

**DRAFT ENVIRONMENTAL BASELINE STUDIES
2005 STUDY PLANS**

CHAPTER 9. TERRESTRIAL WILDLIFE & HABITATS

NOVEMBER 2005

TABLE OF CONTENTS

TABLE OF CONTENTS	9-i
LIST OF FIGURES	9-ii
ACRONYMS	9-iii
9. TERRESTRIAL WILDLIFE AND HABITATS	9-1
9.1 Mine Site.....	9-1
9.1.1 Objectives	9-1
9.1.1.1 Mammals	9-1
9.1.1.2 Raptors	9-2
9.1.1.3 Waterfowl	9-2
9.1.1.4 Breeding Birds	9-2
9.1.1.5 Habitat Mapping	9-3
9.1.1.6 Rare-Plant Occurrence-Potential.....	9-3
9.1.2 Proposed Study Plan—Mammals	9-3
9.1.2.1 Study Area/Scope.....	9-3
9.1.2.2 Methods and Approach	9-4
9.1.2.3 Major Activities	9-4
9.1.3 Proposed Study Plan—Raptors	9-6
9.1.3.1 Study Area/Scope.....	9-6
9.1.3.2 Methods and Approach	9-6
9.1.3.3 Major Activities	9-7
9.1.4 Proposed Study Plan—Waterfowl.....	9-8
9.1.4.1 Study Area/Scope.....	9-8
9.1.4.2 Methods and Approach	9-8
9.1.4.3 Major Activities	9-8
9.1.5 Proposed Study Plan—Breeding Birds.....	9-9
9.1.5.1 Study Area/Scope.....	9-9
9.1.5.2 Methods and Approach	9-10
9.1.5.3 Major Activities	9-10
9.1.6 Proposed Study Plan—Habitat Mapping.....	9-11
9.1.6.1 Study Area/Scope.....	9-11
9.1.6.2 Methods and Approach	9-11
9.1.6.3 Major Activities	9-12
9.1.7 Proposed Study Plan—Rare-Plant Occurrence-Potential	9-12
9.1.7.1 Study Area/Scope.....	9-12
9.1.7.2 Methods and Approach	9-12
9.1.7.3 Major Activities	9-13
9.1.8 Deliverables	9-13

9.2	Road/Port (Including Transportation and Power-Supply Options)	9-14
9.2.1	Objectives	9-14
9.2.2	Study Area and Methods	9-14
9.2.2.1	Mammals	9-14
9.2.2.2	Raptors	9-15
9.2.2.3	Waterfowl	9-16
9.2.2.4	Breeding Birds	9-16
9.2.2.5	Habitat Mapping	9-16
9.2.2.6	Rare-Plant Occurrence-Potential.....	9-17
9.2.3	Deliverables	9-17
9.3	Bibliography	9-18

LIST OF FIGURES (following document)

Figure 9-1, Mine/Road/Port Study Areas for Large Mammals

Figure 9-2, Mine/Road/Port Study Areas for Raptors

Figure 9-3, Mine/Road/Port Study Areas for Waterfowl

Figure 9-4, Mine Site Study Areas for Wildlife Habitat Mapping and Breeding Bird Surveys

Figure 9-5, Road/Port Study Areas for Wildlife Habitat Mapping and Breeding Bird Surveys

ACRONYMS

AASHTO	American Association of State and Highway Transportation Officials
ABA	acid base accounting
ACHP	Advisory Council on Historic Preservation
ACLS	alternative cleanup levels
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
agl	above ground level
AHRS	Alaska Heritage Resource Survey
AKNHP	Alaska Natural Heritage Program
APE	area of potential effect
ARD/ML	acid rock leaching/metal leaching
ASCI	Alaska Stream Condition Index
BEESC	Bristol Environmental & Engineering Services Corporation
BMR	baseline monitoring report
CAD	computer-aided drafting
CC	comprehensive stations with continuous stage monitoring
CIR	color infrared
CWOC	comprehensive stations without continuous stage monitoring
DECD	Alaska Department of Economic and Community Development
DEM	digital elevation model
DNR	State of Alaska Department of Natural Resources
DO	dissolved oxygen
DOT&PF	State of Alaska Department of Transportation & Public Facilities
DQOs	data quality objectives
EC	environmental consequences
EIS	environmental impact statement
EPA	Environmental Protection Agency
EBD	environmental baseline document
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FSP	field sampling plan
GIS	geographic information system
GPS	global positioning system
HGM	hydrogeomorphic

IEE	Initial Environmental Evaluation
IM	initial monitoring station
LDN	Land Design North
LDNPP	Lake Clark National Park and Preserve
MCHTWG	Mulchatna Caribou Herd Technical Working Group
mg/L	milligrams per liter
mm	millimeters
MRLs	method reporting limits
NASA	National Aeronautics and Space Administration
NDM	Northern Dynasty Mines Inc.
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic & Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
ORP	oxidation reduction potential
PJD	preliminary jurisdictional determination
PSD	prevention of significant deterioration
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
SHPO	State Historic Preservation Officer
SOPs	standard operating procedures
SRB&A	Stephen R. Braund & Associates
SWANCC	Solid Waste Agency of Northern Cook County v. U.S. Army Corp of Engineers
SWE	snow-water equivalent
TIN	triangulated irregular network
TPH	total petroleum hydrocarbons
USACE	United States Army Corp of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WMP	water monitoring plan

9. TERRESTRIAL WILDLIFE AND HABITATS

ABR, Inc.—Environmental Research & Services (ABR), will complete the terrestrial wildlife and habitat mapping work for two broad study areas: (1) the proposed mine site and surrounding regions and (2) the proposed road/port area and surrounding regions (includes transportation- and utility-corridor routes, transmission-line routes, and port site).

9.1 Mine Site

9.1.1 Objectives

This study program is designed to determine the species assemblages and the abundance of, distribution of, and habitat-use by terrestrial wildlife in the Pebble Project's mine site and surrounding regions. In addition, an assessment of rare-plant occurrence-potential at the mine site will be conducted. The objectives are to describe baseline conditions prior to mine development and to provide input to the evaluation of mine development options to minimize or prevent adverse impacts to terrestrial wildlife and habitats. The specific objectives for the seven components of this study program are described below.

9.1.1.1 Mammals

The goal of the mammal surveys in 2005 is to provide baseline data of sufficient quality and quantity for the impact-assessment process and mitigation planning for the project, extending and refining the approach implemented in 2004. Mammal surveys are designed to supplement existing information from previously published and unpublished work on the region and to compile and analyze telemetry data previously collected by management agencies for use in impact analyses. Field survey data will provide site-specific information on mammal species to supplement the information gained from the literature review, thereby augmenting and strengthening the baseline data available for the project environmental impact statement (EIS). Specific objectives include the following:

- Map the distribution and quantify the abundance and density of large mammals in the mine area during important seasonal periods for caribou, moose, and brown bear.
- In cooperation with state and federal agencies, perform retrospective analyses of the extensive radio telemetry database for the Mulchatna Caribou Herd to provide as comprehensive an assessment as possible of the use of the mine area by caribou.
- Cooperate with state and federal agencies to obtain existing population and harvest-survey data for moose, bears, wolves, other furbearers, and other mammal species in the mine area for use in baseline characterization and impact assessment.
- Collect information on mammals from incidental sightings by other personnel working on the project for inclusion in the environmental baseline report.

9.1.1.2 Raptors

The objectives of the raptor surveys are to determine the distribution, abundance, and productivity of nesting raptors in the proposed mine area and to assess potential impacts on raptors from mine construction and operation. Special emphasis will be placed on protected or sensitive species, such as Bald and Golden eagles (Bald and Golden Eagle Protection Act), Peregrine Falcons (delisted Endangered Species), and Northern Goshawk. The major objectives are listed below:

- Identify and map raptor nest sites and determine occupancy and productivity of these sites.
- Delineate important tree- and cliff-nesting raptor habitats in the region of the proposed mine.
- Compile a comprehensive list of raptor species nesting in and using the region of the proposed mine.
- Develop strategies to avoid or minimize impacts to raptors in the area, including avoidance guidelines for helicopter and fixed-wing-aircraft pilots.

9.1.1.3 Waterfowl

The objective of this study program is to determine the distribution, status, and relative abundance of waterbirds that might be affected by activities in the mine-site area. Emphasis will be placed on waterfowl and waterbirds of special concern, including both species of swans, Harlequin Ducks, loons, and gulls. The major objectives are as follows:

- Determine the timing, distribution, and abundance of staging waterbird groups during spring and fall migration and molting groups during mid-summer.
- Determine the distribution and abundance of waterbirds—including ducks, swans and gulls—during the nesting and brood-rearing seasons.

9.1.1.4 Breeding Birds

The objectives of this study are to determine the distribution, abundance, and habitat-use of breeding landbirds and shorebirds in the region of the mine site, with the goal of quantifying and evaluating the impacts of the direct removal of breeding bird habitats by development of the proposed mine. Specifically, the breeding bird surveys are designed to accomplish the following objectives:

- Determine which landbird and shorebird species breed in the mine-site region.
- Determine the distribution and abundance of those species in the area.
- Quantify the level of habitat-use by each species during the breeding season.
- Quantify and evaluate the impacts expected from the direct loss of habitat due to mine development.

9.1.1.5 Habitat Mapping

The goal of this study is to classify and map wildlife habitats in a broad region surrounding the Pebble Mine and to use these data to quantify and evaluate the expected direct impacts of mine construction and operations on the habitats of birds and mammals.

9.1.1.6 Rare-Plant Occurrence-Potential

The objectives of this work are to determine whether any of the rarer plant taxa in Alaska have the potential to occur in the Pebble Project area. This analysis will be conducted using existing data on plant distributions and available habitats; those habitats likely to support populations of rare plants will be identified.

9.1.2 Proposed Study Plan—Mammals

9.1.2.1 Study Area/Scope

Aerial surveys for large mammals, analysis of existing telemetry data, analysis of harvest data from the Alaska Department of Fish and Game (ADF&G), and a local mammal-sightings log will be the primary methods used in this study. The aerial transect survey area will encompass the mine deposit and potential disposal sites for tailings/mine rock, plus an additional buffer distance of up to three miles around those locations (Figure 9-1).

The principal mammal species of interest with regard to the Pebble Project is caribou—it is the most abundant large mammal in the region and one that is vitally important both for subsistence use and sport hunting. The mine and access-route options are located within the annual range of the Mulchatna Herd, the second largest herd in the state. One of the hallmarks of the Mulchatna Herd has been the unusual and substantial variation it has shown in range-use in the last 15 years. In previous years, the mine area was thought to host a small number of resident caribou and to provide locally important calving habitat and occasionally winter range. More recently, the herd also has used the area during the post-calving aggregation period and the rut. Field information regarding use of the mine area by caribou will be obtained for the following seasons: late winter/spring, calving, post-calving aggregation (early summer), fall migration/rut, and early winter.

Other large mammal species also are important residents of the mine area and will be included in our surveys. Brown bears are abundant in southwestern Alaska, and black bears also occur in the project region. Winter concentrations of moose have been noted previously (as described in the ADF&G Habitat Management Guides [ADF&G, 1985]) in the Upper Talarik Creek drainage. These species will be included in our surveys, as will others (e.g., furbearers) encountered incidentally during surveys for mammals and other species.

9.1.2.2 Methods and Approach

Several lines of inquiry are being pursued in this study:

- Field surveys, emphasizing aerial survey by fixed-wing airplane and, to a lesser extent, by helicopter.
- Radio-telemetry surveys and analysis of regional telemetry data for caribou, under the terms of cooperative agreements with agencies.
- Analysis of regional harvest data for big game and furbearers.
- Solicitation of mammal sightings in the project area by other personnel working on the baseline studies program.

9.1.2.3 Major Activities

Aerial Surveys

The primary method used to survey large mammal species in the mine area will be systematic aerial surveys of strip transects (spaced at one-mile intervals on U.S. Geological Survey [USGS] section lines; Figure 9-1) from a fixed-wing airplane (Cessna 206 or similar). The size of the transect survey area in 2004 was chosen to encompass the mine site and the potential tailings- and mine-rock-disposal alternatives, and these transects will be extended slightly in 2005 to provide more coverage of a buffer zone surrounding the potential mine facilities. The primary species of interest are caribou, brown bear, and moose, but all species of large mammals will be recorded and mapped opportunistically whenever encountered on each survey. The following list details the seasonal timing and primary purpose of each survey window:

- Early March: Late winter moose and caribou distribution.
- Early May: Spring bears (after den emergence and before leaf-out).
- Late May: Caribou and moose calving.
- Late June or early July: Caribou post-calving.
- Mid-July: Caribou post-calving and bears along salmon-spawning streams (mine area emphasis).
- Mid-August: Bears along salmon-spawning streams (road/port corridor emphasis).
- Mid-October: Caribou breeding season (rut).
- Late November or early December: Early winter moose and caribou.

All transect surveys will use a double-count approach employing two observers viewing the same 875-yard-wide transect strip on the right side of the airplane to quantify “sightability” (defined as “the probability that an animal within the observer’s field of search will be seen by that observer”; Caughley, 1974) of animals in the transect strip. Data will be recorded by a third observer (preferably a local resident, e.g., from a subsistence council or panel) sitting on the left side of the airplane. Complete coverage of the survey area will be obtained. The airplane will be flown at an airspeed of approximately 85 knots and at an altitude of 500 feet above ground level (agl) (occasionally higher or lower, as dictated

by terrain) for all surveys. All mammal locations will be recorded using a global positioning system (GPS) receiver for portrayal on geographical information system (GIS) maps, and basic data will be noted (number; sex/age, when possible; activity; direction of movement).

Radio-telemetry surveys by fixed-wing airplane are being planned in 2005 under the terms of cooperative agreements to be worked out with ADF&G, as discussed and agreed to at the meeting of the Mulchatna Caribou Herd Technical Working Group (MCHTWG) in January 2005. By state regulation (5 AAC 92.047), telemetry surveys by private contractors require a permit from ADF&G. Telemetry surveys will be flown to search for VHF-radio-collared caribou in the region surrounding the mine within two days of each scheduled transect survey, and the data obtained will be shared fully with the MCHTWG .

In addition to fixed-wing-aircraft surveys, an additional survey by helicopter will be used specifically to search for and examine bear dens in the mine area in early May, and two other helicopter surveys will be flown to look for seasonal concentrations of bears along anadromous fish streams in the mine area in mid-July and mid-August. Locations of suspected bear dens will be solicited from other project personnel for examination during these surveys.

Telemetry-Data Analysis

An important element of the mammal study will be analysis of existing telemetry data for caribou collected previously in the region by state and federal resource agencies. These data constitute an extremely important database for use in the environmental baseline report and impact assessment (and thus eventually in the project EIS). The intent is to work cooperatively with ADF&G and the U.S. Fish and Wildlife Service (USFWS) to perform these types of project-specific analyses using fixed kernels and other methods of GIS analysis to summarize and depict seasonal distribution patterns of caribou in relation to project infrastructure. Successful application of these methods will depend on cooperation with agency biologists to identify and work with existing data sets, as was discussed with the MCHTWG in January 2005. We are fully aware of potential sensitivities regarding access to such data. Memoranda of understanding will be established regarding which data are to be used and for what purpose, as well as how they are to be analyzed and presented.

Harvest-Data Analysis

We will request harvest data on big game and furbearer species in the project region from ADF&G to provide background on human use of mammal species. Furbearer harvest data and trapper reports from specific stream drainages (Uniform Coding Units, or UCUs) also provide important background information on the distribution and abundance of these species, which can be difficult to enumerate using field methods. This effort will be coordinated with the subsistence study for the project to further document harvest levels and locations in the project area.

Wildlife-Observation Logs

To take advantage of and solicit input from other contractors working on the project, wildlife-observation log sheets will be posted prominently in common locations at camps for workers to record miscellaneous sightings of wildlife encountered anywhere in the project area. This approach, which greatly expands the number of potential observers, was used successfully at the Pogo Mine in interior Alaska and in 2004 at the Iliamna camp and produced useful information for the environmental baseline report and EIS by

taking advantage of the presence of other observers when survey biologists were not present. Observation log sheets will be distributed in electronic form to other contractors to solicit their input as well. For instance, the fisheries research team plans to record bears observed during their spawning-stream surveys, adding to the information gathered in our surveys of those important seasonal-use areas.

9.1.3 Proposed Study Plan—Raptors

9.1.3.1 Study Area/Scope

The study area in 2004 included all suitable woodland and cliff habitat available for nesting raptors at the mine site and at all the original alternative sites for waste-rock disposal (Figure 9-2). Suitable habitat within a one-mile buffer outside the outer boundaries of these development areas also was surveyed. Large, suitable habitat features (such as large cliffs or drainages) more than one mile outside the outer boundaries also were surveyed when they appeared to provide raptor nesting habitat. In 2005, we will increase the size of the survey area for raptors in the mine region (Figure 9-2). This increase is largely in response to initial agency comments on our 2004 study plan calling for broader study regions for most wildlife surveys. We will continue surveys to locate nests and determine occupancy, but we have added productivity surveys and a mid-winter Bald Eagle survey in 2005.

Several raptor species have been included in predevelopment baseline studies because of their legal or conservation status. Bald Eagles and Golden Eagles are emphasized because they are afforded special protection under the Bald and Golden Eagle Protection Act. The American Peregrine Falcon subspecies, whose range may include the Lake Clark/Iliamna region, was delisted as an endangered species in 1999. The subspecies is included in our baseline studies, along with other cliff-nesting raptors, because of continued agency interest in its populations and sensitivity to disturbance. All cliff-nesting raptors (including the coastal subspecies of Peregrine Falcon) will be identified during the cliff-nesting surveys for Golden Eagles. Other tree-nesting species (e.g., Northern Goshawk) may be identified during pre-leaf-out surveys for Bald Eagles.

A subspecies of the Northern Goshawk is a State of Alaska Species of Special Concern in southeast Alaska. Although nests of Northern Goshawks may be discovered during surveys for Bald Eagles, more intensive coverage of woodland nest sites is often necessary to locate nests of this species. In 2004, an aerial survey was conducted to search for Northern Goshawk nests within the mine area. Play-back of recordings of goshawk calls in such a large area would be cost-prohibitive and premature. Moreover, such intensive survey techniques (call play-back) that could help locate specific nest sites are probably not necessary because suitable habitat in the mine area appears to be limited.

9.1.3.2 Methods and Approach

This work will be accomplished through a combination of the following:

- Low-level helicopter surveys in the mine area.
- Literature and agency-file review to collect information on raptors and known nest sites in the region.

9.1.3.3 Major Activities

Two aerial surveys each in suitable habitats for tree- and cliff-nesting raptors will be conducted by helicopter in the mine area to identify and assess the occupancy of raptor nests (Occupancy Survey) and assess productivity (Productivity Survey) in the region. A separate fixed-wing-aircraft survey will be undertaken in mid-winter to determine if any Bald Eagles are wintering in the area.

Suitable nesting habitats include cliffs for Peregrine Falcons, Gyrfalcons, and Golden Eagles, and forested areas for Bald Eagles and other woodland raptors, including Osprey, Northern Goshawks, *Buteo* hawks, and Great-horned Owls. Common Raven nests also will be recorded.

- Occupancy Surveys will be conducted during the arrival and early-to-mid-incubation stages for raptors in the region (late April-late May). The first survey will occur before deciduous tree leaf-out (early May) and will be used to identify the nests of tree-nesting species, particularly the Northern Goshawk and Bald Eagle. The second survey will occur at least two weeks later and will be used to identify cliff-nesting raptors, particularly Gyrfalcons, Peregrine Falcons, and Golden Eagles.
- Productivity Surveys will be undertaken during the mid-to-late-nestling period for raptors in the region (late June-late July). These surveys also will allow us to identify active nests missed during occupancy surveys and to help determine the status of ambiguous nests.
- Low-level (approximately 150 feet agl) helicopter surveys of suitable forest stands, cliffs, banks, and islets will be undertaken with two observers seated on the same side of the aircraft searching woodlands and cliffs for signs of use by nesting raptors (stick nests, ledges, aggressive or perched birds). Multiple passes of some habitats (cliffs) may be necessary. Standard operating procedures (SOPs) include flying shorelines of the ocean, lakes, streams, and areas of substantial topographical relief.
- SOPs for Goshawks, Bald Eagles, and other tree-nesting raptors will include flying to good woodland stands, along creeks, on hillsides, and along lake edges. All islets and islands will also be searched. Survey flights will employ appropriate angles to look into stick nests.
- SOPs for habitat searches for cliff-nesting species include angling toward the cliff or bank area at least one-half mile from the site and slowly approaching the cliff area. Observers will search for all whitewash, stick nests, and perched and flying birds. When a nest or suggestions of nesting (aggressive pair) occur, observers will get a GPS location and take digital pictures of the site.
- All observations of raptors will be recorded on USGS topographic maps (scale 1:63,360) or aerial photos. Locations also will be recorded using an onboard GPS receiver.
- Information recorded at each site will include species present, physical characteristics of the nest site, brief habitat description, occupied status, and numbers of birds (adults and nestlings) observed.
- Finally, a fixed-wing-aircraft survey will be conducted to determine if Bald Eagles over-winter in the region. Two observers will search open-water areas in early December and/or mid-February for Bald Eagles. The SOP for this survey will include low-level flights in all areas of open water.

9.1.4 Proposed Study Plan—Waterfowl

9.1.4.1 Study Area/Scope

The 2005 study area for waterfowl encompasses the 2004 study area and additional areas to the north and south of the mine-site area that were observed to be used by waterfowl in 2004. The 2004 study area included all suitable wetland habitats available for migrating, staging, nesting, and brood-rearing waterbirds at the mine site and all the original alternative sites for waste-rock disposal (Figure 9-3). The additional survey areas added for 2005 will include Nikabuna and Long lakes (an important fall staging area for swans and ducks), Lower and Upper Talarik creeks, and the waterbodies from Lower Talarik Creek to the Newhalen River.

The Alaska Peninsula and the Lake Iliamna region are important migration routes for many bird species moving to and from breeding areas in western and northern Alaska and eastern Asia. Important waterbird species in the area include Tundra Swans and, possibly, Trumpeter Swans, and a diverse assemblage of dabbling and diving ducks. River deltas in the area (at the proposed port sites and Iliamna Lake) were found to serve as migration stopovers in spring before region-wide breakup.

Harlequin Ducks are likely to breed in the study area and over-winter on nearshore waters in the Kamishak Bay region. The Harlequin Duck was formerly listed as a species of concern by USFWS (Category 2 candidate species). Although its current conservation status is unclear, it has received recent attention by resource agencies, particularly because it has been identified as a species not fully recovered from the *Exxon Valdez* oil spill.

9.1.4.2 Methods and Approach

These objectives will be carried out as follows:

- Conducting aerial surveys of all waterbodies to determine the distribution and abundance of waterfowl and waterbirds during spring and fall migration, nesting, and brood-rearing.
- Describing species composition and the selected use of lakes, rivers, and wetland areas in the mine site and surrounding areas.
- Reviewing literature and agency files to collect information on waterfowl in the region.

A combination of fixed-wing-airplane, helicopter, and ground surveys will be used to determine the composition of breeding waterbirds in the area and to identify areas of high use during nesting, brood-rearing, molting, and migration/staging in the mine area.

9.1.4.3 Major Activities

During each survey, the field team will count and map the distribution and abundance of waterbirds seen on lakes, rivers, and wetland areas.

- First, low-level, fixed-wing aerial surveys will be flown for molting and staging birds during spring (five surveys, April 15-May 25), mid-summer (two surveys, July 15-August 15) and fall

(six surveys, August 20-October 25). The surveys will be flown along a preselected route covering upland lakes in the mine area. Lakes will be grouped as survey units based on relative closeness and other topographic features. One observer will gather information on habitat conditions, flock size, and species composition. The survey will be flown lake-to-lake, and the route will be tracked using a GPS receiver.

- For the breeding pair survey, a fixed-wing aircraft will be flown in early June in a manner similar to that used for the annual breeding pair surveys flown near Bristol Bay by the USFWS. A series of transects will be flown using GPS navigation in the most dense lake areas in the Upper Talarik Creek and Koktuli River basins. Data gathered will include species, estimated numbers, and observation type (e.g., male, pair, flock). An additional survey to locate nesting swans and gulls will be conducted in the mine area in early June by two observers in a helicopter. A series of transects will be flown over lake and tundra habitats in the mine area to search for nesting swans and gulls and between Lower Talarik Creek and the Newhalen River for swans. Nest sites will be recorded on topographic maps and with an onboard GPS receiver.
- Three low-level helicopter surveys are proposed to detect pre-nesting pairs of Harlequin Ducks along streams in the mine area. Observations will be recorded on topographic maps and with an onboard GPS receiver. Surveys could occur in conjunction with other aerial surveys in mid-May to mid-June to reduce personnel and helicopter costs.
- A waterbird brood-rearing survey will be conducted in mid-July. Two observers will circumnavigate lakes and traverse wetlands within selected sample units in the mine area to identify, count, and age broods. A helicopter will be used to survey clusters of small lakes and to transport observers between survey areas.

9.1.5 Proposed Study Plan—Breeding Birds

9.1.5.1 Study Area/Scope

The study area for 2005 was expanded from that used in 2004 and encompasses all facilities proposed to be developed at the mine site, including the open pit, internal mine roads, the mill site, solids-retention areas, and waste-rock sites (Figure 9-4). The study area also includes a substantial area surrounding the proposed mine facilities that is not expected to be developed. Surveys will be focused on the use of habitats in and around the areas proposed for development, but areas not expected to be developed will be surveyed also, for comparison.

As in 2004, breeding bird surveys in the region of the Pebble Mine in 2005 will focus on landbirds and shorebirds. A total of 64 bird species were observed during our surveys in 2004, and many of those were confirmed as nesting in the area. Thirteen of those 64 species are considered conservation priority species for Alaska by at least one statewide, regional, or national working group focused on bird conservation (ADF&G, 1998; BPIFWG, 1999; ASWG, 2000; Audubon Alaska, 2002; USFWS, 2002). Ten of those 13 species of conservation concern were confirmed as nesting in the area (American Golden-Plover, Pacific Golden-Plover, Whimbrel, Hudsonian Godwit, Surf-bird, Short-billed Dowitcher, Arctic Warbler, Gray-cheeked Thrush, Blackpoll Warbler, and Golden-crowned Sparrow).

In 2005, we will continue our habitat-based surveys focused on assessing the direct effects of development. Designed to survey for a range of species, including the species of conservation concern

noted above, these surveys will yield data to enable accurate assessments of habitat preferences for breeding birds in the project area. These habitat-association data will be used in overlays in GIS to determine acreages of breeding bird habitats directly affected (removed) by the proposed mine.

9.1.5.2 Methods and Approach

The survey area for this work was increased from that used in 2004 (Figure 9-4) so that it coincides with the larger area being mapped for wildlife habitats in the mine area and with the core areas being surveyed for mammals, raptors, and waterfowl.

We will use point counts for the breeding bird surveys to be conducted in the mine region in late May/early June 2005. These surveys are scheduled to occur during the peak of breeding for shorebirds and landbirds. Point counts will be conducted in order to record all species seen or heard within standard 10-minute intervals at each sample point location (Ralph et al., 1995). All observations will be categorized in estimated-distance categories to allow density calculations (Laake et al., 1994; Rosenstock et al., 2002).

To allocate plots for sampling, we will first evaluate the 2004 true-color aerial photography for the area and will then selectively survey particular habitats that were not sampled or were under-sampled during our 2004 breeding bird surveys. (The 2004 survey locations were allocated using much older high-altitude color-infrared aerial photography from the National Aeronautics and Space Administration [NASA].) The objective of these surveys will be to collect an adequate number of sample points for each habitat to allow accurate determinations of habitat-use for a range of breeding bird species. These habitat-use data are critical to making accurate assessments of impacts to breeding bird habitats from the proposed development. Because of the high variability inherent in breeding bird point-count data (patchiness in bird presence on the landscape), it is necessary to collect multiple data points in each habitat type. We will attempt to survey at least 30 point count locations in each habitat (as recommended by Ralph et al. [1995] for habitat-association data), and we envision this effort to be on-going with additional data collected in subsequent years, as needed, to increase sample sizes. This protocol of assembling habitat-use data across years is an accepted practice in studies of habitat relationships of breeding birds and does not depend on using random methods to locate sample points (Hutto and Young, 2002). With sufficient data for each habitat type, we will have more robust estimates of habitat relationships for breeding birds in the Pebble Project mine area, and this will result in more accurate estimates of the breeding bird habitat to be directly removed by development of the mine. We are planning to conduct habitat-based point counts at 160 locations in 2005. These point-count data will yield the number of species and individual birds found in each habitat type at each point-count location. These data also will be presented as densities, if the data are sufficient to allow density estimates. Otherwise, the data will be presented as birds per point.

9.1.5.3 Major Activities

Major activities for this work will include the following:

- Identifying the species occurrence, distribution, and abundance of breeding landbirds and shorebirds in the mine area.
- Determining the habitat associations of landbirds and shorebirds in the study area.

- Evaluating the direct impacts on breeding bird habitats from development of the proposed mine.

9.1.6 Proposed Study Plan—Habitat Mapping

9.1.6.1 Study Area/Scope

The habitat mapping and evaluation area will be a contiguous area that encompasses all the proposed facilities at the mine and a buffer area (Figure 9-4). The total area to be mapped will be approximately 72,500 acres and is designed to cover the core areas being surveyed for mammals, breeding birds, raptors, and waterfowl in the mine region. ABR will integrate our mapping of wildlife habitats with the mapping of wetlands by Three Parameters Plus (3PP) to produce an integrated map for the Pebble Project.

9.1.6.2 Methods and Approach

The objectives of the habitat mapping study will be met using the following methods:

- Classifying, mapping, and quantifying the areas covered by various habitat types.
- Identifying the importance of these habitats to wildlife species (using survey data specific to the mine—see individual wildlife survey sections above).
- Quantitatively assessing the area of each mapped wildlife habitat that could potentially be affected by mine construction, using GIS.

Wildlife habitats will be classified and mapped by stereoscopic interpretation of true-color aerial photography (to be provided by Northern Dynasty Mines). In addition, we propose to augment our photo interpretation with NASA high-altitude color-infrared photography, primarily to verify scrub habitats, which are common in the project area. Habitat boundaries will be mapped digitally with *ArcGIS* software using digital orthophoto mosaics for the area. Each map polygon will be coded with a vegetation (land-cover) type, a physiography type, a surface-form type, and a provisional wildlife-habitat type. Wildlife habitats then will be formally derived by combining land-cover types, physiography types, and surface-form types using wildlife-habitat classification systems developed by ABR biologists for similar forest and tundra regions in Alaska (Jorgenson et al., 1989, 2003).

In 2005, we are proposing to conduct map-verification surveys to verify at least that portion of the wildlife habitat mapping that will be completed by July 2005 and to collect ground-reference data in regions that have not yet been mapped. The objective of these field surveys is to verify vegetation, physiography, and surface-form information for several sample sites representing each photosignature or mapped polygon, and to examine, on the ground, those photosignatures that were difficult to interpret during mapping. Map polygons will be corrected as needed following analysis of the 2005 field data. Sites will be accessed by helicopter and on foot and located by navigating to predetermined GPS locations. At a minimum, at each site visited the dominant plant species will be assessed visually, and vegetation, physiography, and surface-form types will be recorded. Soils information also will be collected at the ground reference sites but not for the map-verification sites. Any wildlife observations, including wildlife sign, will be recorded at each site. Any rare plants found that are present on the Alaska Natural Heritage Program (AKNHP) Vascular Plant Tracking List (AKNHP, 2004) will be recorded with photo documentation and voucher specimen collections. The records of any rare plants will be

incorporated into the rare-plant occurrence-potential study (see Section 9.1.7, below). Documentary photos will be taken at each survey location.

To determine impacts to wildlife habitats, we propose to overlay project facility outlines (in a GIS) on the wildlife-habitat map layer to calculate area figures for habitats that will be affected by development of the mine. In our impact assessment for wildlife habitats, we also will make use of the existing land-cover data for Lake Clark National Park and Preserve (NPS, 2001). These public-domain data are coarse-scale (99-foot pixels), and the land-cover classes are general, but the data do cover a broad region surrounding and including the mine site. In addition to evaluating impacts on a local scale at the mine site, we propose to use these Lake Clark land-cover data to evaluate the impacts to wildlife habitats in a broader, regional-scale context that may be useful for the EIS.

9.1.6.3 Major Activities

The major activities for this work will include the following:

- Field surveys to collect ground-verification data to aid in identifying photosignatures and to use in correcting mapped polygons as needed.
- Digital mapping of wildlife habitats.
- An evaluation of wildlife use of the mapped habitats.

9.1.7 Proposed Study Plan—Rare-Plant Occurrence-Potential

9.1.7.1 Study Area/Scope

ABR is not proposing actual surveys of rare plants, but instead is proposing an office-only study to determine the potential for the more rare plant taxa listed by the AKNHP to occur in the mine area.

9.1.7.2 Methods and Approach

We will identify the rare plant species that have the potential to occur in the mine area by reviewing the available literature and by contacting botanists who have conducted surveys near the Pebble Project mine area. We will focus our efforts on only the more rare species, those listed by AKNHP as S1, i.e., critically imperiled in the state (172 taxa).

The distributions of the S1 species listed by the AKNHP will be evaluated for ranges that overlap the Pebble Project area and for habitats that occur in the area. We will use distribution and habitat information for rare plant taxa found in several resources, including commonly used floras of Alaska (Hultén, 1968; Welsh, 1974; and Lipkin and Murray, 1997). In addition, a formal data request to the AKNHP will be made for specific collection-location and habitat information for species that have ranges overlapping the study area. Any synonymies in nomenclature and/or taxonomic changes will be reconciled using the references above plus Kartesz (1994) and BONAP (1998). No field surveys are planned for this study.

Based on a preliminary review of plant distributions in the Pebble Project area, we expect this study to yield a list of perhaps 10 to 15 rare plant taxa that have the potential to occur in the area because their current ranges overlap the area and because suitable habitat is present broadly in the area. After determining this list of potential rare plant taxa for the area, we will seek to identify those taxa for which suitable habitats exist within the project development footprints. In this way, we will determine a short-list of only those taxa that have the highest probability of being affected by the removal or alteration of habitats during project development. Note that this study will not indicate that these plants in fact will be affected by development, but only that suitable habitat for these plants exists within areas slated for development.

These rare-plant potential-occurrence data are not suitable for an impact assessment because the occurrence of a rare plant population in suitable habitat is never certain. Rare species are in fact defined by their patchy occurrence in the wild, and any impact assessment using habitats of potential occurrence would yield a gross overestimate of the acreages of habitats that actually support rare plant populations.

9.1.7.3 Major Activities

The major activities for this work will include the following:

- Literature review and consultation with AKNHP personnel to determine the potential for rare plant taxa to occur in the mine area.
- Identification of habitats in the mine area that could support populations of rare plants.

9.1.8 Deliverables

One report will be produced in 2005 for the terrestrial wildlife studies in the mine area: the Initial Environmental Evaluation (IEE). All other reporting on survey results and habitat mapping from 2005 will be conducted in 2006. The habitat mapping will not be completed in 2005. Using the data available in fall 2005, the potential impacts of mine development on wildlife will be evaluated in the IEE report and suggestions for potential measures to mitigate project impacts on wildlife also will be discussed.

9.2 Road/Port (Including Transportation and Power-Supply Options)

9.2.1 Objectives

The objectives of the wildlife studies in the transportation/utility corridor and port areas are similar to the objectives described above for the mine area (Section 9.1.1).

9.2.2 Study Area and Methods

The studies described in this section entail surveys for two proposed road/port-related project options (Figure 9-1):

- The Alaska Department of Transportation and Public Utilities (DOT&PF)-proposed access road and utility corridor from Cook Inlet to the mine site (including the DOT&PF-proposed port site).
- The “Y-valley” on the coast (proposed laydown area near the mouth of Iniskin and Iliamna Bays).

In addition, we are proposing reconnaissance-level-only surveys for one potential transportation option and two potential power-supply options (Figure 9-1):

- The barging of construction materials across Iliamna Lake from Pile Bay to a potential temporary road on the west side of the Newhalen River to connect to the DOT&PF-proposed access road.
- The potential landfall area for the submarine power cable at Seal Spit in Chinitna Bay.
- The potential overland power-transmission-line alignment from Seal Spit to the proposed port site.

We are not proposing any survey effort for the transportation option of barging construction materials across Iliamna Lake to Iliamna and then using existing roads to connect to the DOT&PF-proposed access road, as the areas to be used in this option either will be covered in other surveys or will involve the use of existing infrastructure (i.e., Iliamna barge landing and existing local roads).

9.2.2.1 Mammals

The objectives and methods for the mammal surveys and studies in the region of the proposed road and port site are similar to those described for the mine site (Sections 9.1.1.1 and 9.1.2), with one significant addition: marine mammal surveys (see next paragraph). The survey area will encompass the proposed road corridor and port site and surrounding regions (Figure 9-1). The timing of the terrestrial mammal surveys will be identical to those conducted in the mine area and the same aircraft, flight crew, and observation procedures will be used as in the mine area transect surveys. Transect lines will be allocated throughout the road corridor to obtain estimates of sightability and density within areas of differing vegetative cover along the corridor. The helicopter surveys for bears in July and August will extend at least a half-mile upstream and downstream of all potential road crossings of fish-spawning streams along the road-alignment alternatives.

Marine mammals—most notably harbor seals—will be of importance for project permitting in the port vicinity and in Iliamna Lake due to their protected status under the Marine Mammal Protection Act and

concerns about the population status of several species in southern Alaska. Accordingly, a new aerial survey element added in 2005 will use visual counts and photographic coverage of harbor seal haulouts in Iniskin, Iliamna, and Cottonwood bays and in Iliamna Lake. This effort will expand survey coverage of the coastal bays to provide more information on seals and other marine mammals (seen incidentally), thereby complementing the boat-based marine wildlife surveys. These aerial surveys will focus on the coastal bays and will not include cetacean surveys offshore. Harbor seal haulouts documented previously in Iliamna Lake (1991, 1998-1999) will be photographed using the same methods as in past surveys (Small, 2001). The harbor seal surveys will be flown at higher altitudes (800 to 1000 feet, weather permitting) to minimize disturbance of seals and will employ oblique aerial photography with a 35-mm camera and zoom lens to facilitate accurate counts of seals using haulouts. Surveys will be timed to coincide with low tide stages and times of day when use of seal haulouts increases and will follow techniques used in other recent surveys in the region (Bennett, 1996; Small, 2001). Local observers will be consulted about their knowledge of seal haulout locations and use.

The potential addition of radio-tracking surveys and the GIS analyses of agency telemetry data on caribou will apply to the road/port area as well. Agency data sets from past population surveys of bears and moose in the road corridor are being sought for inclusion in baseline analyses. Wildlife-sighting log sheets posted at camp locations will include observations made at locations along the route alternatives.

Reconnaissance-only surveys will be conducted in three areas: along the road alignment for the potential temporary road linking Iliamna Lake to the proposed DOT&PF access road, along the potential overland transmission-line alignment from Seal Spit to the proposed port site, and at the landfall area of the potential submarine power cable at Seal Spit (Figure 9-1). These surveys will entail single reconnaissance overflights over the areas to visually inspect the mammal habitats present instead of intensive transect coverage, which is focused on surveying animals directly. We will record our observations and take digital photographs of the habitats observed. We will supplement the records from these surveys with existing aerial photography for the area (if available) and information from the literature.

9.2.2.2 Raptors

The objectives and methods for the raptor surveys in the region of the proposed road and port are identical to those described for the mine site (Sections 9.1.1.2 and 9.1.3). The only difference is that the study area in this case will be a corridor of at least one mile on either side of the centerline of proposed road alignment (including the Y-valley area noted above) and the proposed port site (Figure 9-2).

Reconnaissance-only surveys will be conducted in two areas: along the potential overland transmission line alignment from Seal Spit to the proposed port site and along the potential route of barge traffic in Iliamna Lake (Figure 9-2). These surveys will entail single flights over the areas to visually inspect the nesting-raptor habitats present during May (nest occupancy period). We will describe cliff and woodland habitat in these corridors and document any nest sites located during the survey flights. For the potential barge route, surveys will be confined to areas generally extending from the shorelines of islands and the main coast of Iliamna Lake inland approximately one-half mile (Figure 9-2). The reconnaissance survey area will include the south shoreline of Pile Pay from Pile Bay Village to a point approximately six miles west of Squirrel Point and the southern shorelines of Porcupine, Flat, Seal, Triangle, Rabbit, Twomile and Tenmile islands. Surveys of the potential barge route from landing sites near Iliamna, Newhalen, and points west will be covered by our regional coverage of the mine site. We will supplement the records

from these surveys with existing aerial photography for the area (if available) and information from the literature.

9.2.2.3 Waterfowl

The objectives and methods for the waterfowl surveys in the region of the proposed road and port are identical to those described for the mine site (Sections 9.1.1.3 and 9.1.4). The only difference is that the study area in this case will be a corridor of at least one mile on either side of the centerline of proposed road alignment (including the Y-valley area) and the proposed port site (Figure 9-3). During spring and fall migration, the outlets of rivers flowing into Iliamna Lake will be surveyed for staging waterbirds.

Reconnaissance-only surveys will be conducted in two areas: along the potential overland transmission-line alignment from Seal Spit to the proposed port site and along the potential route of barge traffic in Iliamna Lake (Figure 9-3). These surveys will entail single flights over the areas to visually inspect the waterbird habitats present. We will record our observations and take digital photographs of the habitats observed. We will supplement the records from these surveys with existing aerial photography for the area (if available) and information from the literature.

9.2.2.4 Breeding Birds

The objectives and methods for the breeding bird surveys in the region of the proposed road and port are identical to those described for the mine site (Sections 9.1.1.4 and 9.1.5). The study area in this case, however, will be a 2000-foot-wide corridor centered on the proposed road alignment (including the Y-valley area) and the proposed port site (Figure 9-5).

Reconnaissance-only surveys will be conducted in three areas: (1) along the road alignment for the potential temporary road linking Iliamna Lake to the DOT&PF-proposed access road, (2) along the proposed transmission line that roughly parallels the DOT&PF-proposed access road, and (3) along the potential overland transmission line alignment from Seal Spit to the proposed port site (Figure 9-5). These surveys will entail single flights over the areas to visually inspect the breeding bird habitats present. We will record our observations and take digital photographs of the habitats observed. We will supplement the records from these surveys with existing aerial photography for the area (if available) and information from the literature.

9.2.2.5 Habitat Mapping

The objectives and methods for habitat mapping in the region of the road and port site options are identical to those described for the mine site (Sections 9.1.1.5 and 9.1.6). The study area in this case, however, will be a 2000-foot-wide corridor centered on the proposed road alignment (including the Y-valley area) and the proposed port site (Figure 9-5). The total area to be mapped will be approximately 23,800 acres. ABR will integrate our mapping of wildlife habitats with the mapping of wetlands by HDR, Inc., to produce an integrated map for the Pebble Project.

To enable a comparison of access road alternatives for the EIS, we propose to use the existing (1998) land-cover mapping for Lake Clark National Park and Preserve (NPS, 2001). These land-cover data, derived from Landsat imagery, are coarse-scale (99-foot pixels) and habitat types are general in nature,

but they cover a substantial portion of the study area. We propose to aggregate our fine-scale map classes and map polygons, derived from aerial photography, to create the same habitat classes as mapped for Lake Clark National Park from Landsat imagery. Once this is completed, we will be able to analyze the expected impacts to wildlife habitats along the alternative road alignments (using the general National Park Service [NPS] habitat types) and compare those impacts to those expected along the preferred road alignment. Any gaps in mapping coverage of the alternative road alignments (i.e., not covered by the NPS data or the mapping for the preferred road alignment) will have to be addressed by modification of this study plan.

Reconnaissance-only surveys will be conducted in three areas: (1) along the road alignment for the potential temporary road linking Iliamna Lake to the DOT&PF-proposed access road, (2) along the proposed transmission line that roughly parallels the DOT&PF-proposed access road, and (3) along the potential overland transmission line alignment from Seal Spit to the proposed port site (Figure 9-5). These surveys will entail single flights over the areas to visually inspect the vegetation, physiography, and landforms present (the three primary landscape elements used in our classification of wildlife habitats). We will record our observations and take digital photographs of the landscape elements observed. We will supplement the records from these surveys with existing aerial photography for the area (if available) and information from the literature.

9.2.2.6 Rare-Plant Occurrence-Potential

The objectives and methods for the rare-plant occurrence-potential study in the region of the road and port site options are identical to those described for the mine site (Sections 9.1.1.6 and 9.1.7). The study area in this case, however, will be a 2000-foot-wide corridor centered on the proposed road alignment (including the Y-valley area) and the proposed port site (same as study area for breeding birds and habitat mapping as depicted on Figure 9-5).

9.2.3 Deliverables

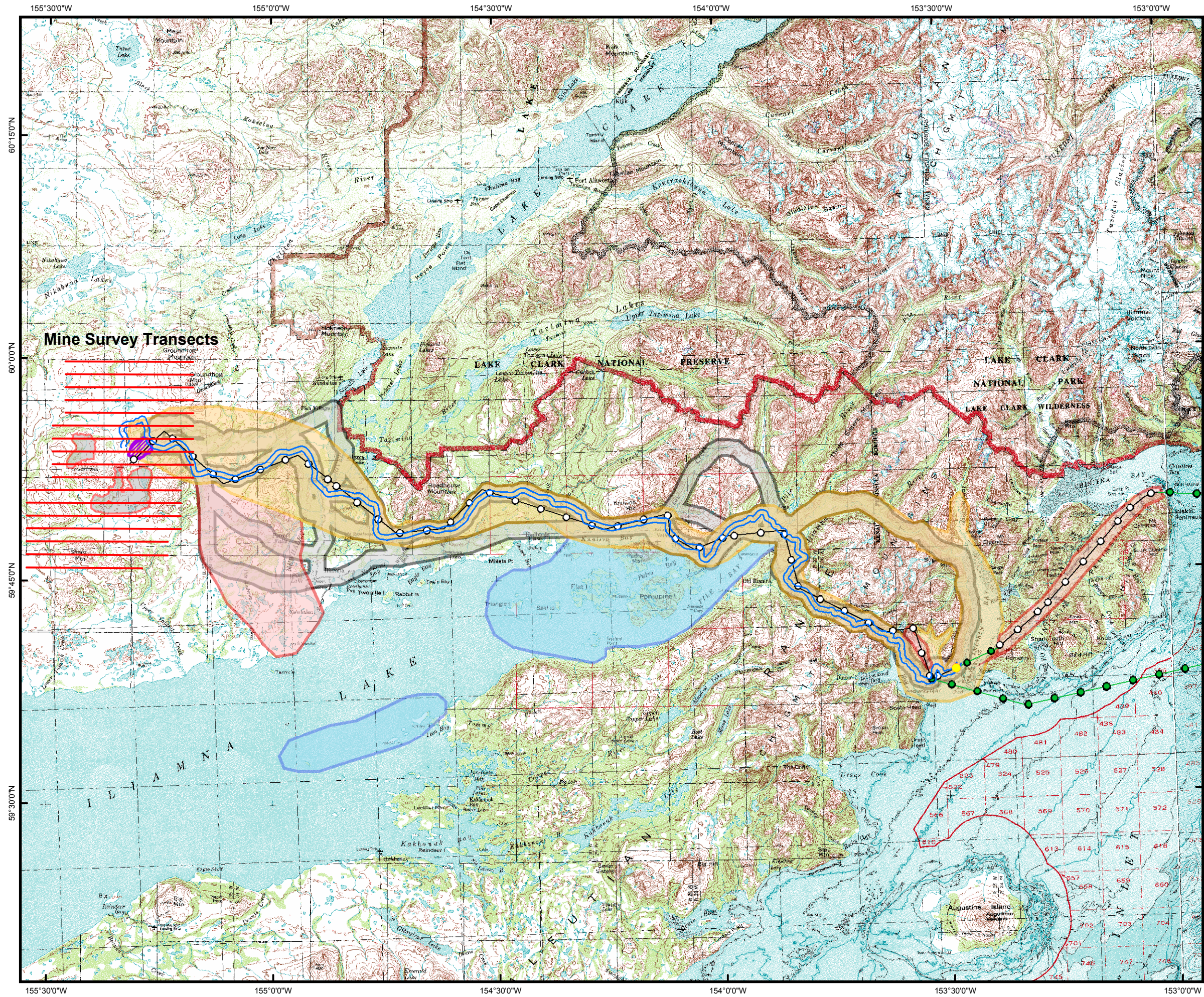
There are no deliverables in 2005 for the wildlife surveys and habitat mapping for the road/utility corridor and port site. Currently, all reporting for this work is scheduled to be conducted in 2006.

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FIGURES



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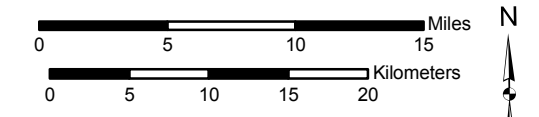
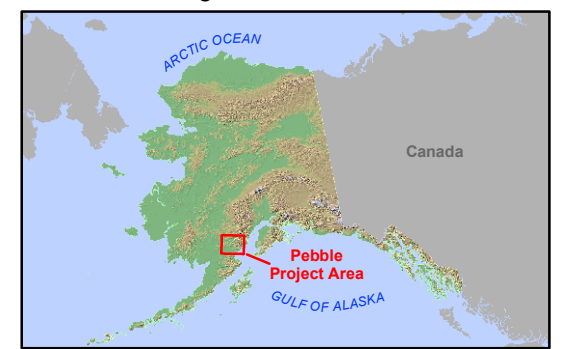
Pebble Project

Mine/Road/Port Study
Areas for Large Mammals
Figure 9-1

Mammal Survey Areas

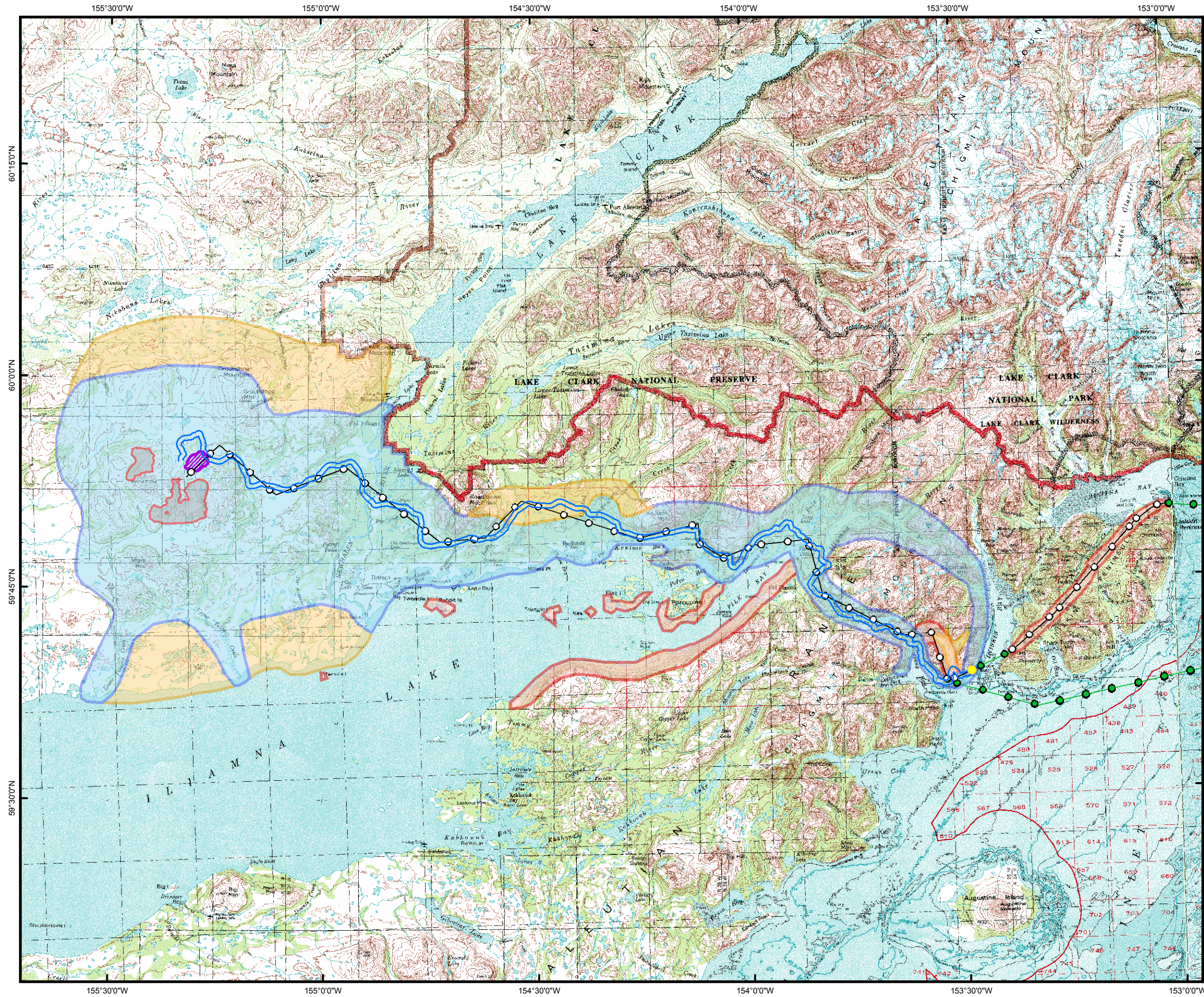
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- Iliamna Lake Seal Survey Area
- Reconnaissance Surveys Only
- Mine Pit
- Mine Development Concept
- 2000-ft Road Corridor
- ○ — Proposed Transmission Lines
- ● — Proposed Submarine Powerlines
- Proposed Port Site

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Scale 1:475,000
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

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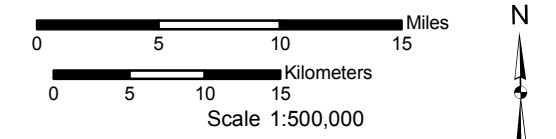
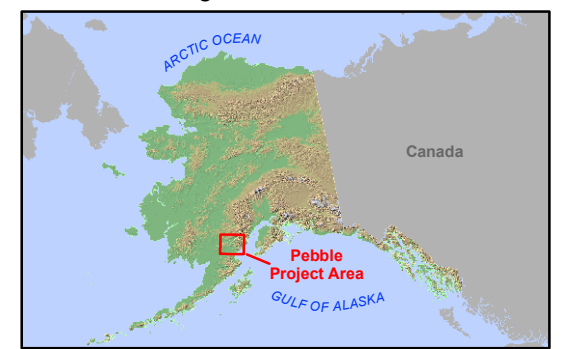
Pebble Project

Mine/Road/Port Study
Areas for Raptors
Figure 9-2

Raptor Survey Area

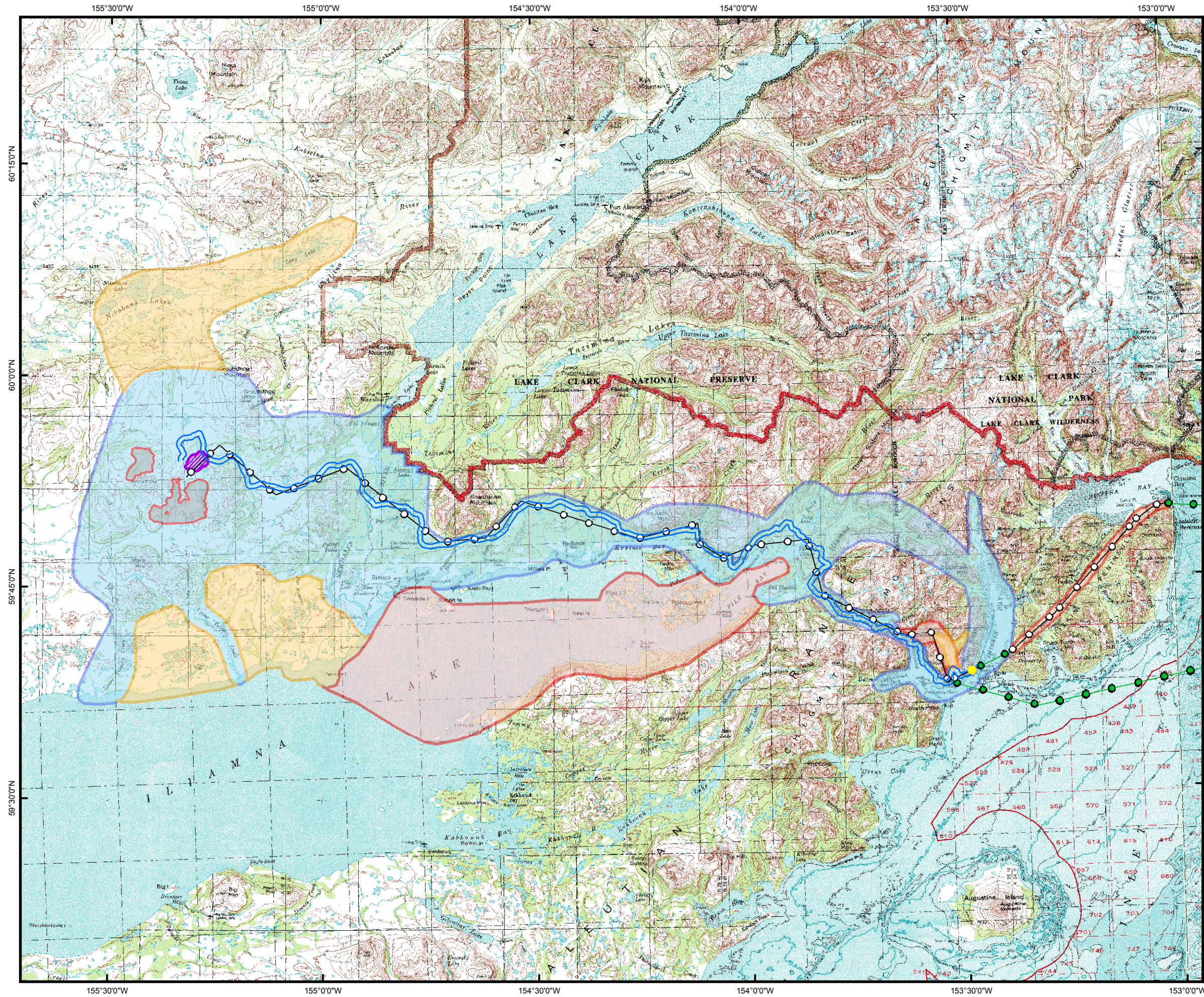
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- 2005 Extension
- Reconnaissance Surveys Only
- Mine Development Concept
- Mine Pit
- 2000-ft Road Corridor
- Proposed Transmission Lines
- Proposed Submarine Powerlines
- Proposed Port Site

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Alaska State Plane Zone 5 (units feet)
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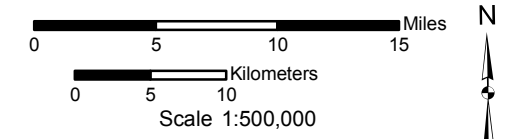
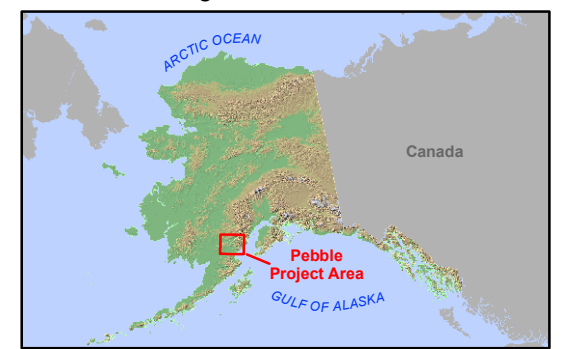
Pebble Project

Mine/Road/Port Study
Areas for Waterfowl
Figure 9-3

Waterfowl Survey Area

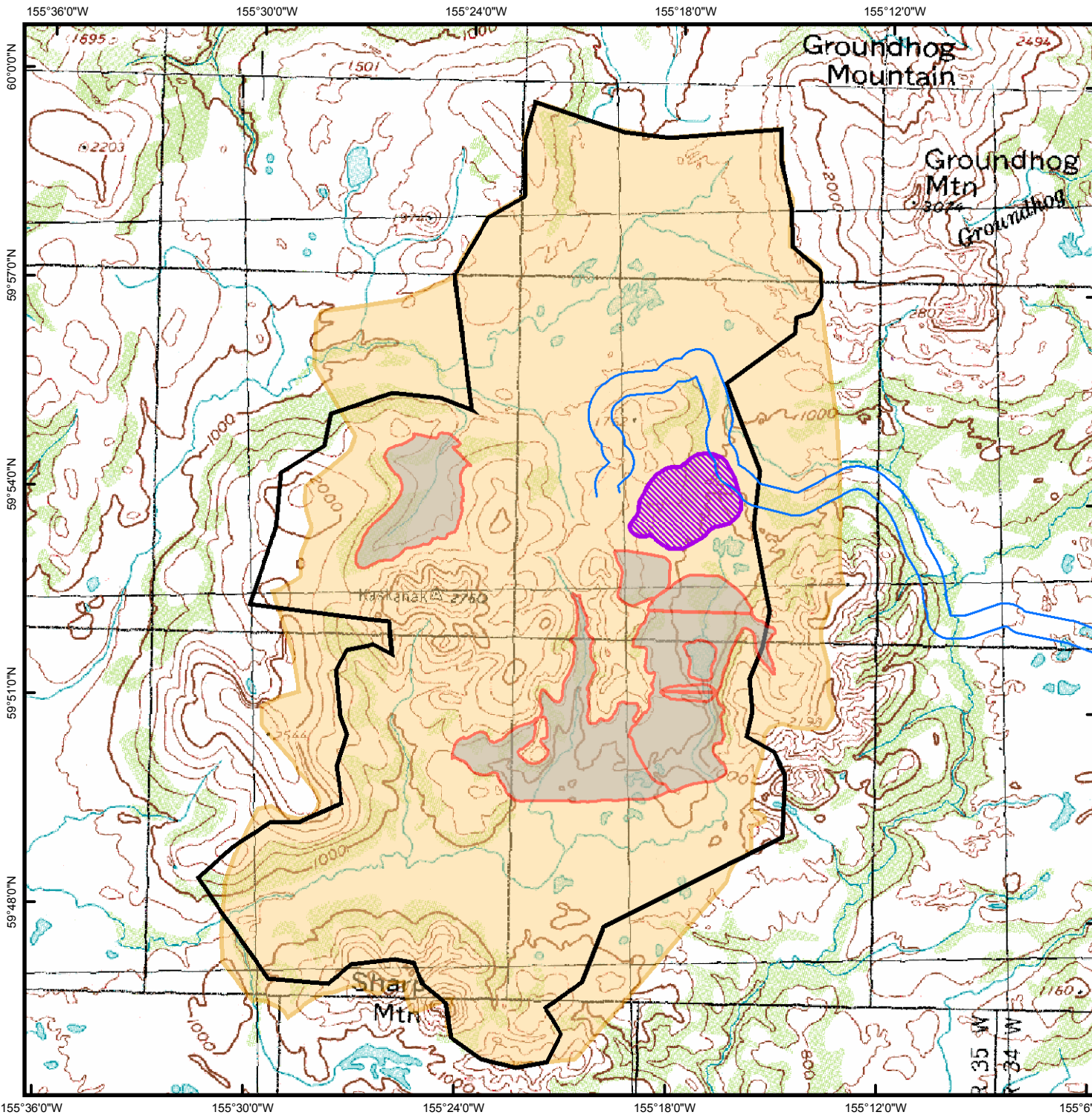
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- Proposed Submarine Powerlines
- Proposed Transmission Lines
- Proposed Port Site

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Northern Dynasty Mines Inc.



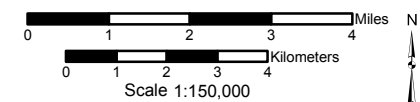
Pebble Project

Mine Site Study Areas for
Wildlife Habitat Mapping
and Breeding Bird Surveys
Figure 9-4

Legend

-  2005 Study Area
-  2004 Study Area
-  Mine Development Concept
-  Mine Pit
-  2000-ft Road Corridor

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Alaska State Plane Zone 5 (units feet)
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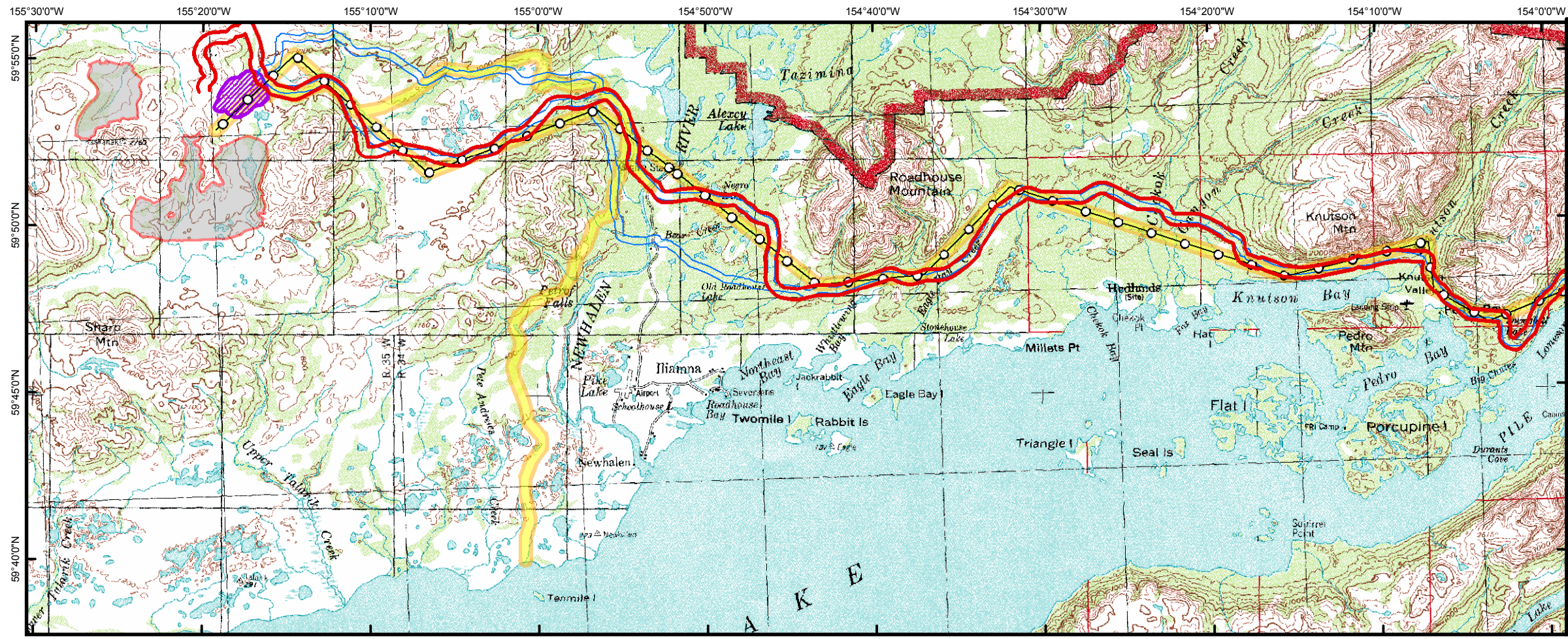
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


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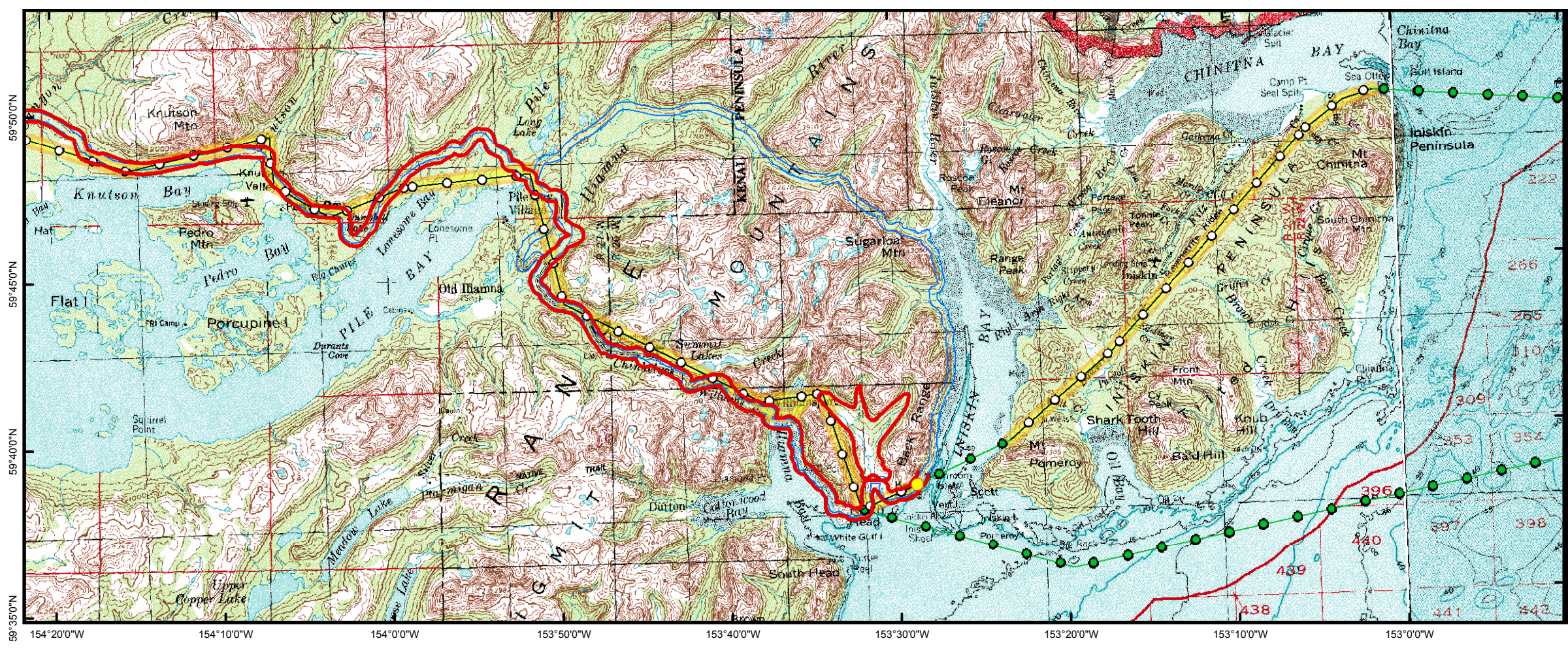


Pebble Project

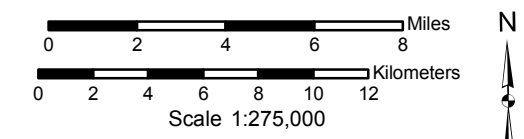
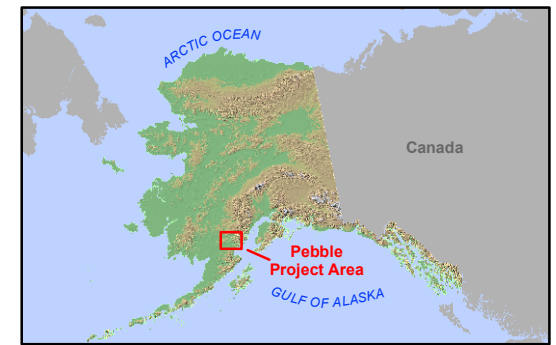
Road/Port Study Areas for
Wildlife Habitat Mapping
and Breeding Bird Surveys
Figure 9-5

Legend

-  2005 Study Area (2000-ft road corridor and Y-valley)
-  2004 Study Area (1312-ft road corridor)
-  Reconnaissance Surveys Only
-  Mine Pit
-  Mine Development Concept
-  Proposed Transmission Lines
-  Proposed Submarine Powerlines
-  Proposed Port Site



Privileged and Confidential



Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: Wildlife Habs_SA_Road_05-170-5.mxd	Date: June 16, 2005
Version: 3	Author: ABR-DD-AZC