Species), merganser, and scoter species (Larned 2005). In Kamishak Bay, the area around the Douglas River Delta (a series of shoals, reefs, and islands at the mouth of the Douglas River) approximately 15 to 20 miles south of the port location, is the primary location where waterbirds congregate in the winter.

During spring migration surveys on April 30, 2018 in the nearshore waters around Amakdedori port, common waterbirds observed were harlequin ducks, black scoters and other scoter species, red-breasted mergansers, and glaucous-winged gulls. No major congregations of waterbirds were detected; however, small groups of various species were observed in Amakdedori Creek and the surrounding ponds.

During waterbird breeding surveys on May 30, 2018, red-breasted mergansers were the most common waterbirds in the vicinity of Amakdedori port, followed by mallards and American wigeon. During fall waterbird surveys in early September and early October 2018 (ABR 2018g, h), commonly observed species included harlequin ducks in nearshore waters, species of mergansers, bald eagles, and gull species. No large congregations of fall-migrating waterbirds were detected during these surveys.

Landbirds and Shorebirds

The main landbird and shorebird species at the Amakdedori port are similar to species that breed in various shrub habitats in the mine site (listed above), including species of sparrows, warblers, and flycatchers. The main difference is that rock sandpipers (*Calidris ptilocnemis*) use the mudflats at the Amakdedori port for foraging during the winter. Rock sandpipers that winter along the shores of Cook Inlet are the northernmost wintering shorebird species in the Pacific Basin (Ruthrauff et al. 2013). They often gather in large flocks numbering in the thousands during the winter, and forage on a variety of bivalve species, depending on shore ice accumulation. Although rock sandpipers generally winter in a few locations in upper Cook Inlet, during periods of extreme cold, they shift their distribution to more southerly locations in the inlet (Ruthrauff et al. 2013). The subspecies of rock sandpiper that typically winters in Cook Inlet is the sensitive subspecies *Calidris ptilocnemis* (Ruthrauff et al. 2013). Data from the citizen science project, eBird, have documented rock sandpipers in Amakdedulia Cove and Kamishak Bay in September and early October, and early March and late April (eBird 2018). Numbers range from several individuals to several hundred birds and there are likely great fluctuations in numbers throughout the fall, winter, and spring. Small numbers of rock sandpipers were also detected in the EIS analysis area by ABR during late April and early May 2018 field surveys around Amakdedori port.

Additional avian species that use the area around the Amakdedori port include a variety of shorebird species that may rest, forage, and stage, and then continue migration. One survey conducted across four seasons in 1976 documented roughly 20,000 shorebirds using the embayments along the western side of lower Cook Inlet, of which 80 percent occurred during spring (Erikson 1977). Surveys conducted each spring between 1994 and 1996 documented 86,000 to 122,000 shorebirds using Tuxedni and Chinitna bays (Bennett 1996). Therefore, Cook Inlet provides important migratory and breeding habitat for a variety of shorebird species. Surveys conducted from February 1997 to February 1999 in upper Cook Inlet from Susitna Flats south to Tuxedni Bay (approximately 80 miles north of Amakdedori port) confirmed that the Cook Inlet is important migratory bird habitat (Gill and Tibbits 1999). Twenty-eight species of shorebirds were recorded using the area, with a rapid increase in numbers of birds during early May, followed by an abrupt departure in mid- to late-May. During this time, the total number of birds frequently exceeded 150,000 birds per day, with western sandpiper (*Calidris mauri*) accounting for three-fourths of all birds recorded (Gill and Tibbits 1999). Approximately 20 to 47 percent of the Pacific Flyway population of western sandpipers used Cook Inlet embayments, especially southern Redoubt Bay (approximately 100 miles north of Amakdedori port). Cook Inlet also supported approximately 11 to 21 percent of the population of dunlin (*Calidris alpina*) that travel in the Pacific Flyway. The main areas along the western side of Cook Inlet that provided shorebird habitat included southern Redoubt Bay (an average of 32,000 birds per day during spring) and Susitna Flats (8,400 rock sandpipers per day during winter) (Gill and Tibbits 1999). Therefore, the intertidal habitats and coastline around Amakdedori port likely provide important shorebird migration habitat, and support winter habitat for rock sandpipers.

Avian surveys were conducted along the port access road in June 2018 (ABR 2018i, j). Surveys followed the standardized point-count procedures developed for the statewide Alaska Landbird Monitoring Surveys and adopted for shorebirds (Handel and Cady 2004). The results for transects along the port access road are detailed above under transportation and natural gas pipeline corridor. Because one of the two transects (consisting of 10 point-count locations per transect) was conducted at Amakdedori port, with the other transect in similar habitat around Kokhanok, the data were combined for both transects. The most commonly detected species in decreasing order of abundance were Wilson's warbler, golden-crowned sparrow, savannah sparrow, fox sparrow, orange-crowned warbler, common redpoll, hermit thrush, American robin, gull species, varied thrush, and yellow warbler. Three species of shorebirds were also detected in low numbers: semipalmated plover, greater yellowlegs, and least sandpiper (ABR 2018j). Overall, the seven most common species were an order of magnitude more abundant than the remaining landbird species, and shorebirds were much less abundant (ABR 2018j). Of the 10 most commonly detected landbird species, all except the American robin and gull species are considered either at-risk or stewardship species by the ADF&G (ADF&G 2015a).

Terrestrial Mammals

Amakdedori port would be in GMU 9A on the northern side of Amakdedori Creek. Primary vegetation communities are shrub-dominated, with small, isolated wetlands. Amakdedori Creek is an anadromous fish creek surrounded by shrubs, and supports brown bears, gray wolf, moose, and other wildlife. Studies around Amakdedori port in summer 2018 included aerial surveys for a variety of terrestrial mammals, including bear dens and bear use at salmon-spawning streams and along the coast. Results are described above.

Large Mammals

Large mammal species around the port are similar to those in the mine site and along the transportation corridor and natural gas pipeline corridor, including caribou, brown and black bear, and moose. Although the primary range of the Mulchatna caribou herd does not extend to Cook Inlet based on 29 years of radio-telemetry data, there may be groups of caribou that occasionally move through the area. In 2018, the ADF&G observed caribou at Chenik Lake, about 5.5 miles south of the Amakdedori port site (ADF&G 2018s). The current range of the Northern Alaska Peninsula herd is approximately 70 miles south of the Amakdedori port site around Naknek Lake (Demma 2011; ADF&G 2015b). Additional scattered individual caribou were observed in 2018, between 3 and 5 miles west of Amakdedori port (Figure 3.23-11).

As detailed in Section 3.24, Fish Values, sockeye and pink salmon are abundant in Amakdedori Creek near the port. Amakdedori port would be approximately 13 miles north of McNeil River Falls at McNeil River State Game Sanctuary, which is a renowned brown bear viewing location with the world's largest concentration of wild brown bears (ADF&G 2018g). During bear surveys in May 2009 for the mine site, brown bears were common on the southern side of Iliamna Lake near Gibraltar Lake just north of the northern boundary with Katmai National Park and Preserve along tributaries that drain into Iliamna Lake. Surveys for bears around salmon-spawning streams in summer 2018 documented brown bears fishing in Amakdedori Creek in July and August (ABR 2018o) (Figure 3.23-12). Many of the details regarding surveys and results for terrestrial mammals are described above. Brown bears were commonly detected around the Amakdedori port and there were multiple dens found during the May 2018 den survey despite limitations of survey timing.

During ABR surveys in 2018, caribou and moose were incidentally observed in low numbers during surveys around Amakdedori port.

Two gray wolves were incidentally detected at the Amakdedori port site during summer 2018 aerial surveys of bears at salmon streams (ABR 2018k).

Small Terrestrial Vertebrates

The same small mammal species and furbearers listed in Table 3.23-1 would be anticipated to occur around the Amakdedori port, with abundance in proportion to their respective habitats. In addition, wood frogs would be expected to occur in freshwater ponds around Amakdedori port, although specific surveys were not conducted at this location.

Marine Mammals

This section addresses non-ESA-listed whales, porpoises, seals, and sea otters that occur in the marine waters in Cook Inlet surrounding the project components of Alternative 1a, which includes Amakdedori port, the natural gas pipeline corridor, and lightering locations. Additional marine mammal populations occur in and around established shipping lanes in the Gulf of Alaska and along the Aleutian Islands that would be transited by the concentrate bulk carriers and supply barges. Because thousands of vessels transit these shipping routes annually and because the total shipping traffic from the project would increase by a small percent, the information presented in this section is focused on Kamishak Bay, where current vessel activity is much lower and the potential for increased impacts from the project is greater. ESA-listed marine mammal species are discussed in Section 3.25, Threatened and Endangered Species.

The Marine Mammal Protection Act (MMPA) (16 USC 1361 et seq.) mandates management of marine mammal population stocks and was enacted in 1972 to prevent the decline of marine mammal species and populations. Additional information on the MMPA is provided in Appendix E, Law, Permits, Approvals, and Consultations Required.

Under Section 3 of the MMPA, the "…term 'population stock' or 'stock' means a group of marine mammals of the same species, or smaller taxa in a common spatial arrangement, that interbreed when mature" (16 USC 1362 [11]). "Population stock" (usually referred to simply as "stock") designations of many groups of marine mammals have changed over the past decade, in large part due to focused efforts to define the stocks, coupled with the availability of relatively new tools from molecular genetics. In the cases of marine mammals for which separate stocks have been delineated, the description and evaluation of potential effects on those stocks are focused on those that may occur in the Cook Inlet project area. However, information on the biological species as a whole is included if it enhances the understanding of the relevant stock(s) or aids in evaluation of the significance of any potential effects on the stock that occurs in or near the program area.

Gray Whale

There are two recognized stocks of gray whales (*Eschrichtius robustus*): the non-federally listed Eastern North Pacific (ENP), and the federally listed endangered Western North Pacific (WNP). Although both stocks of gray whales may occur in the analysis area, the WNP stock of gray whale is discussed in Section 3.25, Threatened and Endangered Species, and the ENP stock is much more likely to occur in the analysis area. The ENP gray whale stock range overlaps with the analysis area, especially around the mouth of Cook Inlet and along the Shelikof Strait. There is a known gray whale migration route through the Shelikof Strait in spring (April and May) (NOAA 1997). The ENP stock is an estimated size of 26,960 animals, with an estimated minimum of 25,849 (Muto et al. 2019).

The ENP stock feeds during the summer and fall in the Bering and Chukchi seas but have also been reported feeding along the Pacific Coast during their annual northern summer migration in waters off southeastern Alaska, British Columbia, Washington, Oregon, and California (Muto et al. 2019). An exception to these general feeding patterns is a small number of whales that summer and feed along the Pacific Coast between Kodiak Island and northern California (Muto et al. 2019). This stock breeds and calves in warmer, shallow waters in Baja, California, and Mexico (Muto et al. 2019). Northward migration, primarily of individuals without calves, begins in February; some cow/calf pairs delay their departure from the calving area until April (Muto et al. 2019).

Generally, gray whales arrive in the Gulf of Alaska between March and June, and typically depart in November and December (Consiglieri et al. 1982) but migrate past the mouth of Cook Inlet to and from northern feeding grounds. Most of the population follow the outer coast of the Kodiak Archipelago to the Kenai Peninsula in spring, or the Alaska Peninsula in fall (Consiglieri et al. 1982). This annual migration takes them past the mouth of Cook Inlet to northern feeding grounds in the Bering and Chukchi seas. Although most gray whales migrate past Cook Inlet on their way north, small numbers have been reported near Kachemak Bay (USDOI BOEM 2015). During National Marine Fisheries Service (NMFS) aerial surveys in Cook Inlet, gray whales were observed in June in 1994, 2000, 2001, 2005, and 2009 on the western side in Kamishak Bay (Shelden et al. 2013) near the project area. One gray whale was observed as far north as the Beluga River (Shelden et al. 2013).

Incidental boat-based observations made by ABR in spring and summer 2018 did not detect any gray whales in the EIS analysis area. Aerial transect surveys (focused on documenting northern sea otters and haulout locations) from Ursus Head south through Kamishak Bay to McNeil Cove in March, May, and June 2019 incidentally detected one gray whale northeast of Augustine Island (ABR 2019b).

Minke Whale

Minke whales (*Balaenoptera acutorostrata*) are most abundant in the Gulf of Alaska during summer, where they occupy localized feeding areas (Zerbini et al. 2006). Minke whales become scarce in the Gulf of Alaska in fall; most whales leave the region by October. Concentrations of minke whales have occurred along the north coast of Kodiak Island (and along the south coast of the Alaska Peninsula (Zerbini et al. 2006). Minke whales were scattered throughout the study area in all oceanographic domains (coastal, middle shelf, and outer shelf/slope) in 2002 and 2008 but were concentrated in the outer shelf and slope in 2010 (Friday et al. 2013).

No estimates have been made for the number of minke whales in the entire North Pacific. Results of surveys from 2010 provide a provisional abundance estimate of 2,020 mike whales on the eastern Bering Sea shelf (Muto et al. 2019). The current estimate for minke whales between Kenai Fjords and the Aleutian Islands is 1,233 individuals (Zerbini et al. 2006). The majority of these observations were in the Aleutian Islands rather than the Gulf of Alaska and in water shallower than 200 meters (Zerbini et al. 2006). Few minke whales were observed during three offshore Gulf of Alaska surveys for cetaceans in 2009, 2013, and 2015; therefore, a population estimate for the species in this area could not be determined (Rone et al. 2017).

During NMFS Cook Inlet-wide aerial surveys conducted from 1993 through 2004, minke whales were observed on three separate occasions (in 1998, 1999, and 2006) near Anchor Point, approximately 90 miles south of the project area (Shelden et al. 2013, 2015, 2017). A minke whale was also reported in the same general location in 2011 and 2013 (Owl Ridge 2014).

Incidental boat-based observations made by ABR in spring and summer 2018 documented four sightings of minke whales in Kamishak Bay, with three of them just offshore from Amakdedori port. Aerial transect surveys (focused on documenting northern sea otters and haulout locations) from Ursus Head south through Kamishak Bay to McNeil Cove in March, May, and June 2019 did not detect any minke whales (ABR 2019a, b, c).

Killer Whale

Killer whales (*Orcinus orca*) inhabiting Cook Inlet are thought to be a mix of resident and transient individuals from two different stocks: the Alaska Resident Stock; and the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock (Muto et al. 2019). Both stocks have the potential to occur in the project area. Alaska resident whales are found from southeastern Alaska to the Aleutian Islands and Bering Sea. Intermixing of Alaska residents have been documented among the three areas, at least as far west as the eastern Aleutian Islands (Muto et al. 2019). At least three communities of transient whales exist and represent three discrete populations in the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock: 1) Gulf of Alaska, Aleutian Islands, and Bering Sea Transients; 2) AT1 Transients; and 3) West Coast Transients (Muto et al. 2019). The Alaska Resident Stock is estimated at 2,347 individuals, with a minimum population estimate of 2,084 (Muto et al. 2019). The Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock is estimated at a minimum of 587 individuals (Muto et al. 2019).

On the west coast of North America, killer whales occur along the entire Alaska coast with seasonal and year-round occurrence noted (Muto et al. 2019). Movements of whales between geographical areas have been documented (Muto et al. 2019). Although recent studies have documented movements of Alaska resident killer whales from the Bering Sea into the Gulf of Alaska as far north as southern Kodiak Island, none of these whales have been photographed farther north and east in the Gulf of Alaska where regular photo-identification studies have been conducted since 1984 (Muto et al. 2019). Gulf of Alaska transients are documented throughout the Gulf of Alaska, including occasional sightings in Prince William Sound. AT1 transients are primarily seen in Prince William Sound and in the Kenai Fjords region (Muto et al. 2019). Aleutian Islands and Bering Sea killer whales are observed in the northern Bering Sea and Beaufort Sea (Muto et al. 2019).

Killer whales are occasionally observed in lower Cook Inlet, especially near Homer and Port Graham (Rugh et al. 2005), approximately 80 miles south of the project area. The availability of prey largely determines the likeliest times for killer whales to be in the area. During aerial surveys conducted between 1993 and 2004, killer whales were observed on only three flights, all in the Kachemak and English Bay area (Rugh et al. 2005). During NMFS aerial surveys, killer whales were observed in 1994 (Kamishak Bay), 1997 (Kachemak Bay), 2001 (Port Graham), 2005 (Iniskin Bay), 2010 (Elizabeth and Augustine Islands), and 2012 (Kachemak Bay; Shelden et al. 2013).

Incidental boat-based observations made by ABR in spring and summer 2018 documented two sightings of killer whales; both of them north of the mouth of the Seldovia River along the eastern side of Cook Inlet. Aerial transect surveys (focused on documenting northern sea otters and haulout locations) from Ursus Head south through Kamishak Bay to McNeil Cove in March, May, and June 2019 did not detect any killer whales (ABR 2019a, 2019b, 2019c).

Dall's Porpoise

Dall's porpoises are widely distributed throughout the North Pacific Ocean preferring deep offshore and shelf-slopes, and deep oceanic waters (Muto et al. 2019). The Dall's porpoise range in Alaska extends into the southern portion of the project area (Muto et al. 2019). Dall's porpoises (*Phocoenoides dalli*) are present year-round throughout their entire range, including the Cook Inlet area and Kamishak Bay (Morejohn 1979). Although there are distribution gaps in upper Cook Inlet (Muto et al. 2019), they are regularly observed throughout Cook Inlet (Nemeth et al. 2007), particularly during spring eulachon and summer salmon runs. They have been observed in lower Cook Inlet around Kachemak Bay (USDOI BOEM 2015), approximately 80 miles east of the project area. The abundance estimate for the Alaska stock of Dall's porpoise is 83,400 animals (Muto et al. 2019), making it one of the more abundant cetaceans in Alaskan waters. Vessel surveys were conducted in the northwestern Gulf of Alaska to document abundance and density of cetaceans in 2013 and 2015 (Rone et al. 2017). The surveys covered different, but overlapping, areas in the 2 years and estimated Dall's porpoise abundance in the Gulf of Alaska at 15,432 in 2013 and 13,110 in 2015.

Dall's porpoises are present during all months of the year throughout most of the eastern North Pacific, although there may be seasonal onshore-offshore movements along the west coast of the continental US (Muto et al. 2019). Dall's porpoises were observed on NMFS aerial surveys during June 1997 (Iniskin Bay, approximately 40 miles north of Amakdedori port), 1999 (Barren Islands, approximately 70 miles east of Amakdedori port), and 2000 (Barren and Elizabeth Islands, approximately 70 and 80 miles east of Amakdedori port, respectively, and Kamishak Bay) (Shelden et al. 2013).

Incidental boat-based observations by ABR in spring and summer 2018 documented two groups of Dall's porpoise, one group of eight in the middle of Cook Inlet, and one individual north of the natural gas pipeline corridor west of Augustine Island. Aerial transect surveys (focused on documenting northern sea otters and haulout locations) from Ursus Head south through Kamishak Bay to McNeil Cove in March, May, and June 2019 did not detect any Dall's porpoises (ABR 2019a, 2019b, 2019c).

Harbor Porpoise

In Alaskan waters, three stocks of harbor porpoises (*Phocoena phocoena*) are currently recognized: Gulf of Alaska, Southeast Alaska, and Bering Sea stocks (Muto et al. 2019). Porpoises found in Cook Inlet belong to the Gulf of Alaska Stock, which are distributed from Cape Suckling to Unimak Pass and most recently was estimated at 31,046 individuals with a minimum population estimate of 26,064 harbor porpoises (Muto et al. 2019).

Harbor porpoises primarily frequent the coastal waters of the Gulf of Alaska and Southeast Alaska, typically occurring in waters less than 100 meters deep (Muto et al. 2019). Harbor porpoises have been reported in lower Cook Inlet from Cape Douglas north to the West Foreland and offshore (Rugh et al. 2005). They have been frequently observed during aerial surveys in Cook Inlet; most sightings are of single animals and are concentrated at Chinitna and Tuxedni bays (north of the project area) on the western side of lower Cook Inlet as well as upper Cook Inlet (Shelden et al. 2014).

NMFS aerial surveys for beluga whales have documented harbor porpoise presence throughout Cook Inlet since 1993, except in 2002, 2003, 2006, and 2013. These surveys encompass the project area, and typically included Chinitna, Iniskin, and Iliamna bays and connecting coastline, which are all north of the project area.

Incidental boat-based observations by ABR in spring and summer 2018 documented several groups of harbor porpoises, primarily along the western edge of lower Cook Inlet west of Augustine Island, including several just south of Amakdedori port. Aerial transect surveys (focused on documenting northern sea otters and haulout locations) from Ursus Head south through Kamishak Bay to McNeil Cove in March, May, and June 2019 documented scattered harbor porpoises in Kamishak Bay and northeast of Augustine Island (ABR 2019a, b, c).

Harbor Seal

Harbor seals (*Phoca vitulina*) are common in Alaskan waters, with statewide abundance estimates at 152,602 (Muto et al. 2017). There are 12 recognized stocks of harbor seals in Alaska. The Cook Inlet/Shelikof Strait harbor seal stock range extends from Unimak Islands along the coast north into upper Cook Inlet and includes the project area. The current Cook Inlet/Shelikof Strait harbor seal stock population estimate is 27,386 individuals (Muto et al. 2019).

Harbor seals are found throughout the entire lower Cook Inlet coastline, hauling-out on beaches, islands, mudflats, and at the mouths of rivers where they whelp and feed (Muto et al. 2019). Montgomery et al. (2007) recorded more than 200 haulout sites in lower Cook Inlet alone. Harbor seal haulout areas occur in Kamishak Bay in close proximity to the project area, including the Amakdedori port. According to aerial surveys flown in August, October, April, and June from 2003 to 2005, both Kachemak and Kamishak bays consistently had high numbers of harbor seals across all seasons (Boveng et al. 2011). The shoreline around the proposed port at Amakdedori had very little use by harbor seals; however, several intertidal reefs directly offshore from the proposed port location had year-round use by low numbers of harbor seals, including use by pups (Boveng et al. 2011). Important harbor seal haulout areas occur in Kamishak and Kachemak bays and along the coast of the Kodiak Archipelago and the Alaska Peninsula. Chinitna Bay, Clearwater and Chinitna Creeks, Tuxedni Bay, Kamishak Bay, Oil Bay, Pomeroy and Iniskin Islands, and Augustine Island are also important spring-summer breeding and molting areas and known haulout sites (Boveng et al. 2012).

A strong seasonal pattern of more coastal and restricted spatial use has been documented during the spring and summer for breeding, pupping, and molting, and more wide-ranging seal movements in and outside of Cook Inlet during the winter months (Boveng et al. 2012). Large-scale patterns indicate that a portion of harbor seals tagged in Cook Inlet move out of the area in the fall, and into habitats in Shelikof Strait, north of Kodiak Island, and coastal habitats of the Alaska Peninsula, considerably south of the project area. In the fall, harbor seals are concentrated in Kachemak Bay on the eastern side of Cook Inlet, Iniskin and Iliamna bays on the western side of Cook Inlet, and south through the Kamishak Bay to Cape Douglas (Boveng et al. 2012). A portion of the Cook Inlet seals move into the Gulf of Alaska and Shelikof Strait during the winter months (London et al. 2012). Seals move back into Cook Inlet as the breeding season approaches (London et al. 2012).

NMFS has conducted annual aerial surveys for beluga whales in Cook Inlet since 1993, which encompass the project area; these surveys have included incidental sightings of harbor seals every year from 1993 to 2016. Bennett (1996) counted a maximum of 90 harbor seals hauled-out along tidal channels in inner Chinitna Bay during aerial surveys conducted from 1994 to 1996. Surveys in 1976 documented 400 harbor seals hauled-out on Gull Island in Chinitna Bay (Calkins 1979).

Incidental boat-based observations by ABR in spring and summer 2018 documented harbor seals throughout the area surveyed in Kamishak Bay, with the largest concentrations south of Amakdedori Creek around the mouth of Amakdedulia Cove. Harbor seals occurred primarily in nearshore waters and were present primarily in the summer; with lower densities in the spring, and much lower densities in the winter and late winter (ABR 2011d). Aerial transect surveys (focused on documenting northern sea otters and haulout locations) from Ursus Head south through Kamishak Bay to McNeil Cove in March, May, June, and October 2019 documented multiple harbor seal haulout locations (ABR 2019f). During the March survey, three harbor seal haulouts with approximately 177 seals were observed offshore from Amakdedori Creek in Kamishak Bay (ABR 2019f). The May survey documented 31 harbor seal haulouts, with approximately 652 seals concentrated primarily around Nordyke Island and Augustine Island

(ABR 2019f). The June survey documented 36 harbor seal haulouts with approximately 294 seals on land located around Nordyke Island, Amakdedulia Cove, Augustine Island, Bruin Bay, and by Fortification Bluff (ABR 2019f). The October 3, 2019 survey documented 373 harbor seals at 11 haulouts; the October 30, 2019 survey documented 458 seals at 20 haulout locations (ABR 2019f).

The NPS conduced an aerial survey of known seabird colonies in the lower portion of Kamishak Bay from the Kamishak Islands to Cape Douglas on June 30, 2018, and documented 401 harbor seals on Shaw Island (Griffin 2018).

Iliamna Lake Seal

A discrete (Burns et al. 2013) population of approximately 400 harbor seals inhabit the freshwater environment of Iliamna Lake (Boveng et al. 2016). The seals are currently managed as if they are part of the nearby Bristol Bay population; however, isotopes in teeth from four seals inhabiting Iliamna Lake indicated that the seals were born in Iliamna Lake and remained in the lake for life (Brennan et al. 2019). Seasonal shifts in abundance have been documented during several aerial surveys; surveys conducted in August produced the highest number of seals observed, and seals have been observed during all other months except March and December (Burns et al. 2016). Total counts of seals are the lowest from March through May and September through November; no surveys have been flown in January or February due to weather limitations (Burns et al. 2016). Seals have a need to haul out in late June and July for pupping and in August for molting; low numbers of seals in other months does not necessarily represent lower numbers of seals in the lake (Burns et al. 2016).

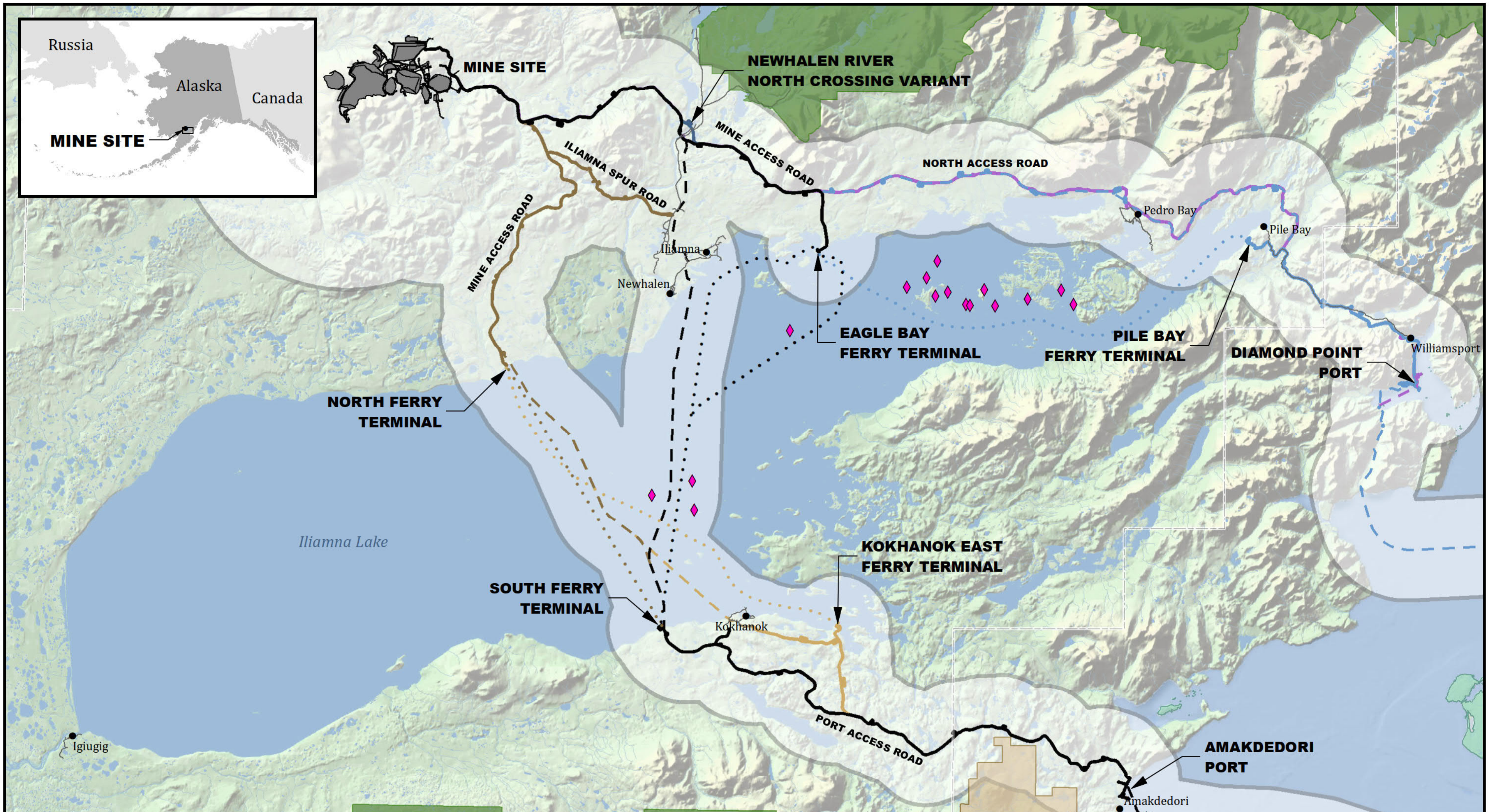
Iliamna Lake seals clearly exhibit distinct patterns of habitat and resource use compared to marine harbor seals (Brennan et al. 2019). Withrow et al. (2015) mapped known sites and a table of corresponding seal counts at those haulout sites from 1984 to 2014. Harbor seals have been observed hauled-out on 24 different islands in Iliamna Lake, exclusively in the eastern half of the lake and in the vicinity of the community of Pedro Bay (Figure 3.23-13). The seals have occasionally been observed around river mouths, but tend to show a strong preference for the eastern half of Iliamna Lake. Of the known haulout sites, 90 percent of all observations were recorded at four locations. A high percentage of pups (22 to 41 percent) were also documented at these same four sites during late July and early August.

In spring, when the ice breaks up, seals begin to redistribute broadly in Iliamna Lake. The peak date of births in Iliamna Lake was based on the peak percentage of pups found in aerial surveys of the lake during May through August of 2010 to 2013 (excluding 2012) (Burns et al. 2016). The average peak pup-count dates were determined to be anywhere from July 12 to July 20 (Boveng et al. 2016). When migrating salmon arrive in the summer and into autumn, seals may be found throughout the lake, but are especially common near and in spawning streams, including the lake's outflow, the Kvichak River where the seals intercept incoming spawning salmon, and along nearshore areas. In the fall, seals continue to haulout on sandbars, spits, and beaches and rocks of the islands used during the summer months (Burns et al. 2016). Also, seals concentrate at the mouths of rivers and creeks in Iliamna Lake where they feed on spawning salmon in the fall (Burns et al. 2016). Iliamna Lake seals are thought to overwinter in the lake (Boveng et al. 2016). The deeper, northeastern portion of the lake is the last to freeze and during the onset of winter, seals are hauled-out much less frequently (Burns et al. 2016). Interviews with residents of Iliamna Lake communities noted that mid-winter haulout locations were clustered around the islands and inlets in the northeastern portion of the lake, as well as along ice pressure ridges (Burns et al. 2016). The seals have been observed to maintain air holes in thin ice to surface to breath (Burns et al. 2016). However, the primary means by which seals survive in the winter is through a reliance on air gaps that form between the shore-fast ice layer and the surfaces of both the lake and dry ground, or ice caves (Burns et al. 2016). In the winter, the lake level is low enough along the shoreline to expose beaches, reefs, and sandbars that allow seals to use dry ground (Burns et al. 2016). In the winter, seals primarily feed on lake trout and other freshwater species of fish (Burns et al. 2016).

Iliamna Lake seals are almost always seen at the northeastern end of the lake on a series of islands and are seen much less in the southwestern end of the Lake (Burns et al. 2016). A few seals are occasionally observed in small areas of open water in the southwestern portion of the lake during the ice-cover period, such as the head of the Kvichak River at Igiugig (roughly 40 miles from the ferry route over Iliamna Lake near Kokhanok); however, these are not regular occurrences (Burns et al. 2013). There are known and potential haulout sites on islands found in the central portion of Iliamna Lake (Figure 3.23-13) (ABR 2011a). The primary seasonal factors influencing seals' behavior were the presence or absence of lake ice, the occurrence of salmon runs into and out of Iliamna Lake, and regional variation in ice conditions during winter (Burns et al. 2016).

Brennan et al. (2019) inferred lifelong residence of Iliamna harbor seals in the lake because the seals do not have a fully marine diet; stomach contents from harvested seals in Iliamna Lake contained no evidence of marine prey items. Brennan et al. (2019) estimated that the maximum amount of time that a seal could have spent eating fully marine fish in the marine environment of Bristol Bay ocean or nearshore waters to be approximately 2 weeks. Iliamna Lake seals forage mainly on salmonids (salmon, trout, char, and grayling), but also forage heavily on lamprey, smelt, sculpin, whitefish, and stickleback (Hauser et al. 2008). Residents reported that crushed shells are often found inside the guts of harvested seals, suggesting seals feed on freshwater clams and snails; however, secondary ingestion may account for these observations (Burns et al. 2016). Large, known seal feeding sites are found in the northeastern portion of Iliamna Lake, on the beaches between UTC and lower Talarik Creek, along the shores on either side of Kokhanok, and at the mouth of the Kvichak River (Burns et al. 2016). Isotopes in teeth suggest that earlier in life, seals relied principally on lake food resources and had a primarily freshwater diet (Brennan et al. 2019); later in life, seals shifted to rely more heavily on seasonally abundant sockeye salmon (Brennan et al. 2019), proven in the observations of seal scat and seal-killed salmon during the spawning season (Hauser et al. 2008). These seals are reliant on lake resources, implying an adapted ability to exploit a food web unlike that of the marine harbor seal.

Specific to the project, components in Iliamna Lake that would intersect with habitat occupied by Iliamna Lake seals include the south ferry terminal, the Eagle Bay ferry terminal, and the ferry route between the two. The small islands around the Eagle Bay ferry terminal are used by Iliamna Lake seals for foraging and for summer and winter hauling-out. The area between Eagle Bay and the south ferry terminal contains several early spring pressure cracks and seal haulout sites, as well as some winter pressure cracks and haulout sites. One island offshore from Eagle Bay is a known seal pupping location (Seal Island III, 0.7 mile from the ferry transit route) (Burns et al. 2016). Therefore, the area around Eagle Bay is used year-round by Iliamna Lake seals. The south ferry terminal is a known seal feeding site and seal pups have been observed along the shore near the mouth of the Gibraltar River. The ferry between the south ferry terminal and the Eagle Bay ferry terminal would transit 0.6 mile to the west of Seal Island II, which is a known summer feeding and haulout location, a winter haulout, and a pupping location (Burns et al. 2016). Therefore, the area around both ferry terminals, along with the ferry route, is used by Iliamna Lake seals for different reasons throughout the year.



Sources: PLP 2020-RFI168; PLP 2019-RFI153; PLP 2008

US Army Corps of Engineers

5 0 5 10
Miles

Analysis Area
Iliamna Lake Seal Haul-out Location (2005-2008)

Action Alternatives
Ferry Routes
Natural Gas Pipelines
Alternative 1a
Alternative 1
Alternative 1 Kokhanok East Ferry Terminal Variant
Alternative 2
Alternative 2 Newhalen River North Crossing Variant
Alternative 3

Other Features
Roads
Borough Boundary
State Game Refuge/Sanctuary
National Wildlife Refuge
National Park

ILIAMNA LAKE SEAL HAULOUTS

PEBBLE PROJECT EIS

FIGURE 3.23-13

California Sea Lion

Since the early 1970s, California sea lions (*Zalophus californianus*) have been observed in increasing number in southeastern Alaska waters (Maniscalco et al. 2004). The increase in detections may be a result of foraging-range expansion north along the Pacific Coast as their population continues to grow in their breeding range (primarily the Channel Islands in southern California). Most of the sea lions observed in the summer and fall have been non-breeding subadult males or females. In Alaska, California sea lions have been observed during all seasons of the year and have usually been associated with Steller sea lion haulouts and rookeries. So far, no California sea lions have been detected in Cook Inlet and the closest recorded location has been the Chiswell Islands (Maniscalco et al. 2004). There is a potential for supply barges to encounter California sea lions in the shipping lanes in southern Alaska.

Northern Sea Otter

Northern sea otters occur year-round throughout lower Cook Inlet (Garshelis 1987), which spans southwest from North Foreland to the inlet mouth between English Bay and Cape Douglas. Two stocks of sea otters occur in Cook Inlet: the Southwest and Southcentral. See Section 3.25, Threatened and Endangered Species, for a discussion of the federally listed Southwest stock, which occurs along the western side of Cook Inlet. The Southcentral Alaska Stock extends from Cape Yakataga to the eastern shoreline of lower Cook Inlet, including Prince William Sound, Kachemak Bay, and the Kenai Peninsula coast (Allen and Angliss 2014; USFWS 2014d); the stock is mostly localized to Kachemak Bay, and south and east of Prince William Sound (Gill et al. 2009). The southcentral stock is discussed because the natural gas pipeline corridor overlaps with the eastern part of Cook Inlet where the stock occurs.

A series of aerial surveys conducted between 2000 and 2010 was used to estimate the current overall Southcentral Alaska Stock population size. The combined population estimate is 18,297 sea otters for the Southcentral Alaska stock (USFWS 2014d). Three regions have been surveyed in Cook Inlet: the North Gulf of Alaska (estimated 428 sea otters), the Cook Inlet/Kenai Fjords (estimated 2,673sea otters), and Prince William Sound (estimated 11,989 sea otters) (USFWS 2014d). Overall abundance assessments show a stable or increasing trend (USFWS 2014d); the Kachemak Bay population in particular experienced a 26 percent annual increase between 2002 and 2008 (Gill et al. 2009). This stock typically occurs at low densities throughout its range, with the exception of Kachemak Bay (Gill et al. 2009; USFWS 2014d). Observations of groups smaller than 10 sea otters from the Southcentral Alaska Stock have occurred along the coast up to Clam Gulch (Rugh et al. 2005; Gill et al. 2009; Garlich-Miller et al. 2018). However, during the winter months, sea otters are not typically observed (USFWS 2014d). USFWS conducted aerial surveys in May 2017 in all areas of Cook Inlet south of approximately 60°16′30″ N in the 40-meter depth contour, including Kachemak Bay in southeastern Cook Inlet and Kamishak Bay in southwestern Cook Inlet. (Garlich-Miller et al. 2018). Total abundance was estimated to be 19,889 sea otters (Garlich-Miller et al. 2018). The Western Cook Inlet survey yielded a total abundance estimate range from 9,665 to 11,600 sea otters (Garlich-Miller et al. 2018). The average density estimate of sea otters on the western side was 2.25 per square kilometer (Garlich-Miller et al. 2018). Most observations occurred between Cape Douglas and Chinitna Bay and the highest sea otter densities (up to 8 sea otter per square kilometer) in Kamishak Bay, west and north of Augustine Island (Garlich-Miller et al. 2018). Sea otters were relatively scarce north of Chinitna Bay, and no sea otters were observed north of Chisik Island (Garlich-Miller et al. 2018).

The mean abundance estimate for eastern lower Cook Inlet was 5,998 sea otters and the average density was 1.89 sea otters per square kilometer. The highest densities of sea otters in eastern lower Cook Inlet were found along the north shore of Kachemak Bay and in Port Graham (Garlich-

Miller et al. 2018). Northern sea otter population densities in central lower Cook Inlet between the Kenai and Alaska peninsulas have generally been reported as low, potentially due to the 100-kilometer stretch of open water between the two peninsulas, with water depths around 100 meters (USFWS 2005). Surveys conducted by the USFWS in May of 2017 showed low numbers of sea otters and density estimates in the middle inlet (Garlich-Miller et al. 2018).

Sea otters are found in nearshore coastal waters, typically in water around 40 meters deep to maintain consistent access to benthic foraging habitat (Riedman and Estes 1990). Sea otters remain in their home range year-round and are forced to move in and out of protected bays in the winter months due to the bays freezing over. Sea otters typically forage in nearshore waters at depths up to 131 feet in the nearshore benthos of rocky and soft-sediment communities (Marshall 2014). Approximately 40 percent of sea otters' daily activity is spent foraging, and they primarily feed on benthic invertebrates, including mussels, crabs, urchins, sea cucumbers, and clams. Sea otters encountered on the eastern Cook Inlet portion of the pipeline route would be considered part of the Southcentral stock. Sea otters encountered at the Amakdedori port site, lightering locations, and western portion of the pipeline route would be considered part of the Southwestern stock.

3.23.2 Alternative 1

The main differences between Alternative 1 and Alternative 1a are that the mine access road for Alternative 1 travels south from the mine site to the north ferry terminal and includes a spur road to Iliamna (Iliamna spur road). In addition, the natural gas pipeline corridor through Iliamna Lake would take a more direct route from the south ferry terminal to the north ferry terminal. Finally, the Kokhanok East Ferry Terminal Variant is the only variant with new geographical areas slightly north of the port access road under Alternative 1a. There are no major differences with the layout of the mine site that necessitate a new discussion of baseline conditions at the mine site for terrestrial wildlife species. Only geographic areas along the transportation corridor and natural gas pipeline corridor that were not previously detailed for Alternative 1a are discussed. Surveys that overlapped with the mine access road were primarily conducted in 2004 and 2005 by ABR during the environmental baseline surveys for the mine site. Complete details are provided in ABR 2011a and summarized below. Wildlife surveys around the port access road that overlap with the Kokhanok East Ferry Terminal Variant were conducted by ABR in 2018 and are also summarized below (ABR 2018g through 2018l).

3.23.2.1 Transportation and Natural Gas Pipeline Corridor

Raptors

Raptor data along the mine access road were collected by ABR during surveys in 2004 and 2005 and are included in the mine site section above under Alternative 1a and shown on Figure 3.23-1. The main species documented along the mine access road include bald eagles along UTC, osprey, and cliff-nesting raptors such as gyrfalcons and rough-legged hawks. Based on surveys in 2004 and 2005, bald eagles were the major raptor species nesting in trees along the Newhalen River. Nesting on the hills and bluffs to the west of the Newhalen River were several cliff-nesting species, including golden eagle, gyrfalcon, rough-legged hawk, and common ravens (Figure 3.23-1). Several of these nests were in close proximity to the mine access road. One bald eagle nest was less than 0.5 mile from the Iliamna spur road. There are no known raptor nests within a mile of the north and south ferry terminals. There is one bald eagle nest more than 2 miles southwest of the south ferry terminal. Two bald eagle and one golden eagle nests are less than a mile away from the Kokhanok spur road (Figure 3.23-1 and Figure 3.23-14).

Specific to the Iliamna spur road crossing of the Newhalen River, there was one bald eagle nest in a tree approximately 0.4 mile north of the bridge across the Newhalen River. Aerial surveys in 2005 found the nest to be inactive. One other bald eagle nest was found approximately 0.85 mile north of the bridge and was active during surveys in 2005 and in 2019 (ABR 2019d). There were no other raptor nests in a 1-mile radius of the bridge crossing of the Newhalen River for the Iliamna spur road.

Waterbirds

This section details the waterbirds present in the transportation corridor and natural gas pipeline corridor for areas outside of the mine survey area (discussed above under Alternative 1a). This includes the mine access road, Iliamna spur road, the north and south ferry terminals, and the Kokhanok East Ferry Terminal Variant based on surveys conducted by ABR in 2004 and 2005 (ABR 2011a), as well as data from 2018 surveys along the port access road (ABR 2018b-h).

Waterbird data north of Iliamna Lake that encompass the mine access road and Iliamna spur road were collected primarily 2005 during surveys in the mine survey area (and methods are described above under the mine site for Alternative 1a). During spring 2005 surveys, there were groups of waterbirds in scattered waterbodies (including along the UTC) around the mine access road ranging from one to 25, and 26 to 100 (Figure 3.23-2). Slightly higher abundances were recorded along the Newhalen River, with around 101 to 250 birds. During fall migration in 2005, concentrations of waterbirds occurred primarily along the UTC and Newhalen River, with no waterbirds recorded in the waterbodies along the north shore of Iliamna Lake (Figure 3.23-3). No groups of swans or geese were observed staging in the area during fall; only brood-rearing groups and adult swans as singles and pairs. The northern part of Iliamna Lake (near creek outflows) supported large concentrations of staging and migrating waterbirds, primarily during spring. Overall, waterbirds occur primarily along the UTC, Newhalen River, and the waterbodies along the northern shore of Iliamna Lake.

Landbirds and Shorebirds

No specific landbird or shorebird surveys were conducted along the mine access road or the Iliamna spur road for Alternative 1. Instead, detailed point-counts were conducted in the mine site and along the transportation corridor (detailed under Alternative 2). Avian surveys in 2005 (for the Alternative 2 transportation corridor) overlapped with a portion of the mine access road where the Iliamna spur road connects to the existing road heading south to the town of Iliamna. The point-count survey methods for conducting landbird and shorebird surveys are detailed under Alternative 1a. The survey area for the transportation corridor in 2005 was 2,000 feet wide and extended from the mine site along the northern side of Iliamna Lake to the Cook Inlet. Only the portion that overlaps with the Iliamna spur road is analyzed in this section. In this section of the analysis area, 15 point-counts (all around the Newhalen River) were conducted in June 2005. The wildlife habitats east of the mine site in the transportation corridor and natural gas pipeline corridor include a large percentage of Upland and Lowland Spruce and Moist Mixed Forest. These wildlife habitats support a slightly different assemblage of bird species that are more dependent on forested habitats. Ten landbird species were considered abundant in the area, including Wilson's warbler, orange-crowed warbler, Swainson's thrush (*Catharus ustulatus*), yellow-rumped warbler (*Setophaga coronata*), golden-crowned sparrow, dark-eyed junco (*Junco hyemalis*), ruby-crowned kinglet (*Regulus calendula*), American robin (*Turdus migratorius*), varied thrush (*Ixoreus naevius*), and hermit thrush (*Catharus guttatus*). Wilson's warbler, orange-crowned warbler, and Swainson's thrush were the most abundant. The two most frequently observed breeding shorebirds were greater yellowlegs and Wilson's snipe. Upland and Lowland Moist Mixed Forest, Upland and Lowland Spruce Forest, and Riverine Moist Mixed Forest supported the highest numbers of breeding landbird and shorebird species.

Landbird and shorebird species along the Kokhanok East Ferry Terminal Variant are similar to those for the port access road, detailed above under Alternative 1a.

Terrestrial Mammals

The mine access road, Iliamna spur road, and Kokhanok East Ferry Terminal Variant are in GMU 9B. Wildlife surveys for the mine access road and Iliamna spur road were conducted as part of the mine study area detailed above for Alternative 1a. Wildlife species detected were the same as those described for Alternative 1a. Specifically, several moose were detected along the north shore of Iliamna Lake and along the lower UTC. Several brown bears were also detected along the lower UTC and nearby streams, particularly in August. Several brown bear dens were detected in close proximity to the mine access road at higher elevations (as opposed to lower marshy areas around the north shore of Iliamna Lake). Few terrestrial mammals were recorded along the Iliamna spur road, with the exception of a black bear on the western side of the Newhalen River. Caribou use of the area is described previously under Alternative 1a; however, the marshy area on the north shore of Iliamna Lake does not appear to be a major use area.

Small Terrestrial Vertebrates

Specific surveys for small terrestrial vertebrates have not been conducted for the mine access road, Iliamna spur road, and Kokhanok East Ferry Terminal Variant. However, the same small mammal species and furbearers listed in Table 3.23-1, discussed under Alternative 1a, are anticipated to occur with abundance in proportion to their respective habitats. In addition, wood frogs would be expected to occur in freshwater ponds along the transportation and natural gas pipeline corridor, although specific surveys have not been conducted at these locations.

Marine Mammals

The only marine mammal species that is known to occur along the transportation corridor and natural gas pipeline corridor for Alternative 1 (outside of Cook Inlet) that is different from Alternative 1a is the Iliamna Lake seal. The most detailed data regarding Iliamna Lake seal are in Burns et al. 2016, and discussed in Alternative 1a. Per Burns et al. (2016), the south ferry terminal near the mouth of the Gibraltar River and near Kokhanok is a known feeding location and seal pup location. The south ferry terminal is approximately 1.7 miles to the southwest from the Gibraltar River mouth, where seal pups have been observed. The entire region around the south ferry terminal is a known seal feeding area. The north ferry terminal, especially around the UTC river mouth, is also a known feeding area. There are no documented seal haulout islands between the north and south ferry terminals that would be transited by the ferry. The closest seal haulout island is approximately 3.5 miles north of the ferry route (Figure 3.23-13). Under the Kokhanok East Ferry Terminal Variant, the ferry would transit past at least three known seal haulouts (including a seal pupping location at Seal Island II [Burns et al. 2016]) between 1.2 and 3 miles away (Figure 3.23-13).

3.23.3 Alternative 2—North Road and Ferry with Downstream Dams

The mine site footprint is similar (apart from minor acreage and footprint differences detailed in Chapter 2, Alternatives) between Alternative 1a and Alternative 2, with no expected differences in wildlife species presence, abundance, or distribution. Therefore, the affected environment is considered the same for the mine site and not repeated here. The major differences in the affected environment between Alternative 1a and Alternative 2 are the north road and ferry that traverse the northern side of Iliamna Lake, and end at the Diamond Point port at Iliamna Bay. The Alternative 1a transportation corridor analysis area ends at the Eagle Bay ferry terminal. Wildlife resources that occur along the mine access road for Alternative 1a and overlap with the western half of the mine access road for Alternative 2 are previously discussed under Alternative 1a. This section focuses on wildlife resources in the transportation corridor and natural gas pipeline corridor east of the Eagle Bay ferry terminal along the ferry route through the eastern portion of Iliamna Lake and the port access road from the Pile Bay ferry terminal to Diamond Point port. It includes wildlife resources around the Eagle Bay and Pile Bay ferry terminals, and those that occur along the transportation and natural gas pipeline corridor between the port at Diamond Point and Eagle Bay.

The most recent comprehensive biological surveys of the Alternative 2 area were conducted by ABR, primarily between 2004 and 2006, with additional surveys conducted up until 2012. These surveys are detailed in the various chapters of the EBD (ABR 2011a, 2011c, 2011d, 2013a, 2013b, 2015a, 2015b, 2015c) and are summarized briefly below. The species-specific sections below provide details of the specific survey methods and a summary of the results. The area where biological surveys were conducted for the EBD (referred to as the transportation corridor survey area) extends approximately from the Newhalen River east along the northern shore of Iliamna Lake to Williamsport, and then along the western edge of Cook Inlet to Chinitna Bay. The transportation corridor survey area included a section of land between the northern edge of Iliamna Lake and the base of the nearby mountains (Roadhouse and Knutson mountains) to the north of the lake. Specific to the project, the survey area included the area around Eagle Bay, Pedro Bay, Pile Bay, Diamond Head, Williamsport, Cottonwood Bay, Iliamna Bay, and Iniskin Bay. Therefore, the entire terrestrial portion of Alternative 2 was surveyed, apart from the portion of the natural gas pipeline corridor from Ursus Cove to Diamond Point. The only survey conducted in this section was an aerial raptor nesting platform survey in 2012, as detailed below.

3.23.3.1 Birds

Project-specific avian surveys conducted by ABR in 2004 and 2005 are the most comprehensive surveys that have been conducted for the region along the northern and eastern edge of Iliamna Lake from the mine site to Cook Inlet (ABR 2011a, 2011c, 2011d). Additional avian surveys were conducted up until 2012, primarily along the western side of Cook Inlet in the area around Iliamna and Iniskin bays, and Ursus Cove.

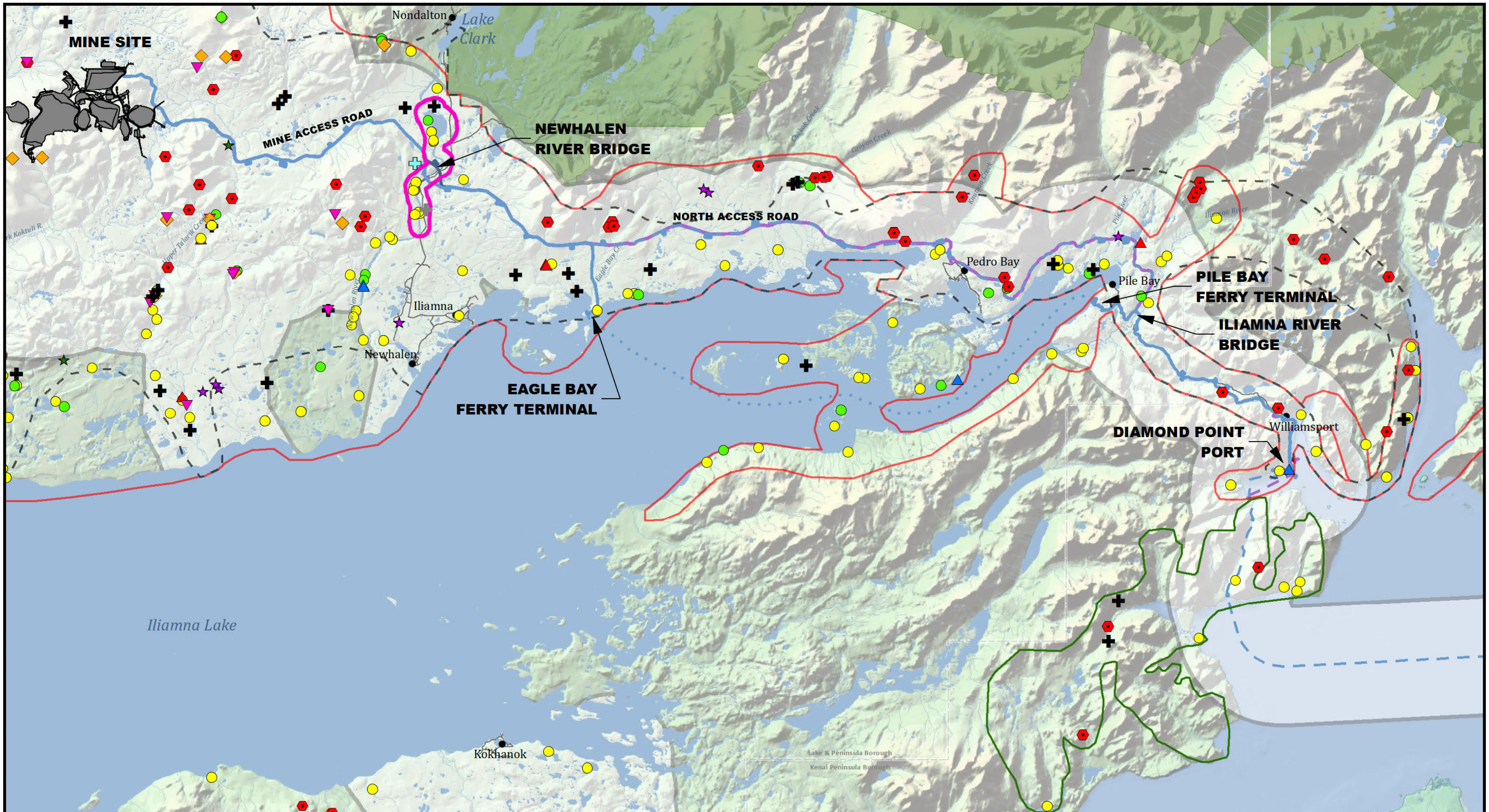
Raptors

Raptor surveys were conducted in 2004 and 2005 for all large tree- and cliff-nesting raptor species. Winter surveys for bald eagles were conducted in 2005 and 2006. Bald eagles were the most abundant nesting species (43 percent of all nests), followed by golden eagles (19 percent of nests), with low numbers of nesting common ravens, osprey, peregrine falcon, gyrfalcon, rough-legged hawk, great horned owl, and red-tailed hawk (ABR 2011a, c) (Figure 3.23-14). The greatest densities of tree-nesting raptors were along the Newhalen and Iliamna rivers and along the shoreline of Iliamna Lake. Scattered bald eagle nests were also distributed on various islands in the eastern edge and along shoreline of Iliamna Lake. The greatest densities of cliff-nesting raptors were found in Canyon Creek and along the southern edge of the Alaska Range north of Iliamna Lake (Figure 3.23-14). Around Roadhouse Mountain, four golden eagle nests were located within approximately 1 mile of a material site. In the reach north of Pedro Bay, at least four golden eagle nests were found less than 0.5 mile from the northern side of the corridor, along with several bald eagle nests slightly farther away along the shore of Iliamna Lake. Near Cook Inlet, most bald eagle nests were in the trees along the coastline or in the lower reaches of rivers draining into Iliamna Lake and Cook Inlet. One bald eagle nest was approximately 0.5 mile east of the Eagle Bay ferry terminal and 660 feet south of the access road. One peregrine falcon nest and several bald eagle nests were detected around Diamond Point. Two golden eagle nests were along the steep cliffs around Williamsport, less than 0.5 mile from the transportation corridor and natural gas pipeline corridor, with one nest 0.28 mile from a material site (Figure 3.23-14). The peregrine falcon nest at Diamond Point was approximately 500 feet to the west of the proposed road to Diamond Point. In September 2012, additional surveys were conducted by ABR for nesting raptors (ABR 2013a). One bald eagle nest in a tree was immediately adjacent to the Diamond Point port (Figure 3.23-14). An additional bald eagle and one golden eagle nest were found in the valley between Ursus Cove and Cottonwood Bay, adjacent to the natural gas pipeline corridor (ABR 2013a).

Specific to the Newhalen River Bridge for the Alternative 2 transportation corridor and natural gas pipeline corridor, there are two potential bridge crossings. The Newhalen River North Crossing Variant contained one active bald eagle nest (per 2019 surveys; ABR 2019d) approximately 1.3 miles north of the northern bridge abutment in a spruce tree. The nest was approximately 1 mile north from a material site for the Alternative 2 mine access road up the Newhalen River. Additional bald eagle nests were found south of the southern crossing location, as detailed under Alternative 1a.

Specific to the Iliamna River bridge, raptor surveys were conducted in 2004 (ABR 2011a). In the vicinity of the bridge location, one bald eagle nest (inactive in 2004) was found approximately 0.7 mile upstream along the Iliamna River.

During surveys for wintering congregations of bald eagles around Iliamna Lake, bald eagles were detected in February and November 2005, and November and December 2006, with a drastic decline in numbers by mid-winter, suggesting that the area is not heavily used as a wintering area for bald eagles (ABR 2011a).



Sources: PLP 2005, 2018, 2019, PLP 2020-RFI168; 2019-RFI153; ABR 2013

US Army Corps of Engineers

4 0 4 8
Miles

Analysis Area

Nest Species
- Bald Eagle
- Common Raven
- Golden Eagle
- Great Horned Owl
- Gyrfalcon
- Merlin
- Osprey
- Peregrine Falcon
- Red-tailed Hawk
- Rough-legged Hawk
- Unidentified Owl
- Unidentified Raptor

Survey Area
- 2004
- 2005
- 2012
- 2019

Action Alternatives
- Ferry Routes
- Natural Gas Pipelines

- Alternative 2
- Alternative 2 Newhalen River North Crossing Variant
- Alternative 3

Other Features
- Roads
- Borough Boundary
- National Wildlife Refuge
- National Park

RAPTOR NESTS NEAR THE ALTERNATIVE 2 AND ALTERNATIVE 3 TRANSPORTATION AND NATURAL GAS PIPELINE CORRIDORS

FIGURE 3.23-14

Waterbirds

The Iliamna Lake region of the Alaska Peninsula is an important migration route for many species of waterbirds moving to and from breeding areas in western and northern Alaska (Conant and Groves 2005). Waterbird surveys were conducted along the transportation corridor and natural gas pipeline corridors by ABR in 2004 and 2005, with a 2006 survey for swans. Thirty-four species of swans, ducks, loons, cranes, and gulls were observed, with 14 of them recorded as breeding in the area. Waterbirds used lakes, rivers, and bays for staging during spring and fall migration. During spring migration, most swans, geese, and dabbling ducks arrived by late April to early May and staged along rivers and areas of open water on lakes and bays of Iliamna Lake (Figure 3.23-15). The highest concentrations were along the Newhalen River at Three-Mile Lake, Goose Cove, and in Chekok Bay. Other locations where species staged included the floodplain of the Iliamna River, and Eagle, Fox, and Pile bays. Diving ducks arrived in mid- to late-May, and staged in large flocks in Whistlewing Bay, Alexcy Lake, and on the Iliamna and Newhalen rivers (ABR 2011a).

During fall migration, waterbirds congregated in many of the same locations as in spring, with additional concentrations of gulls and mergansers on Iliamna Lake at Knutson and Pile bays, and along the southern shore of the lake (Figure 3.23-16). The highest numbers of birds were detected along the lower reaches of the Iliamna River and the southern shore of Iliamna Lake.

Thousands of ducks and gulls were observed during fall surveys, with high duck abundance during mid-August to mid-October (ABR 2011a). In contrast to the vast numbers of ducks and gulls, no groups of swans or geese were observed staging during the fall; only local groups that bred in the area were observed. Overall, there were low numbers of grebes, cormorants, cranes, and shorebirds during spring and fall migrations periods in 2004.

Tundra swans were documented breeding between Chekok Creek and the Newhalen River, with more nests observed in 2005 between UTC and the Newhalen River north of Iliamna Lake. Several tundra swan nests (four nests in 2004 and two in 2005) were observed around the Newhalen River, primarily on the eastern side in the greater floodplain area of the river (Figure 3.23-15). Swans returned to the same territories on subsequent years and were on nests by early May. One pair of trumpeter swans (*Cygnus buccinator*) that bred locally was observed near the Pile River, which is near the western edge of their breeding range.

Harlequin duck pairs were found along streams flowing into Iliamna Lake, with broods on Stonehouse Lake, and on the Newhalen, Pile, and Iliamna rivers.

Common loons were found on deep and large lakes between UTC and the Iliamna River, with most brood locations near the Newhalen and Iliamna rivers. Both Pacific and red-throated loons were uncommon, and no nests or broods were documented.

The marine waters of Iliamna, Cottonwood, and Iniskin bays are important year-round habitat for a variety of waterbird species. A list of all avian species detected in this area during biological surveys from 2004 to 2008 is provided in ABR 2011d. Three main types of surveys were conducted in the marine environment around the Alternative 2 analysis area. These include boat-based nearshore and offshore surveys, fixed-wing surveys, and helicopter-based surveys, as detailed below.

Boat-based nearshore surveys were conducted from summer 2004 to spring 2006. The most commonly detected waterbird species (more than 1,000 birds detected), in decreasing order of abundance across all surveys, were: glaucous-winged gull (9,317 birds), harlequin duck (3,809 birds), greater scaup (1,958 birds), long-tailed duck (1,714 birds), Barrow's goldeneye (1,140 birds), and green-winged teal (1,040 birds) (ABR 2011d). Boat-based offshore surveys from summer 2004 to spring 2006 documented fewer birds; when all surveys were totaled, white-winged scoters (356 birds), glaucous-winged gulls (263 birds), and long-tailed ducks (172 birds) were the most abundant.

Nine fixed-wing aircraft marine surveys were conducted during spring and fall 2004. When all nine surveys were totaled, gulls were the most common group (3,656 unidentified and 1,457 glaucous-winged gulls), followed by unidentified scoters (2,942 birds) and surf scoters (670 birds). Waterbird numbers were higher during fixed-winged surveys in spring and fall 2005, when 11 surveys were conducted. Figure 3.23-17 shows the maximum number of birds from fixed-wing marine surveys in spring 2005 and fall 2005. Large numbers of waterbirds were detected in both spring and fall 2005, primarily in Iniskin Bay, with estimates of several thousand birds. In spring 2005, higher densities of waterbirds were near the mouth and middle of Iniskin Bay; in fall 2005, higher densities were further back in Iniskin Bay. The most abundant species were gulls (15,399 unidentified and 1,899 glaucous-winged gulls), surf scoters (10,084 birds), unidentified scoters (8,804 birds), unidentified scaup (4,430 birds), mallards (3,248 birds), and white-winged scoters (2,237 birds). Fixed-wing aircraft marine surveys by ABR from summer 2004 to spring 2006 documented similar results from previous surveys, which indicated that the number of birds using Iliamna and Iniskin bays is substantial. In the mid-1970s, the largest wintering concentration of seaducks in all of lower Cook Inlet occurred in Iniskin Bay; Iliamna and Iniskin bays contained a large concentration of summering scoters. Gulls, dabblers, and scaup concentrated in Iniskin and Chinitna bays in the summer (Erikson 1977). Agler et al. (1995) also documented large concentrations of birds on the western side of lower Cook Inlet in summer, and the number of wintering birds (primarily waterfowl) in Iliamna and Iniskin bays was the highest in western Cook Inlet.

During helicopter-based marine surveys in fall 2006 through 2008, high waterbird densities (518 to 1,748 birds per square mile) were documented at ends of Cottonwood, Iliamna, and Iniskin bays and near Knoll Head, at the mouth of Iniskin Bay (ABR 2011d). During helicopter-based mid-winter marine surveys from 2006 to 2008, pockets of high bird densities (259 to 518 birds per square mile) were recorded in Iniskin Bay. During late winter and spring 2006 to 2008, bird densities were still high, with some birds in the middle of Iliamna Bay, and other birds near the mouths of Iliamna and Iniskin bays and the nearby rock islands. The highest numbers of bird species during winter months from late February 2006 to early December 2006 were long-tailed ducks (2,051 birds), glaucous-winged gulls (1,704 birds), and harlequin ducks (667 birds). Surveys in 2007 from late January through the middle of December documented a total of 8,114 unidentified gulls, 5,564 long-tailed ducks, 3,276 unidentified scoters, 3,060 surf scoters, and 2,168 black scoters, among others (ABR 2011d; ABR 2015c). Fewer surveys were conducted in early and late winter 2008, but results showed lower numbers of birds of similar species composition to previous surveys.

To summarize the waterbird surveys, ABR (2011d, 2015c) recorded 70 species of birds in marine waters of Cook Inlet, including Iliamna, Iniskin, and Chinitna bays. The greatest number of bird species and density occurred in spring (primarily due to large numbers of shorebirds). Large numbers of waterfowl migrate through the area in spring and fall, and a substantial number of birds winter in the protected bays, especially seaducks. The highest densities of birds in spring and summer occur in nearshore waters and near the mouths of the bays, while the highest densities in winter occur in the offshore waters of the bays (ABR 2011d).

For seabirds, the rocky shoreline, adjacent cliffs, islands, and rock outcrops around Iliamna and Iniskin bays provide important breeding habitat. Many of the nesting colonies are in areas protected as part of the Alaska Maritime National Wildlife Refuge. Some of the first intensive surveys of this area in 1976 detected the following species breeding around the mouths of Iliamna and Iniskin bays: common eider (*Somateria mollissima*), double-crested cormorant, pelagic cormorant, black oystercatcher (*Haematopus bachmani*), glaucous-winged gull, pigeon guillemot, horned puffin, and tufted puffin (Erikson 1977). The North Pacific Seabird Data Portal (an online database of seabird colony population numbers from various surveys[1]) includes several seabird colonies in this area. These are South Head, White Gull Island, North Head, Knoll Head, Toadstools, Entrance Rock, Vert Island, Scott Island, Mushroom Islets, Iniskin Island, Twin Rocks, Pomeroy Island, and Oil Reef (Figure 3.23-10; USFWS 2012b). Several of these islands (White Gull Island, Vert Island, Iniskin Island, and Pomeroy Island) had greater than 500 breeding birds in the late 1970s (ABR 2011a ; Erikson 1977). In total, breeding birds around Iliamna and Iniskin bays in 1976 and 1978 totaled 4,172 birds. ABR resurveyed many of these islands and the surrounding area and observed 1,264 and 1,585 breeding birds in 2004 and 2005, respectively (ABR 2015c). The main differences in bird abundance between the 1970s and the 2004 and 2005 surveys were a drastic decrease in the number of breeding tufted puffins, and a smaller decrease in the number of most other species. The only species that increased in abundance between the 1970s and in the mid-2000s were red-faced cormorant and mew gull; neither species was documented breeding in the 1970s (ABR 2015c). Overall, since the 1970s, the number of breeding seabirds has declined drastically, with the most recent surveys documenting 1,740 to 1,195 birds in 2011 and 2012, respectively (ABR 2015c). Seabird colony densities from June 2011 and June 2012 are shown on Figure 3.23-10. In June 2011, the most commonly detected species with nests were glaucous-winged gulls (467 nests), followed by tufted puffins (109 nests), unidentified puffins (59 nests), pelagic cormorants (30 nests), and double-crested cormorants (13 nests). In June 2012, the most commonly detected species with nests were glaucous-winged gulls (242 nests), pigeon guillemot (13 nests), tufted puffin (11 nests), and pelagic cormorant (11 nests). Since the 1970s, numbers of nesting double-crested cormorants, common eiders, glaucous-winged gulls, pigeon guillemots, and tufted puffins have shown declines. Tufted puffin populations have declined by approximately 97 percent, and double-crested cormorants by 88 percent. One potential cause of decline may have been a collapse of Pacific herring (*Clupea harengus*) in the region (ABR 2015c).

A supplemental reconnaissance-level waterbird survey was conducted in September 2012 between Iniskin and Bruin bays (ABR 2013b). This survey covered the area of the natural gas pipeline corridor between Ursus Cove and Cottonwood Bay. Several groups of waterbirds were in the river delta at the end of Ursus Cove, but no waterbirds were detected along the creek between Ursus Cove and Cottonwood Bay (ABR 2013b).

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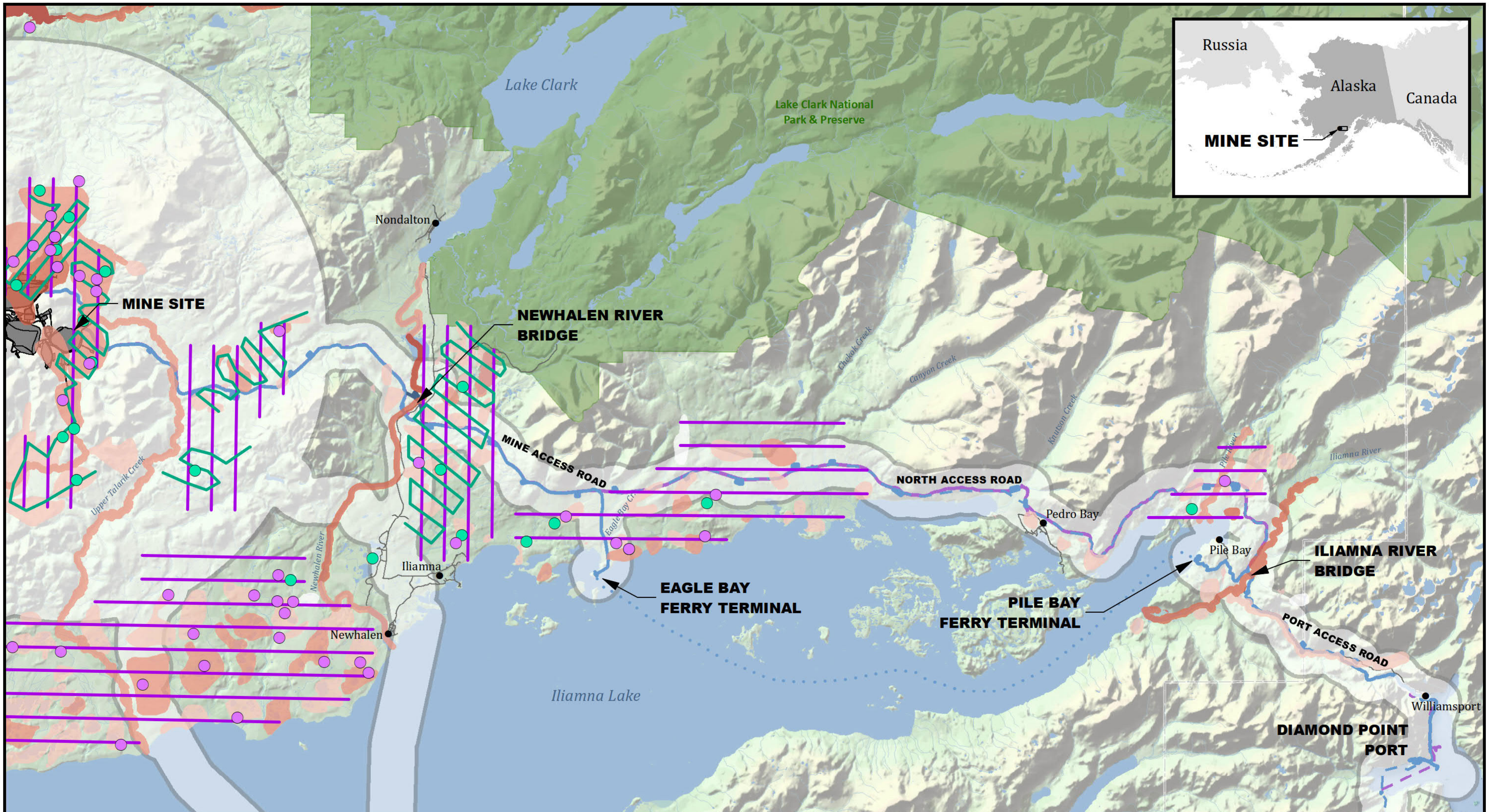
[1] Analyses and conclusions contained in this document are based wholly or in part on information obtained from the North Pacific Pelagic Seabird Database. The author(s) have complied with published guidelines for the ethical use of data.



Sources: PLP 2005, 2018; PLP 2020-RFI168; 2019-RFI153

US Army Corps of Engineers

3 0 3 6
Miles

Analysis Area

Maximum Number of Birds
- 0
- 1 - 25
- 26 - 100
- 101 - 250
- 251 - 500

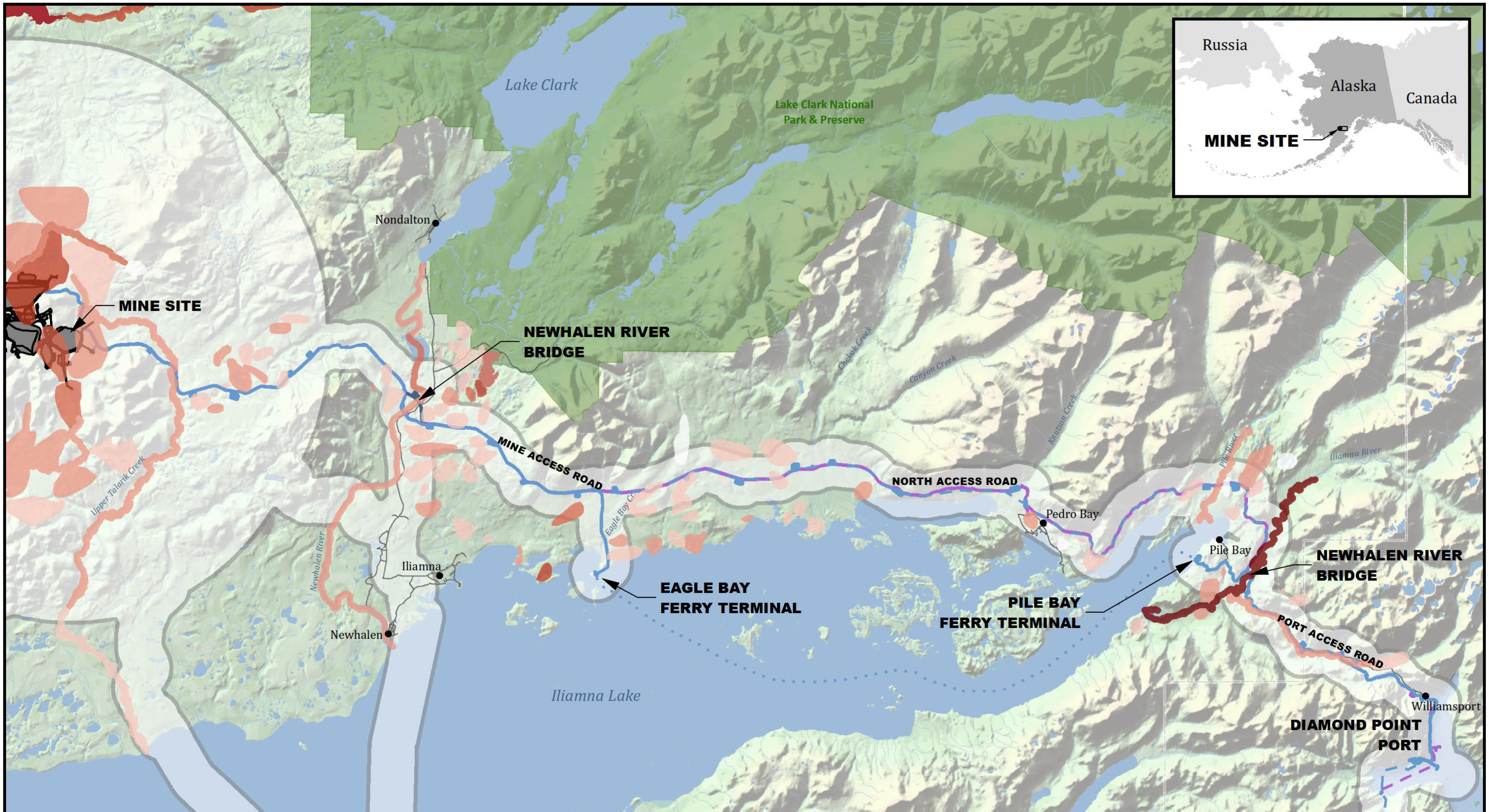
Swans
- 2004 Swan Nest
- 2005 Swan Nest
- 2004 Survey Transect
- 2005 Survey Transect

Action Alternatives
- Ferry Routes
- Natural Gas Pipelines

- Alternative 2
- Alternative 2 Newhalen River North Crossing Variant
- Alternative 3

Other Features
- Roads
- Borough Boundary
- National Wildlife Refuge
- National Park

WATERBIRD STAGING AND SWAN NESTS NEAR THE ALTERNATIVE 2 AND ALTERNATIVE 3 TRANSPORTATION AND NATURAL GAS PIPELINE CORRIDORS, SPRING 2005



Sources: PLP 2005, PLP 2020-RFI168; 2019-RFI153

US Army Corps of Engineers

3 0 3 6
Miles

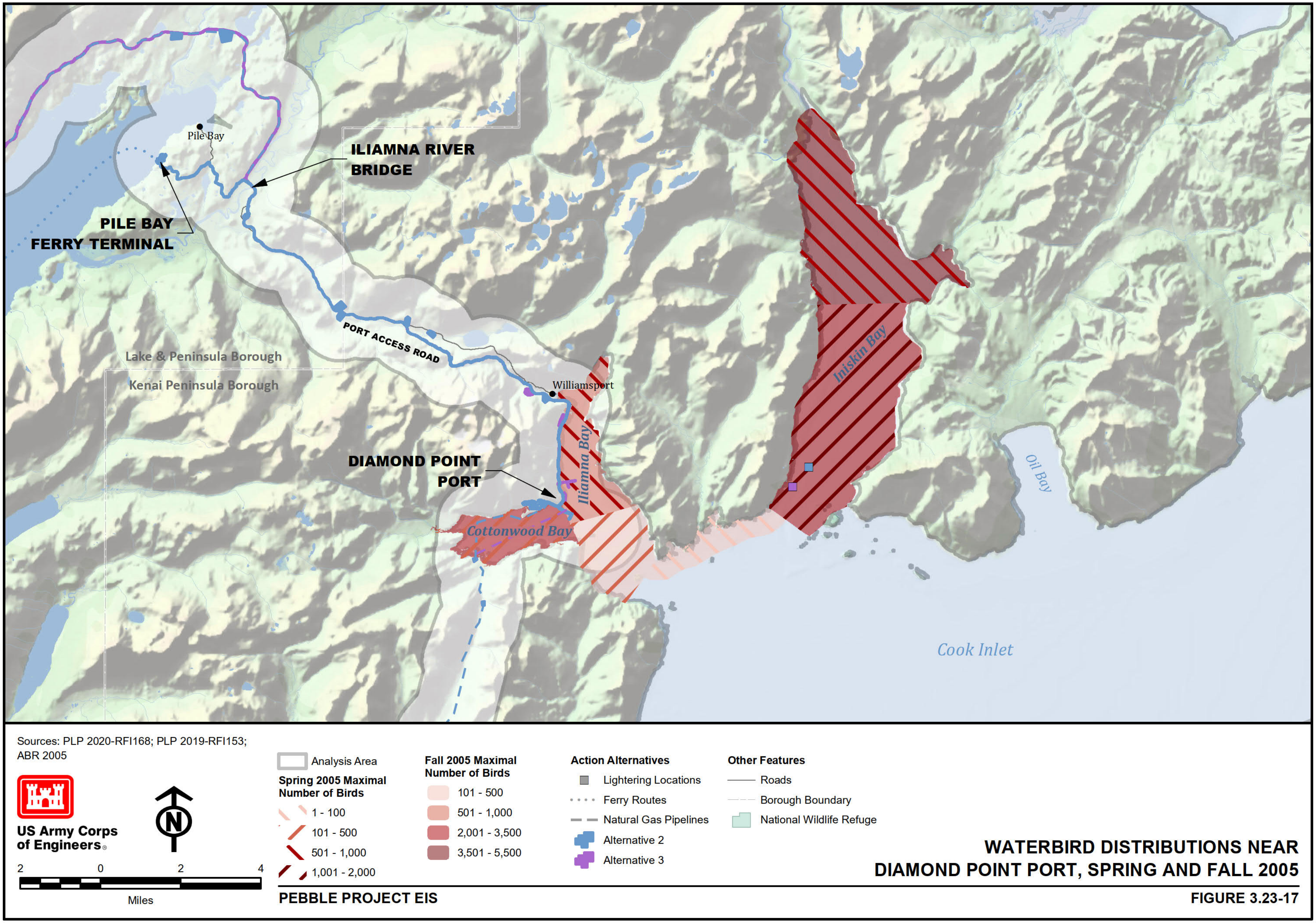
Analysis Area

Maximal Number of Birds
- 0
- 1-25
- 26-100
- 101-250
- 251-500
- 501-1000
- 1001-2000

Action Alternatives
- Ferry Routes
- Natural Gas Pipelines
- Alternative 2
- Alternative 2 Newhalen River North Crossing Variant
- Alternative 3

Other Features
- Roads
- Borough Boundary
- National Wildlife Refuge
- National Park

WATERBIRD STAGING NEAR THE ALTERNATIVE 2 AND ALTERNATIVE 3 TRANSPORTATION AND NATURAL GAS PIPELINE CORRIDORS, FALL 2005



WATERBIRD DISTRIBUTIONS NEAR DIAMOND POINT PORT, SPRING AND FALL 2005

PEBBLE PROJECT EIS

FIGURE 3.23-17

Landbirds and Shorebirds

Point-count surveys were conducted throughout the transportation corridor in June 2005 and consisted of 154 point-count locations. The habitat types with the highest bird abundance (more than five birds per point count) were Riverine Moist Mixed Forest, Riverine Low Willow Scrub, Upland and Lowland Moist Mixed Forest, Upland and Lowland Spruce Forest, Upland Moist Tall Alder Scrub, and Upland Moist Low Willow Scrub. Forty-six species of landbirds (mainly passerines) and seven shorebird species were recorded. Warblers were the most abundant birds, followed by thrushes, waxwings, sparrows and allies, finches, and kinglets. Lower numbers of flycatchers, woodpeckers, swallows, corvids, shrikes, chickadees, nuthatches, and sandpipers were recorded.

The 10 most common landbird species, in descending order of abundance, were: Wilson's warbler, orange-crowned warbler, Swainson's thrush, yellow-rumped warbler, golden-crowned sparrow, dark-eyed junco, ruby-crowned kinglet, American robin, varied thrush, and hermit thrush. Greater yellowlegs and Wilson's snipe were the two most common species, comprising 92 percent of all shorebird detections. Seven of the 53 landbird and shorebird species detected are considered species of greatest conservation need in Alaska (ADF&G 2015a), and include olive-sided flycatcher, gray-cheeked thrush, varied thrush, blackpoll warbler, rusty blackbird, American golden-plover, and solitary sandpiper. Olive-sided flycatchers were considered common (25 detections) and were detected in upland and lowland coniferous and mixed forest. Gray-cheeked thrush were considered common (26 detections) and were most frequently detected in Upland Moist Tall Alder Scrub. They were less common in Riverine Moist Mixed Forest and Upland and Lowland Spruce Forest. Varied thrush were considered abundant (91 detections) and were frequently found in coniferous and mixed forests in upland, lowland, and riverine areas, including Upland Moist Tall Alder Scrub. Blackpoll warblers were also considered common (52 detections) and were observed in Riverine Moist Mixed Forest and riverine tall alder or willow scrub. Rusty blackbird was uncommon (three detections) and was detected in Upland and Lowland Moist Mixed Forest. American golden-plover was uncommon (one detection); one solitary sandpiper was incidentally detected (ABR 2011a).

The nearshore marine waters of Iliamna, Cottonwood, and Iniskin bays are important year-round habitat for a variety of shorebird species, primarily during spring migration. Surveys conducted from 2006 to 2012 documented a wide variety of species in Iliamna and Iniskin bays, with the highest numbers of shorebirds moving through the area in early May on their northern spring migration. Surveys from summer 2004 through spring 2006 documented the numbers and species of shorebirds in Iliamna and Iniskin bays. On May 3, 2005, more than 5,000 shorebirds were recorded in Iliamna and Iniskin bays (ABR 2011c). During spring 2006, the most common shorebirds were western sandpiper (5,682 birds), followed by unidentified sandpipers (17,322 birds), and dunlin (2,157 birds) (ABR 2011c). These birds fed on the mudflats at the back end of Iniskin Bay. Low numbers of rock sandpipers (generally less than 200 birds) also used the bays during fall, winter, and spring from late October through late April; however, they were most abundant in November, when a high of 406 was observed in early November 2006 (ABR 2015c). The largest flocks of rock sandpipers were found foraging on the soft-sediment substrates of inner Iliamna and Iniskin bays.

The only breeding shorebird species detected around Iliamna and Iniskin bays was the black oystercatcher. This species bred in low numbers among the rocky edges around the bay and surrounding areas; seven nests were recorded in 2011 and five nests in 2012 (ABR 2015c). Data from 1976 and 1978 documented 42 black oystercatchers in the area, and surveys in 2005 documented 41 birds; therefore, numbers had remained relatively constant (ABR 2011c).

3.23.3.2 Terrestrial Mammals

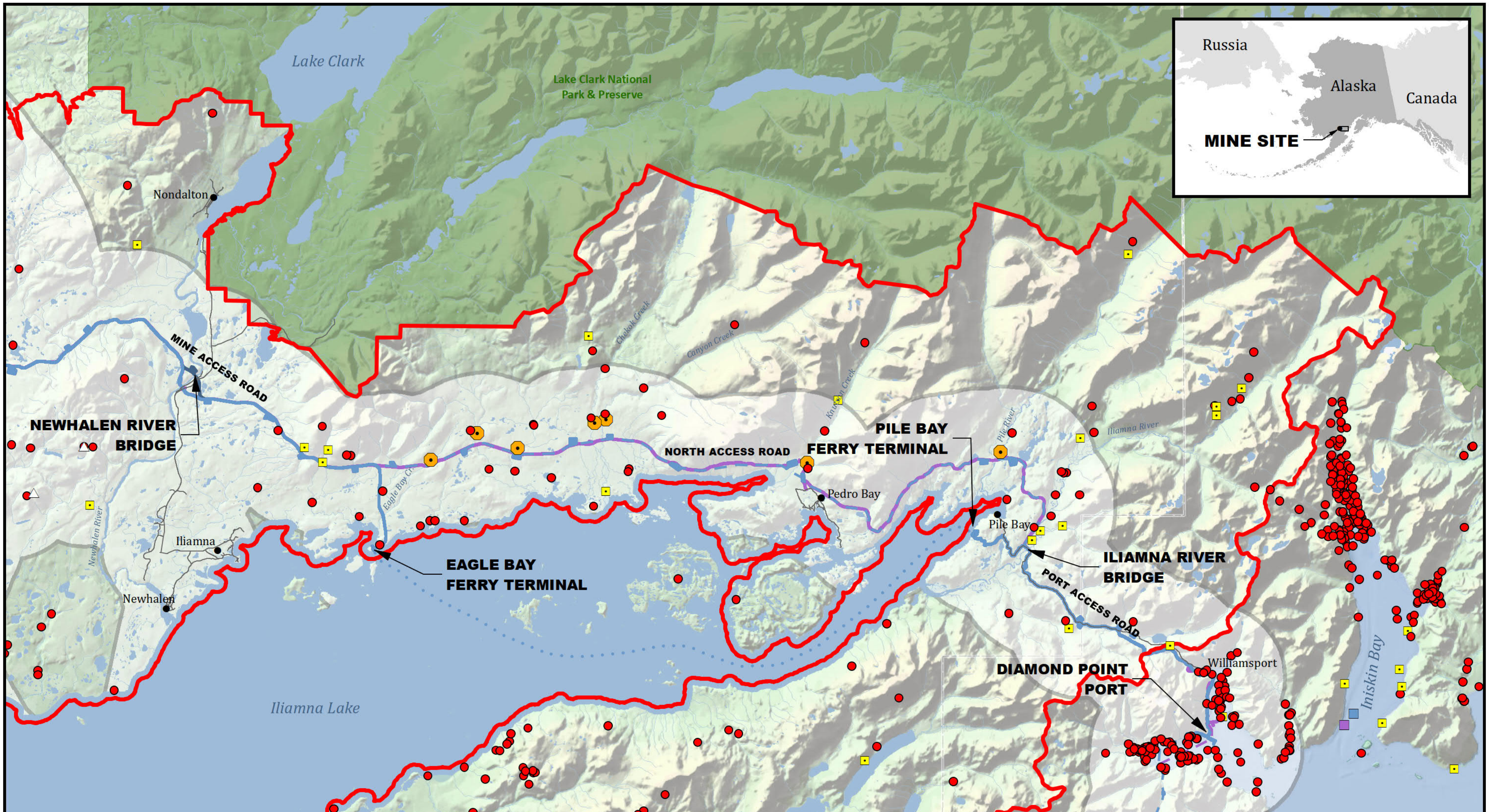
Large Mammals

Very few caribou were observed during wildlife surveys in 2004 or 2005; the steep coastal mountains that dominate the area are not preferred caribou habitat (ABR 2011a; ABR 2011d). A few caribou were around the Newhalen River; both radio and satellite-collared data (given previously described limitations) indicate the species is uncommon along the north shore of Iliamna Lake.

Moose were detected throughout the survey area in low densities, with the greatest local densities east of Roadhouse Mountain. Most moose were observed at lower elevations along the Pile River and Chekok Creek. The estimated density of moose in the transportation corridor area was 0.13 moose per square mile (ABR 2011a). Historical surveys in late March 1992 in the area between the Newhalen River and Williamsport showed an estimated density of 0.18 moose per square mile, and 0.41 moose per square mile in the area between the mine site and Iniskin Bay (ABR 2011a).

The transportation corridor is in an area of transition between substantially higher coastal densities of brown bears and lower inland densities. Historical surveys have estimated 50 bears per 386 square miles in GMU 9B (excluding Lake Clark National Park and Preserve and Katmai National Park and Preserve) (Butler 2005). A more rigorous survey from May 1999 to 2000 estimated 38.6 brown bears per 386 square miles in GMU 9B North, including the area east of Iliamna Lake and Lake Clark National Park and Preserve (Becker 2003; Butler 2007a). The line-transect bear survey in May 2009 (Becker 2010), which encompassed the transportation corridor survey area (plus a large area around Iliamna Lake), resulted in two different brown bear estimates based on different models, ranging between 47.7 and 58.3 brown bears per 386 square miles.

Bear surveys around the eastern part of Iliamna Lake to Diamond Point and Iliamna and Iniskin bays between 2004 and 2007 documented high densities of brown bears, particularly along the Iniskin River and the end of Iniskin Bay (Figure 3.23-18; ABR 2011c). Brown bears were also detected in lower numbers around Cottonwood and Iliamna bays. Large numbers of brown bears were observed in the sedge meadows and mudflats at the heads of Iniskin and Chinitna bays during spring and summer each year, with the highest numbers in June (ABR 2011c). Seasonal use of these coastal areas throughout the year and potential bear aggregations are not well surveyed or documented. Brown bears shifted to salmon-spawning streams later in July and August, which are primarily in the eastern portion of the survey area (ABR 2011a). Little evidence was found of bears digging clams, with only one observation of this behavior in May 2006. Brown bears were observed fishing for salmon in Iniskin River and Portage Creek in Iniskin Bay. Overall, brown bears were concentrated foraging on vegetation early in the summer and transitioned to salmon later in the summer and fall, following the seasonal salmon runs in the area.



Sources: PLP 2005, PLP 2020-RFI168; 2019-RFI153

US Army Corps of Engineers

3 0 3 6
Miles

Analysis Area

Observations (2004 - 2009)

Black Bear

Brown Bear

Brown Bear Den (2004 - 2006, 2010)

May 2009 Bear Density Survey Area

Wildlife Camera Location

Action Alternatives

Lightering Locations

Ferry Routes

Natural Gas Pipelines

Alternative 2

Alternative 2 Newhalen River North Crossing Variant

Alternative 3

Other Features

Roads

Borough Boundary

National Wildlife Refuge

National Park

BEAR OBSERVATIONS AND DENS NEAR THE ALTERNATIVE 2 AND ALTERNATIVE 3 TRANSPORTATION AND NATURAL GAS PIPELINE CORRIDORS

From July through September 2012, ABR conducted a study of bear activity, using time-lapse cameras placed near the location where the transportation corridor and natural gas pipeline would cross UTC to capture bear activity along the stream. Overall, little bear use was recorded on photographs, but bear activity peaked from late July to early August. The highest level of activity occurred late in the evening. Despite the abundance of salmon in UTC, it did not appear that the location where the camera was placed was important to foraging bears during daylight and twilight hours (ABR 2015a). Additional cameras were placed along seven anadromous streams on the north shore of Iliamna Lake, from Roadhouse Mountain to the Pile River. Bear use reflected salmon run timing, with the highest activity from late July to early August. Small, shallow streams with high numbers of spawning salmon were the preferred foraging areas. The highest level of activity occurred during early morning and late evening, but bears spent limited time fishing in the portions of the river in the camera's viewshed, according to the time-lapse photography (ABR 2015a).

Black bears were more common in the area north and east of Iliamna Lake than in other locations around Iliamna Lake (Figure 3.23-18); their density estimate from 1999 to 2000 for GMU 9B North was 76.7 black bears per 386 square miles (with most bears in the northernmost portion of the subunit) (Becker 2003). Most black bears were observed in the eastern part of the survey area around the Iliamna River. Time-lapse cameras placed along salmon-spawning streams in 2012 did not document any black bears.

Few wolves were detected during surveys along the northern shore of Iliamna Lake to Diamond Point, but tracks from a pack of six individuals were noted during late fall 2004 along Chekok Creek (ABR 2011a). A lone wolf was incidentally detected along the Iliamna River. Therefore, the species is anticipated to occur in low numbers in the transportation corridor and natural gas pipeline corridor.

Beavers were recorded west of the Newhalen River, along the Pile and Iliamna rivers and west of Pile Bay north of Iliamna Lake.

<u>Small Terrestrial Vertebrates</u>

Small mammals were incidentally recorded during surveys in 2004 and 2005. Species detected included red fox, river otter, wolverine, and coyote (ABR 2011a). No particular spatial distribution for these species was noted because most were incidental detections, and dense vegetation made observations for less visible species difficult.

Wood frog studies were not conducted for the transportation corridor and natural gas pipeline corridor or the Diamond Point port. The species is expected to occur in suitable habitat in ponds, lakes, streams, and other waterbodies along the north shore of Iliamna Lake to Cook Inlet.

3.23.3.3 Marine Mammals

Alternative 2 includes a ferry route across Iliamna Lake (Figure 3.23-18), which does not affect the species descriptions in this section, with the exception of harbor seals, which occur year-round, primarily in the eastern portion of Iliamna Lake. A general description of marine mammals in the project area is provided above. Where there are differences between species' distribution and habitat use, or specific sightings during surveys identified during literature review between Alternative 1a and the other alternatives, further discussion is provided.

Gray Whale

Gray whales migrate past the mouth of Cook Inlet to and from northern feeding grounds (Muto et al. 2019). Although most gray whales migrate past Cook Inlet, small numbers have been noted by people fishing near Kachemak Bay and north of Anchor Point (USDOI BOEM 2015). During boat-based nearshore (Iliamna, Iniskin, and Chinitna bays) surveys, one gray whale was recorded off-transect in the summer of 2004 near the mouth of Iniskin Bay (ABR 2011d). ABR (2019b) documented one gray whale northeast of Augustine Island near the natural gas pipeline corridor during recent aerial surveys in Kamishak Bay for northern sea otters.

Minke Whale

Minke whales are migratory in Alaska, but have been recently observed off Cape Starichkof and Anchor Point throughout the year (Muto et al. 2019). Surveys conducted in Iliamna, Iniskin, and Chinitna bays did not record any observations of minke whales (ABR 2015c). A single minke whale was recorded just inside the entrance to Iliamna Bay in 2006 (ABR 2015c) and no minke whales were recorded during ABR surveys in Kamishak Bay in 2019 (ABR 2019f).

Killer Whale

Killer whales are observed seasonally and year-round in waters of Alaska. Killer whales are occasionally observed in lower Cook Inlet, especially near Homer and Port Graham (Rugh et al. 2005). During NMFS aerial surveys, killer whales were observed in 1994 and 1997 in Kamishak Bay; in 2005 in Iniskin Bay; and in 2010 in the Elizabeth and Augustine Islands (Shelden et al. 2013). A single killer whale was recorded near North Head at the mouth of Iliamna Bay in 2009 (ABR 2015c). To date, this is the only record of this species on all aerial and boat-based surveys conducted for the project (ABR 2015c; ABR 2019f).

Dall's Porpoise

Throughout most of the eastern North Pacific, Dall's porpoise are present during all months of the year. Dall's porpoises were observed on NMFS aerial flights during the month of June in 1997 (Iniskin Bay), 199 (Barren Island), and 2000 (Elizabeth Island, Kamishak Bay, and Barren Island) (Shelden et al. 2013). During surveys of the northern portion of the analysis area between 2006 and 2012, ABR (2015c) observed one Dall's porpoise near North Head in 2009. No Dall's porpoises were recorded during ABR surveys in Kamishak Bay in 2019 (ABR 2019f).

Harbor Porpoise

The harbor porpoise frequently has been observed during summer aerial surveys of Cook Inlet, with most sightings of individuals concentrated at Chinitna and Tuxedni bays on the western side of lower Cook Inlet (Rugh et al. 2005). During helicopter-based surveys of the northern portion of the EIS analysis area between 2006 and 2012, harbor porpoises were observed in Iniskin, Iliamna, and Chinitna bays, as well as offshore; however, they were most common near the mouths of Iliamna and Iniskin bays (ABR 2015c), all north of the project area. Harbor porpoises exhibited seasonality in abundance and inter-annual variation in abundance (ABR 2015c). There was a pronounced increase in the number and frequency of observations of harbor porpoises in the spring; specifically, in late April and May. Harbor porpoises were recorded in every month except for January, June, and October, although in generally low numbers and with a low frequency of observations (ABR 2015c). ABR (2019f) documented scattered harbor porpoises on the western side of Augustine Island near the alternate lightering location during 2019 aerial surveys in Kamishak Bay.

Harbor Seal

Both Iliamna and Iniskin bays had moderate to high numbers of harbor seals, with high numbers of seals recorded near the mouth of Iniskin Bay based on aerial surveys conducted from June 2003 through October 2005 (Boveng et al. 2011). In particular, the many small islands at the mouth of Iniskin Bay hosted an estimated 230 seals in April, 849 in June, 102 in August, and 350 in October (Boveng et al. 2011).

ABR conducted marine mammal surveys in Iliamna, Iniskin, and Chinitna bays between 2004 and 2008 (ABR 2011d). Harbor seals were recorded during all seasons and were the most abundant marine mammal encountered (ABR 2011d). During the boat-based surveys, harbor seals occurred primarily in nearshore waters and were present primarily in the summer, with lower densities in the spring, and much lower densities in the winter and late winter (ABR 2011d). During offshore boat-based surveys, harbor seals were observed in the spring surveys in low densities, but higher in the summer, early winter, and late winter (ABR 2011d). In the spring, harbor seals occurred mostly in the nearshore waters, with only one recorded in the offshore area (ABR 2011d). The seals occurred throughout the entire bay systems, but were commonly hauled-out on the mudflats in upper Iniskin Bay. In the summer, harbor seals were primarily observed on the islands near the mouth of the bays, and secondarily on the mudflats in upper Iniskin Bay. In early winter, few seals were seen during the offshore surveys; those that were seen during the nearshore surveys were concentrated in the bays and secondarily on the mudflats in upper Iniskin Bay (ABR 2011d). In the late winter, few seals were seen during the offshore surveys; the seals that were seen during the nearshore surveys were concentrated on the Iniskin Islands. Few seals were seen in the bays, likely due to ice presence (ABR 2011d).

During the fixed-wing aircraft surveys described above, the highest counts of harbor seals were during July and August. Most seals were recorded on the Iniskin Islands, but some seasonal variation occurred, especially with respect to the increased numbers hauled-out on Gull Island in Chinitna Bay (ABR 2011d). During 2019 aerial surveys of Kamishak Bay, ABR documented many harbor seals hauled-out around Augustine Island, including a few in Ursus Cove and at Fortification Bluff (ABR 2019b, c).

Iliamna Lake Seal

Detailed information from Burns et al. 2016 regarding the distribution of Iliamna Lake seals, especially around the Eagle Bay ferry terminal is provided under Alternative 1a. Iliamna Lake seals are primarily found in the northeastern half of Iliamna Lake; however, depending on the time of year, stage of fish migrations, and state of ice cover on the lake, seals may be distributed throughout the lake (Burns et al. 2013).

The highest use of haulouts was in the Flat/Seal Island group (southwest of Pedro Bay) and the Thompson Island group (north of Kokhanok) (Figure 3.23-13) (ABR 2011a). Two haulout locations identified during aerial surveys accounted for two-thirds of all the seals observed in Iliamna Lake (ABR 2011a).

In winter, the number of seals observed is relatively low because the vast majority of the lake surface freezes solid in winter, but is greatest in the northeastern parts of the lake (Burns et al. 2013). Small areas of water remain open, particularly in the northeastern portion of the lake where harbor seals most commonly occur (Figure 3.23-13) (Boveng et al. 2016). Pupping and nursing occur in June through August, taking place at haulout sites in the northeastern half of the lake (Burns et al. 2013) near Pedro Bay.

Specific to components for Alternative 2 that occur in the eastern portion of Iliamna Lake, the Pile Bay ferry terminal would be approximately 3 miles north of the mouth of the Iliamna River, which is a major feeding area and summer and winter haulout site. The ferry would transit south of Porcupine Island and go directly past a known seal pupping location and lake trout and other non-salmon fish feeding area. The ferry route would transit past summer and winter haulout locations, feeding areas, and other year-round use areas (Burns et al. 2016).

California Sea Lion

As described above under Alternative 1, California sea lions have been appearing in Alaskan waters in increasing frequency. No California sea lions have been documented in Iliamna or Iniskin bays, because they have not yet been documented in Cook Inlet. There is, however, a potential for supply barges to encounter California sea lions in the shipping lanes in southern Alaska.

Northern Sea Otter

The federally listed southwestern stock of northern sea otter occurs along the western side of lower Cook Inlet, where the Diamond Point port and western portion of the natural gas pipeline would be. This stock of sea otters is discussed under Section 3.25, Threatened and Endangered Species. The non-listed southcentral stock occurs along the eastern side of Cook Inlet. This stock of sea otters, which overlaps with the eastern portion of the natural gas pipeline near the Kenai Peninsula, is discussed above under Alternative 1.

3.23.4 Alternative 3—North Road Only

There are no new geographic areas that are exclusive for Alternative 3—North Road Only that are not previously detailed under Alternative 1a or Alternative 2. Although Alternative 3 includes a road along the northern side of Iliamna Lake, the affected environment would be the same geographical area as for Alternative 2, which would have a natural gas pipeline in the same location as the Alternative 3 access road. The main difference is that the Alternative 3 north road would be a wider permanent footprint compared with the natural gas pipeline; and the dock at Diamond Point would be a caisson design (with a maintenance dredge area). One additional difference between Alternative 2 and Alternative 3 is that the caisson dock for Alternative 3 would be 1 mile north (in Iliamna Bay), compared with the dock at Alternative 2, which is at the confluence of Cottonwood and Iliamna bays. Therefore, the affected environment for Alternative 2 and Alternative 3 is virtually the same. The affected environment descriptions associated with all other components of this alternative are previously described under Alternative 1a and Alternative 2.

3.23.5 Climate Change

Climate change trends are common to all alternatives and their variants, and are therefore discussed collectively. Potential impacts from climate change on bird species are closely tied to changes in the physical and biological environment, including water resources (e.g., timing of spring thaw, freezing, ice/snow cover) and vegetation changes. Changes to vegetation from climate change are discussed in Section 3.26, Vegetation, and would directly impact avian communities. Changes in temperature, precipitation, their level of intensity, and the timing of these changes have the potential to impact avian species. Waterbird and shorebird species may experience a shift in habitat availability due to increased thawing that may permit the habitat to become available earlier in the season. Increased storm surges may also alter the habitat through increased erosion and an influx of salt water. Warmer winters may permit an expansion of spruce bark beetles, which would attract various woodpecker species but result in forest habitat loss. Some species, such as ptarmigan that depend on adequate snow cover to survive winter, are likely to be adversely impacted. There is the potential for trophic mismatch where seasonally timed migration events and reproduction are not synchronized with vegetation and insect population fluctuations. Overall, some bird species may increase in abundance, while others may decline due a warming climate.

3.23.5.1 Birds

The response of seabirds to fluctuations in forage fish density has been a point of research interest for the past several decades, in response to potential impacts from the *Exxon Valdez* oil spill and warming ocean conditions. Since the late 1970s, seabirds in the Gulf of Alaska have exhibited signs of food stress that reveal an overall regime shift in the physical and biological environment of the Gulf of Alaska that has been coincident with a major shift in the fish community compositions (Piatt 2002). To address the concern that ecological conditions in the Gulf of Alaska would not favor recovery of damaged seabird populations, the relationship between oceanography, forage fish, and seabirds near three colonies in lower Cook Inlet were examined between 1995 and 1999 (Piatt 2002). On the eastern side of lower Cook Inlet, upwelling of nutrient-rich waters into the entrance of lower Cook Inlet support high densities of juvenile pollock (*Gadus chalcogrammus*), sand lance (*Ammodytes personatus*), and capelin (*Mallotus catervarius*), which are consumed by high densities of seabirds (e.g., murres, kittiwakes, puffins). Researchers found that a regime shift in the late 1970s reduced the food availability for seabirds in the 1980s and 1990s, which resulted in widespread population declines, lower breeding success, and mass mortality events (Piatt 2002). Further research examined the link between availability of forage fish and breeding success. Piatt et al. (2007b) found that black-legged kittiwake breeding success was a direct function of local prey density, but common murres were able to buffer breeding success by increasing their foraging effort in response to declining prey density. This difference is partially explained by differences in prey sources. Kittiwakes are surface gleaners, and murres are divers able to exploit prey throughout the water column of lower Cook Inlet. However, beginning in 2014, a massive accumulation of warm water in the Gulf of Alaska tested the ability of these seabirds to respond to declining prey availability, resulting in a catastrophic die-off.

The enormous seabird die-off that occurred in 2015 and 2016 occurred simultaneously with the most powerful marine heatwave on record, which stretched from California to Alaska (Piatt et al. 2020). This resulted in a mortality estimate approaching 1 million common murres. Of these birds, approximately two-thirds were adult birds. This die-off event, coupled with 22 complete reproductive failures at multiple colonies region-wide during 2015 and 2016/2017, was unprecedented, and indicative of potential climate change impacts. The prolonged heatwave reduced the phytoplankton biomass, restructured zooplankton communities in favor of lower-calorie species, and increased the metabolic demands of ectothermic forage fish (Piatt et al. 2020). This potentially resulted in a system-wide scarcity of forage species, resulting in mass mortality of common murres and other wildlife species during 2014 through 2017 (Piatt et al. 2020).

In addition to massive seabird die-offs, there was a variety of avian responses to warmer ocean temperatures, including unusual foraging behaviors of fork-tailed storm petrels (*Oceanodroma furcata*) and short-tailed shearwaters (Robinson et al. 2018). Ornithologists observed these two species foraging over land on an extensive intertidal zone on the Bristol Bay coast of the Alaska Peninsula. Both fork-tailed storm petrels and short-tailed shearwaters typically feed offshore over the open ocean; however, the observed aberrant feeding behavior, emaciated body condition of salvaged birds, and a variety of other factors led ornithologists to conclude that these birds were blown to shore while weakened by food stress or compromised health related to the massive seabird die-offs that occurred in the area from 2014-2016 (Robinson et al. 2018).

Long-term population data sets are important in documenting and understanding population-level changes across the landscape potentially linked to climate change, especially in marine ecosystems such as Prince William Sound. One study conducted by Cushing et al. (2018) assessed seabird population data from 1989 through 2012 and found that of 18 genera of marine birds evaluated, 8 genera declined, with the greatest decline associated with genera that feed primarily on pelagic prey resources. This may indicate a shift in pelagic components of the Prince William Sound food web. Some species with the greatest declines include tufted puffins, which declined by 74 percent between 1989 and 2012. *Brachyramphus* murrelets (primarily marbled murrelets) declined by a cumulative 71 percent in Prince William Sound (Cushing et al. 2018). Other species have experienced substantial declines in Prince William Sound, such as pigeon guillemots (41 percent), scoters (61 percent), Bonaparte's gulls (67 percent), arctic terns (84 percent), and storm-petrels (98 percent) (Cushing et al. 2018). The greatest seabird declines occurred among genera that specialize on forage fishes and mesozooplankton.

In addition to loss of forage fish species for some marine birds, the marine heat wave of 2014 through 2016 also revealed the potential for additional impacts potentially exacerbating the decrease in food. Harmful algal blooms have been linked to elevated seawater temperatures and can result in illness and death among seabirds due to exposure from the neurotoxins saxitoxin and domoic acid (Van Hemert et al. 2020). Van Hemert et al. (2020) compared beach-cast murre carcasses from the die-off with healthy birds that had been sampled the preceding and following summers. They also sampled forage fish and invertebrates from the Gulf of Alaska to look for elevated levels of neurotoxins. Although acute exposure to saxitoxin and domoic acid was not a primary factor in the 2015-2016 seabird mortality event (but their role in the die-off cannot be discounted), widespread occurrence of the neurotoxins was found in seabirds, forage fish, and invertebrates (Van Hemert et al. 2020). Therefore, harmful algal blooms resulting in elevated toxin levels has a potential to compromise seabird health in the future if additional marine warming trends continue.

Recent surveys of seabirds in Cook Inlet during the summer of 2018 revealed that despite a return to normal water temperatures following the marine heatwave of 2014 to 2016, the population size and breeding success of common murres and black-legged kittiwakes suggest that the effects of the heatwave remain present (Arimitsu et al. 2019). Both murres and kittiwakes at monitored colonies (on Gull and Chisik islands) failed to produce any young; murre attendance at colonies was below historic levels; many emaciated murres were commonly observed at their colonies; and avian predation was high. Populations of forage fish were also depressed, and researchers observed low densities of most piscivorous seabirds at sea in 2018 (Arimitsu et al. 2019). Marine bird densities during summer 2018, compared with identical surveys in 1996 to 1999 (that were conducted to assess the recovery of seabird populations after the 1989 *Exxon Valdez* oil spill [Piatt 2002]) and 2016 to 2017, were the lowest ever recorded around Chisik Island and Kachemak Bay (Arimitsu et al. 2019). This was due to low abundances of shearwaters, *Brachyramphus* murrelets, black-legged kittiwakes, and common murres. Horned-puffin densities near Chisik Island were the exception, with a slight increase in 2018 compared with 2017. Therefore, marine bird populations in lower Cook Inlet appear to continue to suffer from the effects of the marine heat wave.

In summary, understanding the link between climate change and forage availability is critical to identifying the ecological drivers of seabird population changes (Goyert et al. 2018). Identifying population trends and relating them to climatic change is important in separating out potential future impacts from the project from background changes that are already taking place on the landscape.

3.23.5.2 Terrestrial Wildlife

Climate change is anticipated to have a wide variety of impacts to various terrestrial species. 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. For terrestrial wildlife, a combination of more open water and more nearby upland or forested areas may benefit species like beavers, river otters, wood frogs, and others. An increase in fires due to drying may benefit caribou that use early successional habitat areas but would be a detriment to species that rely on forested cover. Habitat important for moose would be affected, but effects are uncertain. Warming conditions may also lead to increases in infectious disease in wildlife (Bradley et al. 2005).

Climate change may cause shifts in plant phenology; species that cannot shift the timing of their reproductive cycle may be adversely impacted. This potential mismatch between a wildlife species and its food may vary depending on the degree to which they depend on dietary consumption and stored fat reserves (Gustine et al. 2017). A recent study in Alaska by Gustine et al. (2017) examined the long-term (i.e., from 1970 to 2013) changes in temperatures, and characteristics of the growing seasons in relation to forage quality for caribou during important life stages. Despite advanced thaw dates and increased growing season lengths, no decline in forage quality and no evidence for trophic mismatch were found during peak parturition or peak lactation. Another study in northern Canada examined the impacts of climate change on the seasonal distribution of two migratory caribou herds (Sharma et al. 2009). The study found consequences of climate change may include alteration in habitat use, migration patterns, foraging behavior, and demography. Migratory caribou preferred regions with higher snowfall and lichen availability in fall and winter, and cooler areas in summer. Both herds of caribou avoided disturbed and recently burned areas.

Habitat changes in southwest Alaska have been documented by traditional ecological knowledge (TEK), which has resulted in improved moose forage with areas of taller and denser willows, dwarf birch, and alders (Van Lanen et al. 2018). Traditional knowledge has documented ice breakup occurring earlier in the spring, freeze-up occurring later in the fall, lower than normal snowfall amounts, and other climatic changes. This has translated into earlier spring thaw, lakes opening up faster, expanding and taller-growing deciduous shrubs, and earlier leaf-out in spring (Van Lanen et al. 2018). The result has been increased moose abundance, due to increasing range expansion of moose. See Section 3.9, Subsistence, for additional discussion on TEK and habitat change.

3.23.5.3 Marine Mammals

Climate change may have synergistic adverse effects on marine mammals and may include increased incidence of disease (Guimarães et al. 2007), exacerbation of the effects of illness; increased bioavailability of contaminants (Schiedek et al. 2007), increased ocean noise levels (Reeder and Chiu 2010), changes to the density and distribution of prey species (Welch and Batten 1999), and habitat changes. These potential effects would be a result of primary and secondary changes to ecological processes that mammalian species depend on, such as water quality and water circulation. Additional consequences of climate change may include sea level rise, coastal erosion, changes in ocean heat content (which may affect prey species abundance and distribution), ocean acidification (which may affect marine mammal prey species), shifts in the amount and distribution of precipitation, changes in ice extent and snow melt, changes in stream flow and runoff patterns, changes in the timing of spring events, such as migration, poleward shifts in ranges of plant and animal species, and changes in the frequency and intensity of storm events. A potential explanation for the expansion of California sea lions into Alaska is due to warmer ocean temperatures. It is thought that the apparent increase in California sea lions in Alaska may be a result of long-term ocean temperature changes as opposed to interannual variations in the physical conditions of the North Pacific Ocean (Maniscalco et al. 2004).

Habitat alteration, changes in water quality, and food availability could occur as a consequence of climate change. Climate change may affect marine mammals indirectly, because a change in the environment is more likely to have direct effects on marine mammal prey. Changes in the climate may limit the production of forage species that marine mammals rely on. Likewise, ocean acidification (habitat alteration) could adversely affect the population of invertebrates that marine mammals feed on by limiting their growth and shell development. Under such conditions, benthic creatures such as bivalves and polychaete worms would have difficulty creating and maintaining shells, while species such as jellies and squid might flourish. Climate change could cause or contribute to further regime shifts in the lower trophic and the fish communities of Cook Inlet. At the microbial level, blue-green algae could have limited ability to create the calcium carbonate matrices needed to permit them to remain near the surface of the ocean, and such a situation could have severe repercussions throughout the oceanic food web (The Royal Society 2005; Riebesell and Tortell 2011).

Climate change could be beneficial to some marine mammal species but detrimental to others, depending on a species' ability to cope with the environmental changes. Such effects could affect species demographics, behavior, numbers, diet, hearing, and distributions. In Cook Inlet, marine mammal distribution is dependent on ice formation and prey availability, among other factors. The overall impact on marine mammals would vary, because species such as sea otters would likely encounter difficulty finding and foraging on bivalves, while other species such as harbor seals and Steller sea lions may experience changes in fish availability and an increase in squid or other invertebrate prey numbers. Beluga whales often travel along the ice pack and feed on prey beneath it (Richardson et al. 1991). Any loss of ice could result in prey distribution changes or loss. Threats to quantity and quality of beluga whales' prey species may occur due to climate change. Freshwater flow into Cook Inlet, specifically from the melting snow pack, may be altered during climate change, affecting salinity, water nutrient composition and levels, and prey fish density and distribution in upper Cook Inlet, where beluga whales feed and reside.