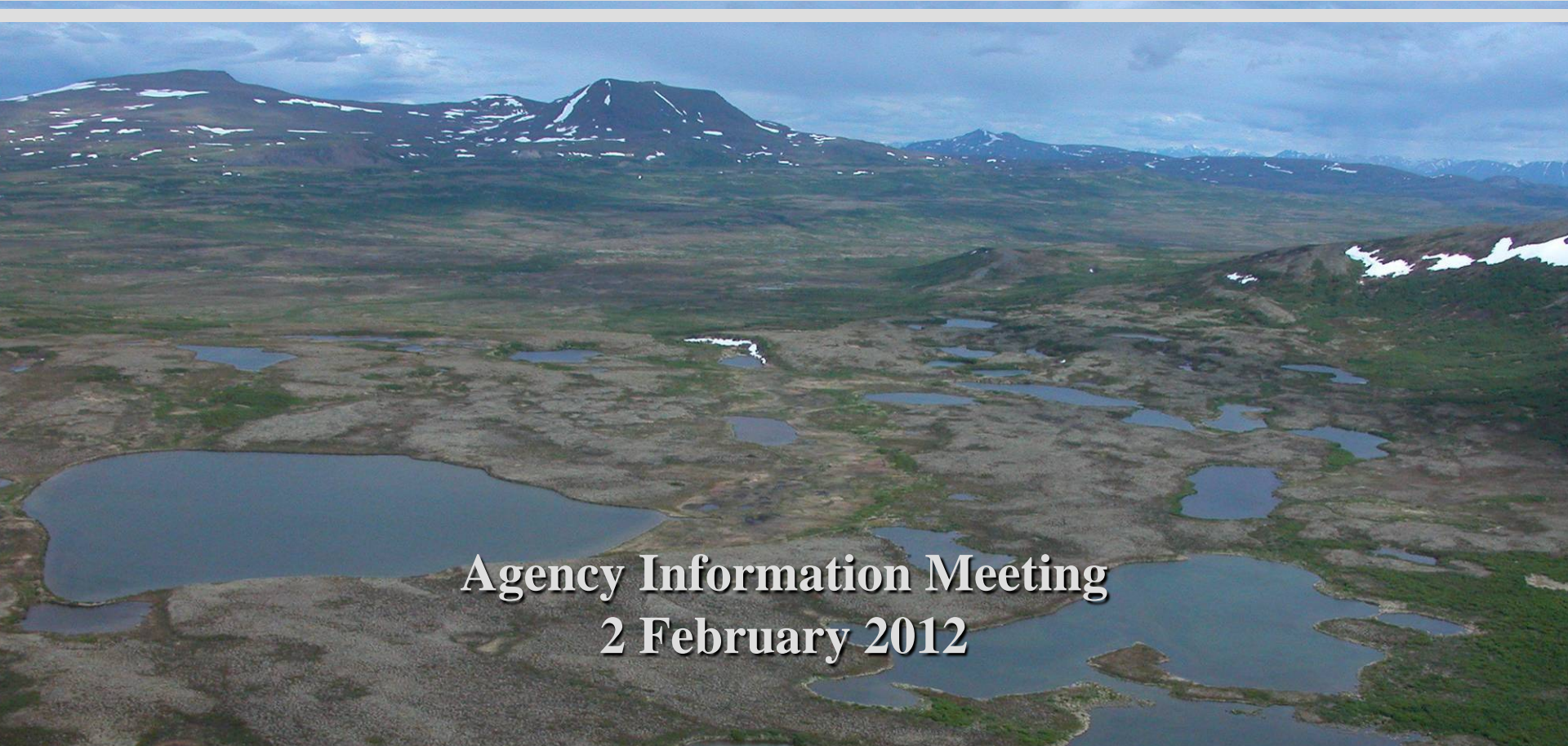


# Avifauna, Amphibians, and Wildlife Habitats



Agency Information Meeting  
2 February 2012

**Pebble Project EBD**

# Presentation Outline

- Overview of avian studies
- Overview of habitat-mapping studies
- Discussion of habitats and bird occurrence in each of the three study areas
- Wildlife habitat-use evaluation studies

# Avian and Amphibian Studies and Wildlife Habitat Mapping

Determined baseline conditions for:

- Breeding raptors (2004-2006)
- Migrant and breeding waterbirds (2004-2005)
- Breeding shorebirds (2004-2005)
- Breeding landbirds (2004-2005)
- Breeding amphibians (2007)
- Wildlife habitats (2004-05 and 2010-2011)

# Avian Studies



# Raptor Surveys

- Cliff-nesting species: Rough-legged Hawk, Golden Eagle, Gyrfalcon, Peregrine Falcon, (Common Raven)
- Tree-nesting species: Osprey, Bald Eagle, Northern Goshawk, Red-tailed Hawk, Merlin, Great Horned Owl
- All breeding raptor surveys (nest occupancy and productivity) by helicopter
- Early winter Bald Eagle surveys by fixed-wing and helicopter

# Waterbird Surveys

- Spring and fall migrant waterbirds, breeding and molting waterfowl, breeding swans and gulls (riverine and lacustrine waterbodies and wetlands), and breeding Harlequin Ducks (streams)
- Calculated densities for breeding waterfowl (USFWS fixed-wing methods) and determined waterfowl productivity with brood-rearing surveys
- Most were aerial surveys (fixed-wing and helicopter)
- Brood-rearing surveys were ground-based

# Shorebird and Landbird Surveys

- Ground-based surveys during the breeding season, in all terrestrial and freshwater aquatic habitats except open waterbodies
- Standard off-road point-count surveys (variable circular-plot surveys with distance estimates)
- 10-min observation periods at each point; most birds detected by songs and calls
- Additional observations recorded in transit between sample points

# Alder Thickets Prominent Near the Cook Inlet Coastline



# Transportation Corridor, Bristol Bay Drainages, Dominated by Mixed Spruce– Birch Forests



# Riverine Poplar Forests



# Poorly Drained and Well-drained Forest Openings



# Extensive Spruce Woodlands to the West Near the Mine Study Area



# Mine Study Area Habitats Dominated by Dwarf Scrub



# Montane Dwarf Scrub and Rocky Alpine Barrens



# Tall and Low Scrub in Both Uplands and Lowlands



# Riverine Low and Tall Willow Scrub



# Poorly Drained Wet Meadows



# **Bird Species Recorded**

**(p. 1 of 3)**

## **Terrestrial and Freshwater Aquatic Habitats Only**

Greater White-fronted Goose  
Canada Goose  
Trumpeter Swan \*  
Tundra Swan  
Gadwall  
American Wigeon  
Mallard  
Northern Shoveler  
Northern Pintail  
Green-winged Teal  
Canvasback  
Ring-necked Duck  
Greater Scaup  
Harlequin Duck  
Surf Scoter \*  
White-winged Scoter  
Black Scoter \*  
Long-tailed Duck \*  
Bufflehead  
Common Goldeneye  
Hooded Merganser  
Common Merganser  
Red-breasted Merganser  
Spruce Grouse  
Willow Ptarmigan

Rock Ptarmigan  
Red-throated Loon \*  
Pacific Loon  
Common Loon  
Red-necked Grebe  
Double-crested Cormorant  
Great Blue Heron  
Osprey  
Bald Eagle  
Northern Harrier  
Sharp-shinned Hawk  
Northern Goshawk  
Red-tailed Hawk  
Rough-legged Hawk  
Golden Eagle \*  
Merlin  
Gyr Falcon \*  
Peregrine Falcon \*  
Sandhill Crane  
Black-bellied Plover  
American Golden-Plover \*  
Pacific Golden-Plover  
Semipalmated Plover  
Spotted Sandpiper  
Solitary Sandpiper \*

\* = Species of Conservation Concern

# **Bird Species Recorded**

**(p. 2 of 3)**

**Terrestrial and  
Freshwater  
Aquatic Habitats  
Only**

Wandering Tattler  
Greater Yellowlegs  
Lesser Yellowlegs \*  
Whimbrel \*  
Hudsonian Godwit \*  
Surfbird \*  
Least Sandpiper  
Short-billed Dowitcher  
Wilson's Snipe  
Red-necked Phalarope  
Bonaparte's Gull  
Mew Gull  
Herring Gull  
Glaucous-winged Gull  
Arctic Tern  
Parasitic Jaeger  
Long-tailed Jaeger  
Great Horned Owl  
Short-eared Owl  
Boreal Owl  
Belted Kingfisher  
Downy Woodpecker  
Hairy Woodpecker  
American Three-toed Woodpecker  
Black-backed Woodpecker \*

Olive-sided Flycatcher \*  
Alder Flycatcher  
Northern Shrike  
Gray Jay  
Black-billed Magpie  
Common Raven  
Horned Lark  
Tree Swallow  
Violet-green Swallow  
Bank Swallow  
Cliff Swallow  
Black-capped Chickadee  
Boreal Chickadee  
Red-breasted Nuthatch  
American Dipper  
Golden-crowned Kinglet  
Ruby-crowned Kinglet  
Arctic Warbler  
Gray-cheeked Thrush \*  
Swainson's Thrush  
Hermit Thrush  
American Robin  
Varied Thrush \*  
American Pipit  
Bohemian Waxwing

\* = Species of Conservation Concern

**Bird  
Species  
Recorded  
(p. 3 of 3)**

**Terrestrial and  
Freshwater  
Aquatic Habitats  
Only**

Lapland Longspur  
Snow Bunting  
Northern Waterthrush  
Orange-crowned Warbler  
Yellow Warbler  
Blackpoll Warbler \*  
Yellow-rumped Warbler  
Wilson's Warbler  
American Tree Sparrow  
Savannah Sparrow

Fox Sparrow  
Song Sparrow  
Lincoln's Sparrow  
White-crowned Sparrow  
Golden-crowned Sparrow  
Dark-eyed Junco  
Rusty Blackbird \*  
Pine Grosbeak  
White-winged Crossbill  
Common Redpoll

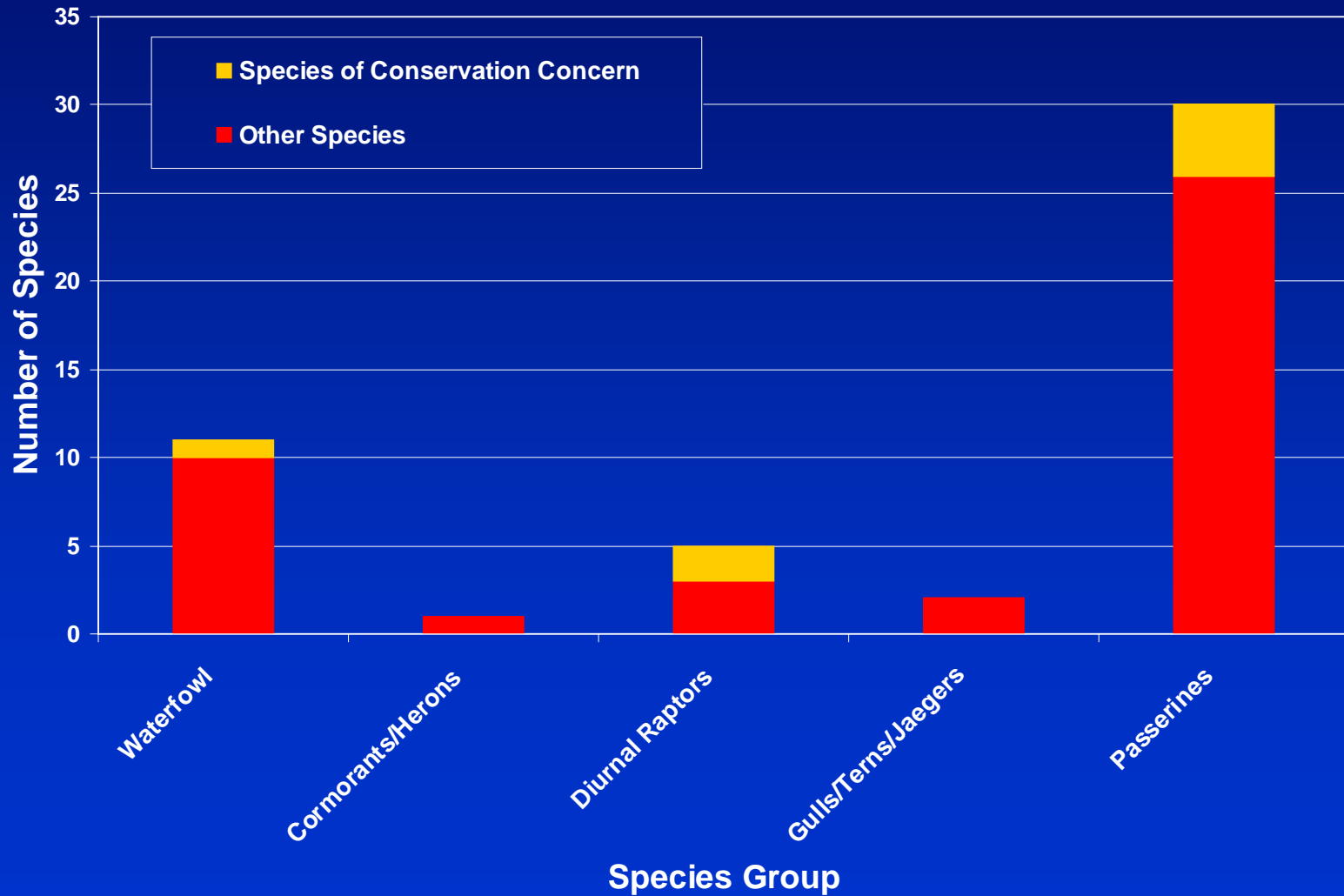
\* = Species of Conservation Concern

# Bird Species Recorded

## (Terrestrial and Freshwater Aquatic Habitats)

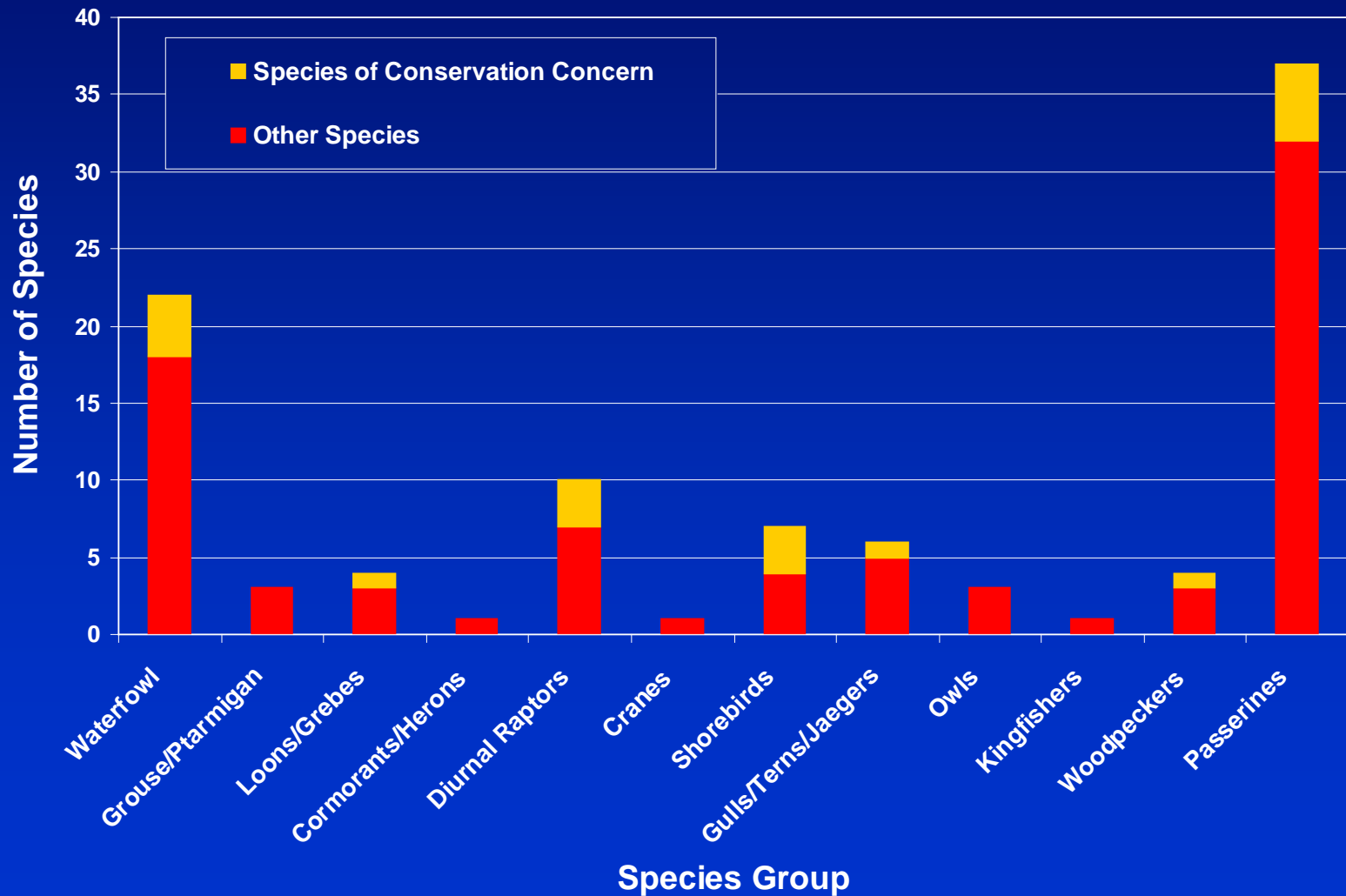
- Across all three study areas, 120 species were recorded in 12 species groups
- Waterfowl (23 species), grouse/ptarmigan (3), loons/grebes (4), cormorants/herons (2), diurnal raptors (11), cranes (1), shorebirds (16), gulls/terns/jaegers (7), owls (3), kingfishers (1), woodpeckers (4), and passerines (45 species)
- No threatened or endangered species
- 22 species of conservation concern

# Bird Species Richness Cook Inlet Drainages



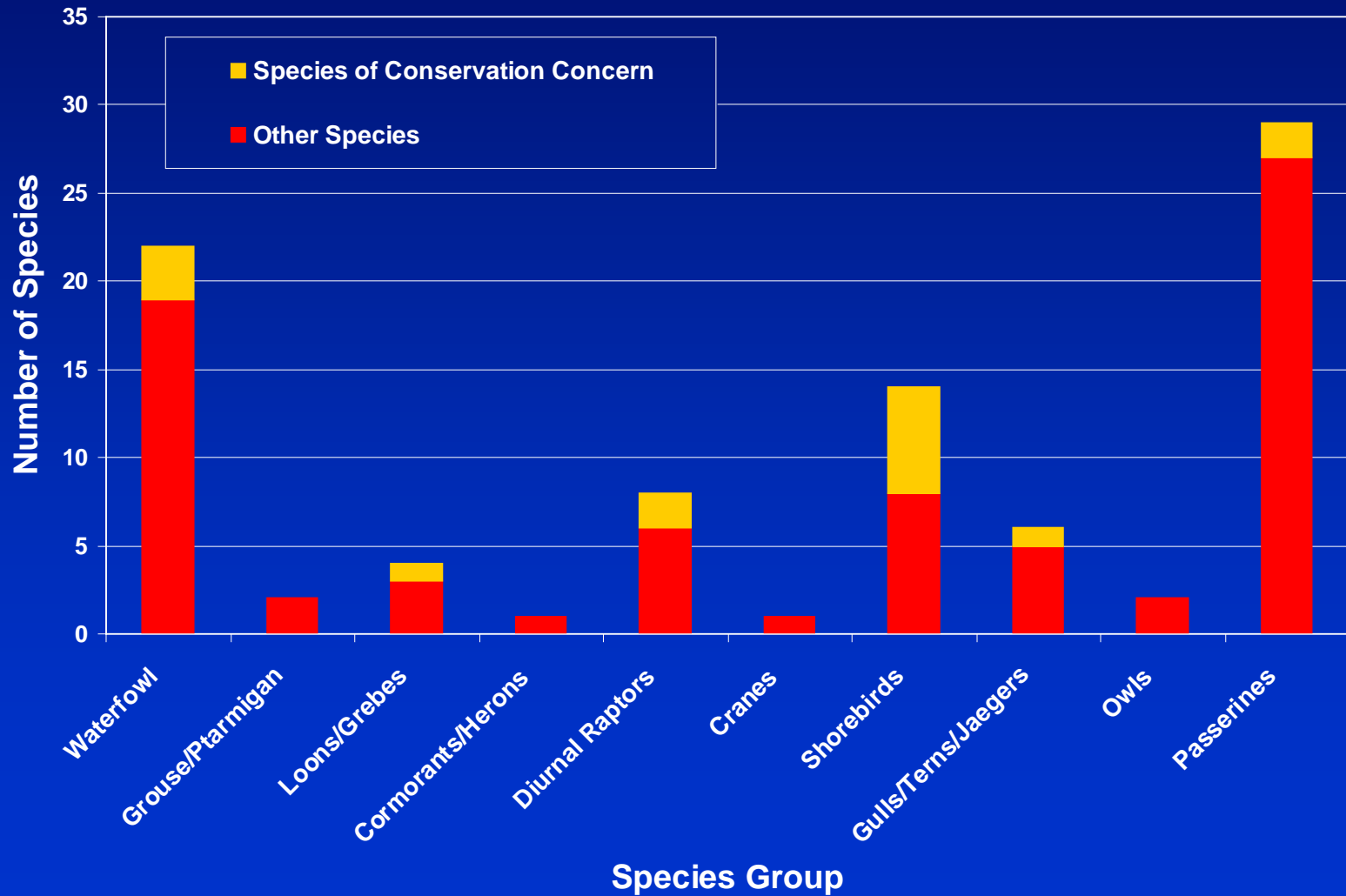
# Bird Species Richness

## Transportation Corridor, Bristol Bay Drainages



# Bird Species Richness

## Mine Study Area

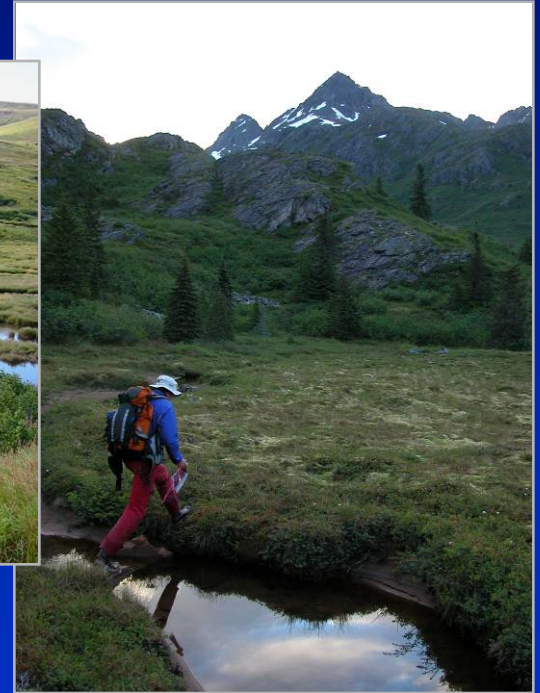


# Wildlife Habitat-mapping Studies



# Habitat Mapping Objectives

- Classify and map vegetation and landscape features to reflect use by wildlife
- Conduct habitat-use evaluations using project-specific wildlife survey data

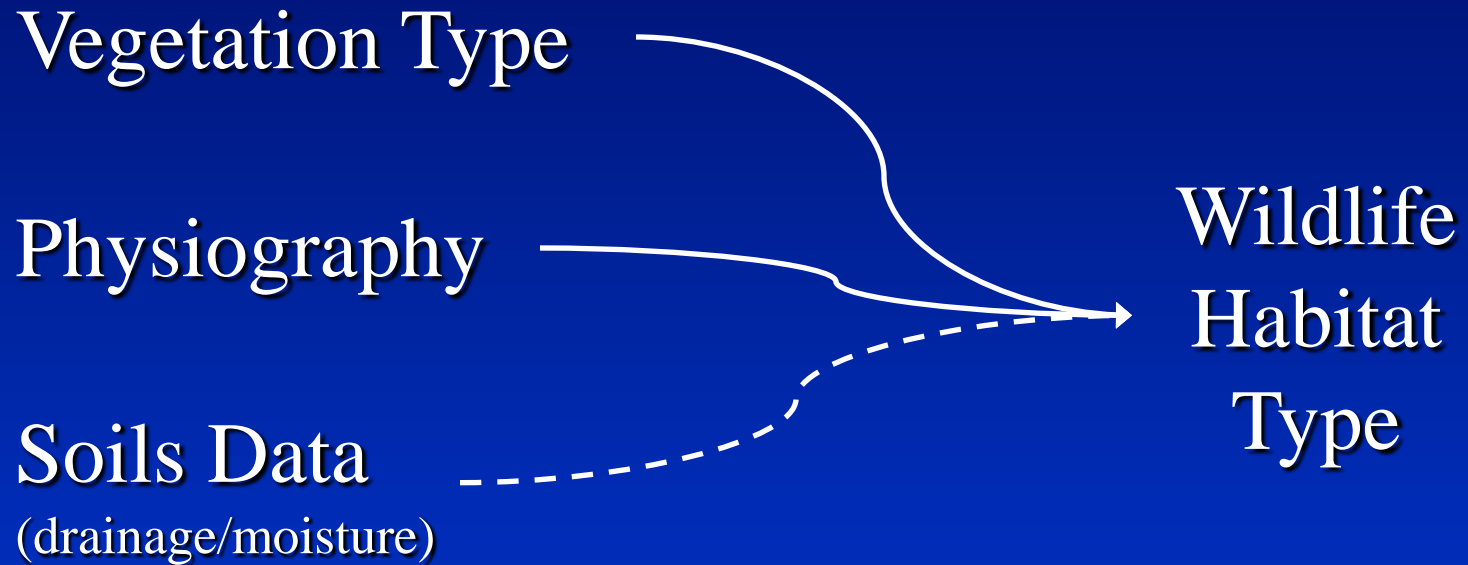


Mine Study  
Area

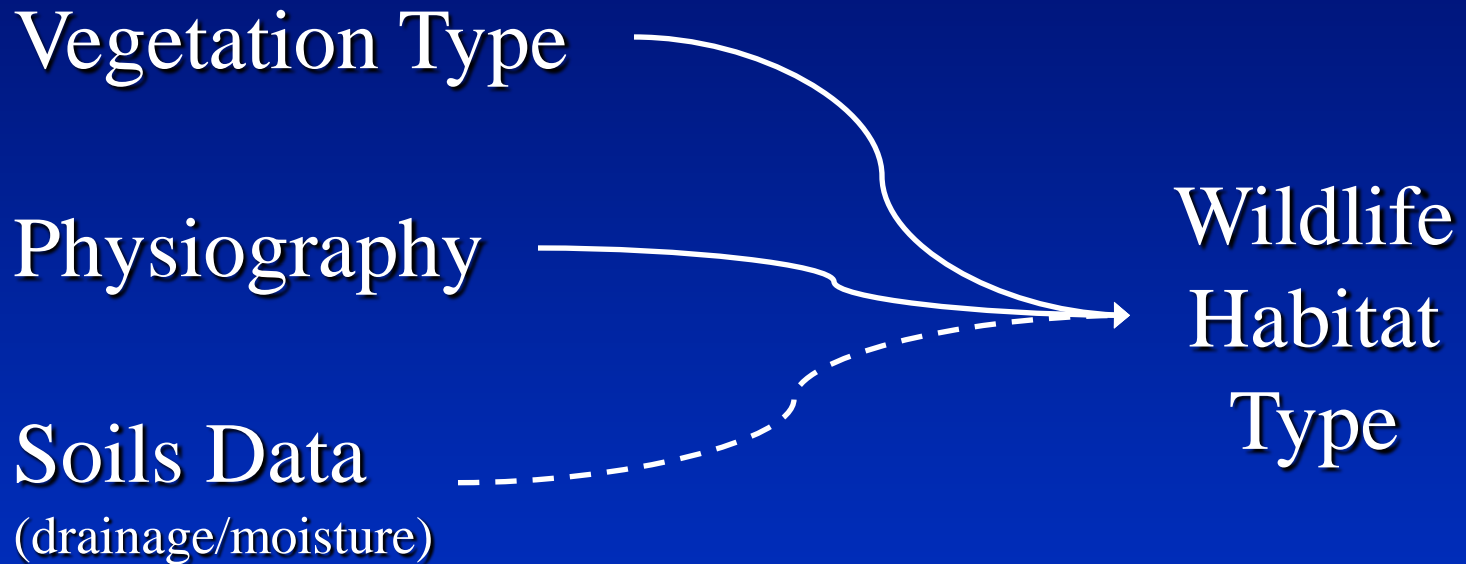


Cook Inlet  
Drainages

# Habitat Mapping Procedure



# Habitat Mapping Procedure



The goal is to derive composite habitat types that reflect use by wildlife more accurately than vegetation types alone

# Habitat Mapping Studies

- Vegetation was mapped by 3PPI and HDR
- Physiography (alpine, upland, lowland, riverine, etc.) was mapped by ABR and merged with vegetation map polygons
- The large number of resulting composite types (vegetation + physiography) were aggregated to a smaller set of habitat types based primarily on shared vegetation structure and physiography
- Soil drainage/moisture information was added, as needed, to refine habitat types

# Cook Inlet Drainages



# Wildlife Habitats Cook Inlet Drainages: 20 Types

Habitat Type	Area (Square Kilometers)	Percent of Study Area
Alpine Dry Barrens	0.13	1.21
Alpine Moist Dwarf Scrub	0.08	0.75
Upland Dry Barrens	1.05	9.81
Upland Dry Dwarf Shrub-Lichen Scrub	<0.01	0.04
Upland Moist Dwarf Scrub	0.33	3.08
Upland Moist Low Willow Scrub	<0.01	0.02
Upland Moist Tall Alder Scrub	8.61	80.47
Upland Moist Tall Willow Scrub	0.02	0.19
Upland and Lowland Spruce Forest	0.09	0.84
Upland and Lowland Moist Mixed Forest	<0.01	0.04
Rivers and Streams	0.04	0.37
Rivers and Streams (Anadromous)	0.04	0.37
Riverine Barrens	0.09	0.84
Riverine Wet Graminoid-Shrub Meadow	0.01	0.09
Riverine Low Willow Scrub	0.01	0.09
Riverine Tall Alder or Willow Scrub	0.10	0.93
Lakes and Ponds	0.02	0.19
Lowland Sedge-Forb Marsh	0.02	0.19
Lowland Ericaceous Scrub Bog	0.04	0.37
Lowland Wet Graminoid-Shrub Meadow	0.01	0.09
<b>Total</b>	<b>10.70</b>	<b>100.00</b>

# Wildlife Habitats, Cook Inlet Drainages



**Figure 41.1-1**  
**Overview of Terrestrial and**  
**Freshwater Wildlife Habitat**  
**Mapping, Cook Inlet Drainages**

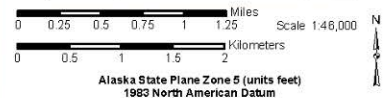
## Legend

### Terrestrial and Freshwater Wildlife Habitats

- Alpine Dry Barrens
- Alpine Moist Dwarf Scrub
- Upland Dry Barrens
- Upland Dry Dwarf Shrub-Lichen Scrub
- Upland Moist Dwarf Scrub
- Upland Moist Low Willow Scrub
- Upland Moist Tall Alder Scrub
- Upland Moist Tall Willow Scrub
- Upland and Lowland Spruce Forest
- Upland and Lowland Moist Mixed Forest
- Rivers and Streams
- Rivers and Streams (Anadromous)
- Riverine Barrens
- Riverine Wet Graminoid-Shrub Meadow
- Riverine Low Willow Scrub
- Riverine Tall Alder or Willow Scrub
- Lakes and Ponds
- Lowland Sedge-Forb Marsh
- Lowland Encroaching Scrub Bog
- Lowland Wet Graminoid-Shrub Meadow

- Mapping Area
- Existing Road
- Community

Digital orthomosaic for the Cook Inlet drainages mapping area from October 1, 2004 and September 28, 2008 aerial photography; ground resolution of 1.5 feet. Imagery by Aero-Metric, Inc.; additional processing by Resource Data, Inc. Background: Landsat 7 ETM+, September 6, 1999.



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

File: 41-1-1\_TerrHabs\_CI\_PLP\_EBO\_v03.mxd Date: May 19, 2011  
 Version: 3 Author: ABR-AZC



see Figure 41.1-2 for marine habitat types

# Raptors (including Owls)

## Cook Inlet Drainages: 6 Species

- Bald Eagle – most common breeding species
- Rough-legged Hawk – rare, probably breeding
- Golden Eagle – uncommon, breeding
- Merlin – rare, probably breeding
- Peregrine Falcon – rare, breeding
- Common Raven – rare, breeding

# Raptors (including Owls)

## Cook Inlet Drainages: Common Species

- *Bald Eagle* – most common breeding species
- Rough-legged Hawk – rare, probably breeding
- Golden Eagle – uncommon, breeding
- Merlin – rare, probably breeding
- Peregrine Falcon – rare, breeding
- Common Raven – rare, breeding

# Waterbirds

## Cook Inlet Drainages: 14 Species

- Trumpeter Swan – migration and breeding
- American Wigeon – migration
- Mallard – migration
- Northern Shoveler – migration
- Northern Pintail – migration
- Green-winged Teal – migration
- Greater Scaup – migration
- Harlequin Duck – migration and breeding
- Common Goldeneye – migration
- Common Merganser – migration
- Red-breasted Merganser – migration
- Great Blue Heron – migration
- Mew Gull – migration
- Glaucous-winged Gull – migration (breeding in marine habitats)

# Waterbirds

## Cook Inlet Drainages: Common Species

- Trumpeter Swan – migration and breeding
- American Wigeon – migration
- Mallard – migration
- Northern Shoveler – migration
- Northern Pintail – migration
- Green-winged Teal – migration
- Greater Scaup – migration
- Harlequin Duck – migration and breeding
- Common Goldeneye – migration
- Common Merganser – migration
- Red-breasted Merganser – migration
- Great Blue Heron – migration
- Mew Gull – migration
- Glaucous-winged Gull – migration (breeding in marine habitats)

# Shorebirds

## Cook Inlet Drainages

- Only two shorebird species observed: Black Oystercatcher and Short-billed Dowitcher
- Neither occurred in terrestrial or freshwater aquatic habitats; both were in intertidal (marine) habitats

# Landbirds

## Cook Inlet Drainages: 30 Species

Olive-sided Flycatcher  
Black-billed Magpie  
Common Raven  
Tree Swallow  
Violet-green Swallow  
Cliff Swallow  
Black-capped Chickadee  
American Dipper  
Ruby-crowned Kinglet  
Gray-cheeked Thrush  
Swainson's Thrush  
Hermit Thrush  
American Robin  
Varied Thrush  
Northern Waterthrush

Orange-crowned Warbler  
Yellow Warbler  
Blackpoll Warbler  
Yellow-rumped Warbler  
Wilson's Warbler  
American Tree Sparrow  
Savannah Sparrow  
Fox Sparrow  
Song Sparrow  
Lincoln's Sparrow  
White-crowned Sparrow  
Golden-crowned Sparrow  
Dark-eyed Junco  
Pine Grosbeak  
Common Redpoll

(11 groups are represented: flycatchers, corvids, swallows, chickadees, dippers, kinglets, thrushes, pipits, warblers, sparrows, and finches)

# Landbirds

## Cook Inlet Drainages: Most Common Species

Olive-sided Flycatcher

Black-billed Magpie

Common Raven

Tree Swallow

Violet-green Swallow

Cliff Swallow

Black-capped Chickadee

American Dipper

Ruby-crowned Kinglet

Gray-cheeked Thrush

Swainson's Thrush

Hermit Thrush

American Robin

Varied Thrush

Northern Waterthrush

Orange-crowned Warbler

Yellow Warbler

Blackpoll Warbler

Yellow-rumped Warbler

Wilson's Warbler

American Tree Sparrow

Savannah Sparrow

Fox Sparrow

Song Sparrow

Lincoln's Sparrow

White-crowned Sparrow

Golden-crowned Sparrow

Dark-eyed Junco

Pine Grosbeak

Common Redpoll

(Dominated numerically by thrushes, warblers, and sparrows)

# Transportation Corridor, Bristol Bay Drainages



# Wildlife Habitats Transportation Corridor, Bristol Bay Drainages: 25 Types

Habitat Type	Area (Square Kilometers)	Percent of Study Area
Alpine Dry Barrens	<0.01	0.01
Alpine Moist Dwarf Scrub	0.18	0.21
Alpine Wet Dwarf Shrub–Sedge Scrub	0.01	0.02
Upland Dry Barrens	0.31	0.37
Upland Dry Dwarf Shrub-Lichen Scrub	0.34	0.40
Upland Moist Dwarf Scrub	8.47	9.96
Upland Moist Low Willow Scrub	0.60	0.71
Upland Moist Tall Alder Scrub	6.77	7.96
Upland Moist Tall Willow Scrub	4.18	4.92
Upland and Lowland Spruce Forest	19.24	22.61
Upland and Lowland Moist Mixed Forest	34.07	40.04
Rivers and Streams	0.37	0.44
Rivers and Streams (Anadromous)	0.59	0.69
Riverine Barrens	0.09	0.10
Riverine Wet Graminoid–Shrub Meadow	0.36	0.43
Riverine Low Willow Scrub	0.51	0.60
Riverine Tall Alder or Willow Scrub	0.41	0.48
Riverine Moist White Spruce Forest	0.18	0.21
Riverine Moist Mixed Forest	2.10	2.47
Lakes and Ponds	1.70	2.00
Lacustrine Moist Barrens	0.06	0.07
Lowland Sedge–Forb Marsh	0.11	0.13
Lowland Ericaceous Scrub Bog	1.91	2.24
Lowland Wet Graminoid–Shrub Meadow	1.88	2.21
Lowland Low and Tall Willow Scrub	0.64	0.75
<b>Total</b>	<b>85.10</b>	<b>100.00</b>

# Wildlife Habitats, Transportation Corridor, Bristol Bay Drainages



**Figure 16.6-1**  
**Overview of Wildlife Habitat**  
**Mapping, Transportation-corridor,**  
**Bristol Bay Drainages Study Area**

**Legend**

**Wildlife Habitats**

- Alpine Dry Barrens
- Alpine Moist Dwarf Scrub
- Alpine Wet Dwarf Shrub-Sedge Scrub
- Upland Dry Barrens
- Upland Dry Dwarf Shrub-Lichen Scrub
- Upland Moist Dwarf Scrub
- Upland Moist Low Willow Scrub
- Upland Moist Tall Alder Scrub
- Upland Moist Tall Willow Scrub
- Upland and Lowland Spruce Forest
- Upland and Lowland Moist Mixed Forest
- Rivers and Streams
- Rivers and Streams (Anadromous)
- Rivine Barrens
- Rivine Wet Graminoid-Shrub Meadow
- Rivine Low Willow Scrub
- Rivine Tall Alder or Willow Scrub
- Rivine Moist White Spruce Forest
- Rivine Moist Mixed Forest
- Lakes and Ponds
- Lacustrine Moist Barrens
- Lowland Sedge-Forb Marsh
- Lowland Ericaceous Scrub Bog
- Lowland Wet Graminoid-Shrub Meadow
- Lowland Low and Tall Willow Scrub

  Mapping Area     Existing Road    • Community

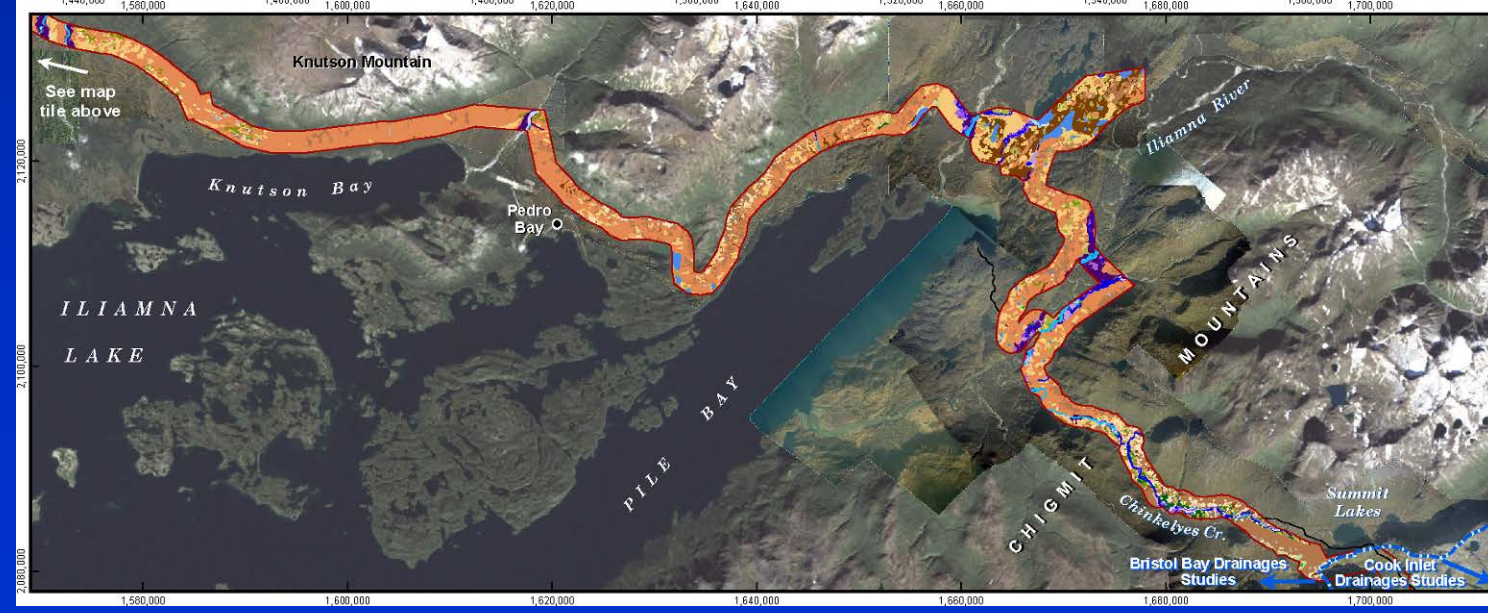
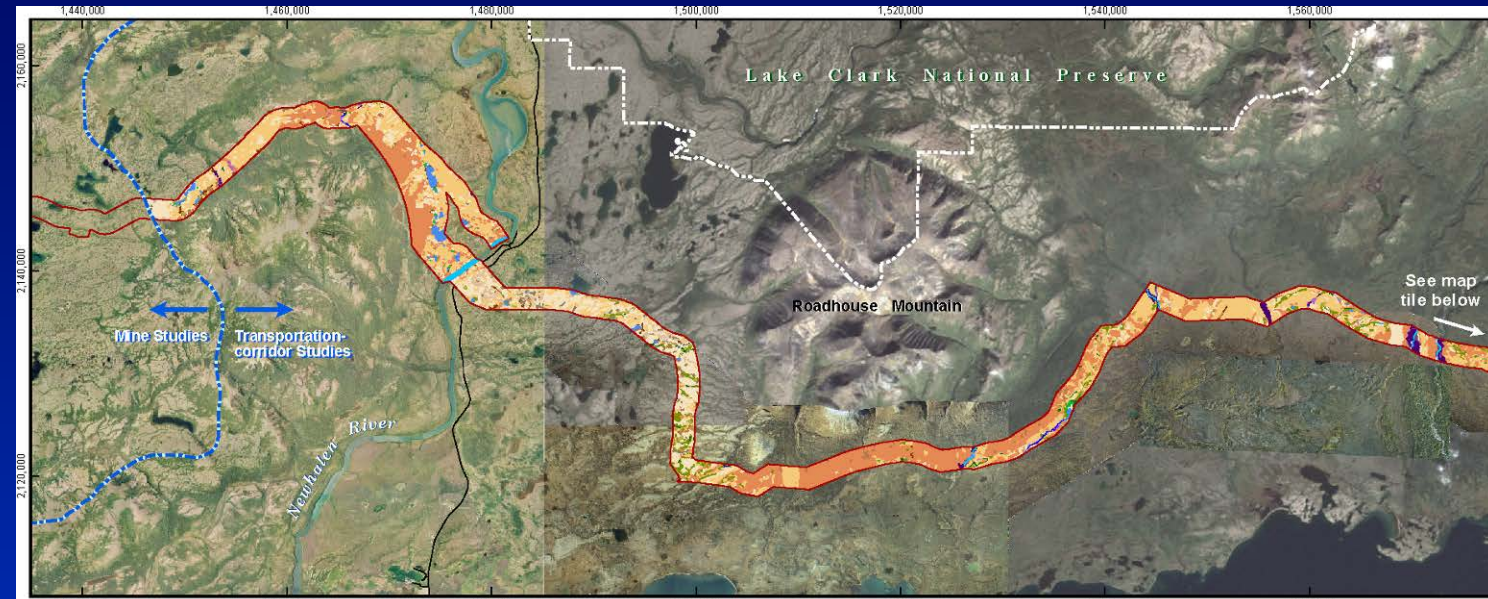
Color orthophotography for the mine mapping area surrounding the Pebble deposit based on July 2004 1:20,000 scale photography; pixel size is 1.5 feet. Imagery by Kodak Mapping Inc., Eagle Mapping Ltd., and Resource Data, Inc. Digital orthomosaic for the transportation corridor mapping area from October 1, 2004 and September 28, 2008 aerial photography; ground resolution of 15 feet. Imagery by Aero-Metric, Inc., additional processing by Resource Data, Inc. Background: Landsat 7 ETM+, September 6, 1999.



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

File: 16-6-1\_Habitats\_TC\_PLF\_EBD\_v03.mxd    Date: May 18, 2011

Version: 3    Author: ABR-AZC



# Raptors (including Owls)

## Transportation Corridor, Bristol Bay Drainages: 14 Species

- Osprey – common, breeding
- Bald Eagle – most common breeding species
- Northern Harrier – uncommon, probably breeding
- Northern Goshawk – rare, probably breeding
- Red-tailed Hawk – rare, breeding
- Rough-legged Hawk – uncommon, breeding
- Golden Eagle – common, breeding
- Merlin – uncommon, breeding
- Gyrfalcon – uncommon, breeding
- Peregrine Falcon – uncommon, breeding
- Great Horned Owl – uncommon, breeding
- Short-eared Owl – uncommon, probably breeding
- Boreal Owl – rare, probably breeding
- Common Raven – common, breeding

# Raptors (including Owls)

## Transportation Corridor, Bristol Bay Drainages: Common Species

- Osprey – common, breeding
- Bald Eagle – most common breeding species
- Northern Harrier – uncommon, probably breeding
- Northern Goshawk – rare, probably breeding
- Red-tailed Hawk – rare, breeding
- Rough-legged Hawk – uncommon, breeding
- Golden Eagle – common, breeding
- Merlin – uncommon, breeding
- Gyrfalcon – uncommon, breeding
- Peregrine Falcon – uncommon, breeding
- Great Horned Owl – uncommon, breeding
- Short-eared Owl – uncommon, probably breeding
- Boreal Owl – rare, probably breeding
- Common Raven – common, breeding

# Waterbirds Transportation Corridor, Bristol Bay Drainages: 34 Species

10 groups are represented: geese, ducks, loons, grebes, cormorants, herons, cranes, gulls, terns, and jaegers

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## Migrants Only

---

Greater White-fronted Goose  
Canada Goose  
Gadwall  
Canvasback  
Surf Scoter  
White-winged Scoter  
Red-throated Loon  
Arctic Tern  
Parasitic Jaeger

---

## Migrant and Breeding Species

---

Tundra and Trumpeter Swan  
American Wigeon  
Mallard  
Northern Shoveler <sup>a</sup>  
Northern Pintail  
Green-winged Teal  
Ringed-necked Duck  
Greater Scaup  
Harlequin Duck  
Black Scoter <sup>a</sup>  
Long-tailed Duck  
Bufflehead <sup>a</sup>  
Common Goldeneye  
Common Merganser  
Red-breasted Merganser  
Pacific Loon <sup>a</sup>  
Common Loon  
Red-necked Grebe <sup>a</sup>  
Double-crested Cormorant <sup>a</sup>  
Great Blue Heron  
Sandhill Crane  
Bonaparte's Gull <sup>a</sup>  
Mew Gull  
Herring Gull <sup>a</sup>  
Glaucous-winged Gull

---

<sup>a</sup> = probable breeder

# Waterbirds Transportation Corridor, Bristol Bay Drainages: Common Species

Both migrants  
and breeders  
dominated  
numerically by  
dabbling and  
diving ducks

---

## Migrants Only

---

Greater White-fronted Goose  
Canada Goose  
Gadwall  
Canvasback  
Surf Scoter  
White-winged Scoter  
Red-throated Loon  
Arctic Tern  
Parasitic Jaeger

---

## Migrant and Breeding Species

---

Tundra and Trumpeter Swan  
American Wigeon  
Mallard  
Northern Shoveler <sup>a</sup>  
Northern Pintail  
Green-winged Teal  
Ringed-necked Duck  
Greater Scaup  
Harlequin Duck  
Black Scoter <sup>a</sup>  
Long-tailed Duck  
Bufflehead <sup>a</sup>  
Common Goldeneye  
Common Merganser  
Red-breasted Merganser  
Pacific Loon <sup>a</sup>  
Common Loon  
Red-necked Grebe <sup>a</sup>  
Double-crested Cormorant <sup>a</sup>  
Great Blue Heron  
Sandhill Crane  
Bonaparte's Gull <sup>a</sup>  
Mew Gull  
Herring Gull <sup>a</sup>  
Glaucous-winged Gull

---

<sup>a</sup> = probable breeder

# Shorebirds

## Transportation Corridor, Bristol Bay Drainages: 7 Species

- American Golden-Plover
- Pacific Golden-Plover
- Greater Yellowlegs
- Lesser Yellowlegs
- Solitary Sandpiper
- Spotted Sandpiper
- Wilson's Snipe

Relatively few  
species, reflecting  
the paucity of  
open habitats

# **Landbirds Transportation Corridor, Bristol Bay Drainages: 46 Species**

18 groups are represented: grouse, ptarmigan, cranes, kingfishers, woodpeckers, corvids, flycatchers, swallows, chickadees, nuthatches, kinglets, old world warblers, thrushes, waxwings, warblers, sparrows, blackbirds, and finches

**Spruce Grouse  
Willow Ptarmigan  
Rock Ptarmigan  
Sandhill Crane  
Belted Kingfisher  
Downy Woodpecker  
Hairy Woodpecker  
American Three-toed Woodpecker  
Black-backed Woodpecker  
Northern Shrike  
Gray Jay  
Black-billed Magpie  
Common Raven  
Olive-sided Flycatcher  
Alder Flycatcher  
Tree Swallow  
Violet-green Swallow  
Black-capped Chickadee  
Boreal Chickadee  
Red-breasted Nuthatch  
Golden-crowned Kinglet  
Ruby-crowned Kinglet  
Arctic Warbler**

**Gray-cheeked Thrush  
Swainson's Thrush  
Hermit Thrush  
American Robin  
Varied Thrush  
Bohemian Waxwing  
Orange-crowned Warbler  
Yellow Warbler  
Yellow-rumped Warbler  
Blackpoll Warbler  
Northern Waterthrush  
Wilson's Warbler  
American Tree Sparrow  
Savannah Sparrow  
Fox Sparrow  
Lincoln's Sparrow  
White-crowned Sparrow  
Golden-crowned Sparrow  
Dark-eyed Junco  
Rusty Blackbird  
Pine Grosbeak  
White-winged Crossbill  
Common Redpoll**

# Landbirds Transportation Corridor, Bristol Bay Drainages: Most Common Species

Dominated  
numerically by  
kinglets,  
thrushes,  
warblers, and  
sparrows

Spruce Grouse  
Willow Ptarmigan  
Rock Ptarmigan  
Sandhill Crane  
Belted Kingfisher  
Downy Woodpecker  
Hairy Woodpecker  
American Three-toed Woodpecker  
Black-backed Woodpecker  
Northern Shrike  
Gray Jay  
Black-billed Magpie  
Common Raven  
Olive-sided Flycatcher  
Alder Flycatcher  
Tree Swallow  
Violet-green Swallow  
Black-capped Chickadee  
Boreal Chickadee  
Red-breasted Nuthatch  
Golden-crowned Kinglet  
Ruby-crowned Kinglet  
Arctic Warbler

Gray-cheeked Thrush  
Swainson's Thrush  
Hermit Thrush  
American Robin  
Varied Thrush  
Bohemian Waxwing  
Orange-crowned Warbler  
Yellow Warbler  
Yellow-rumped Warbler  
Blackpoll Warbler  
Northern Waterthrush  
Wilson's Warbler  
American Tree Sparrow  
Savannah Sparrow  
Fox Sparrow  
Lincoln's Sparrow  
White-crowned Sparrow  
Golden-crowned Sparrow  
Dark-eyed Junco  
Rusty Blackbird  
Pine Grosbeak  
White-winged Crossbill  
Common Redpoll

# Mine Study Area



# Wildlife Habitats

## Mine Study Area: 25 Types

Habitat Type	Area (Square Kilometers)	Percent of Study Area
Alpine Dry Barrens	31.68	6.66
Alpine Moist Dwarf Scrub	115.75	24.33
Alpine Moist Graminoid–Forb Meadow	7.46	1.57
Alpine Wet Dwarf Shrub–Sedge Scrub	4.27	0.90
Upland Dry Barrens	3.18	0.67
Upland Dry Dwarf Shrub-Lichen Scrub	31.04	6.53
Upland Moist Dwarf Scrub	130.00	27.33
Upland Moist Low Willow Scrub	26.54	5.58
Upland Moist Tall Alder Scrub	29.00	6.10
Upland Moist Tall Willow Scrub	27.09	5.69
Upland and Lowland Spruce Forest	0.03	0.01
Upland and Lowland Moist Mixed Forest	0.24	0.05
Rivers and Streams	1.14	0.24
Rivers and Streams (Anadromous)	1.39	0.29
Riverine Barrens	0.15	0.03
Riverine Wet Graminoid–Shrub Meadow	5.54	1.16
Riverine Low Willow Scrub	6.37	1.34
Riverine Tall Alder or Willow Scrub	10.92	2.30
Riverine Moist Mixed Forest	0.39	0.08
Lakes and Ponds	8.24	1.73
Lacustrine Moist Barrens	0.42	0.09
Lowland Sedge–Forb Marsh	0.44	0.09
Lowland Ericaceous Scrub Bog	9.38	1.97
Lowland Wet Graminoid–Shrub Meadow	13.68	2.87
Lowland Low and Tall Willow Scrub	11.37	2.39
<b>Total</b>	<b>475.72</b>	<b>100.00</b>

# Wildlife Habitats, Mine Study Area



**Figure 16.1-1**  
**Overview of**  
**Wildlife Habitat Mapping,**  
**Mine Study Area**

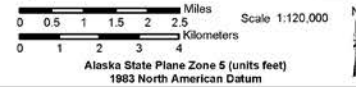
**Legend**

**Wildlife Habitats**

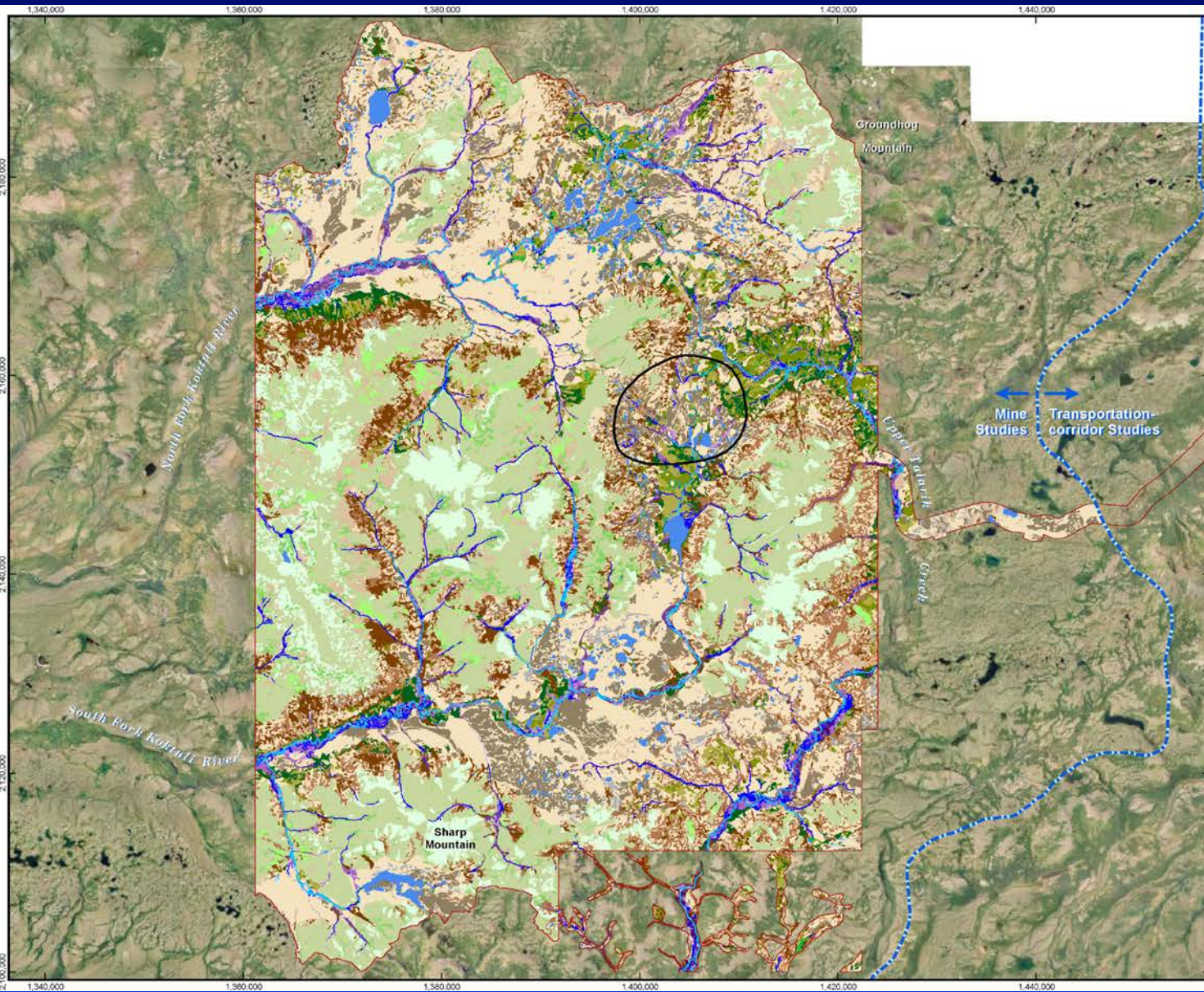
- Alpine Dry Barrens
- Alpine Moist Dwarf Scrub
- Alpine Moist Graminoid-Forb Meadow
- Alpine Wet Dwarf Shrub-Sedge Scrub
- Upland Dry Barrens
- Upland Dry Dwarf Shrub-Lichen Scrub
- Upland Moist Dwarf Scrub
- Upland Moist Low Willow Scrub
- Upland Moist Tall Alder Scrub
- Upland Moist Tall Willow Scrub
- Upland and Lowland Spruce Forest
- Upland and Lowland Moist Mixed Forest
- Rivers and Streams
- Rivers and Streams (Anadromous)
- Riverine Barrens
- Riverine Wet Graminoid-Shrub Meadow
- Riverine Low Willow Scrub
- Riverine Tall Alder or Willow Scrub
- Riverine Moist Mixed Forest
- Lakes and Ponds
- Lacustrine Moist Barrens
- Lowland Sedge-Forb Marsh
- Lowland Ericaceous Scrub Bog
- Lowland Wet Graminoid-Shrub Meadow
- Lowland Low and Tall Willow Scrub

- Mapping Area
- General Deposit Location

Color orthophotography for the mapping area surrounding the Pebble deposit based on July 2004 1:20,000 scale photography; pixel size is 1.5 feet. Imagery by Kodak Mapping Inc., Edge Mapping Ltd., and Resource Data, Inc.



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



# Raptors (including Owls)

## Mine Study Area: 11 Species

- Osprey – rare, probably breeding
- Bald Eagle – most common breeding species
- Northern Harrier – uncommon, probably breeding
- Sharp-shinned Hawk – rare visitor
- Rough-legged Hawk – common, breeding
- Golden Eagle – common, breeding
- Merlin – uncommon, breeding
- Gyrfalcon – uncommon, breeding
- Great Horned Owl – uncommon, breeding
- Short-eared Owl – uncommon, probably breeding
- Common Raven – common, breeding

# Raptors (including Owls)

## Mine Study Area: Common Species

- Osprey – rare, probably breeding
- *Bald Eagle* – most common breeding species
- Northern Harrier – uncommon, probably breeding
- Sharp-shinned Hawk – rare visitor
- *Rough-legged Hawk* – common, breeding
- *Golden Eagle* – common, breeding
- Merlin – uncommon, breeding
- *Gyr Falcon* – common, breeding
- Great Horned Owl – uncommon, breeding
- Short-eared Owl – uncommon, probably breeding
- *Common Raven* – common, breeding

# Waterbirds

## Mine Study Area: 33 Species

Migrant Species	Breeding Species
Greater White-fronted Goose	Tundra Swan
Canada Goose	American Wigeon
Gadwall	Mallard
Canvasback	Northern Shoveler
Ring-necked Duck	Northern Pintail
Surf Scoter	Green-winged Teal
White-winged Scoter	Greater Scaup
Bufflehead	Harlequin Duck
Hooded Merganser	Black Scoter
Red-throated Loon	Long-tailed Duck
Red-necked Grebe	Common Goldeneye
Double-crested Cormorant	Common Merganser <sup>a</sup>
Glaucous-winged Gull	Red-breasted Merganser
Arctic Tern	Pacific Loon
Parasitic Jaeger	Common Loon
	Bonaparte's Gull
	Mew Gull
	Long-tailed Jaeger <sup>a</sup>

8 groups are represented: geese, ducks, loons, grebes, cormorants, gulls, terns, and jaegers

<sup>a</sup> = probable breeder

# Waterbirds

## Mine Study Area: Common Species

---

### Migrants Only

Greater White-fronted Goose  
 Canada Goose  
 Gadwall  
 Canvasback  
 Ring-necked Duck  
 Surf Scoter  
 White-winged Scoter  
 Bufflehead  
 Hooded Merganser  
 Red-throated Loon  
 Red-necked Grebe  
 Double-crested Cormorant  
 Glaucous-winged Gull  
 Arctic Tern  
 Parasitic Jaeger

### Migrant and Breeding Species

Tundra Swan  
American Wigeon  
Mallard  
Northern Shoveler  
Northern Pintail  
Green-winged Teal  
Greater Scaup  
 Harlequin Duck  
 Black Scoter  
 Long-tailed Duck  
 Common Goldeneye  
 Common Merganser <sup>a</sup>  
 Red-breasted Merganser  
 Pacific Loon  
 Common Loon  
 Bonaparte's Gull  
 Mew Gull  
 Long-tailed Jaeger <sup>a</sup>

---

Both migrants  
 and breeders  
 dominated  
 numerically by  
 dabbling ducks

<sup>a</sup> = probable breeder

# Shorebirds

## Mine Study Area: 14 Species

- *Black-bellied Plover*
- *American Golden-Plover*
- Pacific Golden-Plover
- Semipalmated Plover
- *Greater Yellowlegs*
- Lesser Yellowlegs
- Wandering Tattler
- *Whimbrel*
- Hudsonian Godwit
- Surfbird
- *Least Sandpiper*
- Short-billed Dowitcher
- *Wilson's Snipe*
- Red-necked Phalarope

Twice the number of species compared to the transportation corridor, Bristol Bay drainages, which reflects the diversity of open habitats

# Landbirds

## Mine Study Area: 31 Species

<b>Willow Ptarmigan</b>	<b>Orange-crowned Warbler</b>
<b>Rock Ptarmigan</b>	<b>Yellow Warbler</b>
<b>Black-billed Magpie</b>	<b>Blackpoll Warbler</b>
<b>Common Raven</b>	<b>Northern Waterthrush</b>
<b>Alder Flycatcher</b>	<b>Wilson's Warbler</b>
<b>Horned Lark</b>	<b>American Tree Sparrow</b>
<b>Tree Swallow</b>	<b>Savannah Sparrow</b>
<b>Bank Swallow</b>	<b>Fox Sparrow</b>
<b>Black-capped Chickadee</b>	<b>Lincoln's Sparrow</b>
<b>American Dipper</b>	<b>White-crowned Sparrow</b>
<b>Ruby-crowned Kinglet</b>	<b>Golden-crowned Sparrow</b>
<b>Arctic Warbler</b>	<b>Lapland Longspur</b>
<b>Gray-cheeked Thrush</b>	<b>Snow Bunting</b>
<b>Hermit Thrush</b>	<b>White-winged Crossbill</b>
<b>American Robin</b>	<b>Common Redpoll</b>
<b>American Pipit</b>	

(14 groups are represented: ptarmigan, corvids, flycatchers, larks, swallows, chickadees, dippers, kinglets, old world warblers, thrushes, pipits, warblers, sparrows, and finches)

# Landbirds

## Mine Study Area: Most Common Species

**Willow Ptarmigan**

**Rock Ptarmigan**

**Black-billed Magpie**

**Common Raven**

**Alder Flycatcher**

**Horned Lark**

**Tree Swallow**

**Bank Swallow**

**Black-capped Chickadee**

**American Dipper**

**Ruby-crowned Kinglet**

**Arctic Warbler**

**Gray-cheeked Thrush**

**Hermit Thrush**

**American Robin**

**American Pipit**

**Orange-crowned Warbler**

**Yellow Warbler**

**Blackpoll Warbler**

**Northern Waterthrush**

**Wilson's Warbler**

**American Tree Sparrow**

**Savannah Sparrow**

**Fox Sparrow**

**Lincoln's Sparrow**

**White-crowned Sparrow**

**Golden-crowned Sparrow**

**Lapland Longspur**

**Snow Bunting**

**White-winged Crossbill**

**Common Redpoll**

(Dominated numerically by thrushes, warblers, sparrows, and finches)

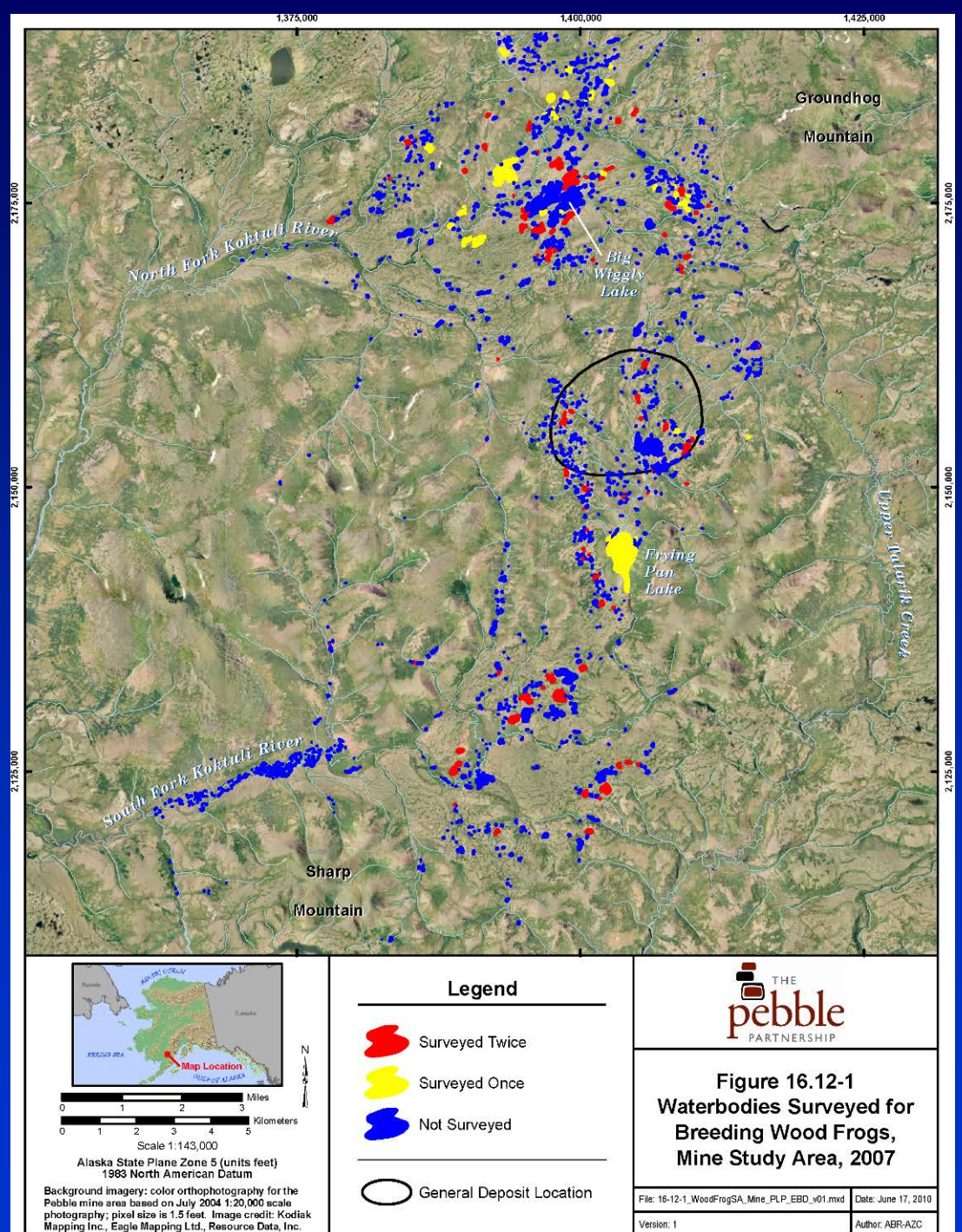
# Wood Frogs, Mine Study Area



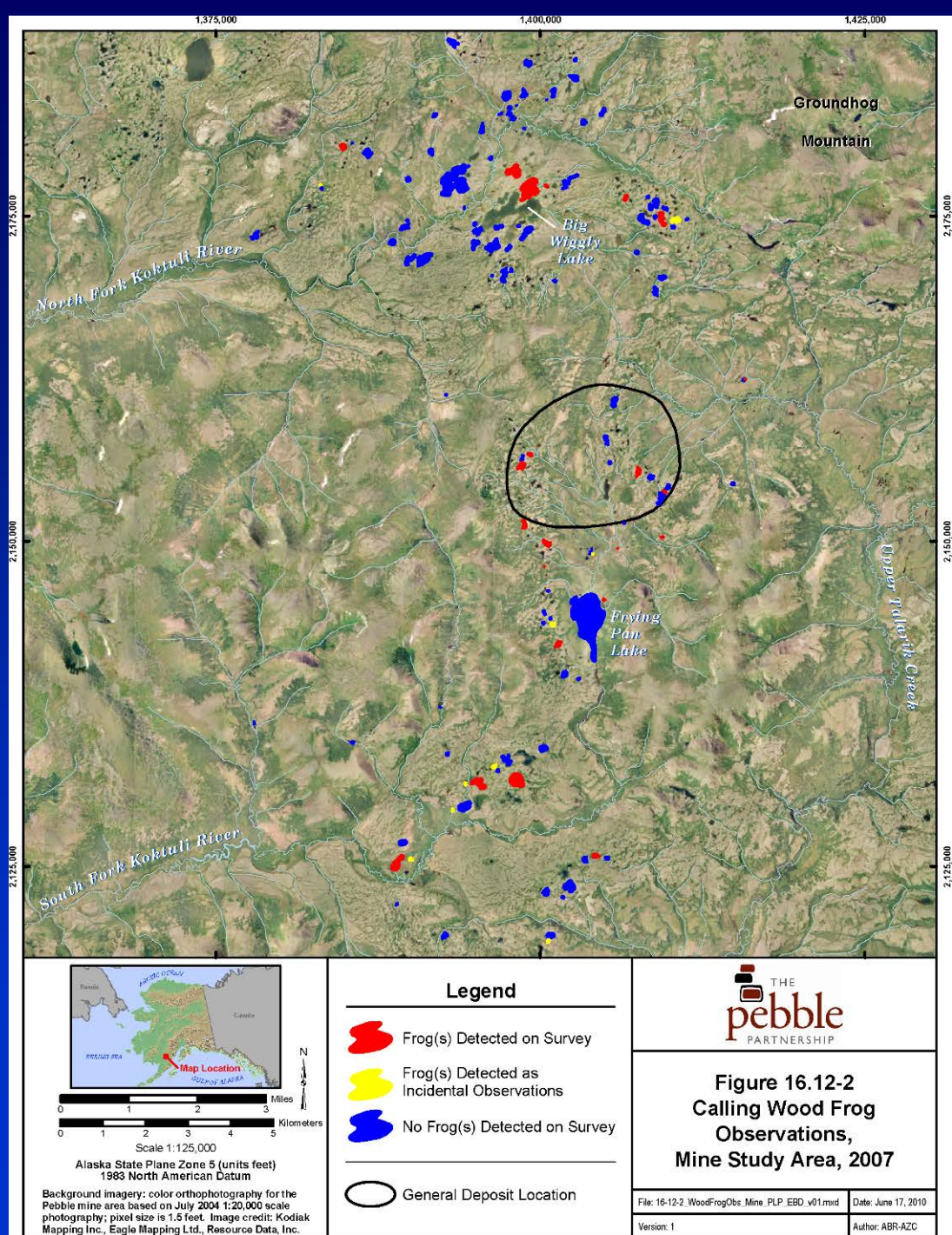
# Wood Frog Surveys

- Standard calling (auditory) surveys for male frogs in May 2007, in mine study area only
- Occupancy surveys of randomly selected waterbodies (repeated survey design using pseudo double-blind-observers = waterbodies were surveyed twice by different observers with no knowledge of first survey results)

# Waterbodies in Sampling Area and Waterbodies Surveyed



# Waterbodies Occupied by Wood Frogs



# Wood Frog Occupancy Results

- In the field, frogs were detected at 22 (19%) of the 119 waterbodies surveyed, but the calculated detection rate (detectability) of wood frogs was low (27%) at the 86 waterbodies surveyed twice
- Correcting for detectability, the estimated occupancy rate of waterbodies in the mine study area was 50%

# Wildlife Habitat-use Evaluations



# Habitat–use Evaluations: Selection of Species of Concern

- Species were selected if they met one or more of five criteria:
  - Protected status (e.g. eagle act)
  - Species of conservation concern
  - Sensitive to disturbance (in freshwater habitats) and indicator of environmental health
  - Concern for management
  - Ecologically important (as predator or prey or because of prominent ecosystem effects)

# Habitat–use Evaluations: 25 Bird Species Assessed, Mine Study Area

Common Name	Protected Species	Conservation Concern	Sensitive Species	Management Concern	Ecologically Important
Tundra Swan			X		
Harlequin Duck			X		
Surf Scoter		X		X	
American Scoter		X		X	
Long-tailed Duck		X		X	
Willow Ptarmigan				X	
Rock Ptarmigan				X	
Red-throated Loon		X			
Common Loon			X		
Bald Eagle	X				
Northern Goshawk					X
Golden Eagle	X				
Merlin					X
Gyr Falcon		X			
Peregrine Falcon		X			
American Golden-Plover		X			
Lesser Yellowlegs		X			
Whimbrel		X			
Hudsonian Godwit		X			
Surfbird		X			
Short-billed Dowitcher		X			
Arctic Tern		X			
Great Horned Owl					X
Gray-cheeked Thrush		X			
Blackpoll Warbler		X			

# Habitat–use Evaluations: Methodology I

- Overlay field observation locations on habitat map polygons to determine habitat types being used
- Assess frequency of use of each habitat type by each bird species from project-specific survey data
- Evaluate survey data coverage to determine which habitats and/or bird species were adequately sampled, undersampled, or unsampled
- For undersampled and unsampled habitats and species, augment project-specific observations with information on habitat use derived from (1) the scientific literature and/or (2) professional judgment based on field work elsewhere in southern Alaska

# Habitat-use Evaluations: Methodology II

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Habitat-value Class	Ranking Score	Description
High	3	Known to be frequently used for nesting and/or foraging during the breeding season; these habitats are also often used during migration
Moderate	2	Moderate-value habitats would be regularly used during the breeding and/or migration seasons, but less so than high-value habitats
Low	1	Low-value habitats would see little use by the species under consideration
Negligible	0	The species is not expected to occur, or will occur very rarely, in negligible-value habitats

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# Habitat-value Arrays: Species Richness by Habitat

Species	Alpine Dry Barrens	Alpine Moist Dwarf Scrub	Alpine Moist Graminoid-Forb Meadow	Alpine Wet Dwarf Shrub-Sedge Scrub	Upland Dry Barrens	Upland Dry Dwarf Shrub-Lichen Scrub	Upland Moist Dwarf Scrub	Upland Moist Low Willow Scrub	Upland Moist Tall Alder Scrub	Upland Moist Tall Willow Scrub	Upland and Lowland Spruce Forest	Upland and Lowland Moist Mixed Forest	Rivers and Streams	Rivers and Streams (Anadromous)	Riverine Barrens	Riverine Wet Graminoid-Shrub Meadow	Riverine Low Willow Scrub	Riverine Tall Alder or Willow Scrub	Riverine Moist Mixed Forest	Lakes and Ponds	Lacustrine Moist Barrens	Lowland Sedge-Forb Marsh	Lowland Ericaceous Scrub Bog	Lowland Wet Graminoid-Shrub Meadow	Lowland Low and Tall Willow Scrub
Tundra Swan						3	3						2	2		2				3		3	2	3	
Harlequin Duck													3	3	2	3	3	2	2		3		3		
Surf Scoter																				3					
American Scoter							3	2												3		3	3	3	
Long-tailed Duck						2	3	3								2	2			3		3	3	3	
Willow Ptarmigan		3					3	3	3	3							2	2					2		3
Rock Ptarmigan	3	3			2	2	2																		
Red-throated Loon																				2					
Common Loon																				3		3		3	
Bald Eagle													2	3	2				3	2					
Northern Goshawk												2								3					
Golden Eagle	3	2	2	2	2	3	3	3				2	2	2		2						2	2	2	2
Merlin									2		2	2	2	2		2			3	2					
Gyrfalcon	3	3	2	2		3	2	2					2	2		2	2					2	2	2	2
Peregrine Falcon													2	2						2					
American Golden-Plover		3		2		3	3																3	3	
Lesser Yellowlegs											2		2	2		2		2		3		3	3	3	2

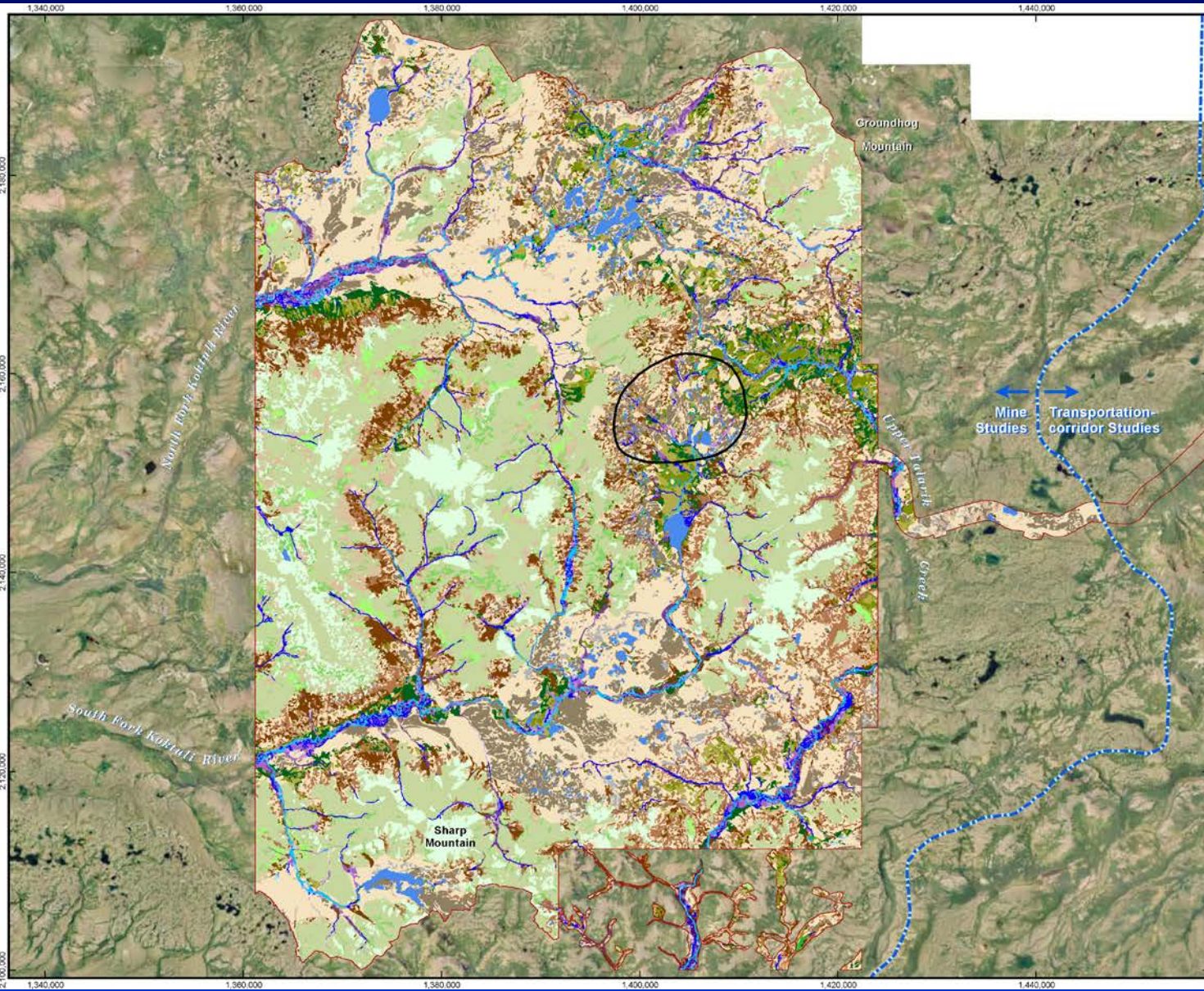
# Habitat–value Arrays: Important Habitats by Species

Species	Alpine Dry Barrens	Alpine Moist Dwarf Scrub	Alpine Moist Graminoid–Forb Meadow	Alpine Wet Dwarf Shrub–Sedge Scrub	Upland Dry Barrens	Upland Dry Dwarf Shrub–Lichen Scrub	Upland Moist Dwarf Scrub	Upland Moist Low Willow Scrub	Upland Moist Tall Alder Scrub	Upland Moist Tall Willow Scrub	Upland and Lowland Spruce Forest	Upland and Lowland Moist Mixed Forest	Rivers and Streams	Rivers and Streams (Anadromous)	Riverine Barrens	Riverine Wet Graminoid–Shrub Meadow	Riverine Low Willow Scrub	Riverine Tall Alder or Willow Scrub	Riverine Moist Mixed Forest	Lakes and Ponds	Lacustrine Moist Barrens	Lowland Sedge–Forb Marsh	Lowland Ericaceous Scrub Bog	Lowland Wet Graminoid–Shrub Meadow	Lowland Low and Tall Willow Scrub
Tundra Swan						3	3						2	2		2				3		3	2	3	
Harlequin Duck													3	3	2	3	3	2	2						
Surf Scoter																				3					
American Scoter							3	2												3		3	3	3	
Long-tailed Duck						2	3	3								2	2			3		3	3	3	
Willow Ptarmigan		3					3	3	3	3							2	2					2		3
Rock Ptarmigan	3	3			2	2	2																		
Red-throated Loon																				2					
Common Loon																				3		3		3	
Bald Eagle													2	3	2				3	2					
Northern Goshawk												2							3						
Golden Eagle	3	2	2	2	2	3	3	3				2	2	2		2						2	2	2	2
Merlin									2		2	2	2	2		2			3	2					
Gyrfalcon	3	3	2	2		3	2	2					2	2		2	2					2	2	2	2
Peregrine Falcon													2	2						2					
American Golden-Plover		3		2		3	3																3	3	
Lesser Yellowlegs											2		2	2		2		2		3		3	3	3	2

# Wildlife Habitats, Mine Study Area

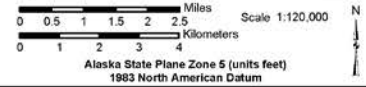


**Figure 16.1-1**  
**Overview of**  
**Wildlife Habitat Mapping,**  
**Mine Study Area**

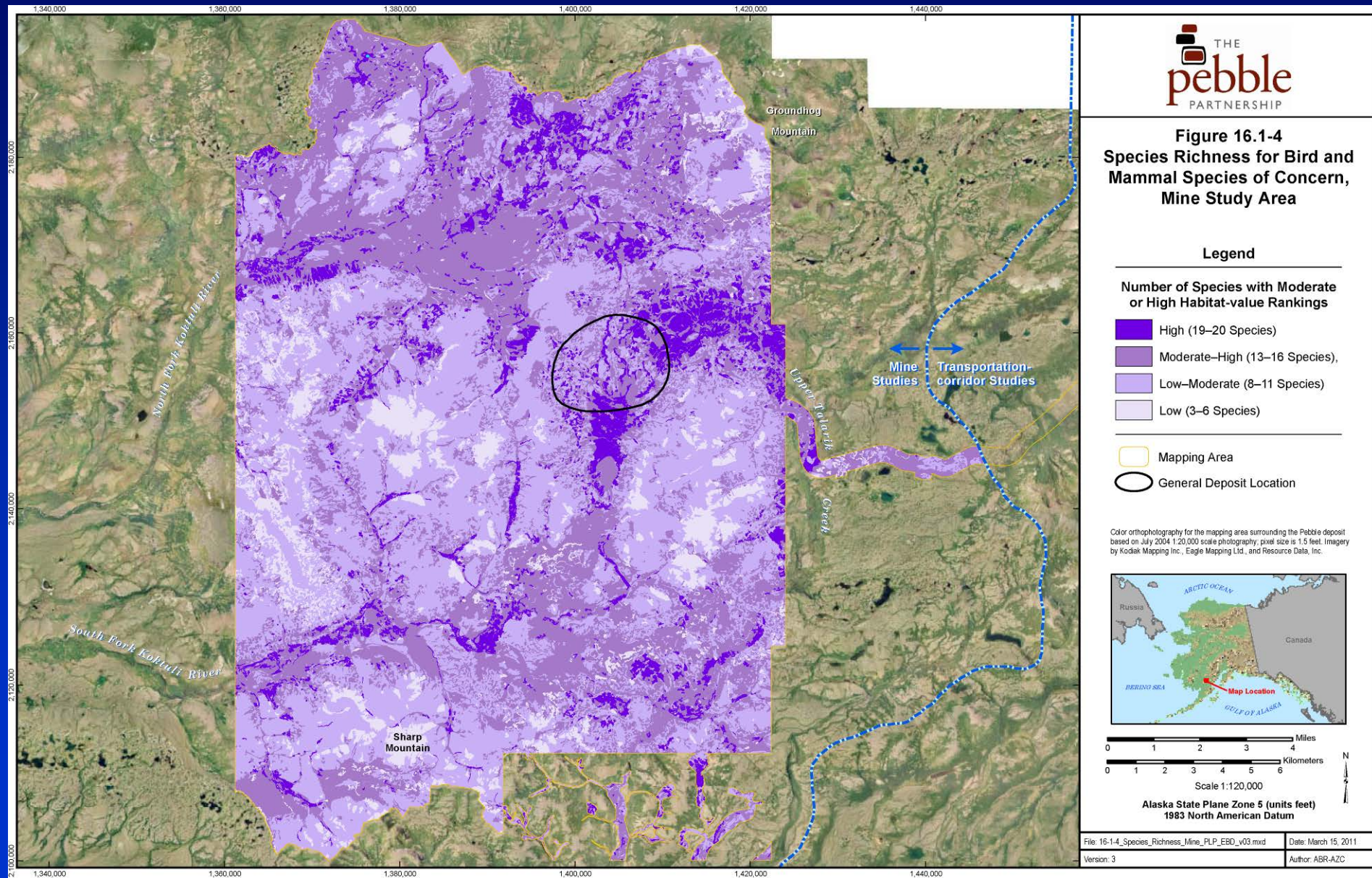


- Legend**
- Wildlife Habitats**
- Alpine Dry Barrens
  - Alpine Moist Dwarf Scrub
  - Alpine Moist Graminoid-Forb Meadow
  - Alpine Wet Dwarf Shrub-Sedge Scrub
  - Upland Dry Barrens
  - Upland Dry Dwarf Shrub-Lichen Scrub
  - Upland Moist Dwarf Scrub
  - Upland Moist Low Willow Scrub
  - Upland Moist Tall Alder Scrub
  - Upland Moist Tall Willow Scrub
  - Upland and Lowland Spruce Forest
  - Upland and Lowland Moist Mixed Forest
  - Rivers and Streams
  - Rivers and Streams (Anadromous)
  - Riverine Barrens
  - Riverine Wet Graminoid-Shrub Meadow
  - Riverine Low Willow Scrub
  - Riverine Tall Alder or Willow Scrub
  - Riverine Moist Mixed Forest
  - Lakes and Ponds
  - Lacustrine Moist Barrens
  - Lowland Sedge-Forb Marsh
  - Lowland Ericaceous Scrub Bog
  - Lowland Wet Graminoid-Shrub Meadow
  - Lowland Low and Tall Willow Scrub
- Mapping Area  
 General Deposit Location

Color orthophotography for the mapping area surrounding the Pebble deposit based on July 2004 1:20,000 scale photography; pixel size is 1.5 feet. Imagery by Kodak Mapping Inc., Edge Mapping Ltd., and Resource Data, Inc.



# Species Richness for Species of Concern



# Habitat Availability for Tree-nesting Raptors



**Figure 16.1-8**  
**Habitat Availability for Tree-nesting**  
**Raptor Species of Concern,**  
**Mine Study Area**

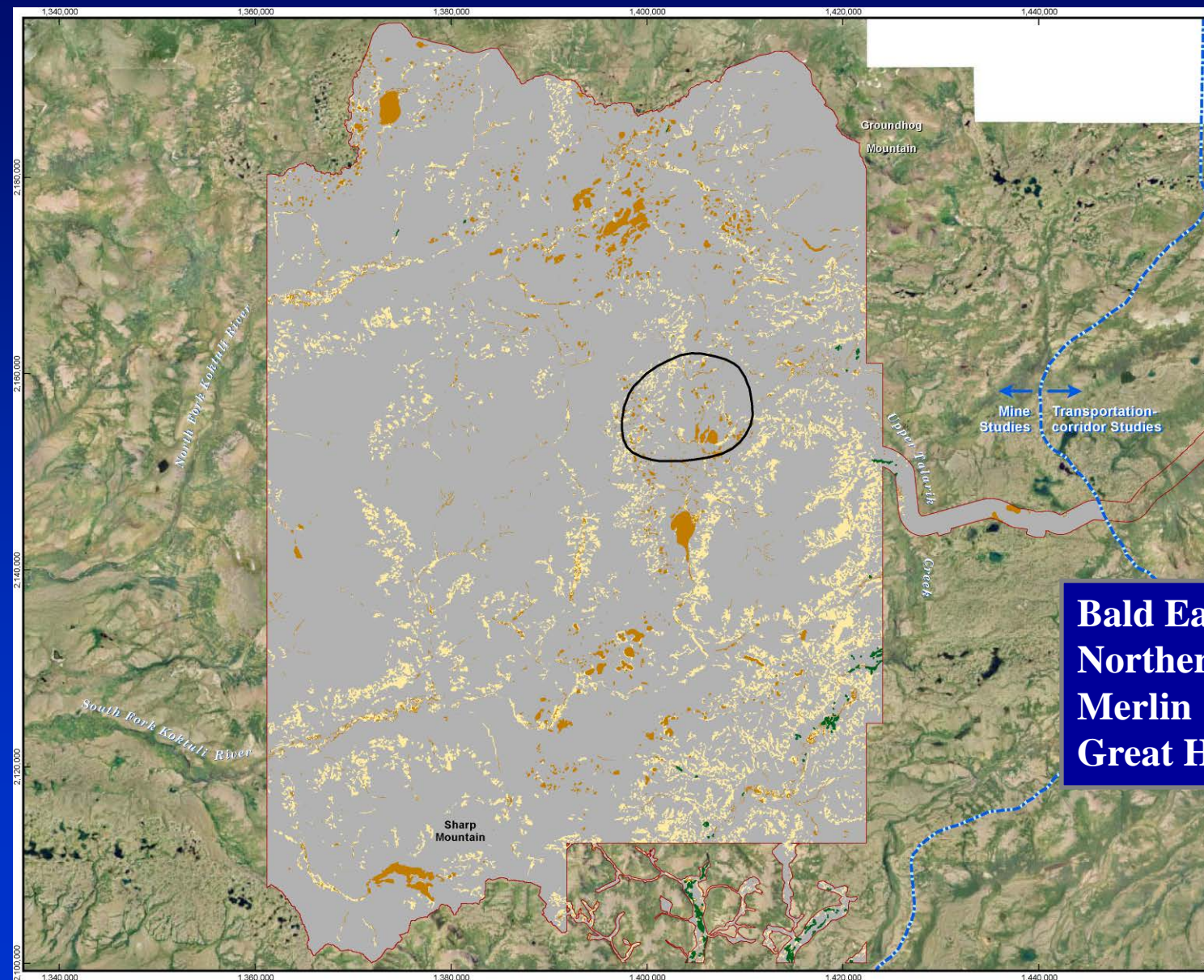
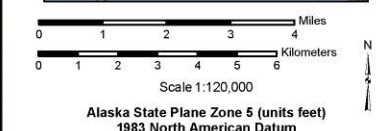
**Legend**

Number of Species with Moderate or High Habitat-value Rankings

- 3-4 Species
- 2 Species
- 1 Species
- 0 Species

- Mapping Area
- General Deposit Location

**Bald Eagle**  
**Northern Goshawk**  
**Merlin**  
**Great Horned Owl**



# Habitat Availability for Cliff-nesting Raptors



**Figure 16.1-9**  
**Habitat Availability for Cliff-nesting Raptor Species of Concern, Mine Study Area**

**Legend**

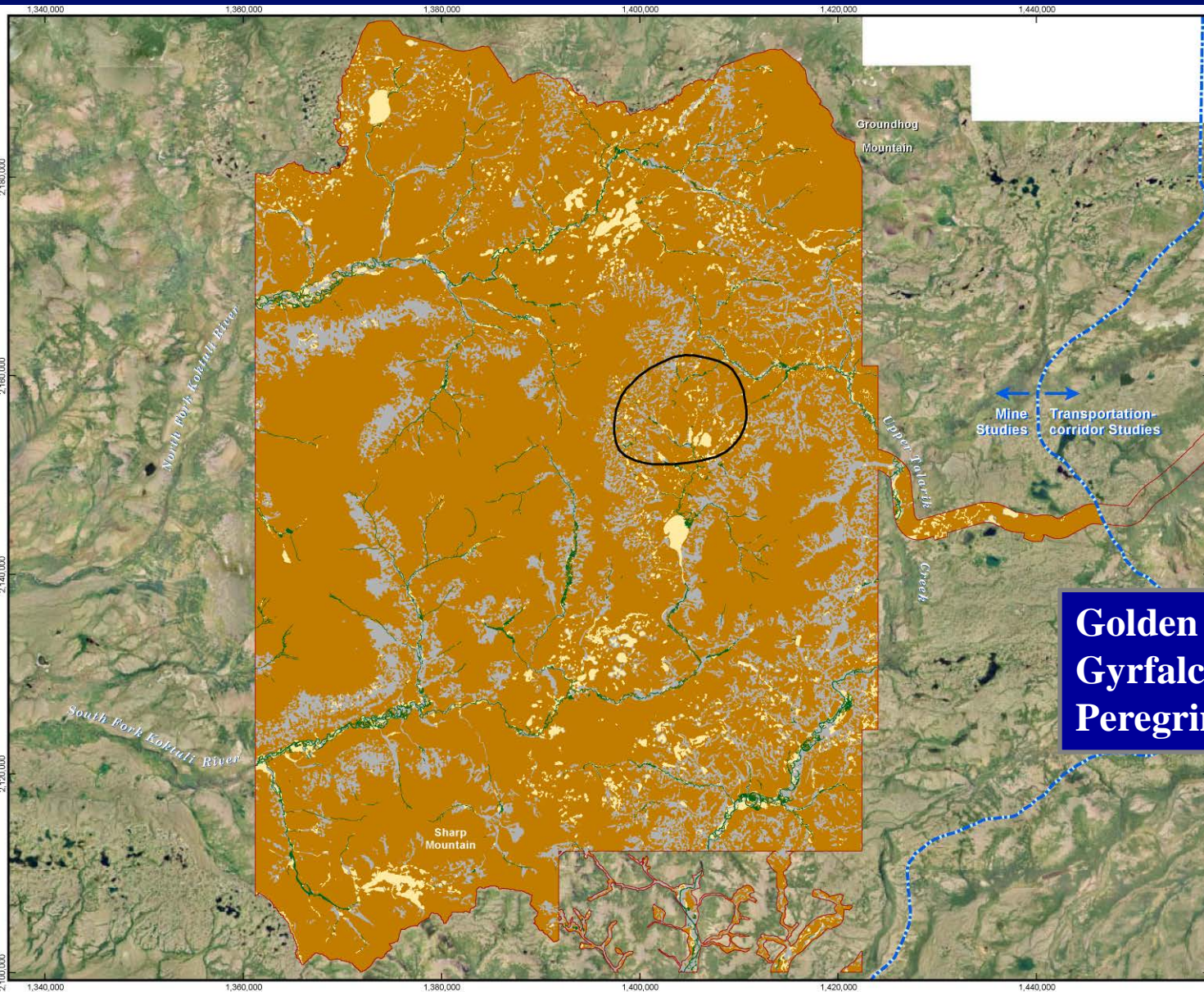
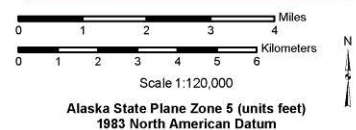
Number of Species with Moderate or High Habitat-value Rankings

- 3 Species
- 2 Species
- 1 Species
- 0 Species

- Mapping Area
- General Deposit Location

**Golden Eagle**  
**Gyrfalcon**  
**Peregrine Falcon**

Showing the Pebble deposit (size is 1.5 feet. Imagery resource Data, Inc.



# Habitat Availability for Waterbirds



**Figure 16.1-10**  
**Habitat Availability for**  
**Waterbird Species of Concern,**  
**Mine Study Area**

**Legend**

Number of Species with Moderate or High Habitat-value Rankings

- 7 Species
- 3-5 Species
- 1-2 Species
- 0 Species

- Mapping Area
- General Deposit Location

**Tundra Swan**  
**Harlequin Duck**  
**Surf Scoter**  
**Black Scoter**  
**Long-tailed Duck**  
**Red-throated Loon**  
**Common Loon**  
**Arctic Tern**

The Pebble deposit size is 1.5 feet. Imagery from Google Earth Data, Inc.

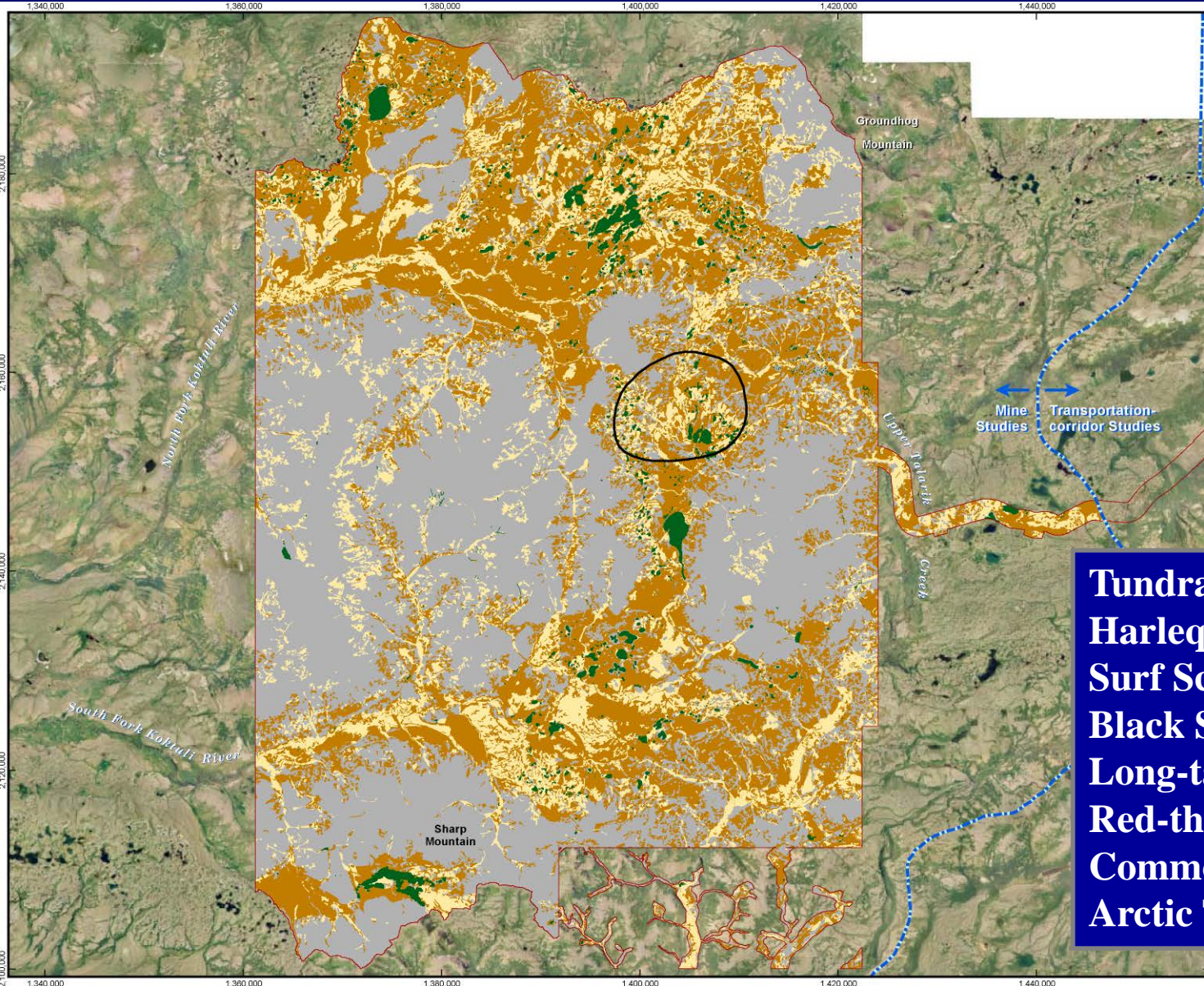


Miles 4  
 Kilometers



Date: April 20, 2011  
 Author: ABR-AZC

Version: 3



# Habitat Availability for Shorebirds



**Figure 16.1-11**  
**Habitat Availability for**  
**Shorebird Species of Concern,**  
**Mine Study Area**

**Legend**

Number of Species with Moderate or High Habitat-value Rankings

- 5 Species
- 3-4 Species
- 1-2 Species
- 0 Species

- Mapping Area
- General Deposit Location

**American Golden-Plover**  
**Lesser Yellowlegs**  
**Whimbrel**  
**Hudsonian Godwit**  
**Surfbird**  
**Short-billed Dowitcher**

Scale 1:120,000

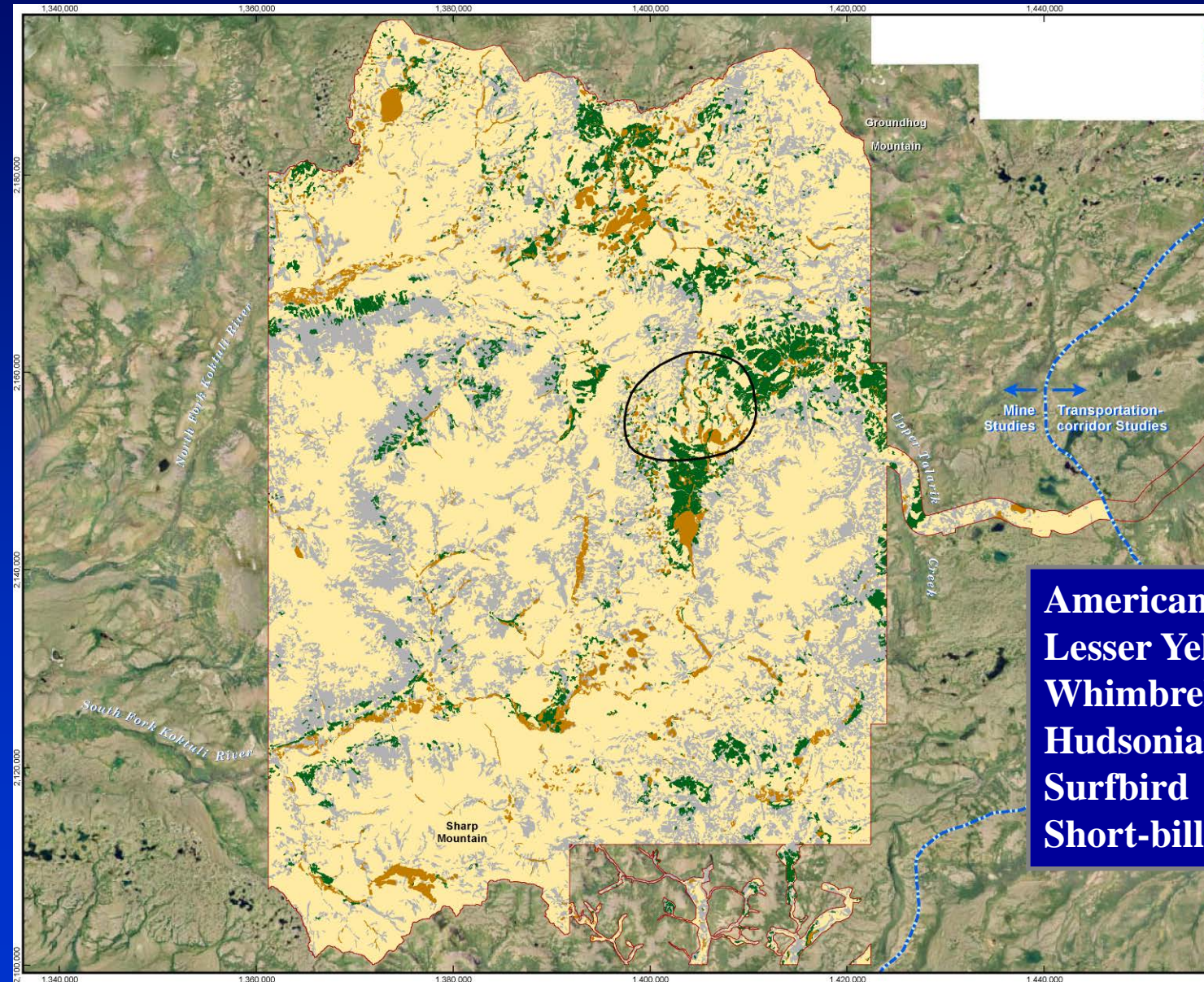
Alaska State Plane Zone 5 (units feet)  
 1983 North American Datum

File: 16-1-11\_Shorebirds\_HabAv\_Mine\_PLP\_EBD\_v02.mxd

Date: April 20, 2011

Version: 2

Author: ABR-AZC



# Habitat Availability for Landbirds



**Figure 16.1-12**  
**Habitat Availability for**  
**Landbird Species of Concern,**  
**Mine Study Area**

**Legend**

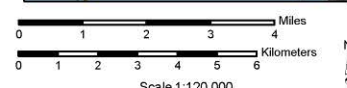
**Number of Species with Moderate or High Habitat-value Rankings**

- 3 Species
- 2 Species
- 1 Species
- 0 Species

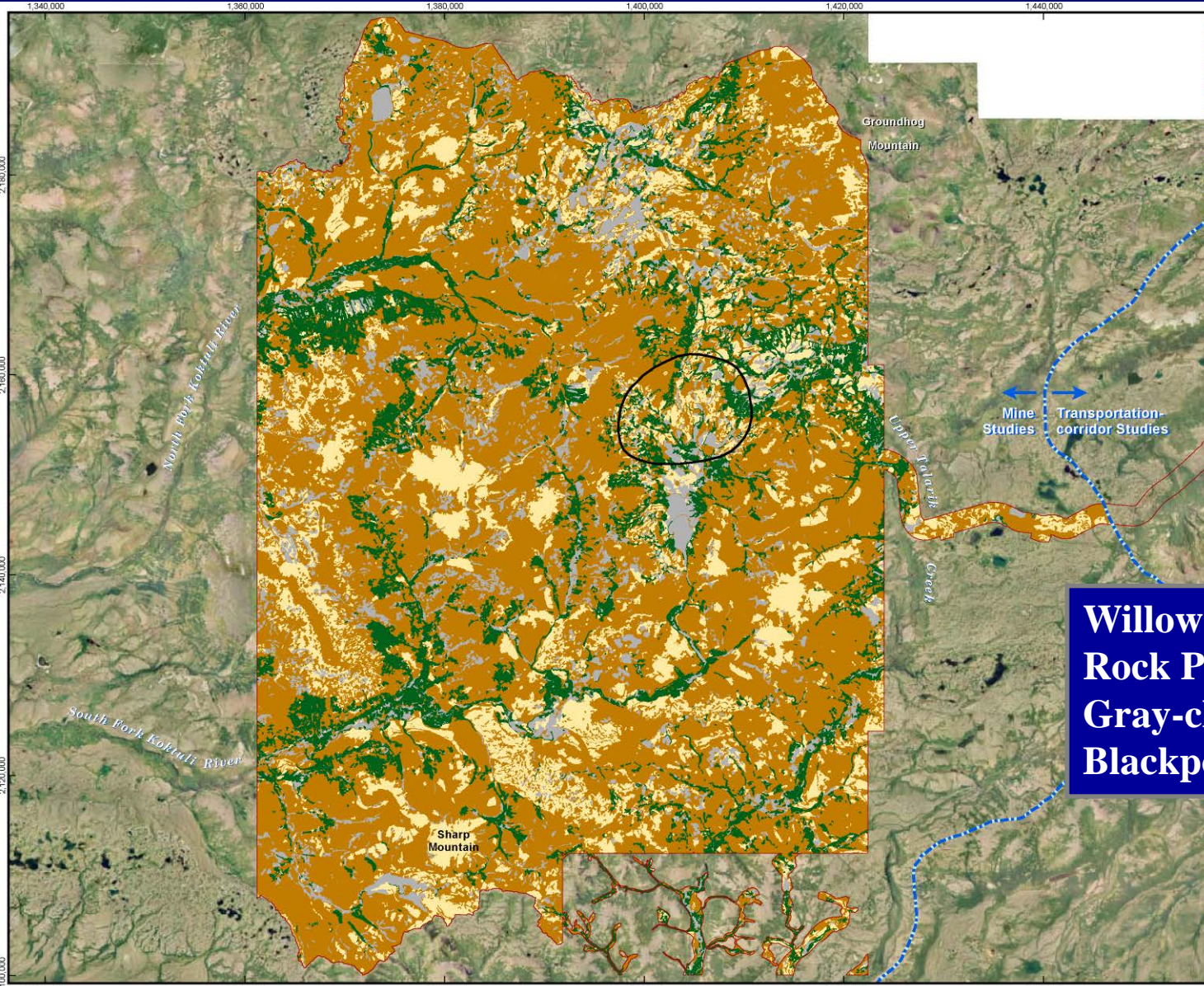
Mapping Area

General Deposit Location

**Willow Ptarmigan**  
**Rock Ptarmigan**  
**Gray-cheeked Thrush**  
**Blackpoll Warbler**



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





Thank you

Questions?