



Pre-Permitting Environmental/Socio-Economic Data Report Series

Report Series N: Terrestrial Habitat and Wildlife

This data release, addressing Pebble's Terrestrial Habitat and Wildlife studies, is the 14th in the Pebble Partnership's Pre-Permitting and Socio-Economic Data Report Series. Since 2004, the Pebble Partnership has retained the independent, Alaska-based environmental consulting firm, ABR, Inc., to conduct a program of ongoing wildlife studies. These studies are divided into the following categories:

- Mammals;
- Landbirds and Shorebirds;
- Raptors;
- Iliamna Lake Harbor Seals; and,
- Waterbirds;
- Wood Frogs.

The study area was divided into two regions, identified as the greater deposit area (also referred to as the mine study area), which includes the Upper Talarik and Koltuli drainages, and the potential transportation corridor (also referred to as the road corridor).

Mammal Studies

Specific work elements for the terrestrial mammal surveys included:

- review relevant literature on all species of mammals inhabiting the region;
- conduct aerial transect surveys of the mine and transportation-corridor study areas during late winter, caribou calving, caribou postcalving, caribou rut/fall migration, and early winter;
- conduct aerial surveys of brown bears along salmon-spawning streams and examine dens of bears and wolves in the mine and transportation-corridor study areas;
- analyze radio-telemetry data provided by the interagency Mulchatna Caribou Herd Technical Working Group;
- conduct an aerial survey of beaver colonies in the mine study area; and
- collection of wildlife observations by other Pebble Project personnel.

Based on historical reports and recent field inventories, 40 species of mammals are known or are suspected to occur within the mine and transportation corridor study areas.

Caribou, bears and moose are ecologically and economically important inhabitants of the region. Brown bears are abundant in Southwest Alaska, whereas black bears occur in lower densities and only in the northern portion of the region. These species were of primary interest for the Pebble Project surveys, but all mammal species encountered incidentally, such as gray wolf and other furbearers, were recorded. Another source of mammal observations was incidental sightings during the surveys of waterfowl, raptors, and breeding birds that were conducted for the Pebble Project.

Except for the aerial survey of beaver colonies, no surveys were conducted specifically for furbearers or small mammals because of the availability of furbearer harvest data and recent inventory surveys conducted in Lake Clark and Katmai National Parks and Preserves for the National Park Service and in the area Northwest of Iliamna Lake and in the Kvichak and Nushagak river drainages for the Bureau of Land Management.

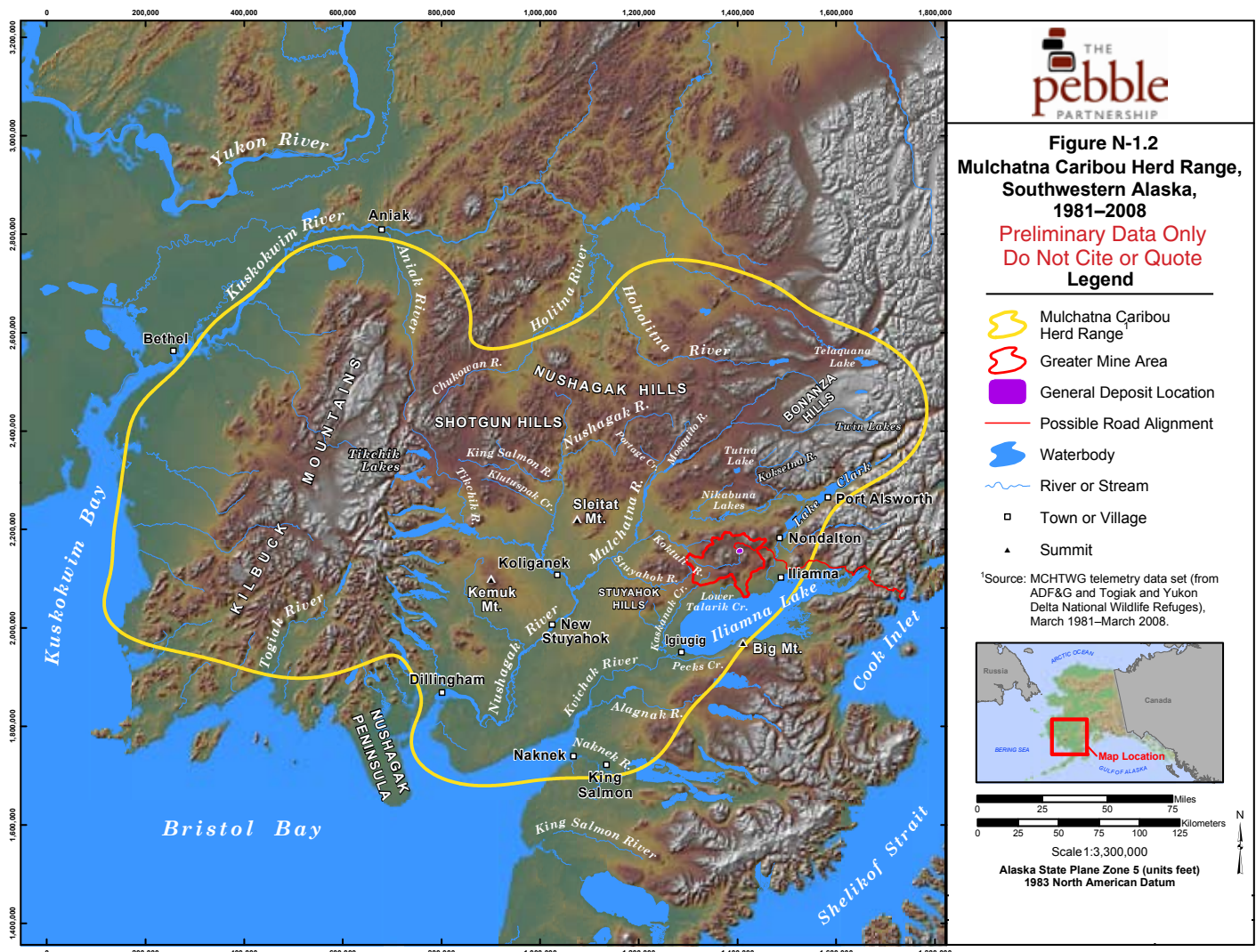
Researchers assessed the distribution and abundance of large mammals in the 477-km² mine survey area using aerial strip-transect surveys, 18 of which were conducted in the study area from 2004 through 2007. In addition, researchers surveyed bear use of salmon-spawning streams in August 2004 and examined bear dens in August 2004, May and August 2005, and May 2006. Incidental observations of large mammals were recorded during other wildlife surveys.

Caribou

The caribou is the most abundant large mammal in southwestern Alaska and is harvested in large numbers by both subsistence and sport hunters. The mine study area is located within the annual range of the Mulchatna Caribou Herd (MCH), which has declined in recent years after peaking in the mid-1990s.

Telemetry data from radio-collared members of the MCH were analyzed to examine seasonal range use over time in relation to the Pebble Project location. Analysis of 27 years of telemetry data for the MCH documented seasonal patterns and changes in range use as the herd grew and expanded its range during the 1980s and 1990s. More than one quarter of all collared caribou in the telemetry data set were located in the study area at least once during the time their collars were active, indicating that many different caribou used the area for at least a short time period. Over all years of data, the greater deposit area experienced moderate to high-density use by collared caribou during spring, low-density use during calving, high-density use during summer and winter, and moderate-density use during autumn.

The greatest numbers of caribou move through the greater deposit area during the postcalving season, when they are harassed by mosquitoes and parasitic flies. Aerial surveys of the mine study area in the postcalving period produced estimates of approximately 10,000 caribou on July 1, 2004, approximately 5,000 caribou on June 28, 2006, and approximately 2,100 caribou on June 27, 2007. Very large aggregations have been recorded in or near the study area in the past, most notably 100,000 caribou in late June 1996 and 180,000 caribou in early July 1997.



In the early 1990s, the mine area was thought to be part of the range used by a small number of resident caribou and to provide locally important calving habitat and, occasionally, winter range, but that local use ceased after the MCH ranged through the area and those caribou moved away with the larger herd. Radio telemetry and aerial transect surveys indicate that the mine area now is primarily used in summer, when large groups occasionally move through the study area. Judging from telemetry data collected during 1981-2008, caribou from the MCH were rarely found in the transportation corridor study area; their principal range is located farther west.



Approximately 1,500 caribou seeking relief from insects on a snowfield on Kaskanak Mt, June, 2007.

Bears and Other Mammals

Brown bears were common in the mine study area: 31 sightings were recorded on surveys in 2004, 35 in 2005, 31 in 2006 (18 of which occurred on a single survey), and 16 on two transect surveys in 2007. Incidental sightings during other wildlife surveys in and near the mine study area totaled 39 brown bears in 2004 and 69 in 2005. In contrast, black bears were recorded in that area only once.

The transportation corridor study area contained moderate densities of brown bears and low densities of black bears, moose, coyotes, wolves and wolverines. One brown bear and one black bear were observed on fixed-wing surveys during 2004, and three brown bears and two black bears were observed on fixed-wing surveys during 2005. Fifteen brown bears also were observed during the helicopter survey of salmon-spawning streams in August 2004, and substantially more were suspected to be present in the vegetation along the streams. Incidental observations in the transportation corridor study area during other wildlife surveys produced sightings of two brown bears in 2004, 55 brown bears in 2005 (greater survey effort accounted for the increased number that year), and five black bears in 2005.

Moose, wolves and wolverines were sighted in both the mine and transportation corridor study areas during aerial surveys and as incidental observations during surveys for other species. The deposit area appeared to have low densities of brown bears, moose, wolves, and wolverines throughout the year. Beavers were plentiful in the greater deposit area, numbering 113 active colonies in October 2005.

Raptors

Raptor surveys were primarily carried out in 2004 and 2005 to determine the distribution, abundance and nesting status of raptors. All raptor species and raptor nests observed in the field were recorded. However, special emphasis was placed on locating nests or individuals of protected or sensitive species, such as Bald and Golden Eagles, Peregrine Falcon and the Northern Goshawk.

The specific study objectives included:

- locate, identify and map primary cliff and tree-nesting raptor nest sites;
- delineate important cliff-nesting raptor habitats; and
- compile a comprehensive list of raptor species nesting in and using the area.

In 2005, study objectives were expanded to include the following:

- locate and enumerate Bald Eagles wintering in the area; and
- determine the rates of success and productivity of nesting raptors.

Occupancy Surveys

Field personnel conducted aerial surveys by helicopter to identify potential habitats, and to locate and document the occupancy status of raptor nests. The first surveys each season were conducted before deciduous-tree leaf-out and were timed to identify the nests of tree-nesting species, particularly Northern Goshawk, but also Bald Eagle and other woodland species.

The second surveys were timed and conducted to coincide with peak occupancy by cliff-nesting raptors, particularly Golden Eagle, Gyrfalcon, Peregrine Falcon and Rough-legged Hawk. Common Raven nests also were recorded in both surveys.

Productivity Surveys

In 2005, an additional aerial survey was conducted during the nestling period to determine the success and productivity of nests located during the first surveys in the mine study area. A nest was considered successful if at least one live nestling at approximately 80 percent of the average age of first flight (preferably more than three weeks old for medium-sized raptors and more than five weeks for large raptors) was observed during productivity surveys.

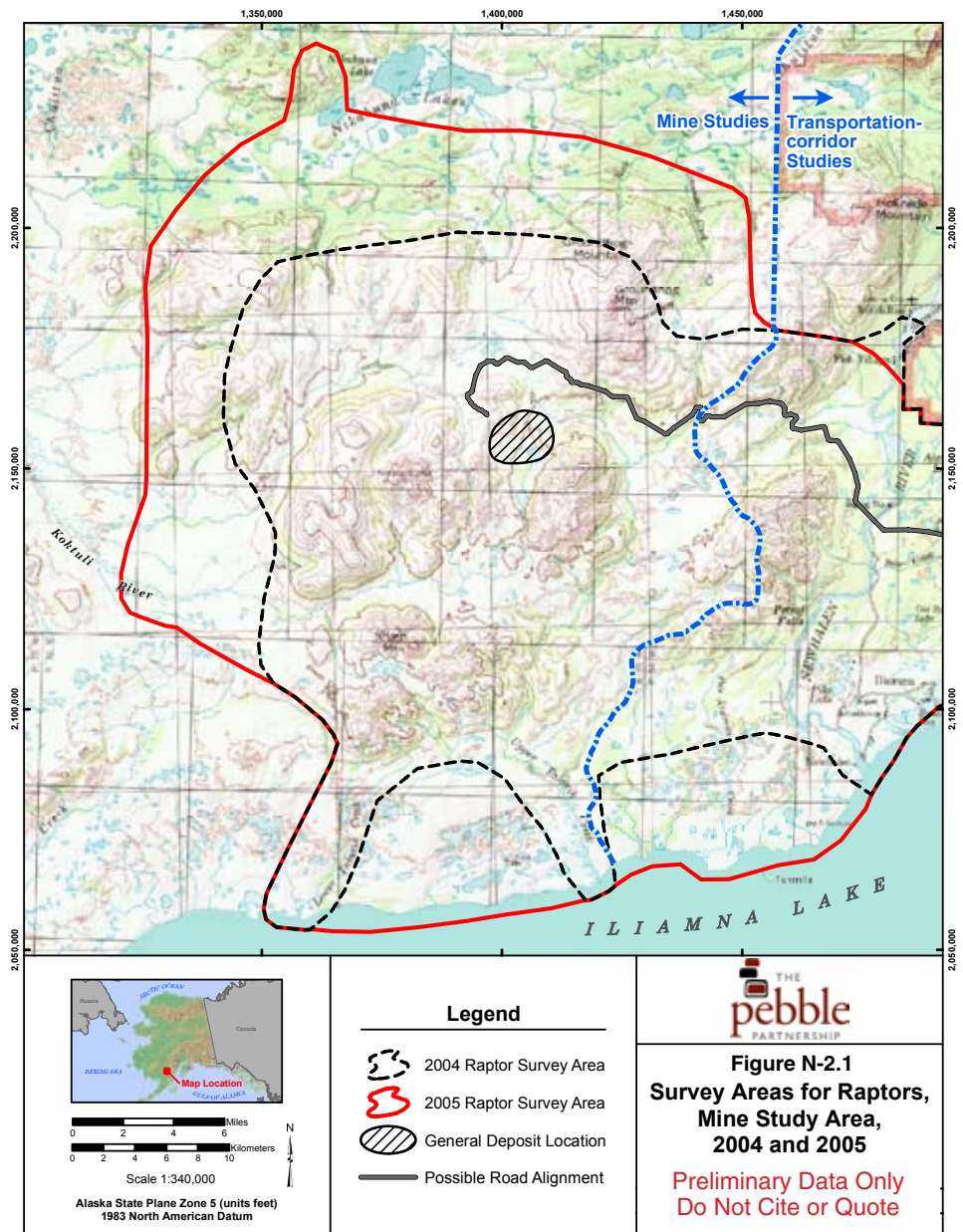
Results

Surveyors successfully mapped the general nest distribution, relative abundance and breeding status of large raptors in the mine study area. Bald Eagle was the most abundant nesting species (30 % of 2005 nests), followed by Golden Eagle (20 %), Rough-legged Hawk (14 %) and Gyrfalcon (13 %).

At least two nests of Merlin and single nests of Osprey and Great Horned Owl were recorded during aerial surveys. No Peregrine Falcons or Northern Goshawks were recorded in the mine study area.

Bald Eagle nests were found along the lower north and south forks of the Kuktuli River, Upper Talarik Creek and Lower Talarik Creek. Golden Eagle, Gyrfalcon and Rough-legged Hawk were the primary cliff-nesting raptors, and their nesting habitats were found in the Upper Talarik Creek and Kuktuli River drainages.

Eight species of raptors and Common Ravens, were identified in the transportation corridor study area. Bald and Golden eagle nests were most abundant, representing 43 and 19 %, respectively, of nests found in 2005. Nests of Common Raven (13 %) and Osprey (5 %) were the next most abundant nests found. The remaining species had three or fewer nests located in the transportation study area: Peregrine Falcon (3), Gyrfalcon (2), Rough-legged Hawk (2), Great Horned Owl (3) and Red-tailed Hawk (1).



Nest sites were widely distributed throughout the transportation study area, but areas of concentration were also evident. Bald Eagles were most abundant along the Newhalen River and along reaches of streams close to the Iliamna Lake shoreline. All Golden Eagle nests were found on cliffs on the southern front of the Alaska Range, often in clusters. Peregrine Falcon nests had not previously been recorded in the Lake Clark/Iliamna region, but researchers were not surprised to find them nesting. Habitats for tree-nesting raptors are abundant in the study areas, particularly east of and including the Newhalen River and below 400-meter elevations. The best habitats for large tree-nesting species, like Bald Eagles, occur in cottonwood stands most closely associated with the floodplains of major rivers like the Newhalen and Iliamna rivers.



Juvenile Peregrin Falcon at Diamond Point, August, 2005.

Suitable and high-value habitats for cliff-nesting species are found along the southern front of the Alaska Range. Good to excellent habitats occur in the hills between Upper Talarik Creek and the Newhalen River; along Canyon Creek and Knutson Mountain, and along the upper Iliamna River (including a few cliffs on Chinkelyes Creek). A few cliffs along the shoreline of Iliamna Lake are suitable, including those on islands in the eastern extent of the lake and those on some lakes between the Pile and Iliamna rivers.

Nesting success and productivity information was determined for five species of raptors in the mine study area, including Bald and Golden Eagles, Gyrfalcon and Rough-legged Hawk. Nesting success ranged from 67 % for Rough-legged Hawk and Golden Eagle to 71 and 80 % for Bald Eagle and Gyrfalcon, respectively. Productivity (young per successful nest) for each of these species generally fell within the ranges of productivity determined for studies elsewhere in Alaska and/or North America.

Nesting success and productivity were determined for five raptor species in the transportation corridor study area in 2005. Ospreys and Golden Eagles, although represented by only a few nests, had high nesting success and productivity compared to other populations in Alaska and North America. Bald Eagles, on the other hand, had lower nesting success (33 %) than comparative populations in southern Alaska and North America. Productivity, however, was similar to values for these other populations. Only one of three occupied Peregrine Falcon nests produced young, which is lower than success rates for Peregrine Falcons nesting elsewhere in Alaska. Finally, a single Red-tailed Hawk nest, probably at the southwestern extent of its breeding range, was successful.

Waterbirds

The objectives of the waterbird studies were to collect baseline data on the occurrence of swans, geese, ducks, loons and gulls during the spring, summer and fall seasons in the potential mine and transportation corridor study areas. All species observed during surveys were recorded, but special emphasis was placed on sensitive species (e.g., Tundra Swan and Harlequin Duck). These studies had five specific objectives:

- to determine the distribution and abundance of waterbirds during spring and fall migration;
- to describe species composition of waterbirds using lakes, rivers and wetlands during breeding and spring and fall migration;
- to determine breeding areas for swans and Harlequin Ducks;
- to determine the productivity of waterfowl based on brood-rearing surveys (mine study area only); and
- to delineate important areas used by waterbirds during breeding and spring and fall migration.

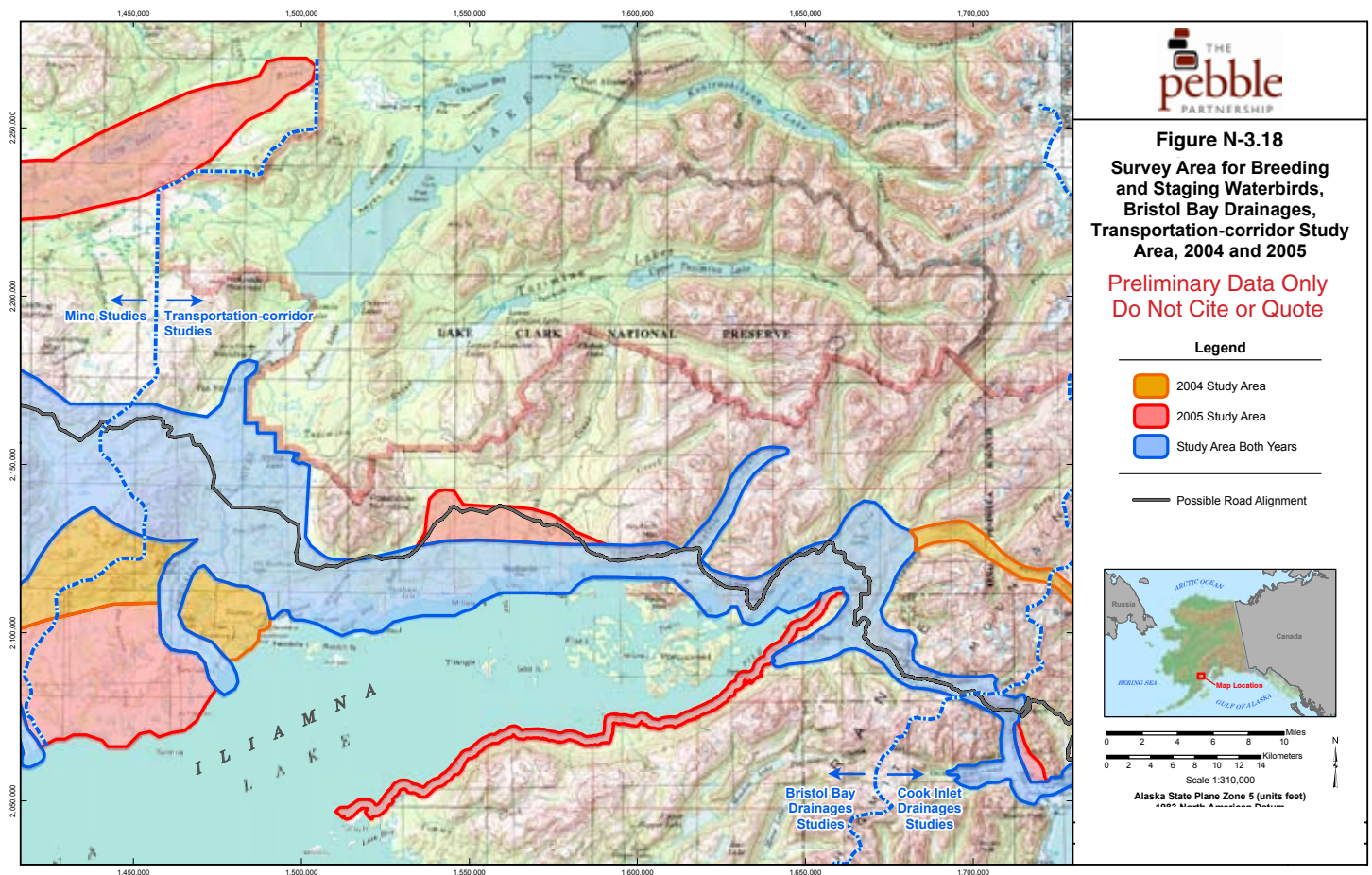
Study Area

Waterbird studies in the vicinity of the Pebble deposit area were conducted during breeding (pre-nesting, nesting, molting and brood-rearing) and during spring and fall migration within a 795-square-kilometer area in 2004 and a 1,135-square-kilometer area in 2005. The mine study area for waterbirds in 2004 and 2005 encompassed the deposit area, plus a large buffer region. The mine study area was divided into three survey areas for purposes of reporting fall and spring migration surveys: the mine survey area, South Talarik survey area and Nikabuna Lakes survey area.

- The mine survey area included all lakes, ponds, wetlands, and rivers originating in the headwater basins of the north and south forks of the Koktuli River and Upper Talarik Creek, an area with a radius of approximately 15 kilometers from the Pebble deposit. All waterbodies east of Upper Talarik Creek that are a part of the Upper Talarik drainage also were included in this survey area.
- The South Talarik survey area included Lower Talarik Creek and the lower quarter section of Upper Talarik Creek in both years because of the regional importance of these areas to waterbirds. The lakes between the two creeks were added to this survey area in 2005.
- The Nikabuna Lakes survey area was added in 2005 to include large lakes of regional importance for migrating waterbirds.

Waterbird surveys in the transportation corridor study area were conducted during breeding (pre-nesting, nesting and brood-rearing) and during spring and fall migration within a 729-square-kilometer area in 2004 and an 885-square-kilometer area in 2005. The study area encompassed all possible road alignment options under consideration for the Pebble Mine, plus a large buffer region.

For each type of waterbird survey, specific survey areas were selected based on suitability of habitat for the species under investigation. For migration surveys, all lakes and rivers in the study areas and associated buffer areas were surveyed, along with some selected outlying areas that might be of regional importance.



For breeding waterfowl and swans, the survey areas included lakes, ponds, wetlands and adjacent terrain in the study areas and associated buffer areas. The surveys for pre-nesting and brood-rearing Harlequin Ducks included all rivers and creeks in the study areas and associated buffer areas.

With few exceptions, fixed-wing aircraft were used for waterbird migration surveys in both the transportation corridor and mine study areas every seven to 10 days during spring and fall migration in 2004 and 2005. These efforts totaled 9 migration surveys flown in 2004 and 12 in 2005, in each study area.

Two breeding population surveys were carried out in the survey areas, once each year. Survey transects were conducted using fixed-wing aircraft, flown at 45 meters above ground at a speed of 145 kilometers per hour. Transects were spaced approximately 800 meters apart and were aligned to cover the largest possible number of waterbodies and wetlands in the study area. Data recorded included transect number, species and number of birds and observation type (e.g., male, pair, flock) and followed the current USFWS *Standard Operating Procedures for Aerial Waterfowl Breeding Ground Population and Habitat Surveys*.

Aerial surveys to locate swan nests were conducted in both study areas on June 3, 2004 and May 28, 2005. Although swan nests were recorded on all avian surveys, the migration and breeding-pair surveys focused primarily on water surfaces and shorelines. In contrast, the swan-nesting survey was designed to cover both wetlands and the terrain surrounding wetlands. The purpose of the swan productivity and species delineation survey in September 2006 was to search for swan broods and identify the swan species occurring in the study area.

In 2004 and 2005, seven surveys were flown specifically for Harlequin Duck pre-nesting and brood rearing in the mine study area and five in the transportation corridor study area. For each observation, data recorded were a GPS waypoint; river name; species; total number of birds in the group; numbers of pairs, males, and females; number of young; the birds' location (i.e., on the water, shore, or flying); and stream flow (swift or placid). Water clarity (clear, turbid, or glacial) also was recorded for each stream.

Five to seven ground surveys for waterbird broods were conducted by 2–3 observers in July in both 2004 and 2005. The survey area for brood-rearing waterbirds included wetlands, ponds and lakes in selected locations in the mine study area. Selection criteria for survey sites in 2004 included the proximity of the waterbody to the ore body and/or projected affected areas, the relative abundance of birds recorded in different portions of the study area during the breeding-pair survey and logistical considerations. In both years, a few lakes were surveyed with a helicopter because of logistical constraints on getting to those lakes by foot. For each waterbody surveyed, researchers recorded species of waterbirds; number and sex of adults; and if a brood was present, the number of young and the brood age class.

Summary of findings

Thirty-seven species of waterbirds were observed during nesting, brood-rearing, molting and migration surveys in the mine study area. Representatives from 10 taxa were recorded: geese (2 species), swans (1), ducks (19), loons (3), grebes (1), cormorants (1), shorebirds (5), gulls (3), terns (1) and jaegers (1). Twenty-one species were confirmed to breed in the mine study area based on the presence of a brood recorded during ground surveys for broods. One additional species, Common Merganser, probably bred in the mine study area in 2004 and 2005 based on its presence in the area during the breeding season, the availability of suitable nesting habitats and because the mine study area occurs within their general breeding range. Fifteen species were seen only occasionally and in small numbers and were assumed to be migrants through the area. All waterfowl species observed were within their migration or breeding range.



Tundra Swan, July, 2007.

Photo Courtesy of ABR, Inc.

Thirty-four species of waterbirds were observed during breeding, brood-rearing and migration surveys in the transportation corridor study area. Representatives from 11 taxa were recorded: geese (2 species), swans (1), ducks (18), loons (3), grebes (1), cormorants (1), cranes (1), shorebirds (1), gulls (4), terns (1) and jaegers (1). Fourteen species were confirmed to breed in the transportation corridor study area based on the presence of a nest or brood recorded during surveys. Another 11 species probably bred in the transportation corridor study area in 2004 and 2005, as indicated by their presence in the area during the breeding season, the availability of suitable nesting habitats and the area being within their general breeding range. Nine species were seen only occasionally and in small numbers and were assumed to be migrants through the area.

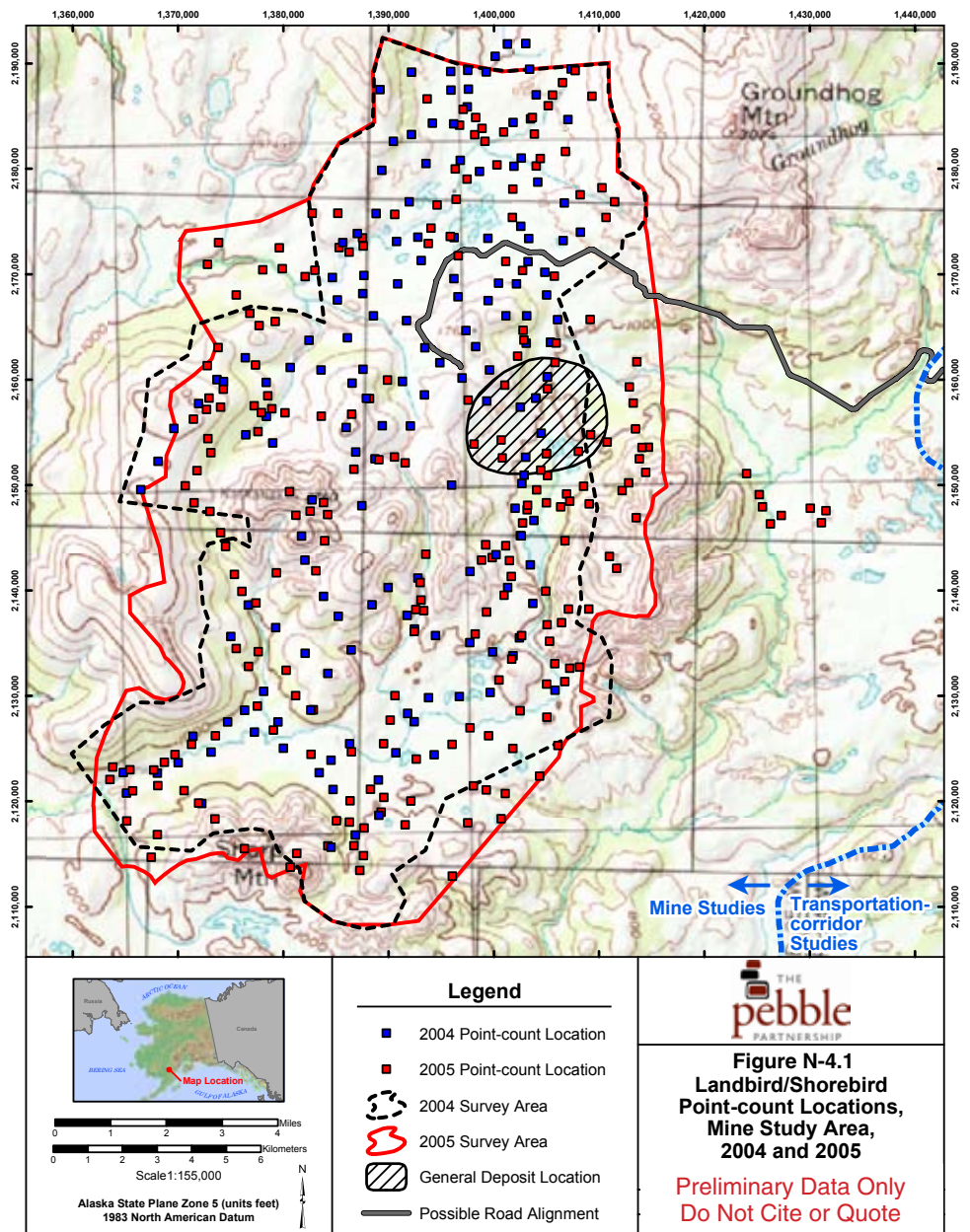
Landbirds and Shorebirds

The primary objective of this study was to collect baseline data on breeding landbirds and shorebirds occurring in the vicinity of the Pebble Project. During the surveys in 2004 and 2005, researchers recorded all species observed in the field, paying special attention to species of high conservation concern. The specific objectives of this study were to:

- determine which landbird and shorebird species use the study areas during the breeding season;
- quantify the abundance of each species; and
- determine which habitats are important for reproduction for each species.

In 2004 and 2005, surveys in the region of the possible mine encompassed both the deposit area and a large buffer region. The rationale behind selection of these survey areas (referred to as the mine study area) was to make them large enough to encompass all important breeding-bird habitats both in the possible development area and in a larger area not expected to be developed. This allowed for an evaluation of the breeding-bird habitats available in a broad area surrounding the project. The breeding-bird surveys in the mine study area were conducted within an area of 252 square kilometers in 2004; in 2005 the survey area was expanded to 293 square kilometers.

The transportation corridor study area was surveyed in 2005 and consisted of a 610-meter-wide corridor in which a possible access road and power transmission line was envisioned. The width of the study area (610 meters) was chosen because it adequately contained all important breeding-bird habitats likely to be directly affected by construction and operation of a



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Figure N-4.1
Landbird/Shorebird
Point-count Locations,
Mine Study Area,
2004 and 2005
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road in the area. The transportation corridor study area was 108 kilometers long and comprised approximately 66 square kilometers. The study area followed the centerline of the possible road alignment that was current in June 2005. After surveys were conducted in June 2005, the road alignment was changed substantially in two locations: near the mine study/transportation corridor study boundary to the west and near Pile Bay at the east end of Iliamna Lake.

Surveys for breeding landbirds and shorebirds were conducted in the two study areas according to the approach described in the *Draft Environmental Baseline Studies, Proposed 2004 Study Plans* and the *Draft Environmental Baseline Studies, 2005 Study Plan* (available online at www.pebblepartnership.com). This work included the following activities:

- allocating point-count sample plots based on aerial photosignature type, which allowed sampling of all the important breeding-bird habitats in the study areas;
- performing early-morning point-counts at each sample location;
- recording habitat-use information for all species observed (when possible) at each point-count location; and,
- recording observations and habitat-use information for less common species and/or species of high conservation concern when in transit between sample locations.



Three-Toed Woodpecker at nest, Transportation Corridor, June, 2005.

Researchers used variable circular-plot point-count methods, timing the surveys to coincide with the peak breeding period for landbirds in southwestern Alaska. Point-counts were conducted in standard 10-minute intervals. Four categories of observations were made during the point-count survey efforts and the habitats being used by the bird(s) were recorded whenever possible for each category:

- **Focal observations** were of birds recorded during the point-count period using the habitat that was being sampled directly at the point-count location; only these observations were used in the preliminary habitat-association analyses conducted in this study.
- **Nonfocal observations** were of birds recorded during the point-count period but using different habitats (which were typically adjacent to the focal habitat being sampled directly). Focal and nonfocal observations combined were used to assess abundance for landbirds and shorebirds in this study.
- **Incidental observations** were recorded at the point-count location but were not made during the point-count period (birds were either seen before or after the count period). Incidental observations were recorded primarily to collect more data on the less common species.
- **In-transit observations** were made as researchers moved between point-count locations. These nonsystematic observations were primarily of less common species and/or observations of nests, defensive behavior indicative of the presence of a nest, or fledglings being tended by an adult(s).

Researchers conducted a total of 166 point-counts in the mine study area in 2004 and conducted 227 point-counts in 2005. Including incidental and in-transit observations, researchers identified 28 landbird species and 14 shorebird species in 2004 and 2005. In the transportation corridor study area a total of 154 point-counts were conducted in 2005. Including incidental and in-transit observations, researchers identified 46 landbird species and seven shorebird species in the transportation corridor study area.

Using point-count survey data, researchers calculated a mean of 10.2 landbirds and 1.1 shorebirds per point-count over both years in the mine study area. Nine landbird species were considered to be abundant breeders in the mine study area; no shorebird species were considered abundant breeders (shorebirds typically nest at lower densities).

Using point-count survey data for the transportation corridor study area, researchers calculated a mean of 11.6 landbirds and 0.3 shorebirds per point-count. Ten landbird species were considered abundant in the study area. Three of these species (Wilson's Warbler, Orange-crowned Warbler and Swainson's Thrush) were especially abundant and comprised 33 % of all landbird observations. Shorebird species were much less common; no shorebird species was considered abundant in the transportation corridor study area.

A variety of shorebird species were observed in the mine study area and six of the 14 species observed were considered common breeders. Of the various landbird and shorebird species-groups observed, sparrows were by far the most abundant breeders, while warblers, thrushes and finches also were common. Larks, pipits and swallows were less common, and ptarmigan, flycatchers, corvids and kinglets were rarely recorded in the area. Sandpipers and plovers were the only shorebird species-groups recorded.

In the mine study area, riverine tall scrub, upland dwarf scrub, upland low scrub, upland tall scrub and lowland scrub-bog habitats supported the highest numbers of breeding-bird species. Individual landbird and shorebird species often used a range of different habitats, with the more common species using a larger set of habitats than the uncommon species.

Harbor Seals – Iliamna Lake

Iliamna Lake has long been known to host an unusual population of harbor seals, but little biological information is available on this population. Therefore, surveys of harbor seals in Iliamna Lake were conducted to assess the seasonal occurrence and abundance of the species in areas near a possible alternative transportation route for the Pebble Project. Four study objectives were identified for study during 2005 and 2007:

- review existing information on the population of harbor seals inhabiting the lake;
- enumerate harbor seals hauled out at known and newly discovered sites in Iliamna Lake during spring, summer and fall;
- search for new haulout sites; and
- examine factors affecting haulout use.

The surveys in 2005 and 2007 focused on replicating survey counts at haulouts for which previous data were available. Most haulout sites were identified in 2005 using existing literature, but five more sites were found in 2005 and two more were added in 2007.

Twenty aerial surveys were flown in a fixed-wing airplane over eastern and central Iliamna Lake between March 30 and Dec. 13, 2005 and nine surveys were flown between May 21 and Oct. 11, 2007. Flights were scheduled to coincide with aerial surveys of terrestrial mammals in the transportation corridor and terrestrial and marine mammals in the vicinity of the possible port site, and with selected waterfowl-migration surveys.

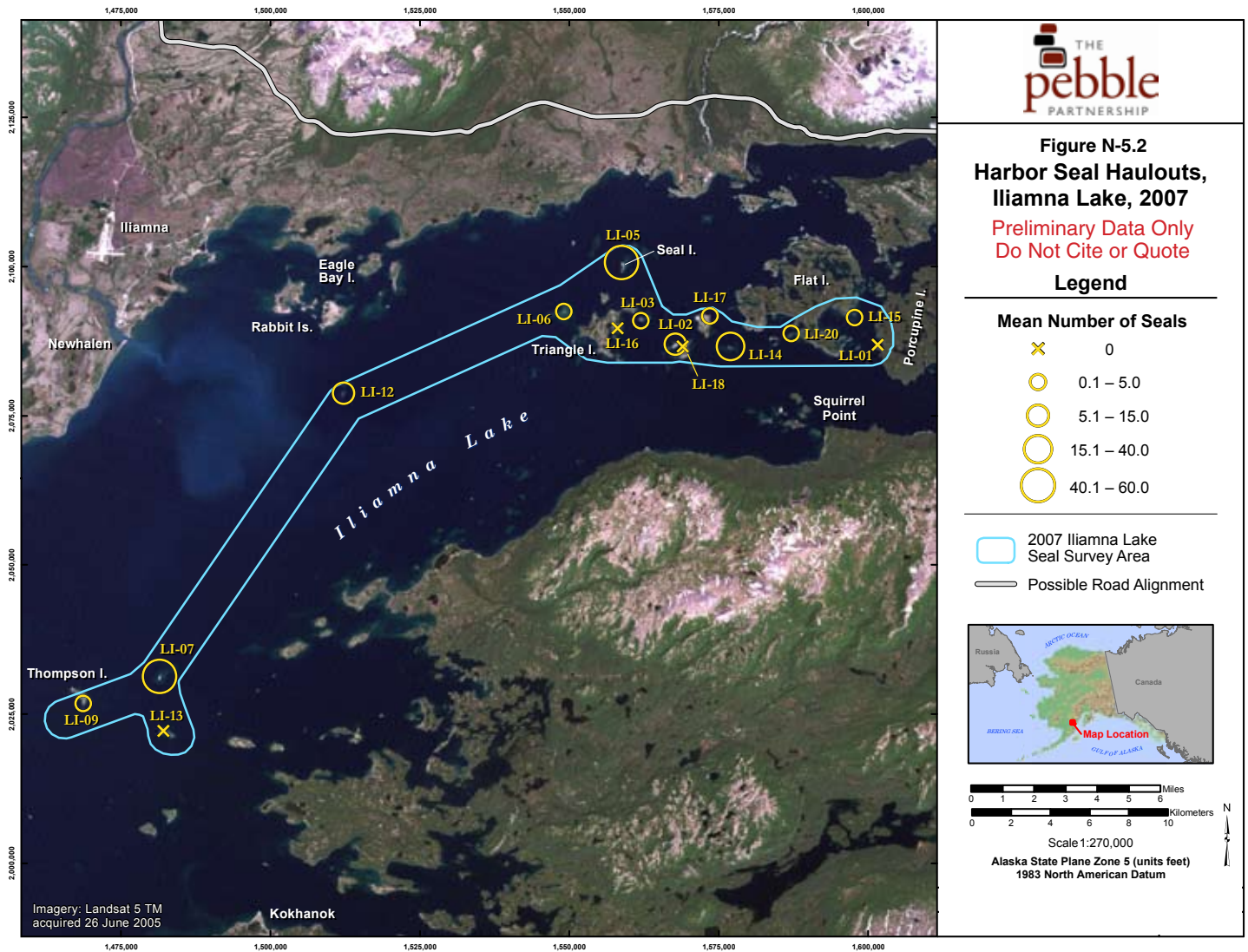
During each survey, one or two observers and the pilot examined each potential haulout location from an altitude of 305 meters (1,000 feet). The site was circled to allow the crew to count, using binoculars, the number of seals hauled out on land or in the water nearby. If more than about 20 seals were present, photographs were taken and the numbers of seals in the photographs were counted later. If the photographs were of sufficient quality to yield accurate counts, the photographic counts were used instead of the field counts when the numbers differed.

Total counts among all surveys ranged from zero to 276 seals in 2005 and zero to 313 seals in 2007. The number of harbor seals hauled out varied substantially among seasons and was highest in summer, peaking during the molting period in August. Peak counts from Pebble surveys were obtained on Aug. 17, 2005 and Aug. 15, 2007. The peak numbers counted during the 2005 and 2007 surveys were greater than the peak number counted in 1991, but less than the peak count in 1998.

Harbor seals inhabit Iliamna Lake year-round, but there are no geographic barriers to the movement of seals between the lake and Bristol Bay. Observations and harvests of seals in the Kvichak River near Igiugig and experience in the Canadian Arctic



Iliamna Lake Harbor Seals at haulout, August, 2007.



suggest that the Iliamna Lake population may not be as isolated as it might appear, despite the fact that seals are present year-round. The area of Iliamna Lake where harbor seals occur most consistently is at the opposite end of the lake from the outlet at the Kvichak River:

Haulout use by harbor seals in Iliamna Lake is influenced by seasonal variations in the water level of the lake, as well as by annual variation in the extent and duration of winter ice cover. The timing and location of spawning activity by sockeye salmon in summer and early fall also appears to affect haulout use.

Wood Frogs

The main objectives of the wood frog surveys in 2007 were to determine the presence and distribution of breeding wood frogs, estimate the occupancy rate of waterbodies by breeding wood frogs and evaluate habitat characteristics of waterbodies used by breeding wood frogs in the mine study area.

The wood frog study included the following activities:

- collection and review of relevant literature on wood frogs inhabiting Alaska and the region encompassing the mine study area;
- sampling of a random set of waterbodies in the study area (mapped in a GIS) for the presence of breeding wood frogs;
- evaluation of the distribution of breeding wood frogs;
- estimation of the occupancy rate of waterbodies used for breeding by wood frogs; and
- identification of important habitat characteristics associated with wood frog presence.

The study area for breeding wood frogs included all waterbodies mapped in the mine study area, ranging from very small ponds (less than 0.01 hectare) to large lakes (approximately 60 hectares). The majority of the waterbodies (93 %) were less than 1.0 hectare in size. The complexity of the waterbody shorelines in the study area ranged from simple (without islands) to complex (with islands) and waterbodies varied in their depth, connectivity to stream drainages, annual water retention, presence of emergent and aquatic vegetation, and type and composition of shoreline vegetation.

The mine study area contains 1,668 waterbodies with 119 of these randomly selected for surveys of breeding wood frogs, using size and presence or absence of emergent/aquatic vegetation as strata in the random selection process. Repeat surveys were conducted at 86 of the sampled waterbodies two to four days after the initial survey. The figure below shows the waterbodies selected for survey in the mine study area, as well as all the waterbodies that were available for selection.

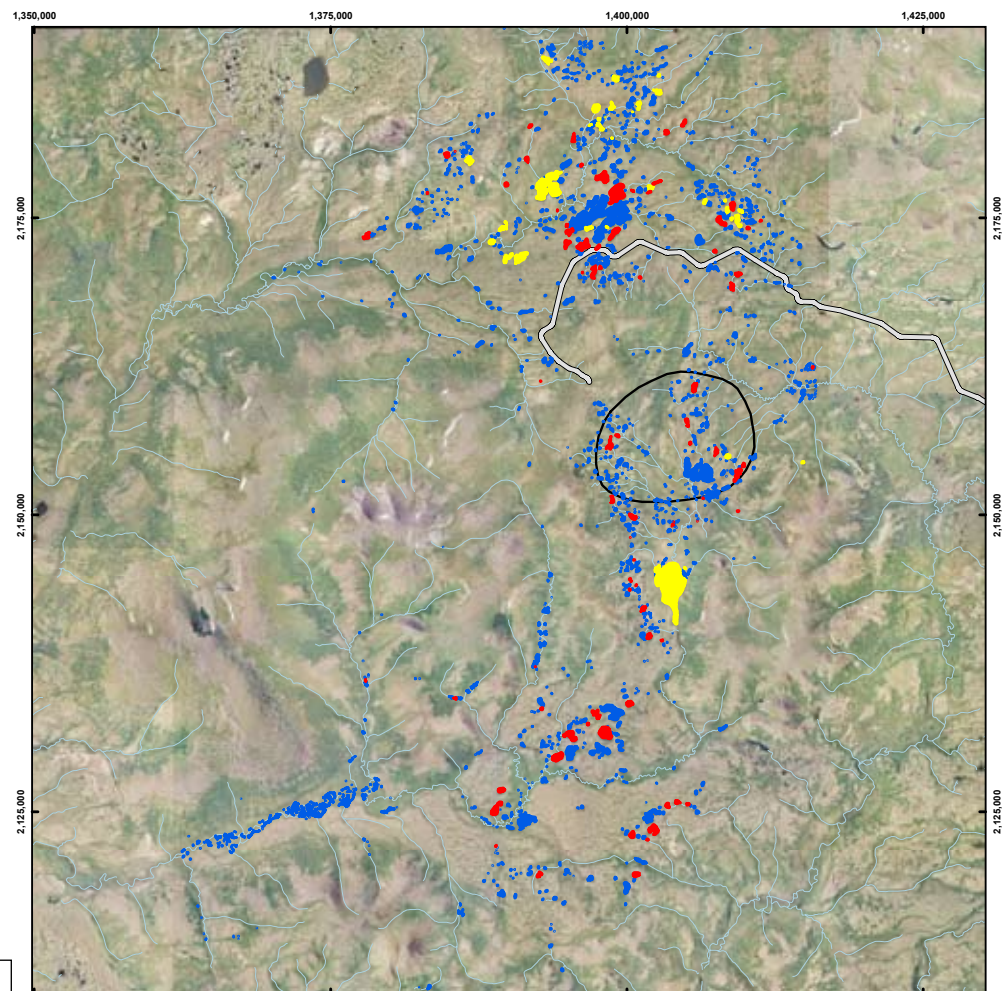
Researchers conducted calling surveys for breeding (male) wood frogs in the mine study area in May 2007, during the peak period of breeding. Researchers followed standard USGS amphibian calling-survey protocols, with modifications only in the diurnal timing of the survey period to correct for Alaska's long daylight hours in May, and to work within safety constraints of the project.

Analysis of the survey data indicate that size of a waterbody and whether it is a beaver pond have only minimal influence and little magnitude of effect on wood frog occupancy rates in the mine study area. Generally, the analyses suggest that a waterbody is more likely to be occupied by wood frogs if it is more than 1.5 meters deep, contains even a small amount of emergent or aquatic vegetation and has herbaceous or low or tall shrub vegetation nearby.

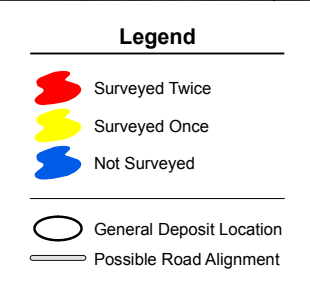
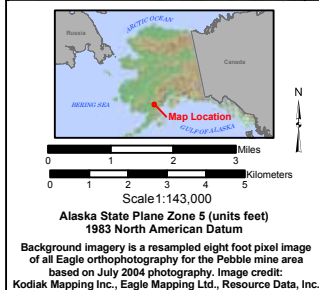
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Wood Frog Habitat, May, 2007.



The Terrestrial Habitat and Wildlife data report, released as part of the Pebble Partnership's Pre-Permitting Environmental & Socio-Economic Data Report Series, is available online at www.pebblepartnership.com.



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Figure N-6.1
Waterbodies Surveyed for Breeding Wood Frogs, Mine Study Area, 2007

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