5.3 Wildlife

This section describes wildlife resources (primarily game mammals, nongame mammals, marine mammals, and birds) regularly present in the proposed Port MacKenzie Rail Extension study area and potential impacts to those resources from the project. Section 5.1 describes the regulatory setting for wildlife, Section 5.3.1 defines the study area, Section 5.3.2 describes the analysis methodology, Section 5.3.3 describes the affected environment (existing conditions), and Section 5.3.4 describes potential environmental consequences (impacts) to wildlife resources from the proposed rail line.

5.3.1 Study Area

The study area is 5 miles on each side of a segment centerline (a 10-mile-wide corridor) along the proposed rail line segments. The study area provides context for the evaluation of potential impacts to wildlife from the proposed Port MacKenzie Rail Extension project. Population estimates, and harvest and management of game mammals are based on Alaska Department of Fish and Game (ADF&G) Game Management Unit 14. The proposed rail line alternatives would cross Subunits 14A and 14B. Within the study area is the 200-foot right-of-way (ROW) of the rail line segments.

5.3.2 Analysis Methodology

SEA evaluated potential impacts to wildlife based on habitat use, habitat requirements, and seasonal movements of animals in the study area. SEA based the wildlife habitat analysis on the results of the vegetation analysis described in Section 5.2 using the reported density and habitat use of animals present in the study area; based the analysis of impacts to eagle, raptor, large owl, loon, and swan habitats on raptor survey data for the proposed Port MacKenzie Rail Extension (Shook and Ritchie, 2008) and waterbird data from the U.S. Fish and Wildlife Service (Conant *et al.,* 2007; Platte *et al.,* 2008); and based the analysis of habitat loss for small owls, shorebirds, seabirds, and landbirds on density data for breeding bird survey routes in or near the study area (Sauer *et al.,* 2008; Benson, 2001).

SEA evaluated potential fragmentation of large contiguous habitat areas, referred to as core areas or habitats, by visual comparison and consideration of spatial statistics generated using the Patch Analyst (Centre for Northern Forest Ecosystem Research, Thunder Bay, Ontario, Canada) extension for ArcGIS® (ESRI, Redlands, California), as follows:

- Aggregated habitat polygons for the existing raster image landcover map (Homer *et al.*, 2004) by landcover class within the study area.
- Constructed core habitat areas using a 100-foot buffer, based on the 30-meter pixel size for the landcover map.
- Identified and computed spatial statistics for core habitats larger than 100 acres that the segments would cross.

SEA estimated rail collision mortality for moose based on the reported annual mortality for moose from segments of the existing rail line operating in Game Management Subunits 14A and 14B. SEA evaluated timing and severity of disturbance and collision mortality along specific segments and alternatives based on fall moose distribution data (ADF&G, 2008), moose habitat mapping, and patterns of historical moose-train and moose-vehicle collision mortalities.

5.3.3 Affected Environment

The proposed rail line would be within ADF&G Game Management Unit 14 (6,625 square miles) and would cross Subunits 14A (2,561 square miles) and 14B (2,152 square miles). Moose and black bears are the primary big game mammals in the study area. Trappers harvest marten, beaver, red fox, lynx, mink, and wolves in the area. Appendix E provides additional descriptions of mammals and birds in the study area. Wildlife habitats in the study area are dominated by forested habitats (50 percent), followed by wetland habitats (32 percent), open water habitats (11 percent), developed or barren areas (4 percent), and agricultural habitats (3 percent) (Homer *et al.,* 2004).

5.3.3.1 Mammals

Bears

Black and brown (grizzly) bears are common in Game Management Unit 14. During spring, black bears use moist lowlands where early growing vegetation, especially horsetail (*Equisetum* spp.), comprises the bulk of their diet. Black bears also eat carrion, moose calves, and salmon when available. During fall, black bears primarily feed on berries, especially blueberries, in open meadows or alpine areas. Brown bears feed on a variety of plants and animals, using their long claws to expose ground squirrels in burrows and dig roots. Brown bears feed on berries, grasses, sedges, horsetails, cow parsnips, salmon, roots, and various mammals, including ground squirrels and moose. As food becomes scarce and temperatures drop in fall, both black and brown bears go into hibernation in dens generally excavated into small mounds, hillsides, or river terraces. Bears may remain dormant in winter dens as long as 7 to 8 months. Sows give birth to their young while in their winter dens and emerge with their young in May.

Black bear and brown bear populations in Subunits 14A and 14B are managed to provide the greatest opportunity for hunters (Kavalok, 2005, 2007). Hunters harvested an average of 76 black bears per year in Subunits 14A and 14B from 1996 through 2003 (Kavalok, 2005). Many black bears are harvested by resident hunters during May at bait stations as bears emerge from their dens and during late September in conjunction with moose and other big game (Kavalok, 2005). Hunters harvested an average of 15 brown bears annually in Game Management Unit 14 from 1996 through 2005 (Kavalok, 2007). Most brown bears are harvested during fall, although about one quarter of the harvest occurs during spring (Kavalok, 2007). Bear population trends in Subunits 14A and 14B are suspected to be stable or increasing (Kavalok, 2005, 2007).

Moose

Moose in the study area include both locally migrant and resident populations (Masteller, undated; Modafferi, 1988). Estimated annual home ranges for moose in Southcentral Alaska

average 112 square miles for nonmigratory cows and 195 square miles for migratory cows; cow summer ranges vary from 4 square miles to 100 square miles (Hundertmark, 1997). Moose ranges are influenced by the sex and age of individuals, the range characteristics of the cow, and habitat conditions (Hundertmark, 1997). Moose tend to use traditional migratory routes and calves learn migratory behavior as they follow their mothers on annual migrations (Hundertmark, 1997). Fall movements to winter habitats occur post-rut and are generally initiated by snow depths of more than 15 inches (Peek, 1997). Moose are well adapted to traveling across snow, but depths of more than 28 inches can affect moose movements and habitat use (Peek, 1997). Moose might use closed canopy needleleaf forests, which generally have lower snow depths, as snowpack reaches more than 38 inches (Peek, 1997).

During calving in mid May to mid June (Modafferi, 1988), cow moose generally select habitats with heavy cover, such as dense tall shrub or closed needleleaf forests, often returning to areas used for calving in previous years (Masteller, undated; Tremblay *et al.,* 2007). Moose forage on sedges, horsetail, pondweeds, and grasses during spring, and vegetation in shallow ponds, forbs and the leaves of birch, willow, and aspen during summer. Aquatic habitats provide aquatic and emergent vegetation, relief from insects, drinking water, and water for cooling to assist with thermoregulation. Moose mate from mid September through October (Modafferi, 1988), selecting more open habitats during the rut. During fall, moose transition from a leafy to a woody diet and feed on willow, birch, and aspen twigs during winter. Moose generally use open areas with abundant shrub forage during winter.

Moose populations in Subunits 14A and 14B are managed to provide for high levels of human consumptive use, and to provide a maximum opportunity for hunters (Peltier, 2006a, 2006b). Most moose are harvested by hunters using off-road vehicles or highway vehicles for access during the general hunting season in fall, with an average annual harvest of 468 moose in Subunit 14A and 62 moose in Subunit 14B (Peltier, 2006a, 2006b). The moose population in Subunit 14A has remained relatively stable at about 5,500 to 6,500, and the moose population in Subunit 14B has remained relatively stable at around 1,500 (Peltier, 2006a, 2006b).

Wolves

Wolves are common throughout the study area. Wolves are social animals that live in packs of 2 to 12 animals, usually including parents and pups; larger packs contain multiple females and can include two or three litters of pups. Wolves breed in February and March, and litters are born in May or early June, averaging four to seven pups. Pups are born in a den excavated in well drained soil. Wolves center their activities near their den sites, traveling as far as 20 miles in search of food to bring back to the den. Pups are weaned during mid summer, and pups are usually moved away from the den in mid to late summer.

Wolf populations in Subunits 14A and 14B are managed to provide for optimum harvest of wolves (Peltier, 2006c). Most harvested wolves are taken by trappers using snares and traps during mid winter, although hunters shoot some, with an average annual harvest of 14 wolves per year in Subunit 14A and 7 wolves per year in Subunit 14B (Peltier, 2006c). Abundant moose, beaver, and salmon have allowed wolf numbers to increase in Game Management Unit 14 over the last 30 years (Peltier, 2006c). During winter, a pack might kill a moose every few

days. Wolf and prey populations can be affected by a number of factors, including weather and food availability.

Furbearers

Furbearers are quite varied in ecology and habitat use. Beaver, mink, muskrat, and river otter all depend on aquatic habitats, but only beaver and muskrat forage on vegetation. Ermine and mink prefer riparian woodlands and feed on small warm-blooded mammals, but will eat birds, eggs, frogs, fish, and insects. Martens depend on small warm-blooded mammals, but also subsist on berries, bird eggs, and vegetation preferring forested areas with black spruce and bogs. Wolverines (a weasel relative) are habitat generalists that can be expected to use available forested and riparian habitats in the study area. They are solitary animals and primarily scavengers, although they will also prey on small mammals.

The canids – red fox, coyote, and wolf – range widely and use many habitat types, with home range size increasing with the increasing size of the species. These three species compete for smaller prey and will exclude the smaller canid from their range such that foxes are less abundant where coyote are common, and coyote are absent or scarce where wolves are abundant.

Lynx have a wide range; the size of their range is dependent on prey availability. Lynx populations are particularly influenced by hare populations, which in turn are regulated through vegetation following an 8- to 10-year cycle. All furbearers use some type of nest, den, or burrow for reproduction and some species use these structures year round.

Furbearers targeted by trappers in this area are marten, river otter, wolf, wolverine, beaver, fox and lynx, although the reported harvest indicates that muskrat, red fox, and mink were most often reported as harvested (Blejwas, 2006). Wolverine and lynx are considered scarce in Game Management Unit 14, while red squirrels, mice, and rodents are considered abundant (Blejwas, 2006). Most trappers in Game Management Unit 14 use traps or snares to harvest furbearers and access trapping areas from established roads and trails using snow machines (Peltier, 2007).

Other Mammals

Other mammals in the study area include bats, flying squirrels, porcupines, shrews, voles, and lemmings. Bats, flying squirrels, and porcupines depend on forested habitats. Shrews, voles, and lemmings are important forage for raptors, owls, and many furbearers.

Marine Mammals

Beluga whales, harbor porpoises, and harbor seals might be present in the Knik Arm near Port MacKenzie near the southern terminus of the proposed Port MacKenzie Rail Extension. Beluga whales, harbor porpoises, and harbor seals are likely to travel upriver in the Susitna and Little Susitna Rivers in pursuit of prey species.

5.3.3.2 Birds

There is a suite of resident birds in the study area, including owls, grouse, ravens, magpies, jays, woodpeckers, chickadees, and finches. Many birds in the study area are migratory, arriving or

passing through in spring beginning with raptors and waterfowl in April and continuing with the arrivals of songbirds through May, passing through or leaving in late summer and fall during July through October. Hunters harvest waterfowl primarily during the fall migration from September to December, and harvest upland game birds from late summer through March.

Waterbirds

Waterbirds, including waterfowl, loons, grebes, gulls, and shorebirds, are considered migratory. The most abundant waterfowl in the study area are mallard, green-winged teal, scaup, American wigeon, goldeneye, northern pintail, and scoters, which generally nest near aquatic habitats (Mallek and Groves, 2008). Many geese, ducks, swans, sandhill cranes, and shorebirds stage in and migrate through the Cook Inlet basin during spring and fall. Trumpeter swans, common loons, Pacific loons, and red-necked grebes nest in the study area on the numerous lakes and ponds (Conant *et al.,* 2007; Platte *et al.,* 2008). Shorebirds and cranes generally nest in wetland habitats, although some shorebirds nest in upland habitats. Shorebirds in the study area include common snipe, greater and lesser yellowlegs, spotted sandpipers, solitary sandpipers, and red-necked phalaropes (URS, 2006; Sauer *et al.,* 2008). Seabirds in the area include herring gulls, mew gulls, glaucous-winged gulls, Bonaparte's gulls, and arctic terns (URS, 2006; Sauer *et al.,* 2008). Hunters harvest ducks, geese, snipe, and sandhill cranes from ponds, lakes, wetlands, agricultural fields, and rivers during fall migrations.

Raptors

Raptors in or near the study area include bald eagles, red-tailed hawks, sharp-shinned hawks, osprey, great horned owls, great gray owls, northern saw-whet owls, and boreal owls (Sauer *et al.,* 2008; Shook and Ritchie, 2008; Benson, 2001). Bald eagles are the most abundant large raptor nesting in the study area, followed by red-tailed hawks (Shook and Ritchie, 2008). Balsam poplar is the most commonly used nest tree for large stick nests along the proposed rail line alternatives, followed by aspen, spruce, and birch (Shook and Ritchie, 2008). Smaller raptors and owls are not effectively surveyed during normal breeding-bird and stick-nest surveys. Owl surveys in the Chugach National Forest approximately 30 miles south-southeast of the study area indicate that boreal and northern saw-whet owls are likely abundant in the area (Benson, 2001).

Landbirds

Landbirds belong to many diverse groups and include both migrant and resident birds. Resident birds remain active during winter. Resident woodpeckers, chickadees, crossbills, and redpolls rely primarily on fruit and seed crops. Resident ravens, magpies, and gray jays scavenge on winter or predator-killed carrion. However, many birds feed primarily on insects that are not available during winter, and these birds remain in Southcentral Alaska only during the summer breeding season when insects are abundant.

Birds of Conservation Concern

Forty-two birds featured in the ADF&G Comprehensive Wildlife Conservation Plan (ADF&G, 2006) have been documented to occur in the study area during the breeding season, including 5 waterbirds, 3 waterfowl, 2 seabirds, 2 shorebirds, 6 raptors, 2 owls, and 22 landbirds. The 22

landbirds include 7 resident birds, 7 short-distance migrants, and 8 long-distance migrants. Eight birds in the study area are designated U.S. Fish and Wildlife Service Birds of Conservation Concern – the arctic tern, bald eagle, horned grebe, lesser yellowlegs, murrelet species (marbled or Kittliz's murrelets), olive-sided flycatcher, rusty blackbird, and solitary sandpiper (USFWS, 2008). Three birds in the study area are designated ADF&G Alaska Species of Special Concern – blackpole warbler, olive-sided flycatcher, and Townsend's warbler (ADF&G, 1998).

5.3.4 Environmental Consequences

The potential impacts of proposed Port MacKenzie Rail Extension construction and operations to wildlife would be influenced by the animals' dependence on specific habitats, the availability of preferred and used habitats, the amount of preferred habitat the project would affect, ecology and life history, and past and present population trends. Because game mammal populations are managed for sustainable human harvest, project-related effects to population abundance and distribution, available habitat, and predator-prey relationships can also affect management of these game mammals. Appendix E provides supporting descriptions of environmental consequences, and the results of qualitative and quantitative analyses.

5.3.4.1 Proposed Action

This section first describes general impacts common to all alternatives, then describes how those general impacts apply to wildlife, and concludes with a description of specific impacts along segments and alternatives. Many potential impacts to wildlife would be similar regardless of alternative and are therefore described as common impacts.

Common Impacts

Construction Impacts

Temporary impacts could occur from construction-related activities such as clearing the ROW, laying the new railbed and rail line, installing communications towers and power lines, construction staging areas, and excavation of borrow sites. In general, construction-related activities would cause temporary (short-term) disturbance and displacement of wildlife, although these activities could also cause mortality. Vegetation clearing and fill placement during construction would result in long-term habitat loss and alteration. Potential construction impacts to wildlife would include:

- Short-term habitat loss – The project would require temporary removal of vegetation cover, which provides wildlife habitat, in construction staging areas. These sites would be revegetated after rail line construction activities were completed.
- Short-term disturbances – Disturbances from construction activities would result in temporary displacement of wildlife from the project area, potentially resulting in reduced survival and reduced productivity. Construction noise and human activity could cause denning mammals to flee from hibernation sites or abandon young. Abandoned young would likely perish and the energy expended during fleeing could cause reduced survival rates over harsh winter months. Bears and moose could be intentionally harassed by hazing to protect workers and equipment. Construction activities during breeding seasons could lead to loss of

breeding success, especially if animals were differentially displaced because of sex or age. Disturbance-related displacement from favored breeding habitats could result in energy spent finding suitable replacement habitats, thus limiting survival of offspring or adults.

- Construction mortality – Construction-related traffic along the access road would include gravel haul trucks and other traffic. Wildlife could be hit and killed or fatally injured by construction vehicles, especially within areas or during weather conditions with poor visibility coincident with high traffic levels. Mammals in hibernation, in dens or nests with young, or in middens or nests in trees that are unable to escape during ROW clearing and gravel placement or extraction would be destroyed. Birds with eggs or young in nests in trees or on the ground would be destroyed during ROW clearing.

- Long-term habitat loss – Vegetation clearing, placement of gravel fill, and gravel extraction would result in permanent loss of wildlife habitats and alteration of surrounding habitats. Construction of the 30- to 45-mile rail line would require a minimum area of about 900 acres and a maximum area of about 1,300 acres of primarily forested and wetland wildlife habitats. For all habitat types at the scale of mapping used for assessment (Homer *et al.,* 2004), the maximum area of impact would represent less than 1 percent of habitats available within 5 miles of the proposed alternatives.
- Long-term habitat alteration – Wildlife that reuse den or nest sites might abandon them due to habitat changes and disturbance next to the project. This displacement from previously used habitats would require extra energy that could reduce survival rates. Alteration of habitats would include reduced or increased forage, vegetation for herbivores, insects for insectivores, small mammals for carnivores, and fish for marine mammals. Changes in the natural fire regime that maintains the boreal forest ecosystem could result from the addition of the rail line, which could act as a fire break through this region.

Operations Impacts

Rail line operations would include running one round-trip train per day over the rail line and maintaining the ROW. Rail line operations would result in the following common types of impacts to wildlife:

- Operations mortality – Train traffic on the rail line would result in wildlife fatalities, especially in areas or under weather conditions with poor visibility and in areas with concentrated use by wildlife. Collision-related mortality would be most obvious for large wildlife because collisions with small mammals and birds would generally occur without notice. An unknown number of small mammals and birds would be killed or injured during collisions with trains. Mammals and birds that feed on carrion from previous collisions with trains and birds attracted to gravels along the road and railbeds would likely have an increased incidence of collision mortality. Power lines on poles associated with the rail line and three new communications towers would increase the collision potential for birds (Manville, 2005).
- Habitat fragmentation – Review and analysis of land cover mapping (Homer *et al.*, 2001) indicates that the proposed rail line would contribute to habitat fragmentation of forested and wetland habitats (Appendix E). Issues relevant to wildlife related to habitat fragmentation

include barriers to movement, creation of edge effects, reductions in core areas of available habitats, facilitation of predator movements, intrusion of invasive species, and intrusion of humans (Jalkotzy *et al.*, 1997). Much of the habitat the proposed rail line would cross is a mosaic of habitats, has been previously fragmented by improved and unimproved roads, and is crossed by a network of trails.

- Barrier to movements – All large wildlife and most birds would be expected to cross the rail line ROW unimpeded. However, small animals such as lemmings, shrews, voles, and amphibians would likely be unable to cross the rail line and some mammals and resident landbirds might avoid crossing the rail line. Brood-rearing waterfowl and waterbirds would likely be unable to cross the rail line and might avoid crossing along waterways through small-diameter culverts.
- Edge effects and reductions in core habitat size – Fragmentation splits large areas of contiguous habitat of uniform type (patches or core habitats) into smaller pieces; increasing the amount of habitat edge or the area where one habitat is bordered by a differing habitat. In particular, fragmentation of late-succession forest habitats would impact forest nesting landbirds and old-growth dependent mammals, such as the martin, by fragmenting large patches of forest and creating edge habitat. This could lead to a reduction in core habitat size which would ultimately result in decreased reproductive potential.
- Facilitation of predator movements – Any alteration of predator survival (especially for wolves and bears, the primary predators of moose in the region) due to increased nutrition from rail-killed moose or other large game mammals or decreased energy for travel from creation of a travel corridor would have the potential to disrupt predator-prey relationships in the area.
- Intrusion of invasive species – Invasive plants and animals reduce habitat quality for native wildlife, reduce biodiversity, and threaten ecosystem integrity. Section 5.2 addresses invasive plant species; Section 5.4 addresses invasive animals in the study area, including northern pike.
- Human disturbance – ARRC regulations would prohibit access to the rail line ROW.

• Reduced survival or productivity – Disturbance from train passage could cause animals nesting or foraging near the ROW to startle and flee, potentially alerting predators to their location and facilitating predation. Periodic disturbances during the breeding season could lead to a loss or reduction in breeding success because adults tending young might be interrupted or displaced from dens or nest.

- Displacement or attraction – Wildlife displaced by the rail line could experience decreased survival or productivity because of increased energy costs expended from using marginal habitats or expended locating new preferred habitats. Predators and scavengers such as wolves, coyotes, foxes, ravens, and magpies might be attracted to the rail line by the increased availability of carcasses from animals colliding with trains, which would benefit predators and scavengers.
- Exposure to spills and leaks of toxic materials – Chapter 11 addresses the potential for spills or releases of toxic materials**.** Wildlife could be exposed to small leaks of fuels, oils, antifreeze, and other toxic substances used to operate and maintain equipment, or by

exposure to spills caused by derailment or collision during rail line operations. A spill could also lead to a reduction in available food because it would kill forage such as insects, small mammals, and fish.

Bears

The proposed alternatives would have similar effects on black and brown (grizzly) bears. Based on the reported densities, there are an estimated 64 to 120 black bears and 24 to 32 brown bears in the study area (Kavalok, 2006, 2007). Habitat loss from the proposed alternatives would result in reduced habitat for less than one black bear and less than one brown bear and would likely be of no consequence to existing black and brown bear populations.

Construction of the proposed rail line across rivers and streams would fragment riparian habitats bears use for travel and forage. The rail line would cross most major rivers via bridges, which generally would have sufficient height and span to allow bears to cross underneath. The rail line and access road could act as a fire break, leading to decreased incidence of wildland fires spreading across the rail alignment. Fires can be either beneficial to bears by increasing plant growth and berry crops and leading to increased forage and prey animals, or detrimental to bears by clearing large areas of forest, thus reducing black bear numbers, or adversely affecting salmon streams, thus reducing prey. If construction of bridges and bridge approaches for streams with salmon spawning runs occurred coincident with these runs during summer into early winter, bears could be temporarily displaced from these foraging habitats.

The rail line alternatives could coincide with bear den sites. Vegetation clearing and excavation during fall and winter could affect one black or brown bear den, based on the estimated density of bears in the study area. While there could be impacts to a few individuals, these impacts are unlikely to have adverse impacts on the bear population. Food-conditioned bears attracted to worksites or construction areas by food and garbage odors might be killed in defense of life or property. Sows that become food-conditioned by access to human food or garbage teach their cubs to also associate humans with food, which can eventually lead to the destruction of entire family groups.

Few bears would be expected to be hit by trains. Bears would generally be expected to avoid the rail line, although some bears might be attracted to the rail line if grains or animal feeds such as wheat, barley, oats, or dog foods were spilled and not effectively removed. Bears could also be attracted to the rail line by rail-killed carrion during their active periods – spring through fall. The one round-trip train per day and periodic summer maintenance work would cause displacement of up to one bear, and this impact is unlikely to adversely impact the bear population.

Moose

Preferred moose habitats include riparian willow, poorly drained meadows, and early succession forests. Based on fall moose densities adjusted by the proportion of the study area within each Game Management Unit, there would be an estimated 2,873 moose in the study area (Peltier, 2006a, 2006b). Habitat loss from project alternatives would result in reduced habitat for five to seven moose, which would likely be of no consequence to the existing moose population. The

total area of vegetation removed for the ROW might underestimate the total impact to moose habitat if moose avoid the ROW and access road (Laurian *et al.*, 2008; Rolley and Keith, 1980). However, snow conditions and migratory behaviors can negate avoidance, and because moose use a variety of habitats and readily cross rail lines and roadways during most of the year, habitat loss and fragmentation as a result of the rail line would generally be of minor consequence to moose.

Moose-train collision mortality from operation of the 33- to 47-mile-long rail line would average three to four moose per year, ranging from one to nine collision mortalities per year, primarily during January, February, November, and December (ADF&G, 2008). Increased train traffic on the mainline as a result of rail line construction would result in a combined direct and indirect moose-train collision mortality average of 6 to 7 moose per year, ranging from 3 to 17 moose per year. Brush cutting for vegetation maintenance could concentrate highly palatable forage for moose along the rail line (Rea and Gillingham, 2007; Rea *et al.,* 2007), which could increase the time moose spend near the rail line, thereby increasing the probability that the animal would cross the rail line and be hit by a train. Migratory moose could experience a disproportionate level of mortality compared to resident moose, if movements across the proposed rail line were more common for migratory populations than resident populations. An unknown number of moose would also likely be injured during unreported glancing blows; some of these injuries would likely cause reduced survival or reduced mobility, which would facilitate predation.

The proposed rail line may result in indirect effects on moose habitat, movements, survival, and reproduction related to disturbance, as well as direct and indirect loss of moose habitat and moose due to moose-train collision mortality. All moose would be expected to successfully cross the rail line ROW, unless they were hit by a train or work vehicle. The one round-trip train per day and periodic maintenance work could also cause displacement of moose from the ROW.

Wolves

Wolves are habitat generalists, and would not likely be directly affected by habitat loss due to proposed rail line construction, but could be indirectly affected by habitat loss if there were changes in potential prey species. Rail line construction could directly affect wolf den sites. There could be natal and seasonal den sites for the estimated 18 to 21 wolf packs in Game Management Unit 14 along the rail line alternatives. Noise from construction activities would affect a larger area than the immediate footprint of the project and could result in displacement of a few individual wolves from the immediate area. If construction activities occurred in early spring shortly after pups were born, disturbance near an active den site could lead to abandonment of the den and loss of the pups, but could also result in adult wolves moving the pups to a new den site.

Wolves hunt daily, traveling in areas that provide the best passage, such as rivers, ridges, creeks, trails, and infrequently used roads. Wolves residing in the study area would likely be attracted to and travel along the rail line, although few wolves would be expected to be hit by trains. Indirect effects due to disturbance could cause displacement of wolves from the vicinity of rail line, although wolves would be more likely to be attracted to the rail line by the increased availability of animal carcasses from moose-train collisions and bird collisions with power lines.

Furbearers and Other Mammals

Forested, wetland, and riparian habitats would be the primary habitats used by the diverse assemblage of furbearing animals in the area. Estimated potential impacts to furbearer and other mammals as a result of habitat loss would result in average habitat loss for furbearers that could affect as many as 7 to 17 beavers, 21 to 42 ermine, 16 to 60 least weasels, 6 to 16 female mink, 30 to 58 muskrats, 463 to 926 red squirrels, and 26 to 69 snowshoe hare (see Appendix E, Table E-4). Average habitat loss for other mammals, many of which serve as a forage base for furbearers, raptors, and owls, could affect as many as 802 northern bog lemmings, 5 to 39 northern flying squirrels, 19 to 44 porcupine, 1,036 to 3,453 shrews, and 1,036 to 4,144 voles (see Appendix E, Table E-4). Habitat loss in riparian areas would be of disproportional consequence to river otters, muskrats, or beavers if burrows and den sites were destroyed and suitable substrates and materials for den construction were rare. As these animals are very common in the study area, the effects of habitat loss on furbearer and other mammal populations in the project area is unlikely to adversely impact the species' population.

A few furbearers and other mammals would likely be hit and killed by construction vehicles. Several train-animal collision mortalities could be expected each year due to proposed rail line operations, and porcupines would be especially vulnerable. Small animals such as lemmings, shrews, voles, and amphibians would be physically blocked from crossing the rail line ROW or would likely experience increased predation as they were exposed while attempting to cross the ROW. Bats with young roosting in trees would be destroyed if these trees were removed during ROW clearing activities in spring and summer.

Many mammals are curious and could experience fatalities if they ingest toxic substances either directly or indirectly through self cleaning of oiled fur or hair or through consumption of oiled prey. Fur provides insulation that is lost upon contact with petroleum-based products such as diesel fuel and oil, leading to hypothermia, especially for mammals tied to aquatic environments, such as beavers and otters.

Marine Mammals

Habitat impacts at large river crossings would likely be sufficiently far from river deltas that harbor porpoises and beluga whales would be unlikely to come in contact with bridges. Harbor seals might travel as far as bridge locations on the Little Susitna River but would unlikely to regularly occur this far upstream. Most project construction and operations effects on marine mammals would be caused by impacts to stream habitats and water quality for prey species – anadromous salmonids and other forage fishes such as eulachon, smelt, and whitefish – and disturbance from potential increased ship traffic at Port MacKenzie facilities. These indirect impacts would be likely to result in negligible effects to forage species and minor disturbance to a few harbor seals and harbor porpoises. Section 5.5 and Appendix H address potential project impacts to the Cook Inlet beluga whale.

Birds

The primary impacts to birds from proposed rail line construction and operations would be habitat loss, alteration, and fragmentation and mortality from collisions with power lines on

poles and with communications towers. All birds would experience a loss of nesting, foraging, and migration staging habitats due to rail line construction along a linear alignment. The loss of forested habitat would be considered a long-term impact, even if a portion of this habitat were subsequently restored, because of the time it takes for forested habitat to regenerate. Loss of forest communities would generally require 5 to 20 years or more to reestablish trees and shrub habitat for cover, perching, and nesting for most raptors and landbirds; 50 to 100 years for trees large enough to support eagle and large owl nests; and more than 50 years to grow the snags to support cavity nesting landbirds. Construction of the rail line and associated facilities would result in short-term disturbance and long-term habitat modification along the approximately 30- to 45-mile-long rail line. Average habitat loss would affect as many as 50 waterbirds and waterfowl, 6 raptors and owls, 35 shorebirds, 4 seabirds, and 940 landbirds (Sauer *et al.,* 2008; Mallek and Groves, 2008; Benson, 2001; Shook and Ritchie, 2008).

Construction of railbeds and roadbeds across wetlands would alter the suitability of habitats near these structures for ground-nesting waterbirds and waterfowl due to changes in water abundance and distribution. Reduced habitat suitability would indirectly affect bird survival and reproductive potential. Tree-nesting raptors and cavity-nesting landbirds reuse nest structures and loss of nest trees could lead to reduced or lost reproduction in subsequent years from energy spent establishing new nests and nesting territories. This would have a disproportionate and delayed consequence for long-distance migrant landbirds (Schmiegelow and Hannon, 1999).

Habitat fragmentation caused by loss and changes in vegetation cover within the ROW through large areas of core forest habitats would have the greatest effect on resident and migrant landbirds (Hinkle *et al.*, 2002), although resident birds would be likely to respond to the rail line and access road corridor as a barrier to movement (Desrochers and Hannon, 1997). Forest-nesting landbird abundance, diversity, and reproduction rates all become depressed as a result of fragmentation associated with linear developments (Jalkotzy *et al.*, 1997). Linear developments can increase landbird nest predation by concentrating predator forage activity, such as gray jays and ravens, along the newly created edge habitats (Ibarzabal and Desrochers, 2004; Marzluff and Restani, 1999).

Rail line operations would result in continued disturbances to birds due to train movement. Disturbance to nesting birds could result in incubating birds flushing from their nests and leaving the nest vulnerable to mammalian and avian predators. For ground-nesting birds, flushing might alert nearby mammalian and avian predators to the location of the nest, which could subsequently result in nest depredation and lost reproduction. Many waterfowl and shorebirds stage in the project area during spring and fall migrations, remaining within an area to congregate and feed while on their way to and from breeding and wintering habitats. Many landbirds migrate through Interior Alaska on their way to and from nesting grounds in Western and Arctic Alaska. Disturbance of migrant birds in staging habitats could limit the birds' ability to acquire the fat stores necessary to continue migration, and could reduce reproductive outputs of birds traveling to nesting grounds in spring, or reduce survival of birds traveling to wintering grounds in fall.

Bird nests with eggs or young in trees, shrubs or on the ground would be destroyed if ROW clearing activities occurred during spring and summer. Factors influencing collision risk are related to the type of bird, environmental factors, and the location and configuration of the power

lines and towers. Power-line poles and communications towers would provide perches for raptors and other predatory birds, which would facilitate predation on ground-nesting waterfowl, waterbirds, and landbirds and would lead to reduced productivity of birds nesting close to these structures. Heavy bodied, less-agile birds and birds in large flocks, such as cranes, swans, and geese, would be more likely to experience fatalities from collisions with power lines and communications towers because they might lack the ability to quickly negotiate obstacles. Power poles associated with the project could result in fatalities from electrocution for opportunistic raptors using them for nesting sites, or vantages for territorial defense and hunting. Raptors are particularly susceptible to electrocution by poorly designed power poles, especially when these are placed near nesting territories or foraging habitats.

Oiled birds ingest contaminants during preening, leading to toxicity. Birds could also ingest oiled prey, especially birds that regularly scavenge on carcasses. Feathers of birds provide insulation and buoyancy that are lost upon contact with petroleum-based products such as diesel fuel and oil, leading to hypothermia and an inability for waterbirds and waterfowl to float.

Birds of Conservation Concern

Forty-two birds featured in the ADF&G Comprehensive Wildlife Conservation Plan have been documented in the study area, and an average of 271 birds (216 to 346, depending on alternative) could be affected by reduced habitat availability and suitability due to proposed rail line construction (see Appendix E, Table E-8). Habitat loss could affect a number of U.S. Fish and Wildlife Service- and ADF&G-designated birds of conservation and special concern, as detailed in Appendix E, Table E-8, which presents the number of nesting birds impacted [arctic tern; bald eagle – average 4 birds, range 2 to 12 birds; blackpole warbler – average 35 birds, range 30 to 43 birds; horned grebe; lesser yellowlegs – average 9 birds, range 8 to 11 birds; murrelet species; olive-sided flycatcher – average 15 birds, range 13 to 18 birds; rusty blackbird – average 2 birds, range 1 to 2 birds; solitary sandpiper – average 1 bird, range 1 bird; and Townsend's warbler]. Averages and ranges are not provided for bird species that have been documented in the project area, but data are insufficient to estimate the scale of impact. Other potential impacts to birds of conservation concern are as described for birds above.

Impacts to Wildlife by Segment

Southern Segments and Segment Combinations

Construction of the southern segments and segment combinations would result in direct loss of between 450 to 600 acres of wildlife habitat (Table 5.3-1). None of the southern segments and segment combinations would cross moose calving habitat (Table 5.3-1). The southern segments and segment combinations would generally cross more high-density moose habitat (estimated fall 2008) than the northern segments and segment combinations (Figure 5.3-1), although high-density moose areas can vary annually. Habitats supporting between 300 and 470 birds would be lost due to construction of the southern segments and segment combinations (Table 5.3-2). Construction of the southern segments and segment combinations could result in disturbance to nesting trumpeter swans and loons within 0.5 mile of the ROW (Table 5.3-3). Raptor and owl nests within 0.5 mile of the ROW that could be disturbed or destroyed during construction include bald eagle, osprey, and great horned owl nests (Table 5.3-3).

Table 5.3-1
Direct Loss of Wildlife Habitat for the Southern Segments and Segment Combinations[a,b] (acres)

Habitat Type	Southern Segments and Segment Combinations			
	Mac West-Connector 1	Mac West-Connector 2	Mac East-Connector 3	Mac East
Agricultural (total)	***64***	***93***	***4***	***<1***
Closed Evergreen Forest	109	88	86	47
Open Evergreen Forest	1	1	0	0
Woodland Evergreen Forest	2	2	<1	<1
Closed Deciduous Forest	37	36	133	121
Open Deciduous Forest	4	4	9	9
Woodland Deciduous Forest	10	10	13	13
Closed Mixed Forest	162	158	235	186
Open Mixed Forest	3	3	9	8
Woodland Mixed Forest	5	5	6	6
Forested Habitats (total)	***332***	***306***	***491***	***390***
Emergent Wetlands	40	37	21	13
Shrub/Scrub Wetlands	11	11	33	31
Woody Wetlands	158	134	40	34
Wetland Habitats (total)	***209***	***182***	***94***	***78***
Total Habitat Area	**605**	**581**	**589**	**468**
Moose Habitats				
Moose Calving Habitat	0	0	0	0
Moose Winter Habitat	351	242	73	1
Moose Foraging Habitat				
Woodland and Open Forests	24	24	37	36
Emergent Wetlands	40	37	21	13
Shrub/Scrub Wetlands	11	11	33	31
Woody Wetlands	158	134	40	34
Total Moose Foraging Habitat	**233**	**206**	**131**	**114**

[a] Sources: Homer *et al.,* 2004; ADF&G, 1985. Habitat impacts include the 200-foot right-of-way and terminal reserve areas.
[b] Totals might not equal sums of values due to rounding.

The southern segments and segment combinations would contribute to fragmentation of primarily agricultural and woody wetland core habitats (Figure 5.3-2 and Appendix E). Both the Mac West-Connector 1 Segment Combination and the Mac East-Connector 3 Segment Combination would skirt the edges of the Point MacKenzie Agricultural Project and would cross agricultural core habitats. In all instances, most of the agricultural area would remain intact, but the edge would be encroached upon at several locations primarily because the agricultural edge is uneven (Figure 5.3-2). The Mac West-Connector 1 and Mac West-Connector 2 segment combinations would cross a large area of woody wetland core habitat and would contribute to fragmentation of this habitat. The Mac West-Connector 2 and Mac East-Connector 3 segment combinations would fragment core areas of mixed and evergreen forest habitats near the junction of the Mac East Segment and Connector 3 Segment (Figure 5.3-2).

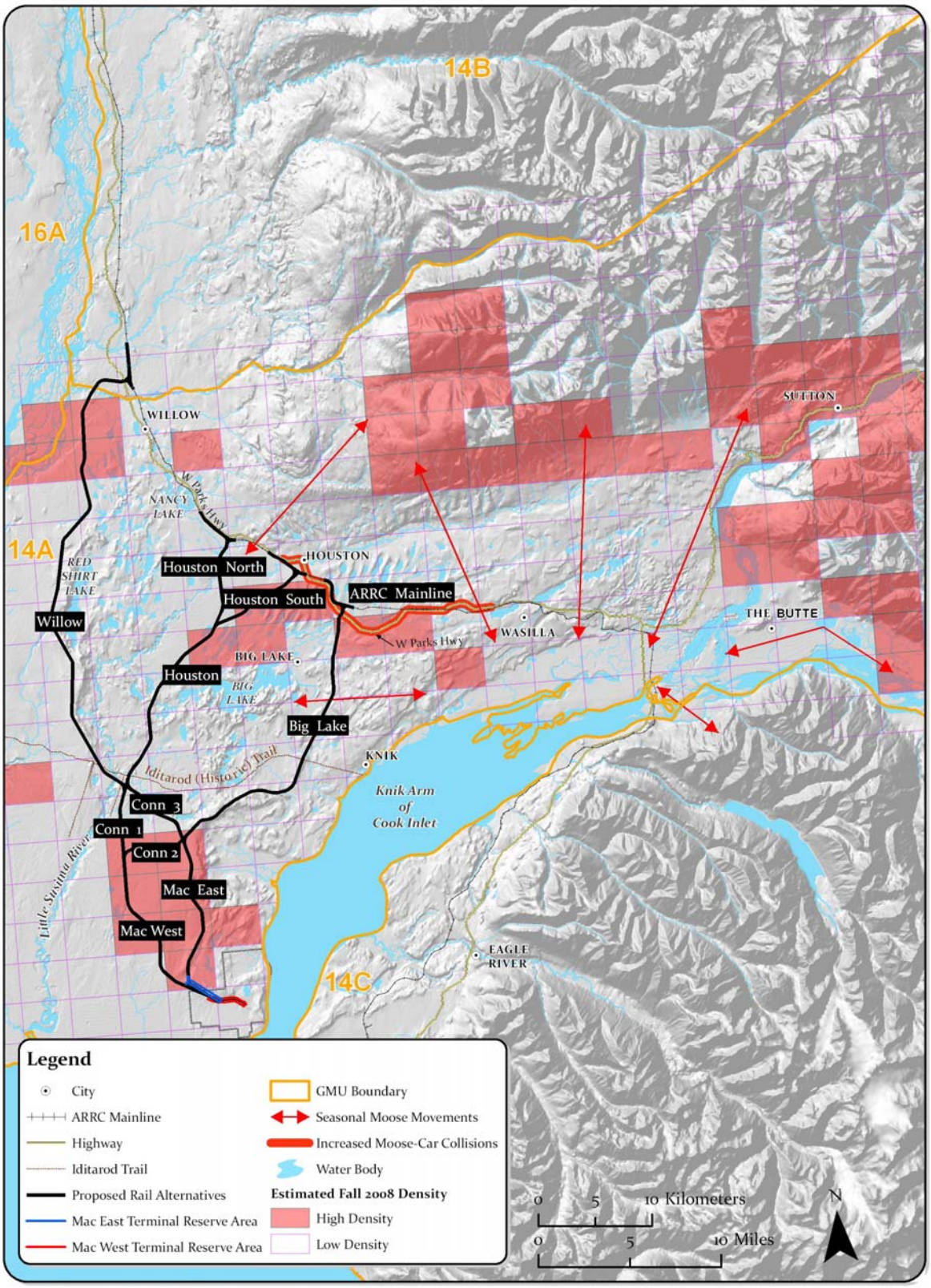

Figure 5.3-1. Estimated Fall 2008 Moose Density and Generalized Movement Patterns (ADF&G, 2008; Masteller, undated; Modafferi, 1988)

Table 5.3-2
Estimated Nesting Habitat Loss Impacts to Birds for the Southern Segments and Segment Combinations (individuals displaced)[a,b]

Bird Type	Mac West-Connector 1	Mac West-Connector 2	Mac East-Connector 3	Mac East
Waterbirds	2	1	2	1
Geese & Swans	1	0	1	0
Ducks	*25*	*19*	*24*	*19*
Dabbling Ducks	15	6	15	12
Diving and Sea Ducks	10	13	9	7
Raptors and Owls	3	3	3	2
Shorebirds	16	15	15	10
Seabirds (gulls)	2	1	2	1
Landbirds	*422*	*395*	*407*	*276*
Resident	31	29	30	21
Short-Distance Migrant	110	103	107	72
Long-Distance Migrant	281	263	270	183
Total Individuals[c]	**471**	**434**	**454**	**309**

[a] Sources: Shook and Ritchie, 2008; Sauer *et al.,* 2008; Platte *et al.,* 2008; Mallek and Groves, 2008; Benson, 2001.
[b] Estimate based on 200-foot right-of-way and terminal reserve footprint areas multiplied by nesting season density for waterbirds, geese and swans, ducks, small owls (Benson, 2001), shorebirds, seabirds, and landbirds in the study area (Appendix E). Raptors and large owl impacts based on nests identified within the 200-foot right-of-way (Shook and Ritchie, 2008).
[c] Total includes waterbirds, geese and swans, ducks, raptors and owls, and landbirds. Dabbling ducks and diving and sea ducks are subcategories of ducks. Landbirds categorized by migration are subcategories of landbirds.

Table 5.3-3
Estimated Nesting Habitat Disturbance to Swans, Loons, Raptors, and Owls along the Southern Segments and Segment Combinations (nests or nesting lakes disturbed)[a,b]

Bird Type	Mac West-Connector 1	Mac West-Connector 2	Mac East-Connector 3	Mac East
Trumpeter Swans	0	0	2	0
Common Loons (No. of young)[d]	3	3	4	0
Common Loon Lakes (No. with broods)	5 (2)	5 (2)	4	0
Pacific Loons	0	0	1	0
Total Waterbirds	**3**	**3**	**7**	**0**
Bald Eagle	1	0	0	0
Osprey	1	1	1	1
Red-tailed Hawk	0	0	0	0
Great Horned Owl	0	0	1	0
Great Gray Owl	0	0	0	0
Northern Saw-whet Owl[c]	1	1	1	1
Boreal Owl[c]	2	2	2	1
Total Raptors and Owls	**5**	**4**	**5**	**3**

[a] Sources: Conant *et al.,* 2007; Platte *et al.,* 2008; Shook and Ritchie, 2008; Benson, 2001.
[b] Estimate based on nest of nesting lake observations within 0.5 mile of proposed segments. Data for waterbirds are a sample of segment areas and actual impacts might be higher; surveys for raptors and large owls covered the entire segment.
[c] Estimate for small owls based on nesting densities near the study area multiplied by the 200-foot right-of-way and terminal reserve footprint areas (Benson, 2001).
[d] No. = Number.

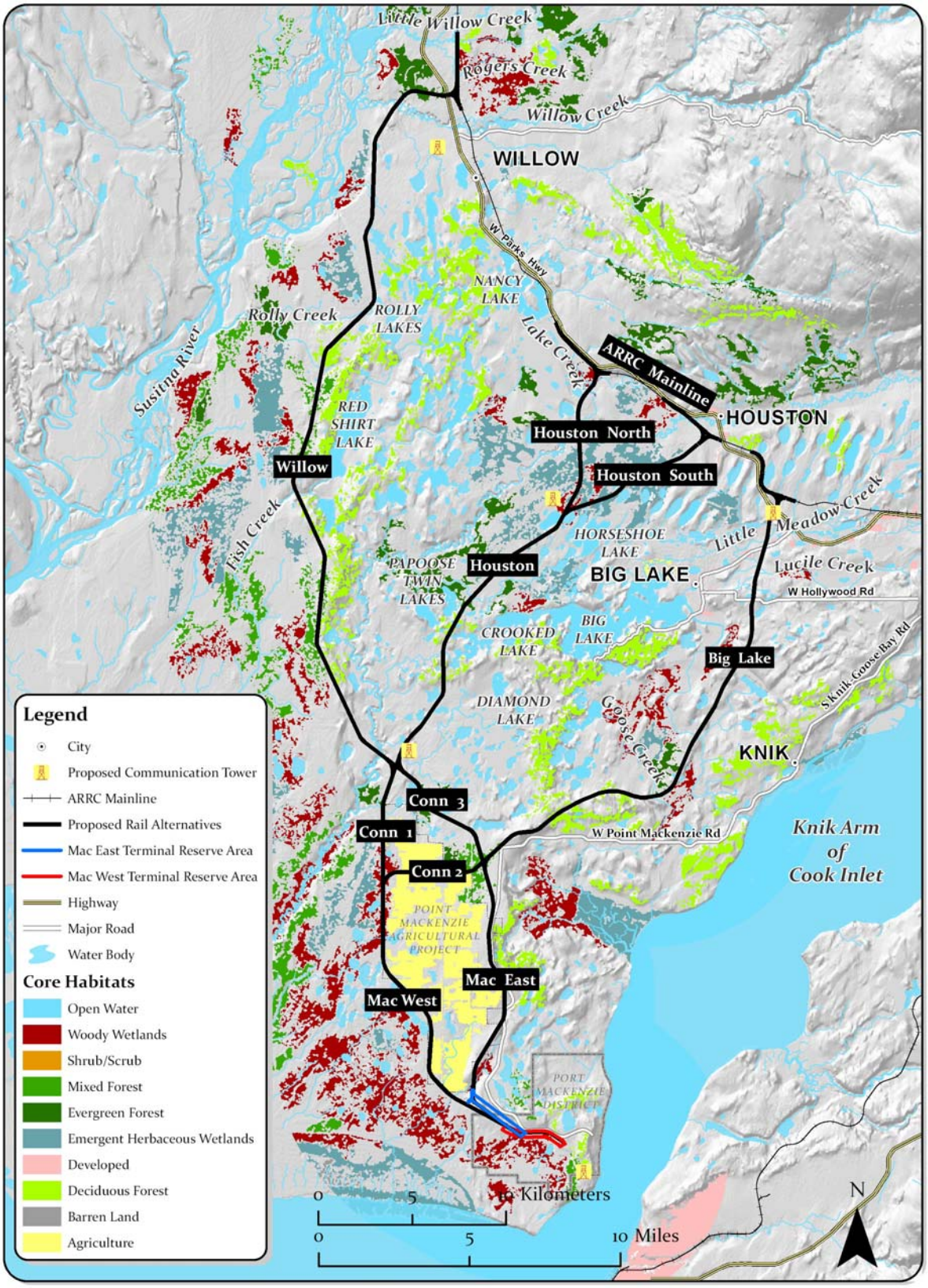

Figure 5.3-2. Core Habitat Areas in the Study Area (Homer *et al.*, 2004)

Northern Segments and Segment Combinations

Construction of the northern segments would result in direct loss of between 400 and 700 acres of wildlife habitat (Table 5.3-4). The northern segments and segment combinations would generally cross through less high-density moose habitat (estimated fall 2008) than the southern segments and segment combinations, although high-density moose areas can vary annually (Figure 5.3-1; ADF&G, 2008). All of the northern segments and segment combinations except Big Lake would cross moose calving habitat (Table 5.3-4). Habitats supporting between 500 and 800 birds would be lost due to construction of the northern segments and segment combinations (Table 5.3-5).

Table 5.3-4
Direct Loss of Wildlife Habitat for the Northern Segments and Segment Combinations (acres)[a,b]

Habitat Type	Willow	Big Lake	Houston-Houston North	Houston-Houston South
Agricultural (total)	***2***	***<1***	***0***	***0***
Closed Evergreen Forest	89	43	82	65
Open Evergreen Forest	<1	2	1	1
Woodland Evergreen Forest	<1	<1	1	1
Closed Deciduous Forest	228	114	79	55
Open Deciduous Forest	20	15	11	3
Woodland Deciduous Forest	5	3	5	1
Closed Mixed Forest	270	115	68	47
Open Mixed Forest	7	5	5	3
Woodland Mixed Forest	4	3	2	1
Forested Habitats (total)	***625***	***300***	***256***	***177***
Emergent Wetlands	25	57	81	146
Shrub/Scrub Wetlands	4	41	1	27
Woody Wetlands	27	77	109	90
Wetland Habitats (total)	***57***	***174***	***191***	***263***
Total Habitat Area	**684**	**474**	**447**	**441**
Moose Habitats				
Moose Calving Habitat	307	0	328	295
Moose Winter Habitat	645	0	445	413
Moose Foraging Habitat				
Woodland and Open Forests	38	28	27	10
Emergent Wetlands	25	57	81	146
Shrub/Scrub Wetlands	4	41	1	27
Woody Wetlands	27	77	109	90
Total Moose Foraging Habitat	**94**	**203**	**218**	**273**

[a] Source: Homer *et al.* 2004; ADF&G, 1985. Includes 200-foot ROW, stream and road relocation areas along the Big Lake Segment.
[b] Totals might not equal sums of values due to rounding.

Table 5.3-5
Estimated Nesting Habitat Loss to Birds for the Northern Segments and Segment Combinations (individuals displaced)[a,b]

Bird Type	Willow	Big Lake	Houston-Houston North	Houston-Houston South
Waterbirds	2	2	1	1
Geese & Swans	1	1	0	0
Ducks	*30*	*21*	*19*	*19*
Dabbling Ducks	18	13	12	12
Diving & Sea Ducks	12	8	7	7
Raptors and Owls	4	3	3	2
Shorebirds	28	20	18	18
Seabirds (gulls)	3	2	2	2
Landbirds	*760*	*536*	*478*	*495*
Resident	56	40	35	37
Short-Distance Migrant	199	140	125	129
Long-Distance Migrant	505	356	318	329
Total Individuals[c]	**828**	**585**	**521**	**537**

[a] Sources: Shook and Ritchie, 2008; Sauer *et al.,* 2008; Platte *et al.,* 2008; Mallek and Groves, 2008; Benson, 2001.
[b] Estimate based on 200-foot right-of-way, stream and road relocation footprint areas multiplied by nesting season density for waterbirds, geese and swans, ducks, small owls (Benson, 2001), shorebirds, seabirds, and landbirds in the study area (Appendix E). Raptors and large owl impacts based on nests identified within the 200-foot right-of-way (Shook and Ritchie, 2008).
[c] Total includes waterbirds, geese and swans, ducks, raptors and owls, and landbirds. Dabbling ducks and diving and sea ducks are subcategories of ducks. Landbirds categorized by migration are subcategories of landbirds.

Construction of the northern segments and segment combinations could result in disturbance to nesting trumpeter swans and loons within 0.5 mile of the ROW (Table 5.3-6). Raptor and owl nests within 0.5 mile of the ROW that could be disturbed or destroyed during construction include bald eagle, red-tailed hawk, great horned owl, and great gray owl nests (Table 5.3-6).

The northern segments and segment combinations would contribute to fragmentation of primarily forested and emergent wetland habitats (Figure 5.3-2; Appendix E). The Willow Segment would cross the largest area of core evergreen forest and the Houston-Houston South Segment Combination would cross the largest area of core emergent wetland habitat (Figure 5.3-2).

Impacts to Wildlife by Alternative

The primary potential impacts to wildlife from proposed Port MacKenzie Rail Extension construction would be habitat loss and alteration, moose-train collision mortality, bird-power line and communications tower collision mortality, and potential changes in human disturbance and harvest patterns.

Rail line construction would result in direct loss of an average of approximately 1,100 acres (ranging from 930 acres to 1,272 acres depending on alternative) of wildlife habitat (Table 5.3-7), which is less than one percent of the 435,895 acres of available habitat in the study area. By comparing the total forested habitat averaged across all alternatives (719 acres) to the total

Table 5.3-6
Estimated Nesting Habitat Disturbance Impacts to Swans, Loons, Raptors, and Owls along the Northern Segments and Segment Combinations (nests or nesting lakes disturbed)[a,b]

Birds or Lakes	Willow	Big Lake	Houston-Houston North	Houston-Houston South
Trumpeter Swans	2	0	1	1
Common Loons (No. of young) [d]	7	2	9 (4)	8 (4)
Common Loon Lakes (No. with broods)	7	6	12 (4)	10 (4)
Pacific Loons	5	1	2	3 (2)
Total Waterbirds	**14**	**3**	**12**	**12**
Bald Eagle	6	1	1	1
Osprey	0	0	0	0
Red-tailed Hawk	0	0	6	5
Great Horned Owl	0	0	1	0
Great Gray Owl	0	0	1	1
Northern Saw-whet Owl[c]	2	1	1	1
Boreal Owl[c]	2	2	1	1
Total Raptors and Owls	**10**	**4**	**11**	**9**

[a] Source: Conant *et al.,* 2007; Platte *et al.,* 2008 ; Shook and Ritchie, 2008; Benson, 2001.
[b] Estimate based on observations within 0.5 mile of proposed segments. Note that data for waterbirds are a sample of segment areas and actual impacts might be higher; surveys for raptors and large owls covered the entire segment.
[c] Estimate for small owls based on nesting densities near the study area multiplied by the 200-foot right-of-way, stream relocation and road relocation areas (Benson, 2001).
[d] No. = Number.

wildlife habitat loss averaged across all alternatives (1,074 acres) SEA's analysis indicates that on average, 67 percent of wildlife habitat loss would be from forested habitats (Table 5.3-7). Similarly, by comparing the total wetland habitat averaged across all alternatives (317 acres) to the total wildlife habitat loss averaged across all alternatives (1,074 acres) SEA calculated that 30 percent of wildlife habitat loss would be from wetland habitats. Across all alternatives, rail line construction would result in the loss of less than one percent of the total forested habitat available in the study area, as well as less than one percent of the total wetland habitat available in the study area. This habitat loss would contribute to habitat fragmentation of core forested and wetland habitats (Figure 5.3-2). Habitat loss impacts to bears, moose, wolves, furbearers, other mammals, and birds are previously described under the heading Common Impacts. Habitat fragmentation would detrimentally impact some species, such as small animals and resident landbirds, which are not anticipated to cross the rail line. Other species, such as moose and other large mammals would be expected to cross the rail line ROW unimpeded, and thus are not expected to be adversely impacted by habitat fragmentation due to rail line construction. In general, the landscape in the study area is composed of a mosaic of small habitat patches (Appendix E) averaging less than 4 acres in size. Core habitat areas, the interior areas of habitat patches, greater than 100 acres in size, averaged larger for open water and agriculture habitat types than other habitat types (Appendix E). Core areas greater than 100 acres for wildlife habitats crossed by rail line segments averaged 6 to 49 times larger than core wildlife habitats throughout the study area (Appendix E).

Table 5.3-7
Direct Loss of Wildlife Habitat for the Alternatives (acres)[a,f,g]

	Alternatives								Summary	
Habitat Type	**Mac West-Connector 1-Willow**	**Mac West-Connector 1-Houston-Houston North**	**Mac West-Connector 1-Houston-Houston South**	**Mac West-Connector 2-Big Lake**	**Mac East-Connector 3-Willow**	**Mac East-Connector 3-Houston-Houston North**	**Mac East-Connector 3-Houston-Houston South**	**Mac East-Big Lake**	**Average Habitat Loss[b]**	**Available Study Area Habitat**
Agricultural (total)	***66***	***64***	***64***	***94***	***7***	***5***	***5***	***1***	***38***	***12,192***
Forest Type										
Evergreen	195	190	173	136	173	168	151	92	160	66,340
Deciduous	304	146	110	181	405	247	211	272	234	93,449
Mixed	442	238	214	289	515	306	282	314	325	97,324
Forest Structure										
Closed	880	524	462	554	1,018	657	596	614	663	237,204
Open	35	25	14	29	45	36	25	40	31	15,155
Woodland	26	26	20	23	29	28	23	25	25	4,754
Forested Habitats (total)[c]	***941***	***574***	***496***	***606***	***1,093***	***721***	***643***	***678***	***719***	***257,113***
Emergent Herbaceous Wetlands	65	121	186	94	46	102	167	70	106	70,426
Shrub/Scrub Wetlands	15	12	38	52	38	34	60	71	40	13,580
Woody Wetlands	185	267	248	211	66	148	129	109	170	82,584
Wetland Habitats (total)	***265***	***400***	***472***	***356***	***149***	***284***	***356***	***250***	***317***	***166,590***
Wildlife Habitat Total[d]	**1,272**	**1,038**	**1,032**	**1,056**	**1,249**	**1,010**	**1,003**	**930**	**1,074**	**435,895**
Moose Habitats										
Calving	307	328	295	0	307	328	295	0	233	132,242
Winter	981	783	751	242	705	502	470	1	554	241,990
Forage Habitat[e]	326	451	506	408	224	348	403	315	373	186,499

[a] Sources: Homer *et al.,* 2004; ADF&G, 1985.
[b] Averaged value by category for the eight alternatives. Does not represent an alternative. Average of the combined habitats (i.e., forested, wetland, wildlife) are average values for the alternatives and do not represent the sum of categories.
[c] The sum of forested habitats is based on the sum of two separate habitat groupings: 1) leaf type (evergreen, deciduous, mixed) or 2) cover type (closed, open, woodland).
[d] Totals do not include developed land other than agricultural land, although most of the developed habitats in the project area likely support some wildlife use.
[e] Moose forage evaluated as the total of open and woodland forests, and all wetlands.
[f] Totals might not equal sums of values due to rounding.
[g] Segment-level data does not sum to alternative-level data as a result of the method used to calculate the rail line routes. Connector segment acreages were calculated by summing both possible "arms" of each connector segment (the arms necessary to connect the segment to either the Willow or Houston segments). Alternative acreages were calculated by generating a smooth path from the respective Mac Terminal to either the Willow or Houston segment, and thus include only the one, necessary connector "arm" (as the extra "arm" connecting to the other segment would not be necessary if that route was built).

Combined direct moose-train collision mortality for the proposed alternatives and indirect moose-train collision mortality from increased train traffic on the existing rail line would average 6 to 7 moose per year, ranging from 3 to 17 moose per year (Appendix E). Power lines on poles and communications towers built to support the rail line would increase collision mortality for all birds, but would have the greatest potential for damage where power lines and towers were near staging habitats, such as wetlands, agricultural fields, and tidal mudflats, used by sandhill cranes, geese, swans, ducks, or shorebirds during migration; or when power lines and towers were near raptor nests and foraging habitats.

ARRC regulations prohibit unauthorized access to rail line ROWs and bars public access across the rail line except at authorized crossing locations. Although grade crossings at public and private roads and officially recognized trails would maintain existing access along established routes, user access to other areas across the rail line would be controlled.

Both increased moose mortality and changes in hunter and trapper access could require changes in the management of game mammals in the portions of Game Management Subunits 14A and 14B, which all rail line alternatives cross.

Mac West-Connector 1-Willow Alternative

This alternative would result in the loss of 1,272 acres of wildlife habitat (Table 5.3-7) and fragmentation of 2,847 acres of forested and woody wetland core habitats (Table 5.3-8). Of the 1,272 acres of wildlife habitat loss under this alternative, 74 percent (941 acres) would comprise forested habitat and 21 percent (265 acres) would comprise wetland habitat (Table 5.3-7). This alternative would result in the loss of the largest area of moose winter habitat (981 acres) of all the alternatives (Table 5.3-7) and would cross 65 percent low-density and 35 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially bears, wolves, furbearers, raptors, owls, and forest-nesting landbirds, would be expected to be high because of the remoteness of the area and proximity to anadromous fish resources on the Susitna River and its tributaries. Nesting-habitat loss would affect 1,275 birds (Table 5.3-9). Nesting-habitat disturbance would affect 17 swans and loons, the greatest number of bald eagle nests (6) of all the alternatives, and an estimated 14 raptor and owl nests (Table 5.3-10). Construction of the Mac West-Connector 1-Willow Alternative would open a corridor through primarily closed forest habitats that would contribute to fragmentation.

Mac West-Connector 1-Houston-Houston North Alternative

This alternative would result in the loss of 1,038 acres of wildlife habitat (Table 5.3-7) and fragmentation of 2,592 acres of primarily woody wetland and emergent wetland core habitats (Table 5.3-8). Of the 1,038 acres of wildlife habitat loss under this alternative, 55 percent (574 acres) would comprise forested habitat and 39 percent (400 acres) would comprise wetland habitat (Table 5.3-7). This alternative would result in the loss of nearly 800 acres of moose winter habitat and over 300 acres of moose calving habitat (Table 5.3-7) and would cross 71 percent low-density and 29 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially bears, wolves, furbearers, raptors, owls, and forest-nesting landbirds, would be expected to be moderate because of recreational

Table 5.3-8
Core Habitats Greater than 100 Acres Fragmented by Alternative[a,b]

	Mac West-Connector 1-Willow		Mac West-Connector 1-Houston-Houston North		Mac West-Connector 1-Houston-Houston South		Mac West-Connector 2-Big Lake		Mac East-Connector 3-Willow		Mac East-Connector 3-Houston-Houston North		Mac East-Connector 3-Houston-Houston South		Mac East-Big Lake	
	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres
Wildlife Habitats																
Evergreen Forest	10	716	5	256	5	256	6	343	10	831	5	371	5	371	5	225
Deciduous Forest	30	496	19	113	19	113	12	502	30	496	19	113	19	113	12	502
Mixed Forest	37	427	2	1	2	1	11	549	46	638	11	212	11	212	13	244
Emergent Wetland	0	0	10	871	7	1,536	0	0	0	0	10	871	7	1,536	0	0
Shrub/Scrub Wetland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Woody Wetland	12	1,209	21	1,350	20	1,303	10	1,237	4	711	13	852	12	805	4	753
Agriculture	3	7,060	3	7,060	3	7,060	4	8,321	1	2,785	1	2,785	1	2,785	0	0
Forests	77	1,638	26	370	26	370	29	1,393	86	1,965	35	697	35	697	30	971
Wetland	12	1,209	31	2,221	27	2,840	10	1,237	4	711	23	1,723	19	2,341	4	753
Forest and Wetland	89	2,847	57	2,592	53	3,210	39	2,631	90	2,675	58	2,419	54	3,038	34	1,725

[a] Source: Homer *et al.*, 2004.
[b] No. = number of core habitat polygons greater than 100 acres crossed by alternative. Area = total area of core habitats greater than 100 acres crossed by alternative in acres.

development in the area. Nesting-habitat loss would affect 973 birds (Table 5.3-9). Nesting-habitat disturbance would affect 15 swans and loons, 2 bald eagle nests, and an estimated 16 raptor and owl nests (Table 5.3-10). Construction of the Mac West-Connector 1- Houston-Houston North Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Mac West-Connector 1-Houston-Houston South Alternative

This alternative would result in the loss of 1,032 acres of wildlife habitat (Table 5.3-7) and fragmentation of 3,210 acres of primarily emergent wetland and woody wetland core habitats (Table 5.3-8). Of the 1,032 acres of wildlife habitat loss under this alternative, 48 percent (496 acres) would comprise forested habitat and 46 percent (472 acres) would comprise wetland habitat (Table 5.3-7). This alternative would result in the loss of more than 700 acres of moose winter habitat and almost 300 acres of moose calving habitat (Table 5.3-7) and would cross 66 percent low-density and 34 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be moderate to high because of habitat characteristics and recreational development in the area. Nesting-habitat loss would affect 990 birds (Table 5.3-9). Nesting-habitat disturbance would affect 15 swans and loons, 2 bald eagle nests, and an estimated 14 raptor and owl nests (Table 5.3-10). Construction of the Mac West-Connector 1-Houston-Houston South Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Mac West-Connector 2-Big Lake Alternative

This alternative would result in the loss of 1,056 acres of wildlife habitat (Table 5.3-7) and fragmentation of 2,631 acres of forested and wetland core habitats (Table 5.3-8). Of the 1,056 acres of wildlife habitat loss under this alternative, 57 percent (606 acres) would comprise forested habitat and 34 percent (356 acres) would comprise wetland habitat (Table 5.3-7). This alternative would result in the loss of more than 200 acres of moose winter habitat (Table 5.3-7) and would cross 51 percent low-density and 49 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, forest-nesting and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational and rural development in the area. Nesting-habitat loss would affect 1,024 birds (Table 5.3-9). Nesting-habitat disturbance would affect 6 loons, 1 bald eagle nest, and an estimated 8 raptor and owl nests (Table 5.3-10). Construction of the Mac West-Connector 2-Big Lake Alternative would open a corridor through forested and wetland habitats that would contribute to fragmentation.

Mac East-Connector 3-Willow Alternative

This alternative would result in the loss of 1,249 acres of wildlife habitat (Table 5.3-7) and fragmentation of 2,675 acres of forested and woody wetland core habitats (Table 5.3-8). Of the 1,249 acres of wildlife habitat loss under this alternative, 88 percent (1,093 acres) would comprise forested habitat and only 12 percent (149 acres) would comprise wetland habitat (Table 5.3-7). This alternative would result in the loss of about 700 acres of moose winter habitat and

Table 5.3-9
Estimated Nesting Habitat Loss for Birds for the Alternatives[a]

	Individuals Displaced by Alternative[b]								Summary	
Bird Type	**Mac West-Connector 1-Willow**	**Mac West-Connector 1-Houston-Houston North**	**Mac West-Connector 1-Houston-Houston South**	**Mac West-Connector 2-Big Lake**	**Mac East-Connector 3-Willow**	**Mac East-Connector 3-Houston-Houston North**	**Mac East-Connector 3-Houston-Houston South**	**Mac East-Big Lake**	**Average Impact[c]**	**Estimated Project Area Population[d]**
Waterbirds	4	3	3	3	4	3	3	3	3	1,587
Geese and Swans	1	1	1	1	1	1	1	1	1	543
All Ducks	*54*	*43*	*44*	*45*	*53*	*42*	*43*	*40*	*46*	*21,109*
Dabbling Ducks	34	27	27	28	33	26	27	25	28	13,127
Diving and Sea Ducks	20	16	17	17	20	16	16	15	17	7,982
Raptors and Owls	7	7	6	6	7	6	5	5	6	4,063
Shorebirds	43	33	33	34	42	31	32	29	35	Unknown
Seabirds (gulls)	4	3	3	4	4	3	3	3	4	Unknown
Landbirds	*1,162*	*883*	*900*	*931*	*1,135*	*851*	*867*	*794*	*940*	*456,024*
Resident	86	65	67	69	84	63	64	58	69	24,957
Short-Distance Migrant	304	231	235	243	297	222	227	208	246	182,238
Long-Distance Migrant	772	587	598	619	754	566	576	528	625	248,828
Total Individuals[e, f]	**1,275**	**973**	**990**	**1,024**	**1,245**	**936**	**953**	**874**	**1,034**	**483,326**

[a] Sources: Rosenberg, 2004; Shook and Ritchie, 2008; Sauer *et al.,* 2008; Platte *et al.,* 2008; Mallek and Groves, 2008; URS, 2006; Benson, 2001.

[b] Estimate based on 200-foot right-of-way, terminal reserve, stream relocation, and road relocation footprint areas multiplied by nesting season density for waterbirds, geese and swans, ducks, raptors and owls in the study area (Appendix E). Estimate based on route mileage multiplied by nesting season linear density for shorebirds, seabirds and landbirds in the study area.

[c] Averaged value by category for the eight alternatives. Does not represent an alternative.

[d] Estimate based on regional or average project area densities multiplied by area within 5 miles of all proposed segments, or on the proportion of the project area and total population estimates for Bird Conservation Region 4 in Alaska.

[e] Total includes waterbirds, geese and swans, ducks, raptors and owls, and landbirds. Dabbling ducks and diving and sea ducks are subcategories of ducks. Landbirds categorized by migration are subcategories of landbirds and totals for birds of conservation concern are included within the appropriate category above.

[f] Differences in totals are due to rounding and significant figures.

Table 5.3-10
Estimated Nesting Habitat Disturbance to Swans, Loons, Raptors, and Owls by Alternative[a]

Birds	Individuals Displaced by Alternatives[b]								Estimated Study Area Population or Nests[c]
	Mac West-Connector 1-Willow	Mac West-Connector 1-Houston-Houston North	Mac West-Connector 1-Houston-Houston South	Mac West-Connector 2-Big Lake	Mac East-Connector 3-Willow	Mac East-Connector 3-Houston-Houston North	Mac East-Connector 3-Houston-Houston South	Mac East-Big Lake	
Trumpeter Swans	2	1	1	0	4	3	3	0	224
Common Loons (No. of young)[e]	10	12 (4)	11 (4)	5	11	13 (4)	12 (4)	2	657
Common Loon Lakes (No. with broods)	12 (2)	17 (6)	15 (6)	11 (2)	11	16 (4)	14 (4)	6	
Pacific Loons (young)	5	2	3 (2)	1	6	3	4 (2)	1	141
Total Waterbirds	**17**	**15**	**15**	**6**	**21**	**19**	**19**	**3**	**1,022**
Bald Eagle	6	2	2	1	5	1	1	1	30 nests
Osprey	1	1	1	1	1	1	1	1	7 nests
Red-tailed Hawk	0	6	5	0	0	6	5	0	44 nests
Great Horned Owl	0	1	0	0	1	2	1	0	7 nests
Great Gray Owl	0	1	1	0	0	1	1	0	7 nests
Northern Saw-whet Owl[d]	3	2	2	3	3	2	2	2	1,200
Boreal Owl[d]	4	3	3	3	4	3	3	3	1,600
Total Raptors and Owls	**14**	**16**	**14**	**8**	**14**	**16**	**14**	**7**	**2,895**

[a] Sources: Conant *et al.,* 2007; Platte *et al.,* 2008; Shook and Ritchie, 2008; Benson, 2001.
[b] Estimate based on observations within 0.5 miles of proposed segments, note that data for waterbirds are a sample of segment areas and actual impacts could be higher, surveys for raptors and large owls covered the entire segment.
[c] Estimate based on densities within the surveyed areas or observed nests.
[d] Estimate for small owls based on nesting densities near the study area multiplied by alternative footprint areas (Benson, 2001).
[e] No. = Number.

307 acres of moose calving habitat (Table 5.3-7) and would cross 61 percent low-density and 39-percent high density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially bears, wolves, furbearers, raptors, owls, and forest-nesting landbirds, would be expected to be high because of the remoteness of the area and proximity to anadromous fish resources on Susitna River and its tributaries. Nesting-habitat loss would affect 1,245 birds (Table 5.3-9). Nesting-habitat disturbance would affect an estimated 21 swans and loons, the largest number of all the alternatives; 5 bald eagle nests; and an estimated 14 raptor and owl nests (Table 5.3-10). Construction of the Mac East-Connector 3-Willow Alternative would open a corridor through primarily closed forest habitats that would contribute to fragmentation.

Mac East-Connector 3-Houston-Houston North Alternative

This alternative would result in the loss of 1,010 acres of wildlife habitat (Table 5.3-7) and fragmentation of 2,419 acres of emergent wetland, woody wetland, and forested core habitats (Table 5.3-8). Of the 1,010 acres of wildlife habitat loss under this alternative, 71 percent (721 acres) would comprise forested habitat and 28 percent (284 acres) would comprise wetland habitat (Table 5.3-7). This alternative would result in the loss of about 500 acres of moose winter habitat and more than 300 acres of moose calving habitat (Table 5.3-7), and would cross 66 percent low-density and 34-percent high density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational and rural development in the area. Nesting-habitat loss would affect 936 birds (Table 5.3-9). Nesting-habitat disturbance would affect an estimated 19 swans and loons, 1 bald eagle nest; and an estimated 16 raptor and owl nests (Table 5.3-10). Construction of the Mac East-Connector 3-Houston-Houston North Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Mac East-Connector 3-Houston-Houston South Alternative

This alternative would result in the loss of 1,003 acres of wildlife habitat (Table 5.3-7) and fragmentation of 3,038 acres of emergent wetland, woody wetland, and forested core habitats (Table 5.3-8). Of the 1,003 acres of wildlife habitat loss under this alternative, 64 percent (643 acres) would comprise forested habitat and 35 percent (356 acres) would comprise wetland habitat (Table 5.3-7). This alternative would result in the loss of 470 acres of moose winter habitat and nearly 300 acres of moose calving habitat (Table 5.3-7), and would cross 61 percent low-density and 39 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational development in the area. Nesting-habitat loss would affect 953 birds (Table 5.3-9). Nesting-habitat disturbance would affect an estimated 19 swans and loons, 1 bald eagle nest, and an estimated 14 raptor and owl nests (Table 5.3-10). Construction of the Mac East-Connector 3-Houston-Houston South Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Mac East-Big Lake Alternative

This alternative would result in the loss of 930 acres of wildlife habitat (Table 5.3-7) and fragmentation of 1,725 acres of forested and woody wetland core habitats (Table 5.3-8). Of the

930 acres of wildlife habitat loss under this alternative, 73 percent (678 acres) would comprise forested habitat and only 27 percent (250 acres) would comprise wetland habitat (Table 5.3-7). This alternative would cross 58 percent low-density and 42 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, forest-nesting and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational and rural development in the area. Nesting-habitat loss would affect 874 birds (Table 5.3-9). Nesting-habitat disturbance would affect an estimated 3 loons, 1 bald eagle nest, and 7 raptor and owl nests (Table 5.3-10). Construction of the Mac East-Big Lake Alternative would open a corridor through forested and wetland habitats that would contribute to fragmentation.

5.3.4.2 No-Action Alternative

Under the No-Action Alternative, ARRC would not construct and operate the proposed Port MacKenzie Rail Extension, and there would be no impacts to wildlife.