

**CHUITNA COAL PROJECT:
Addendum to the Project-wide Wildlife Baseline Studies Report**

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February 2008

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WILDLIFE HABITAT MAPPING

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INTRODUCTION

As part of the process of assessing baseline conditions for terrestrial wildlife in the region of the proposed Chuitna Coal Project, a wildlife habitat map for the Chuitna Coal Mine, the Chuitna Project Infrastructure, and the Ladd Landing Development was produced. The mapping performed involved integrating vegetation and land cover data with landscape features to derive a wildlife habitat map that reflects use by wildlife better than vegetation or land cover data alone. The wildlife habitat map-classes derived in this effort primarily are defined by vegetation structure (as opposed to species composition) and physiography (e.g., upland, lowland, and riverine areas) because these attributes in combination are strongly correlated with use by wildlife.

The wildlife habitat mapping reported here is used in conjunction with field observations of wildlife in the area (Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report) to enable assessments of the value of habitats in the project area to wildlife for foraging, breeding, migration, overwintering, and other critical aspects of their life histories. That information then is used to conduct quantitative evaluations of the amount of habitat (by value class for each species) used by wildlife that would be removed for development of the proposed mine (see Part D7-2: Mine Wildlife Protection Plan).

STUDY AREA

The Chuitna Coal Project area is located on the west side of upper Cook Inlet near the coastal communities of Beluga and Tyonek. The terrain in the area has been strongly influenced by glacial and riverine forces from the nearby Alaska Range mountains and spans a region from the coastal bluffs at the Cook Inlet coast inland approximately 12 mi (19 km) to the proposed mine site at an elevation of approximately 900 ft (~275 m). At the lower elevations in the infrastructure corridor and near the coast at Ladd Landing, the terrain is characterized by little topographic relief where small changes in elevation separate upland and lowland areas. By far

the dominant habitats in this area are the mixed forest types, which occur in both upland and lowland settings, but are more typical of upland sites. In poorly drained lowlands, scrub bog and graminoid vegetation is dominant and numerous lakes and ponds occur. Tall scrub habitats often occur in areas of disturbance and in riverine corridors. At the higher elevations in the mine site, the landscape is a mosaic of undulating, well-drained upland ridges consisting of quaternary glacial outwash moraine and till materials interspersed with poorly drained basins, kettle lakes, lowland flats, and riverine corridors (ERT 1985). In this area too, mixed forests are the dominant habitats on upland ridges but they are more patchy and interspersed with tall scrub and graminoid–herbaceous meadow habitats (bordering on subalpine). Lowland bog, wet graminoid habitats, and the relatively few lakes and ponds are restricted in the mine site to well-defined basins and flats. Riverine habitats typically are characterized by open tall scrub and graminoid vegetation.

The proposed Ladd Landing Development is located north of Ladd Landing near the mouth of the Chuit River and extends inland to the north to Viapan Lake (Wildlife Habitats Map 1). The Chuitna Project Infrastructure area runs northeast from Ladd Landing between Tukallah and Viapan Lakes, then northwest through a large wetland area east of Threemile Creek, and finally due west for approximately 6 mi (10 km) where it intersects with the southeast corner of the Chuitna Coal Mine. The western boundary of the Chuitna Coal Mine borders 2004 Creek (an upper tributary of the Chuit River) at the base of Lone Ridge and the eastern boundary is defined by Lone Creek. The mainstem of the Chuit River is approximately 2 mi from the southern border of the mine area and the northern border is 2 mi south of Scarp Creek. The specific study area boundaries for the wildlife mapping effort were defined by drawing 0.5 mi (0.8 km) buffers around the proposed Chuitna Coal Mine area and the Ladd Landing Development, and a 0.25 mi (0.4 km) buffer around the proposed facilities in the Chuitna Project Infrastructure.

METHODS

FIELD SURVEYS

Field surveys to collect wildlife habitat ground-truth information were conducted from 31 July to 4 August 2006. Sample plot locations were selected prior to the field work using true-color, digital orthophotographs (taken on 4 June 2005 at a scale of 1" to 15,000' and scanned to a

1-ft-pixel resolution; Aero-Metric, Anchorage, AK). Field sample plots were located along transects designed to traverse a number of distinct vegetation types or photo-signatures identifiable on the aerial photography. Transects were located non-randomly in areas that maximized the range of possible vegetation types encountered over distances that could be walked in a day. A total of 101 plots were sampled throughout the study area, with some plots occurring in representative surrounding areas to collect a full suite of habitat data for the area. Earlier in summer 2006, the ABR field crews surveying breeding landbirds also collected habitat ground-truth information and recorded digital photographs at 159 point-count locations (Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report). Field plots were accessed by helicopter and on foot using handheld GPS receivers and field maps of the digital aerial photography. In the field, sample plots were located in habitat areas representative of the larger unit that would eventually be mapped from the aerial photography (i.e., small inclusions of other habitat types were avoided).

At each sample plot, vegetation structure and plant species composition were measured using visual cover estimates within a 10-m radius of the plot center. Cover estimates of individual plant species were made to the nearest 5% for cover values $\geq 10\%$, and to the nearest 1% for cover values $< 10\%$. Vegetation structure was documented by estimating percent cover of all species combined in vegetation strata classes (trees, tall shrubs, low shrubs, dwarf shrubs, herbs, graminoids, mosses, lichens, water, litter, and bare soil). For each plot, the appropriate Level IV vegetation type from the *Alaska Vegetation Classification* (Viereck et al. 1992) was recorded.

In addition to the vegetation data, the appropriate physiography class and surface form types were recorded at each plot. The surface form categories used (both microtopography and macrotopography) were modified from Washburn (1973) and Jorgenson et al. (2002). To collect soils information, a small 15-inch (40 cm) soil pit was dug to determine water depth, drainage, soil moisture, organic depth and dominant mineral type (organic, sandy, loamy). Each soil pit was photographed and documentary habitat photos and GPS coordinates were recorded at each sample plot.

Field plant identifications for most vascular plants were made using *Flora of Alaska and Neighboring Territories* (Hultén 1968). Trees and shrubs, with the exception of willows (*Salix*

spp.), were keyed using *Alaska Trees and Shrubs* (Viereck and Little 1972). Willows were keyed using *A Guide to the identification of Willows in Alaska, the Yukon Territory and Adjacent Regions* (Argus 2001). Plant taxonomy and species groupings in this report follows that used in the baseline wetlands and vegetation report for the Chuitna Coal Project (Part C: Environmental Resources Information, Baseline Report for Vegetation and Wetlands) which, in turn, follows *The Plants Database* (USDA-NRCS 2006) and *Flora of North America North of Mexico* (FNA 1993–2006) with the exceptions listed in section 2.3.1 (Part C: Environmental Resources Information, Baseline Report for Vegetation and Wetlands).

All tabular field data were recorded on pocket PCs and were uploaded to a *Microsoft Access* database and checked for errors in coding by comparison with reference tables before starting the habitat mapping process.

WILDLIFE HABITAT MAPPING

Digital polygon delineation of Level IV vegetation types (Viereck et al. 1992) represented in the June 2005 digital aerial photography of the Chuitna Coal Project area was conducted by HDR Alaska Inc. (Part C: Environmental Resources Information, Baseline Report for Vegetation and Wetlands). These polygons were then used as a starting point for the wildlife habitat mapping. Wildlife habitats were derived by adding physiography and surface form attributes to each of the mapped vegetation polygons. Field ground-truth data along with 121 plots of HDR Alaska Inc.'s vegetation and field photo data were used concurrently in an effort to evaluate and represent all wildlife habitats delineated from different aerial photosignatures. In cases where a single vegetation type crossed physiography boundaries, the vegetation polygon was split to represent the different physiographic areas. This occurred primarily in riverine areas but also occasionally between lowland and upland areas as well. Polygons of ≤ 0.25 acres in size were eliminated from the original vegetation polygon map and merged with nearby vegetation types to minimize the representation of small habitat inclusions within broader habitat types. All aerial photo interpretation and digitizing was performed onscreen using *ArcGIS 9.2* software.

Once physiography and surface form types were assigned to each map polygon, an initial set of habitat types was created by deriving unique combinations of physiography and vegetation type. This resulted in a proliferation of habitat types with many combinations of physiography

and vegetation type. These habitat types were then aggregated into applicable broader classes sharing similar structure characteristics at a functional wildlife habitat scale. Additional specific aggregations were conducted to combine open and closed scrub types, and upland and lowland mixed forests when these types were determined to be used similarly by wildlife in the Chuitna Coal Project area. In cases in which individual plant species are important wildlife food sources (i.e., willow scrub for moose) some original habitats were preserved in the mapping.

RESULTS AND DISCUSSION

A total of 28 wildlife habitats were mapped in the study area (Wildlife Habitats Map 1; Appendix A, Habitat Descriptions; Table 1, Habitat Acreage). The most common habitat type in the study area is Open Mixed Forest, which comprises 7,895 acres (46.4% of the study area). Open Mixed Forest was separated into 2 different habitat types, one with a bluejoint–herb understory and one with a shrub understory (Appendix A, Habitat Descriptions). Open Mixed Forest with Bluejoint–Herb Understory (4,251 acres, 25.0% of the study area) occupies well-drained ridges and undulating upland terrain. Open Mixed Forest with Shrub Understory (3,644 acres, 21.4% of the study area) varies in understory shrub species composition between the Ladd Landing Development, the eastern portion of the Chuitna Project Infrastructure, and the Chuitna Coal Mine. Open Mixed Forest with Shrub Understory in the eastern portion of the study area tend to be larger polygons with thick closed shrub understory whereas polygons within the Chuitna Coal Mine are smaller and more commonly occupy less well-drained areas, which often were mapped as forested wetlands by HDR Alaska Inc. (Appendix D, Vegetation and Wetlands Maps for Project Area *in* Part C: Environmental Resources Information, Baseline Report for Vegetation and Wetlands). The 2 types of open mixed forest were separated because the differences in drainage and vegetation structure create different habitats for some mammals and for many landbird species.

Disturbed Open Broadleaf Forest (447 acres, 2.6% of the study area) is found only in the eastern portion of the study area where areas of open mixed forest have been selectively logged to remove spruce trees. Other forest types found in the area are Open Broadleaf Forest (221 acres, 1.3% of the study area), Closed Broadleaf Forest (86 acres, 0.3% of the study area) and Open White Spruce Forest (480 acres, 2.8%).

Tall scrub habitats are found in upland, lowland, and riverine physiographic areas and together these types account for 1,724 acres (10.1% of the study area). Upland Tall Scrub is the fourth most common individual habitat type, comprising 1,366 acres (8.0% of the study area). Upland Tall Willow Scrub, Lowland Tall Scrub, Lowland Tall Willow Scrub, Riverine Tall Scrub, Riverine Tall Willow Scrub, and Disturbed Alder Scrub each account for <1% of the study area. The tall scrub habitats, in both upland and lowland settings, are dominated by Sitka alder (*Alnus viridis* ssp. *sinuata*) and thinleaf alder (*Alnus incana* spp. *tenuifolia*) with a smaller component of willows (*Salix* spp.). The tall willow scrub habitats, on the other hand, are strongly dominated by willows. These 2 forms of tall scrub were separated because the former types, dominated by alder, are used to a greater degree by bears, whereas willow scrub is a preferred browse for moose.

Poorly drained lowland bog habitats (Lowland Bog and Lowland Bog/Pond Complex) together comprise 2,787 acres (16.4% of the study area). Both bog types are mosaics of low scrub, dwarf tree woodland, and graminoid vegetation but are dominated by low sweetgale (*Myrica gale*) and ericaceous scrub. Lowland Bog consists of continuous bog vegetation whereas Lowland Bog/Pond Complex contains shallow lakes and ponds intermixed with bog vegetation. Lowland Bog/Pond Complex has up to 50% cover of open water and was mapped as a separate type because of its importance to breeding waterbirds and shorebirds. Two similar habitats, commonly associated with the bog types and often occurring along bog margins or as inclusions within a larger bog area, are Lowland Dwarf Spruce Woodland (311 acres, 1.8% of the study area) and Lowland Black Spruce Forest (218 acres, 1.3% of the study area).

Upland Bluejoint–Herb Meadow covers 979 acres (5.8% of the study area). This upland type is found on well-drained, undulating ridges, often associated with and grading into Open Mixed Forest with Bluejoint–Herb Understory. Upland Bluejoint–Herb Meadow polygons were separated from the surrounding open mixed forest when they were >0.25 acres, although polygons of this type generally were small with a mean area of 1.5 acres. Different patches of Upland Bluejoint–Herb Meadow vary in species composition, with some containing pure stands of fireweed (*Chamerion angustifolium*), and others with a more even mix of herbs and bluejoint grass (*Calamagrostis canadensis*). Although, pure stands of fireweed could be classified as Fireweed Meadow, it was not possible to separate these patches on the aerial photos from

meadows containing substantial bluejoint grass. A similar habitat, Upland Bluejoint Meadow (16 acres, <1% of the study area), is a wetland type found in small depressions within upland regions dominated by mixed forests. Most of the polygons of this type were below the 0.25 acre mapping threshold, in which case they were included within the surrounding mapped polygon. The mean polygon size for this type was <0.5 acres.

Upland *Myrica* Scrub (151 acres, 1% of the study area) occurs in upland depressions and gently sloping concavities. This habitat is strongly dominated by closed low sweetgale scrub communities with mesic soil conditions. There is less organic accumulation in the soils in this type in contrast to the wetter sweetgale scrub types that occur in Lowland Bog habitats.

Tall shrub swamp habitats were found in both riverine and lowland physiographic areas and were separated as 2 habitat types. Riverine Tall Shrub Swamp occurs within the active floodplain of streams and accounted for 210 acres (1.2% of the study area). Lowland Tall Shrub Swamp (135 acres, <1% of the study area) typically occurs on lowland flats adjacent to active riverine floodplains and in lowland areas bordering small lakes.

Riverine meadows were split into 2 habitat types, Riverine Bluejoint Meadow (230 acres, 1.4% of the study area) and Riverine Sedge Meadow (17 acres, <1%). Riverine Bluejoint Meadow is an aggregate of bluejoint and bluejoint–shrub vegetation and often contains small patches, or scattered occurrences, of tall shrubs (typically willows). Riverine Sedge Meadow is an aggregate of wet and aquatic sedge vegetation. This type is rare in the study area but is a distinct habitat, which is more frequently flooded than Riverine Bluejoint Meadow.

Shallow Lacustrine Water (360 acres, 2.1% of the study area) is found throughout the study area in kettle depressions. Upper Perennial River, the only other open water type, covers 100 acres, <1% of the study area. This habitat includes stretches of running water and deep pools, which often occur upstream of beaver dams.

Three unvegetated or partially vegetated habitat types occur in the Ladd Landing Development and eastern infrastructure area. Coastal Mud Flat (586 acres, 3.5% of the study area) is located along the length of coast in the proposed Ladd Landing Development area. Above the mud flats are steep bluffs, some of which are composed of unconsolidated materials that do not support vegetation; these areas were mapped as Partially Vegetated Bluff and account

for 7.4 acres (<0.1% of the study area). Unvegetated road and building pads composed of gravel fill are found in the Ladd Landing Development and the eastern portion of the infrastructure area, and account for 32 acres (<1% of the study area).

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Table 1, Habitat Acreages. Wildlife habitat acreages and relative percentages in the proposed Chuitna Coal Mine, Chuitna Project Infrastructure, and Ladd Landing Development areas, Alaska, 2006.

Habitat Type	Area (acres)	Percent of study area
Open Broadleaf Forest	220.6	1.3
Disturbed Open Broadleaf Forest	447.2	2.6
Closed Broadleaf Forest	85.4	0.5
Open Mixed Forest w/ Bluejoint–Herb Understory	4,250.7	25.0
Open Mixed Forest w/ Shrub Understory	3,644.0	21.4
Open White Spruce Forest	479.3	2.8
Upland Tall Scrub	1,366.4	8.0
Disturbed Alder Scrub	16.7	0.1
Upland Tall Willow Scrub	103.8	0.6
Upland Myrica Scrub	150.5	0.9
Upland Bluejoint–Herb Meadow	979.4	5.8
Upland Bluejoint Meadow	16.3	0.1
Lowland Tall Scrub	78.3	0.5
Lowland Tall Willow Scrub	147.5	0.9
Lowland Tall Shrub Swamp	134.7	0.8
Lowland Black Spruce Forest	218.1	1.3
Lowland Dwarf Spruce Woodland	310.5	1.8
Lowland Bog	2,061.0	12.1
Lowland Bog/Pond Complex	725.6	4.3
Shallow Lacustrine Water	360.4	2.1
Riverine Tall Scrub	6.9	0.0
Riverine Tall Willow Scrub	4.4	0.0
Riverine Tall Shrub Swamp	210.0	1.2
Riverine Bluejoint Meadow	229.6	1.4
Riverine Sedge Meadow	16.8	0.1
Upper Perennial River	100.0	0.6
Partially Vegetated Bluff	7.4	0.0
Coastal Mud Flat	586.2	3.5
Gravel Fill	32.2	0.2
Total	16,989.9	100.0

Appendix A, Habitat Descriptions. Classification and description of wildlife habitat types mapped in the area of the proposed Ladd Landing Development, Chuitna Project Infrastructure, and Chuitna Coal Mine, Alaska, 2006.

Habitat Type	Description
Open Broadleaf Forest	Occurs on undulating morainal terrain, upper and lower slopes evenly dispersed throughout the proposed mine, infrastructure corridor, and export facility areas. An aggregate of woodland and open forest types is dominated by either Kenai birch (<i>Betula kenaica</i>) and/or balsam poplar (<i>Populus balsamifera</i>). Closed understory species include highbush cranberry (<i>Viburnum edule</i>), lady fern (<i>Athyrium filix-femina</i>), Barclay's willow (<i>Salix barclayi</i>), white spruce (<i>Picea glauca</i>), and cowparsnip (<i>Heracleum maximum</i>) and devil's club (<i>Oplopanax horridus</i>). Soils are well-drained.
Disturbed Open Broadleaf Forest	Occurs on upland areas within the permit boundary for the proposed export facility and the eastern portions of the infrastructure corridor. Disturbed plant community resulting from selective logging within Open Mixed Forest vegetation types. Resulting forest canopy ranges from woodland (10–24% cover) to open (25–59% cover) composed of Kenai birch and balsam poplar. Understory and forest floor plant species include rusty menziesia (<i>Menziesia ferruginea</i>), white spruce, thinleaf alder (<i>Alnus incana</i> ssp. <i>tenuifolia</i>) and highbush cranberry. Soils are well drained, terrain is undulating with small kettle features.
Closed Broadleaf Forest	Occurs on well-drained soils near the coastal bluff within the permit boundary for the proposed export facility. Closed canopy (>60%) is composed of Kenai birch with white spruce in the understory. Forest floor vegetation is composed of herbs and low shrubs such as stiff clubmoss (<i>Lycopodium annotinum</i>), woodland horsetail (<i>Equisetum sylvaticum</i>), strawberryleaf raspberry (<i>Rubus pedatus</i>) and Lapland cornel (<i>Cornus suecica</i>).
Open Mixed Forest with Bluejoint–Herb Understory	Common habitat type throughout the proposed mine and western infrastructure corridor. Occurs on undulating morainal terrain, upper and lower slopes. A woodland (10–24% cover) to open (25–59% cover) tree canopy composed of white spruce, Kenai birch, and less frequently, balsam poplar. The graminoid and herb understory is dominated by fireweed (<i>Chamerion angustifolium</i>), bluejoint (<i>Calamagrostis canadensis</i>), lady fern, and field horsetail (<i>Equisetum arvense</i>), which vary in relative abundance in different sites. The shrub component is dominated by thinleaf alder, highbush cranberry, and Greene's mountain ash (<i>Sorbus scopulina</i>). Soils are well-drained.
Open Mixed Forest with Shrub Understory	A common habitat type occurring throughout the proposed mine, infrastructure corridor, and export facility areas on a variety of upland and lowland sites including shallow slopes, flats, toe-slopes, and drainage-ways. Woodland (10–24% cover) to open (25–59% cover) tree canopy is composed of white spruce, and Kenai birch. Species composition in the understory varies from coastal areas to the near-subalpine areas at the proposed mine site. In the mine area, the shrub understory typically is composed of dense thickets of Richardson's willow (<i>Salix richardsonii</i>), Barclay's willow, Sitka alder (<i>Alnus viridis</i> ssp. <i>sinuata</i>), thinleaf alder, dwarf birch (<i>Betula nana</i>), sweetgale (<i>Myrica gale</i>), and bluejoint. Common understory species in the export facility and eastern infrastructure corridor are rusty menziesia, thinleaf alder, highbush cranberry, western oakfern (<i>Gymnocarpium dryopteris</i>) and stiff clubmoss. Often forested wetlands within the mine area but more commonly found on drier substrates in the corridor and export facility.

Appendix A, Habitat Descriptions (continued).

Habitat Type	Description
Open White Spruce Forest	Occurs on poorly drained uplands and lowlands on flats, drainage-ways, toe-slopes, forest margins, flat banks, basins, and lower slopes. Generally found at the edges of riverine corridors in the proposed mine site and western infrastructure corridor. Woodland (10–24% cover) to open (25–59% cover) tree canopy composed of white spruce. Understory species include tealeaf willow (<i>Salix pulchra</i>), Barclay’s willow, sweetgale, highbush cranberry, oval-leaf blueberry (<i>Vaccinium ovalifolium</i>), dwarf birch, bluejoint, and field horsetail. Usually forested wetlands.
Upland Tall Scrub	Occurs on well-drained, undulating morainal terrain, drainage-ways, and flats. An aggregate of tall (>1.5 m) shrub stands, including both open (25–74% cover) and closed (>75% cover) canopies of tall closed alder scrub and tall closed alder–willow scrub. Mostly confined to the proposed mine site and western infrastructure corridor. Over 80% of this type in the mapped area is tall closed alder scrub. The dominant shrub species are thinleaf alder, Sitka alder, Barclay’s willow, tealeaf willow, and Sitka willow (<i>Salix sitchensis</i>). The understory is composed of devil’s club, bluejoint, lady fern, spreading woodfern (<i>Dryopteris expansa</i>), claspleaf twistedstalk (<i>Streptopus amplexifolius</i>), and field horsetail.
Disturbed Alder Scrub	Linear features found within the permit boundary for the proposed export facility and eastern portions of the infrastructure corridor. Disturbed plant community resulting from clearing Open Mixed Forest vegetation types. Dominant species include thinleaf alder and Sitka alder.
Upland Tall Willow Scrub	Occurs on well-drained, undulating morainal terrain, drainage-ways, flats, and lower slopes throughout the proposed mine site and western infrastructure corridor. An aggregate type of tall (>1.5 m) willow-dominated communities that can be open (25–74% cover) or closed (>75% cover). Dominated by Barclay’s willow, Richardson’s willow, feltleaf willow (<i>Salix alaxensis</i>), lady fern, field horsetail, and dwarf bilberry (<i>Vaccinium caespitosum</i>).
Upland Myrica Scrub	Found on upland sites on lower concave slopes, flats, drainage-ways, and basins in the proposed mine area. An aggregate type of open (25–74% cover) and closed (>75% cover) low shrub (<1.5 m) communities. The dominant species is sweetgale. Associated species include dwarf birch, bluejoint, and field horsetail. Poorly drained to moderately well-drained clay-loam and sandy-loam soils; less organic accumulation than the sweetgale scrub vegetation occurring in bogs.
Upland Bluejoint–Herb Meadow	Occurs on undulating morainal terrain, upper and lower slopes in the proposed mine site and western infrastructure corridor. Herb-rich meadows dominated by tall, luxuriant growth of fireweed, bluejoint, lady fern, and field horsetail. The species vary in relative abundance in different sites. Soils are well-drained.
Upland Bluejoint Meadow	Found in poorly drained upland basins, drainage-ways, and on concave slopes throughout the mapping study area. Small, closed graminoid stands composed almost entirely of bluejoint. Mapped only if area was >0.25 acres.
Lowland Tall Scrub	Occurs on somewhat poorly drained toe-slopes, lower slopes, drainage-ways, and flats throughout the project area. An aggregate type composed of tall (>1.5 m) alder and alder–willow scrub stands; both open (25–74% cover) and closed (>75% cover) stands occur. The dominant shrub species are thinleaf alder, Sitka alder, Barclay’s willow, tealeaf willow, and Sitka willow. The forb and graminoid-dominated understory is characterized by species such as devil’s club, bluejoint, lady fern, spreading woodfern, claspleaf twistedstalk, and field horsetail. Soils are moist and loamy with relatively little organic matter accumulation.

Appendix A, Habitat Descriptions (continued).

Habitat Type	Description
Lowland Tall Willow Scrub	This type is found on somewhat poorly drained toe-slopes, lower slopes, drainage-ways, and flats throughout the mapping study area. An aggregate of closed (>75% cover) and open (25–74% cover) tall willow (>1.5 m) shrub canopies; dominant willow species is Barclay’s willow. Other associated shrub species are tealeaf willow and Kenai birch. Understory species include bluejoint, Canadian burnet (<i>Sanguisorba canadensis</i>), lady fern, and dwarf marsh violet (<i>Viola epipsila</i>). Moist mineral soils with little organic matter accumulation.
Lowland Tall Shrub Swamp	Occurs on extremely poorly drained flats, lake margins, and drainage-ways throughout the mapping study area. An aggregate of open (25–74% cover) and closed (>75% cover) tall-shrub (>1.5 m) canopy composed of thinleaf alder, Barclay’s willow, and Kenai birch. Understory is variable but usually is strongly dominated by bluejoint. Wetland-obligate herbs such as purple marshlocks (<i>Comarum palustre</i>), buckbean (<i>Menyanthes trifoliata</i>), and water horsetail (<i>Equisetum fluviatile</i>) also may be present. Soils are flooded.
Lowland Black Spruce Forest	Occurs on flats, forested margins of bogs, and toe-slopes throughout the proposed export facility area and infrastructure corridor. Frequency of Lowland Black Spruce Forest decreases towards the mine area as this type grades into needleleaf forests dominated by white spruce. The black spruce (<i>Picea mariana</i>) forest canopy ranges from woodland (10–24% cover) to open (25–59% cover). Understory species include sweetgale, dwarf birch, tealeaf willow, lingonberry (<i>Vaccinium vitis-idaea</i>), water horsetail and field horsetail. Poorly drained, loamy soils with moderate, organic-matter accumulation (<15 inches).
Lowland Dwarf Spruce Woodland	Occurs on poorly drained flats, toe-slopes, drainage-ways, and along bog edges; often in transitional areas between bog vegetation and adjacent forests. Found throughout the mapping study area. Characterized by a sparse woodland tree canopy (10–25% cover) dominated by dwarf white spruce in the proposed mine site and far western infrastructure corridor, or black spruce in the majority of the infrastructure corridor and the export facility. The understory is open or closed low scrub, dominated by sweetgale and associated species such as dwarf birch (<i>Betula glandulosa</i>), field horsetail, black crowberry (<i>Empetrum nigrum</i>) and bluejoint. The soils are always poorly drained and dominated by organics.
Lowland Bog	Commonly found on extremely poorly drained flats throughout the mapping study area. An aggregate type consisting of four low-shrub and emergent-vegetation types. <i>Myrica</i> –graminoid bog is dominated by sweetgale, dwarf birch, and bluejoint. Shrub–birch bog is dominated by dwarf birch and ericaceous shrubs. Wet sedge meadow contains water sedge (<i>Carex aquatilis</i>), mud sedge (<i>Carex limosa</i>), water horsetail, buckbean, and purple marshlocks. Finally, willow–graminoid bog is dominated by Barclay’s willow, sweetgale, and bluejoint. <i>Myrica</i> –graminoid bog is the dominant vegetation type within this complex. Soils are wet with >40 cm organic accumulation in most places.
Lowland Bog/Pond Complex	Found in flooded basins throughout the mapping study area. Dominated by shallow open water with islands and bog vegetation. Unmapped terrestrial vegetation types within this complex are the same as described for Lowland Bog, with the addition of emergent pond lily and open water. Cover of open water or aquatic vegetation communities is >50%.
Shallow Lacustrine Water	Shallow ponds and lakes (>0.25 acre) found in kettle basins. Emergents such as pond lily (<i>Nuphar polysepalum</i>) and buckbean can occur along waterbody margins.

Appendix A, Habitat Descriptions (continued).

Habitat Type	Description
Riverine Tall Scrub	Occurs on flat riverbanks along Threemile Creek. The closed (>75% cover) tall shrub canopy is composed of thinleaf alder and Sitka willow with <i>Tilesius's</i> wormwood (<i>Artemisia Tilesii</i>), bluejoint, ostrich fern (<i>Matteuccia struthiopteris</i>) and field horsetail in the understory. Soils are gravelly, well-drained.
Riverine Tall Willow Scrub	Occurs on flat riverbanks along Threemile Creek. The closed (>75% cover) and open (25–74% cover) tall shrub cover is dominated by willows (Sitka willow, Richardson's willow, tealeaf willow) with lesser amounts of balsam poplar and thinleaf alder. Bluejoint and field horsetail dominate in the understory.
Riverine Tall Shrub Swamp	Occurs on active floodplains of streams throughout the mapping study area. An open tall-shrub (>1.5 m) canopy dominated primarily by thinleaf alder with lesser amounts of Sitka alder. Understory is variable but usually is composed of bluejoint. Wetland-obligate herbs such as purple marshlocks, buckbean, and water horsetail also may be present. Soils are flooded throughout the growing season.
Riverine Bluejoint Meadow	Occurs on moist to poorly drained sites within riverine corridors throughout the mapping study area. Bluejoint forms closed stands in the active floodplains of streams. These areas are strongly dominated by bluejoint, but patches of low and/or tall shrubs (typically willow spp.; <25% cover) often are present. Associated species include water sedge, water horsetail, fireweed, thinleaf alder, and tealeaf willow. Soils range from sandy loams to peat.
Riverine Sedge Meadow	Flooded areas in active floodplains of streams, usually surrounding beaver dams. An uncommon habitat type but found throughout the mapping study area. An aggregate of aquatic marsh and wet meadow vegetation types. Common species include swordleaf rush (<i>Juncus ensifolius</i>), thread rush (<i>Juncus filiformis</i>), pendant grass (<i>Arctophila fulva</i>), silvery sedge (<i>Carex canescens</i>), lakeshore sedge (<i>Carex lenticularis</i>), and rough bentgrass (<i>Agrostis scabra</i>). A small shrub component may be present, including tealeaf willow and Barclay's willow.
Upper Perennial River Partially Vegetated Bluff	Permanently flooded channels of freshwater streams, including beaver dams. Only found on steep slopes above intertidal mud flats at the coast. Vegetation was not sampled within this habitat type but total cover is <10% based on photo interpretation. Steeps slopes composed of unconsolidated sands and gravels.
Coastal Mud Flat	Intertidal mud flats along Cook Inlet coast in the proposed export facility area. Unvegetated and subject to tidal fluctuations.
Gravel Fill	Gravel roads and building pads found throughout the proposed export facility area and eastern infrastructure corridor. Unvegetated.

NESTING DIURNAL RAPTORS

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INTRODUCTION

Raptors are traditional in their use of nesting sites and this can make them susceptible to impacts from disturbances in or near their breeding areas. All raptors are currently protected by the Migratory Bird Treaty Act (16 U.S.C. 703-712, <http://permits.fws.gov/ltr/ltr.shtml>). Eagles and their nests receive additional protections under the Bald and Golden Eagle Protection Act (U.S.C. 688, <http://permits.fws.gov/ltr/ltr.shtml>). These legislations require any significant development to identify and protect active raptor nest sites; and in the case of eagles, even protect inactive nests. Information on locations, occupancy, and appropriate management of traditional raptor nest sites are, therefore, important to reduce and mitigate for impacts from industrial developments.

Nests of large, diurnal cliff- and tree-nesting raptors were identified and mapped in the Chuitna Coal Project area during 2006 (see Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report). Because of their relative abundance and protected status it was appropriate to conduct occupancy and productivity surveys for nest sites of tree-nesting raptors within and near the Chuitna Coal Project area again in 2007. Efforts were focused on surveys for protected species of management and conservation concern, such as Bald Eagles and Northern Goshawks. (All other raptor species were recorded when observed, but no concerted efforts were made to determine their distribution or abundance in the area.) Specific objectives were to:

- Confirm the presence and general abundance of large tree-nesting raptors using the project area;
- Locate and map the distribution of nest sites of large tree-nesting raptors within and near the project area in 2007; and

- Determine occupancy and productivity of all identified stick nests within and near the project area in 2007.

STUDY AREA

The survey area for tree-nesting raptors in 2007 included the footprint of the proposed development area of the Chuitna Coal Project and an area encompassing a 0.5 mi (800 m) buffer around the proposed footprint. Additionally, all diurnal raptor stick nests located during 2006 within 1.0 mi (1.6 km) of the development footprint, along the coast between the Beluga airstrip and the project area, and at the mouth of the Chuit River near Ladd Landing were monitored for occupancy status in 2007.

METHODS

OCCUPANCY SURVEYS

Northern Goshawks

Aerial surveys for Northern Goshawks were conducted following a standardized line-transect protocol (Woodbridge 1993, Fuller and Mosher 1981), similar to the methods used in 2006 (Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report), except that surveys in 2007 were conducted in a Hughes 500 helicopter instead of an R-44. Occupancy surveys for Northern Goshawks were conducted 23–24 April 2007, prior to leafout of trees in the area. In addition, ground-based surveys were conducted using playback recordings of Northern Goshawk alarm calls (cassette tape player and megaphone; Kennedy 1993) to elicit territorial responses from Northern Goshawks at 2 locations where Northern Goshawks had been recorded in 2006, but not confirmed from aerial surveys in 2007. This was done to verify occupancy status by goshawks of those areas within the project area in 2007.

Bald Eagles

Aerial surveys to locate Bald Eagles and other tree-nesting raptors were conducted following protocols used during raptor surveys in 2006 (Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report). A Hughes 500 helicopter was used with 2 observers on the same side of the aircraft to check occupancy status of all stick nests in 2007 that were located in the study area in 2006, observed during surveys for nesting Northern

Goshawks in 2007, as well as site-specific search (in suitable woodland habitats) for any additional stick nests in the study area. Occupancy surveys were conducted for Bald Eagles and other diurnal tree-nesting raptors on 10 May 2007, prior to leafout of trees in the area.

NEST SUCCESS AND PRODUCTIVITY SURVEYS

A second set of aerial surveys was conducted 10 July 2007 (during the nestling period) to determine nest success and productivity of all nests identified during occupancy surveys. One observer revisited all nests to determine productivity of active nests and to confirm the status of all inactive nests observed during previous surveys. The observer used GPS coordinates to relocate all nests. At nest sites the occupancy status and number of young observed were recorded, and chicks were aged when possible. A nesting pair was considered successful if at least 1 live nestling (preferably >3 weeks old) was observed. Nest occupancy rate for Bald Eagles was calculated as the number of active nests/territories being occupied from the number identified within the study area. Overall productivity was calculated as both the number of young/active nest or total nesting pairs, and as the number of young/successful nest or successful pair, in order to compare with other studies.

Survey flight altitudes, aircraft speed, and other survey methods were similar to those employed during occupancy and productivity surveys conducted in the Chuitna Coal Project area in 2006 (Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report).

RESULTS

A total of 27 stick nests of raptors were located and monitored in the study area for occupancy status and productivity. These nests included 2 Northern Goshawk nests, 21 Bald Eagle nests, and 4 other medium-sized stick nests. During surveys, Red-tailed Hawk and Rough-legged Hawk also were observed in the study area. Although nesting could not be confirmed for other raptor species during surveys in 2007, it is suspected that many of them (e.g., Red-tailed Hawk, Merlin, Great-horned Owl, Sharp-shinned Hawk, Northern Harrier) may breed in the area.

NORTHERN GOSHAWK

During aerial occupancy surveys for nesting goshawks, a Northern Goshawk nest was relocated near the infrastructure boundary in 2006 (Raptor Nests Map 7 in Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report) and found unoccupied in 2007. Because this was an active nest in 2006 and goshawks are known to have multiple nest sites within a territory, ground-based playback calls in the vicinity of the known nest were used to attempt to determine if a goshawk pair still occupied the territory in 2007. The ground-based playback call protocol elicited a response from a territorial Northern Goshawk and a bird and new active nest within the pair's territory were located (Raptor Nests Map 2). The active nest was located in a paper birch (*Betula papyrifera*) tree within the same mixed spruce-birch forest stand as the nest used in 2006, and was located 820 ft (250 m) from the area proposed for Personnel Housing facilities at the Chuitna Coal Mine. One adult was observed incubating eggs at the nest site on 23 April. A revisit to the nest on 10 May indicated that the nest was still active. The nest could not be located from the air and the observer was unable to check the nest from the ground on 20 July. Therefore, nest fate and productivity could not be determined in 2007.

No other Northern Goshawk nests were located in the study area during aerial surveys. Ground-based playback calls also were used at a location near the southwestern end of the proposed mine area where a territorial goshawk pair was observed in 2006 (Raptor Nests Map 7 in Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report) to attempt to locate a pair in 2007. The playback calls did not elicit any response from goshawks in that area.

BALD EAGLE

During aerial occupancy surveys for tree-nesting raptors a total of 21 Bald Eagle nests were recorded in the study area. Eleven of these nests were <0.25 mi (<350 m) from another nest and likely were alternate nest sites within the territory of the first nest. Therefore, it is estimated that 15 Bald Eagle territories occurred within the study area in 2007. Of these, 1 nest occurred 0.5 mi (800 m) northeast of the proposed mine affected area, 7 territories occurred within 0.1–1.0 mi (150–1600 m) of the infrastructure affected area, 1 nest occurred 0.5 mi (800 m) southeast of the affected area of the proposed Ladd Landing Development, 3 territories occurred along the mouth of the Chuit River, and 3 territories occurred along the coast between the Beluga airstrip and the project area (Raptor Nests Map 2). Of the 15 Bald Eagle territories monitored in 2007, 4 were occupied by Bald Eagles (27% occupancy rate) during surveys on 10 May. Two of these nests were located along the proposed infrastructure corridor, and 2 were on the coast to the south and north of the Ladd Landing area (Raptor Nests Map 2). Productivity surveys in July indicated that all 4 active Bald Eagle nests were successful (100% nest success), and overall productivity was 1.5 chicks/active territory, and 1.5 young/successful nest (6 young) in 2007.

OTHER SPECIES

During aerial occupancy surveys for tree-nesting raptors 4 medium-sized stick nests were located that could be used by Red-tailed Hawks, Great-horned Owls, or Common Ravens. All of these nests were within the mine area and were unoccupied in 2007 (Raptor Nests Map 2).

DISCUSSION

NORTHERN GOSHAWK

Suitable habitat (mixed spruce-birch forest) for Northern Goshawks is extensive across much of the infrastructure area and lower mine area. The observation of a Northern Goshawk pair using the same territory in 2006 and 2007 confirms that suitable habitat for Northern Goshawks exists and is consistently being used within the proposed project development area. This territory has at least 2 nests within and adjacent to the Chuitna Project Infrastructure and the territorial pair may use habitats in the mine area for foraging as well.

BALD EAGLE

Suitable habitat (open broadleaf and mixed spruce-birch-poplar forests) for nesting Bald Eagles occurs across much of the Chuitna Coal Project area, but is particularly prevalent in the southeastern portions of the proposed Chuitna Project Infrastructure and Ladd Landing Development areas. Aerial surveys in 2007 identified 1 Bald Eagle nest near the northern end of the proposed mine affected area, 1 nest within the affected area of the Ladd Landing Development, and 7 other Bald Eagle nesting territories within 1.0 mi (1.6 km) of the Chuitna Project Infrastructure. Additionally, there were 6 other Bald Eagle nesting territories in close proximity to the Cook Inlet coast near the project area.

Of the total of 15 nests monitored in the study area, only 2 adjacent to the infrastructure corridor area and 2 along the Cook Inlet coast were active in 2007. This occupancy rate (27%) is lower than was estimated for the Beluga region in 2006, for which the occupancy rate was 45% (see Raptors, Table 7 in Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report). In addition, nest success in 2007 was 100%, but the sample size was small and may not be representative of the region. For example, nest success was 60% for Beluga region in 2006 (Part C: Environmental Resources Information, Project-wide Wildlife Baseline Studies Report) and nest success rates of 48% and 59% have been documented in interior Alaska (Steidl et al. 1997). Combined with rates of success for Bald Eagle nests in the area in 2006, however, these data suggest that the Beluga region may be a highly productive area for nesting Bald Eagles.

OTHER SPECIES

The only observations of hawks nesting in the area were 4 unoccupied hawk-sized nests within the proposed mine area. Red-tailed Hawks are probably not common in the area proposed for the Chuitna Coal Project, but are possible breeders within or near the area. Additionally, their nests can be used by other raptor species (e.g., Great-horned Owls) and Common Ravens, which also likely breed in the area.

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