Lake Clark Nat'l. Park & Preserve
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Port Alsworth, AK

Johnson Tract
Transportation and Port Easements Identification Process
Environmental Analysis Document

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Prepared for:

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U.S. Department of Interior
Washington, D.C.

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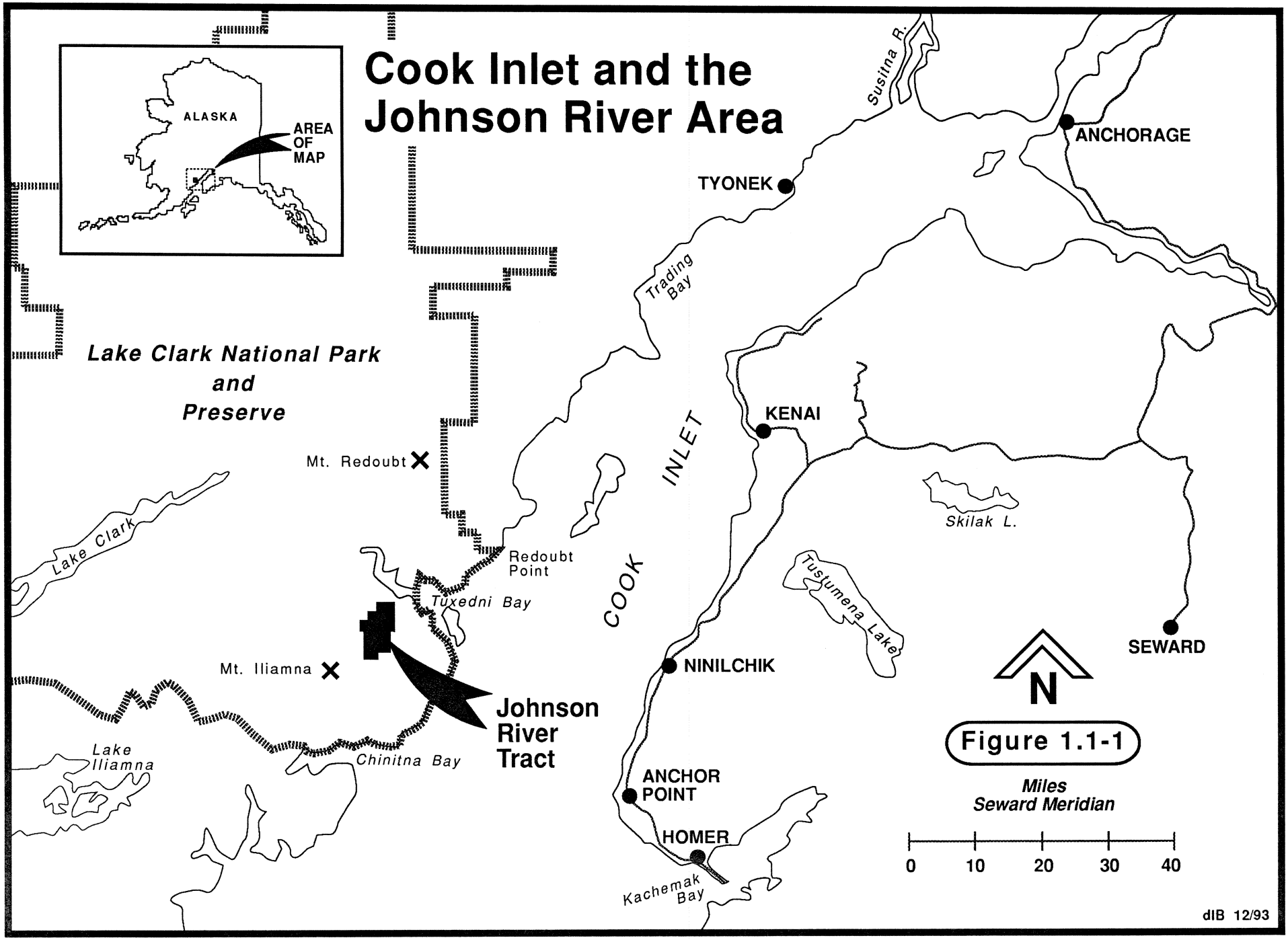
Introduction

1.1 Purpose of and Need for Action

Pursuant to the terms of the Cook Inlet Land Exchange of 1976, ratified by the United States Government in PL 94-204, Cook Inlet Region, Inc. (CIRI) received title to interests in approximately 21,120 ac in the Johnson Tract on the west side of Cook Inlet in southcentral Alaska (Fig. 1.1-1). In 1980 the Johnson Tract was surrounded by, but not included in, the newly created Lake Clark National Park and Preserve (LCNP). Following 12 years of mineral exploration on the Johnson Tract, CIRI and its lessees have determined there is a strong likelihood that the tract contains commercially viable minerals.

Under the terms of PL 94-204, the Secretary of Interior (Secretary) is required to convey (the *proposed action*) to CIRI "...an easement for a port which shall reasonably provide for receiving, shipping, storage and incidental handling, and incidental facilities thereto, of the minerals extracted from..." the Johnson Tract. The Secretary also is to convey to CIRI "...a transportation easement to provide transportation by road, rail, or pipeline, of the minerals from the [Johnson River Tract] to the port easement." The Secretary and CIRI are to "mutually agree on the location of these two easements." The purpose of the proposed action, therefore, is to fulfill the easements conveyance mandate of PL 94-204.

Following environmental and technical field reconnaissance studies during the summer of 1993, and coordination with the Alaska Regional Office of the National Park Service (NPS) and the staff of LCNP, CIRI and its lessee, Westmin Resources, Limited, of Vancouver, British Columbia, have developed this environmental analysis document. The purpose of this environmental analysis document is to describe the existing environment of the Johnson River area, identify reasonable transportation and port easements alternatives, discuss the relative technical constraints, environmental impacts, and economic considerations between the alternatives, and select a preferred alternative.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Chinitna Bay
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The purpose of this document is *not* to analyze those aspects of the potential mining project that will occur on the privately owned Johnson Tract. Those aspects of development will be the focus of the normal required state and federal permitting processes that will occur if the project proceeds. Rather, this document is focused on identification of the preferred transportation and port easements alternative. It includes descriptions and impact analyses of those aspects of the potential mining project that are indeed relevant to identification of the preferred easements alternative. Once a preferred alternative is mutually agreed to by the Secretary and CIRI, more detailed field studies will be conducted in 1994 by CIRI, Westmin, and the NPS to further refine the environmental and technical aspects of construction and operation of a road and port facility within the preferred alternative's easements.

While similar in scope and format to an environmental review document prepared under the National Environmental Policy Act (NEPA) of 1969, this analysis is not a NEPA review. Under the terms of PL 94-204, conveyances of the Johnson Tract and the associated transportation and port easements to CIRI are considered as conveyances under the Alaska Native Claims Settlement Act (ANCSA) of 1971. Section 910 of the Alaska National Interest Lands Act (ANILCA) of 1980 states that conveyances, withdrawals, easement determinations, or other actions that lead to conveyances to Native corporations pursuant to ANCSA are exempt from NEPA review.

This analysis also is not being prepared under Title XI of ANILCA that addresses transportation and utility easements in and across conservation system units. The PL 94-204 grant of the Johnson Tract transportation and port easements to CIRI predated ANILCA by years, and Section 1109 of ANILCA specifically states that nothing in Title XI shall be construed to adversely affect any valid existing right of access.

1.2 Background

The need to identify and convey to CIRI transportation and port easements from the Johnson Tract to the shore of Cook Inlet originated from the selection rights of CIRI and its villages along the western shore of Cook Inlet. These rights are the result of historic agreements between CIRI, the Federal Government, and the State of Alaska to fulfill the intent of ANCSA and achieve a variety of other public purposes, including the creation of Lake Clark National Park and Preserve.

ANCSA Selections. Unlike the situations that confronted other Alaska Native corporations, the formulas established by ANCSA for land withdrawals and Native selections simply did not work in the Cook Inlet Region. This was largely because the region encompasses the heart of the most settled and developed lands in Alaska. Long before passage of ANCSA, most of the lowlands throughout the region had been settled, selected by the State under the Alaska Statehood Act, or withdrawn by the Federal Government for other public purposes (e.g., Kenai National Moose Range, Chugach National Forest, Fort Richardson and Elmendorf Air Force Base military withdrawals, etc.).

In fulfilling his responsibility under ANCSA to provide for Native selections, the Secretary thus was forced to designate "in lieu" (deficiency) withdrawal areas on the fringes of the region for CIRI and village selections. Most of these areas were characterized by observers as largely "mountain tops and glaciers." Among the few good in lieu areas withdrawn by the Secretary for selections were the shores of Lake Clark and nearby lakes such as Kontrashibuna and Tazimina -- the heart of the area that had been proposed as a national park. Appendix A shows the location of the valid original 61,864 acres of Lake Clark selections made by CIRI's village corporations.

Cook Inlet Land Exchange. When negotiations between CIRI and the Interior Department failed to provide CIRI with selection rights to areas that better fit ANCSA's definition of "customary and traditional lands," CIRI sought redress in the courts. The State of Alaska then entered the process to protect its own selection rights. A long negotiation process followed between the Interior Department, the State, and CIRI, culminating in the Cook Inlet Land Exchange, the largest land exchange agreement in American history. Recognizing the significance of the issues at stake, and the chaos that would be created by continuing litigation and/or arbitrary land patterns, the Joint Federal/State Land Use Planning Commission for Alaska endorsed the agreement. The *Terms and Conditions for Land Consolidation and Management in the Cook Inlet Area* were enacted into federal law in January of 1976 (PL 94-204) and approved by the Alaska Legislature in March 1976.

Creation of Lake Clark National Park. From the Interior Department's perspective, the centerpiece of the land exchange was the "Lake Clark Tradeout" provision under which all 61,864 acres of valid village selections were removed from within the

heart of the proposed Lake Clark National Park. This stipulation created a public land ownership pattern that made establishment of the park a realistic possibility. To compensate the villages for removing their selections from the proposed park, CIRI and the State made available to the villages 30,932 ac of prime, high value lands immediately adjacent to the village sites in the lowlands of the Matanuska and Susitna valleys and on the Kenai Peninsula. Moreover, under the terms of the land exchange agreement, CIRI contractually bound itself to support creation of Lake Clark National Park and Preserve as established by ANILCA in 1980.

Johnson Tract Conveyance. One aspect of the land exchange agreement provided that CIRI was to receive a known mineral prospect area on the west side of Cook Inlet at the head of the Johnson River. At that time this area was outside the boundaries of the proposed Lake Clark National Park. Known as the Johnson Tract, the conveyance was to be divided into two blocks of roughly equal size: a northern block to which CIRI would receive title to the metalliferous minerals only, and a southern block to which CIRI would receive title in fee simple, subject to a restrictive covenant that the surface estate would only be used for purposes incident to mining and mineral extraction (Fig. 1.2-1). These blocks were conveyed to CIRI by the Bureau of Land Management on May 14, 1979 and March 10, 1982, respectively.

When it established Lake Clark National Park and Preserve in 1980 in Section 201(7) of ANILCA, Congress significantly expanded the boundaries of the original park proposal and "came over the mountains" to the shores of Cook Inlet, thus including the previous in lieu Native selection withdrawal areas. Section 103(c) of ANILCA, however, specifically excludes from Lake Clark National Park and Preserve privately owned lands such as the Johnson Tract. Thus, while the Johnson Tract is surrounded by the park, it is not a part of the park, and is not subject to the regulations applicable solely to public lands within the park.

Transportation and Port Easements. In accepting the compromises offered in the Cook Inlet Land Exchange, CIRI wanted to insure that the land and resources it was to receive could be readily utilized for the benefit of its Alaska Native shareholders. Because the Johnson Tract was likely to be surrounded by the future Lake Clark National Park, CIRI successfully bargained that access easements located on and traversing federal lands be conveyed to CIRI in addition to the land and mineral

interests in the Johnson Tract itself. The easements contained in PL 94-204 are for transportation between the Johnson Tract and Cook Inlet, and for a port on Cook Inlet. The locations of these easements are to be mutually agreed upon by the Secretary and CIRI. The section of the *Terms and Conditions for Land Consolidation and Management in the Cook Inlet Area* that contains the Johnson Tract and related easement conveyance language may be found in Appendix B.

Johnson Tract Mineral Exploration. In 1981 Anaconda Minerals Company entered into a lease agreement with CIRI to explore the Johnson Tract. In 1981 and 1982 Anaconda established small camps on the southern block to explore the main Johnson River deposit, and in 1983 it built a 50-person seasonal exploration camp (Fig. 1.2-1). Every year since 1981 activity has occurred on the Johnson River deposit, with a total of approximately 70 holes drilled in the ore body. In 1983 and 1984 nine holes were drilled in a different area on the northern block. In 1985 Anaconda's involvement with the property ended and it was leased to Howard Keck, with exploration conducted by Hunt, Ware and Proffett.

In spring of 1993, Howard Keck assigned the lease to Westmin Resources, Limited, of Vancouver, British Columbia. During the 1993 field season, Westmin conducted due diligence work and confirmatory diamond drilling of seven holes totalling approximately 6,500 ft on the Johnson River deposit. The prospect has a defined mineral inventory of approximately 813,000 short tons of 0.36 oz/ton gold, 0.97 percent copper, 9.18 percent zinc, and an undefined amount of lower grade mineralization. The results of the 1993 drilling work have not been fully interpreted and the inventory undoubtedly will change to some extent when completed.

Coordination With the National Park Service. In April 1993 CIRI and Westmin approached representatives of LCNP and indicated that results of mineral exploration on the Johnson Tract appeared to warrant commencement of field reconnaissance environmental and technical studies to provide baseline information for identifying the transportation and port easements. Meetings with representatives from LCNP, the NPS Alaska Regional Office, CIRI and Westmin were held in May and July, and several contacts and short meetings occurred during July and August.

In early September a Memorandum of Understanding titled *Information and Data Collection Concerning a Transportation Easement and Port Easement in Lake Clark National Park* was signed by LCNP and CIRI. In mid-September representatives from LCNP, the NPS Alaska Regional Office, and Westmin made an overflight of the Johnson River area and visited the Johnson Tract exploration camp.

Field Reconnaissance Studies. During August and September of 1993 Westmin contracted with several consultants to conduct field reconnaissance baseline studies for the following resources as a basis for determining the preferred alternative for the transportation and port easements: water quality, wetlands, fish, wildlife, cultural resources, paleontological resources, and subsistence. In addition, a preliminary engineering survey of the transportation easement alternatives was conducted, including a bathymetric survey at a site in Tuxedni Channel.

Development Schedule. Based on the results from the 1993 drilling program, Westmin tentatively plans to develop an approximately 1 km underground drift in 1994 on the southern block of the tract to access the ore body for definition drilling (Fig. 1.2-1). Existing plans are to mobilize in approximately mid-June of 1994 to prepare the proposed portal area, and to commence drifting in mid-July. The drift is expected to reach the ore body by November, with definition drilling completed in approximately February 1995.

During the 1994 field season, CIRI, Westmin, and the NPS will conduct additional field studies along the preferred transportation easement and at the port easement to further refine the environmental and technical aspects of construction and operation of a road and port facility. This information also will be used during the permitting process for these facilities.

If the project proves technically and economically feasible, and all state and federal permits have been received, development likely would commence later in 1995 or in the spring of 1996.

Chapter 2

Project Description

The action being considered in this environmental document is the identification and conveyance of the preferred transportation and port easements for the development and supply of mining infrastructure and the transportation of minerals between the privately owned Johnson Tract and Cook Inlet. That action is only indirectly related to the potential Johnson Tract mining activities which are not the subject of this document.

Certain aspects of mine development, supply, and operation, however, are germane to the process of identifying transportation and port easements alternatives and selecting a preferred alternative. This chapter therefore describes those plans for mine development and operation that may affect the proposed action, based on currently understood qualitative and quantitative characteristics of the ore body. Additional ore may be found as this project proceeds, however, which could alter some project components significantly.

Location

The Johnson River area is located on the west side of Cook Inlet immediately south of Tuxedni Bay, approximately 120 mi southwest of Anchorage and 60 mi southwest of the City of Kenai (Fig. 1.1-1). The area is within the Kenai Peninsula Borough (KPB).

For the purposes of this analysis, the term *Johnson River area* includes the drainages of the Johnson River; those flowing directly into Cook Inlet and Tuxedni Channel from Slope Mountain; the Bear Creek and Hungryman Creek drainages; Chisik and Duck islands; and the adjacent waters of Cook Inlet and Tuxedni Channel (Fig. 1.2-1).

Project Description

Based on the currently known reserves, ore would be mined underground from the exploration drift excavated in 1994. The ore would be loaded into up to 8, 40-ton haul

trucks (possibly with trailers) underground or from an ore stockpile at the mine mouth, transported directly to the port site, and stored in the open on a leveled pad. Underground mining and ore truck hauling could continue year around if operations proved feasible throughout the winter. Depending on truck capacity, the length of the ore trucking season, and the time of year, up to approximately 25 to 30 round trips per day would be made between the mine and the port by ore trucks. A few additional daily round trips would occur by tanker or supply trucks and light utility vehicles.

The ore would be loaded onto a barge and transported across the Gulf of Alaska to Westmin's near-tidewater mill at Stewart, British Columbia, adjacent to the City of Hyder in extreme southeast Alaska. The number and timing of barge loadings would depend on the size of the barge and the length of the shipping season. Currently it is expected that one 15,000 ton barge likely would make approximately two round trips each month of the year, however, winter barging is uncertain due to weather in the Gulf of Alaska and ice conditions in Tuxedni Channel. Based on currently known reserves, no processing of ore, except for crushing, would occur at the mine site.

The road from the mine to the port site would be a well constructed mining road with culverts adequately sized to pass the 20-year, 24-hour storm event. The road would be ditched and graded to handle runoff and minimize erosion. Road width likely would be increased in stages. For the initial project the driveable width likely would be 18 ft (one lane) with turnouts approximately every one-half mile to allow ore trucks to pass each other. If future mining projects warrant, the driveable road surface could be widened to 30 feet (two lanes).

The total disturbed width of the filled road footprint (toe slope to toe slope) would vary depending on topography and the type of road construction (cut and fill vs borrow). The minimum disturbed width would be 50 ft, with the large majority of the distance being under 100 ft wide. In addition to periodic turnouts, a road maintenance equipment pad, possibly with a shelter, may be required near Bear Creek Pass, and snow fencing may be necessary at several points along the route. These facilities will be taken into consideration when construction and operational easements are determined.

The final configuration of the port facilities will not be known with any certainty until after the 1994 field season. For the initial project the port would be a barge loading facility. Depending on port location, required water depth, and the distance from shore necessary to reach that depth, the facility could be a relatively short nearshore bulkhead or a long structure reaching 2,500 ft from shore. Such a long structure could be built on pilings, periodic sheet pile conveyor foundations, or a periodically breached rock-fill causeway. Barge loading from the structure could be by front-end loaders, loaders and trucks, or by conveyor. Since future mining projects could require use of ocean-going vessels, the port configuration must be compatible with loading such vessels, or be capable of being upgraded to do so.

It is estimated that approximately 270,000 short tons of ore would be mined and transported annually over a three-year mine life based on the current estimate of the size of the ore body. Additional ore, however, may be found during the drifting and definition drilling process. Exploration for other mineral prospects in the vicinity of the mine would continue during the mining operation.

During operation, up to 65 workers would live in a camp located at the existing exploration camp site, or at another suitable site closer to the mine portal. Workers likely would be transported to and from the existing airstrip by chartered fixed-wing aircraft.

Fuel would be barged to the port site and pumped to upland storage facilities at the port with a capacity of approximately 400,000 gallons. It is unlikely that more than four fuel barges per year would visit the port. Fuel would be hauled from the port storage facilities to the mine site by a dedicated fuel truck, or by ore trucks on the backhaul towing fuel trailers or carrying fuel cubes in the truck bed. Fuel also would be stored at the mine.

Other supplies for the mining operation also would arrive by barge or small ship and be trucked to the mine. These would include heavy equipment, spare parts, camp modules, lumber, and comestibles. To accommodate these items there would need to be a lay down area at the port site.

Chapter 3

Affected Environment

To determine potential impacts from the various transportation and port alternatives, an understanding of the environment as it exists *before* any of those alternatives is developed is necessary. This chapter describes, on a resource-by-resource basis, the existing environment of the Johnson River area that would be affected by development of the alternatives.

3.1 Land Status and Use

The large majority of uplands in the Johnson River area is within LCNP, created by ANILCA in 1980, and is subject to the park's management regulations. There are two exceptions to park ownership. The first is Chisik and Duck islands, to the northeast across Tuxedni Channel, which are within the Tuxedni Unit of the Alaska Maritime National Wildlife Refuge (NWR) under the jurisdiction of the FWS (Fig. 1.2-1). The second is the Johnson Tract at the head of Johnson River Valley owned by CIRI. This tract consists of two blocks totalling 33 sections (approximately 21,120 acres). The southern block contains 18 sections (11,520 acres) and is owned by CIRI in fee. The northern block consists of 15 sections (9,600 acres) on which only the metalliferous minerals are owned by CIRI.

Like the majority of the coast between Redoubt Point and Chinitna Bay on the west side of Cook Inlet (Fig. 1.1-1), a significant portion of the land near the coast in the Johnson River area has been selected by Cook Inlet Region Native village corporations (Fig. 1.2-1). Title to these lands likely will be transferred in the relatively near future from the Federal Government to individual Native village corporations. These lands would not be subject to the regulations applicable solely to public lands within the park.

Several small parcels in the area are privately owned by individuals who received title through operation of the public land laws, e.g., trade and manufacturing sites and

homesites, before passage of ANCSA and creation of the national park. Most of these parcels, including Silver Salmon Lodge, are on or near the coast south of the mouth of the Johnson River, and a few are on the northwestern end of Chisik Island. The Snug Harbor Cannery at the southeast end of Chisik Island also is in private ownership.

Six cabins/houses are located on Tuxedni Channel between Fossil Point and the vicinity of the Deep Water port site (Fig. 1.2-1). Four of these are likely associated with existing nearby state shore fishery leases (set net sites). All six structures appear to be in trespass. NPS research indicates that no permits or other tenure has been granted for any of the sites although at least three of them have been there for many years (Gilbert, 1993).

The State of Alaska owns the tide and submerged lands from the line of mean high tide seaward for a distance of three miles. All shore fishery leases are on state tidelands and submerged lands and give an exclusive right to fish, but only on the tidelands and submerged lands.

The Johnson River area is within the Kenai Peninsula Borough and therefore falls under the jurisdiction of the Kenai Peninsula Borough Coastal Management Program (KPB, 1990).

3.2 Geology

The Johnson River area is underlain by a sequence of Jurassic-aged volcanic and sedimentary rocks that dip gently towards the southeast. These are uncomformably and discontinuously overlain by a relatively thin mantle of glacially derived sediments, recent volcanic ash, and fluvial reworked deposits of these materials.

The mineral deposit itself is located within volcanic rocks that have been correlated with the Talkeetna Formation, and dated at 180 million years old. These rocks are volcanic flows, tuffs, and sediments derived from these rocks after their deposition. Overlaying the volcanic rocks is a thick sequence of sandstones, siltstones, and conglomerates that are progressively younger towards the coast, These are formally called the Tuxedni Group which is divided into the Tuxedni, Chinitna, and Naknek formations.

3.4 Surface Water Hydrology

The two major drainages involved with analysis of the transportation easement alternatives, Johnson River and Bear Creek, consist of broad valleys with moderate side slopes (Fig. 1.2-1). Johnson River in particular exhibits the classic braided river channel pattern. Benches are common along and above the active flood plains of both drainages. The degree of incision of the mountain slopes is highly variable along each drainage near the transportation easement alternatives (Three Parameters Plus, 1993).

No long-term flow data are available for either drainage, but similar drainages in mountainous terrain in the Cook Inlet Basin have mean annual runoffs of up to 8 cubic feet per second (cfs) per square mile, with peak runoff means between 50 to 100 cfs per square mile (Selkregg, 1975). Low flows generally occur in late winter when precipitation is stored as snow and groundwater additions to the streams are at a minimum. Low flows occasionally occur during dry summer months, but streams such as the Johnson River are maintained by glacial melt.

3.5 Soils

Two major soil groups are found in the Johnson River area. The first, Rough Mountainous Land (RM1), is found in the western higher elevations of the area and is made up of steep rocky slopes, icefields, and glaciers (Reiger and Schoephorster, 1979). Some slopes in the mountains support a sparse shrubby vegetation, but most are barren. Thin soils occur in the vegetated areas on lower slopes and in valleys, but almost all are stony and shallow over bedrock or bouldery deposits. In most cases these soils can be classified into the same subgroups as those of hilly areas adjacent to the mountains.

The second soil group, Typic Cryandepts (IAII), is found in the eastern, lower elevations of the area and is defined as very gravelly, hilly to steep -- rough mountainous land association (Reiger and Schoephorster, 1979). The principal components are:

- Typic Cryandepts, very gravelly, hilly to steep (55 percent) consisting of shallow, well drained volcanic ash over very gravelly glacial till on valley sides and

rounded hills. They range from sea level to about 2,000 ft. Below 1,000 ft the vegetation is dominantly alder and grasses. Areas above 1,000 ft or areas exposed to strong winds are dominated by low shrubs, forbs, and lichens.

- Rough mountainous land (35 percent) consists of mountain peaks and ridges, rocks escarpments, and talus slopes with little or no soil cover. These areas are generally above 2,000 ft and are either barren or sparsely vegetated with shrubby tundra plants.

- Riverwash (10 percent) consists of recent deposits of sand and gravel on flood plains and braided rivers. These are mostly barren, but willow, alder, and grasses normally grow on the riverbanks.

A reconnaissance survey of the transportation easement alternatives (Three Parameters Plus, 1993) revealed both moderately well drained and very poorly to somewhat poorly drained ash soils. In the upper third of the Johnson River drainage, the ash layer is relatively thin and the soils are characteristically moderately well drained. Exceptions in this area are very limited, except where beaver activity has created large backwaters and soils have flooded for some period of time.

In the middle and lower Johnson River and Bear Creek drainages, where ash has accumulated to a depth of 8 or more inches, the soils generally are more poorly drained, even on some relatively steep side slopes. This seems to be due in part to the highly stratified and variable composition of the ash layers, some of which are very slow draining (Three Parameters Plus, 1993).

3.6 Vegetation

Viereck and Little (1972) identified three vegetation types in the Johnson River area: coastal spruce-hemlock forest, shrub thickets, and alpine tundra.

The coastal spruce-hemlock forest is characterized in Cook Inlet by a predominance of Sitka spruce (*Picea sitchensis*) with western hemlock (*Tsuga heterophylla*) being relatively uncommon. Blueberry (*Vaccinium spp.*), huckleberry (*V. parvifolium*), devilsclub

The surficial unconsolidated material overlaying the Jurassic rocks is a combination of material derived from continental glaciation during the Pleistocene Era, local alpine glaciers flowing from the surrounding mountains, and volcanic ash material derived from the nearby volcanoes such as Mt. Augustine, Mt. Iliamna, and Mt. Redoubt. Mt. Iliamna, 7.5 miles southwest of the head of Johnson River, is the nearest of these volcanoes. Although it has no record of eruptive activity in the historic past, there is continual fumarolic activity with gas discharge and precipitation of sulphur around the vents.

3.3 Physiography

The Johnson River area is located between the crest of the Alaska Range and Cook Inlet (Fig. 1.2-1). It is flanked on the north by Tuxedni Bay, and on the south by similar landforms bordering Chinitna Bay. The major peaks at the head of Johnson River are between 5,000 and 5,300 ft high. Nearby to the southwest, Mt. Iliamna reaches just over 10,000 ft. Glaciers are common, with the 14-mi long Tuxedni Glacier flowing north from Mt. Iliamna to the head of Tuxedni Bay. Three other glaciers from the same ice field, Johnson, Double, and Lateral, flow into the head of the Johnson River drainage at elevations of between 400 to 1,000 ft.

The Johnson River Valley below the glacier is approximately 14 miles in length, dropping in elevation from 1,000 ft to sea level. At mid-point the valley is approximately 2 miles wide, being restricted in width near its mouth by two mountains -- Triangle Peak (3,505 ft) on the south and Slope Mountain (3,810 ft) on the north. Two passes, 1,000 and 650 ft in elevation, connect from the mid-point of the Johnson River Valley to Red Glacier on the south and Bear Creek Valley on the north, respectively. There are only a few small lakes, under 50 acres, in the terminal moraines and the wetlands adjacent to the Johnson River. The lower two-thirds of the Johnson River Valley contains a relatively large expanse of marsh and ponds.

The Bear Creek Valley drains northeast to Tuxedni Channel, as does Hungryman Creek. Difficult Creek drains northeast into Tuxedni Bay proper. Tuxedni Bay and Tuxedni Channel are fringed by mudflats. The mudflats disappear at the southeast end of Tuxedni Channel where the steep slopes of Slope Mountain meet the sea. On the north side of the 1- to 2-mile wide Tuxedni Channel is Chisik Island.

(*Oplopanax horridus*), and salal (*Gaultheria shallon*) are the most important shrubs. Cottonwood (*Populus trichocarpa*) is found along some glacial outwash rivers.

The shrub thicket vegetation type found in the Johnson River area is predominantly the coastal alder (*Alnus sinuata*) thicket. This thicket is found between the beach and the forest, between the treeline and the alpine tundra meadows, and extends from treeline downward through the forest in avalanche tracks and along streams. The alder thicket is almost impenetrable, with devilsclub and salmonberry (*Rubus spectabilis*) frequently present in the understory. Beneath the alders there is often a well developed grass and fern layer, as well as a number of herbs and shrubs.

Alpine tundra is found at higher elevations. Much of this type consists of barren rocks, but interspersed between the bare rocks and stubble are low mat plants, both herbaceous and shrubby. Dominant in this type are low mats of white mountain-avens which may cover entire ridges and slopes along with many mat-forming herbs such as moss-campion (*Silene acaulis)*, black oxytrope (*Oxytropis nigrescens)*, arctic sandwart (*Minuartia arctica*), and several grasses and sedges.

With respect to the specific parts of the Johnson River area that will be crossed by the transportation and port easements, aerial photos and limited ground investigation show the major vegetation types as meadow-like areas, dense shrub thickets, and an open-forest shrub complex (Three Parameters Plus, 1993).

3.7 Wetlands

Waters of the United States, including their adjacent wetlands, fall under the regulatory purview of the U.S. Army Corps of Engineers (COE) and the U.S. Environmental Protection Agency (EPA). Areas that possess three essential characteristics: hydrophytic vegetation, hydric soils, and wetland hydrology, are referred to as jurisdictional wetlands by regulatory agencies. For the COE and EPA to exert their regulatory authority over an area, each of these characteristics must be exhibited (FGMI, 1993). According to the federal wetlands regulations (33 CFR 328, 1986), jurisdictional wetlands are defined as follows:

> Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Three Parameters Plus (1993) conducted a reconnaissance evaluation of wetlands in the Johnson River area and concluded that, independently, hydrophytic vegetation, hydric soils, and wetland hydrologic characteristics occur in many places in the Johnson River area. Areas where all three parameters occur together, however, appear less prevalent, especially along the transportation easement alternatives. Definitive identification of jurisdictional wetlands would require more detailed field investigation; however, results of this evaluation are adequate for determining the relative impacts of the transportation and port easements alternatives.

Based on this reconnaissance evaluation, Figure 3.7-1 shows the areas likely to contain jurisdictional wetlands in the vicinity of the transportation and port easements alternatives. The upper Johnson River drainage contains only one area which appears to meet the criteria for a jurisdictional wetland. In the middle and lower Johnson River drainage, two large wetland systems border the river on the north and south. These wetlands are documented coho rearing and trumpeter swan nesting and rearing habitat.

Several small wetland areas along the Iliamna Point Alternative consist of a series of small, slow-draining benches. These areas contain no open water and are not considered high value habitat (Three Parameters Plus, 1993).

The lower Bear Creek Valley and floodplain are predominantly jurisdictional wetlands, but some of the more heavily forested areas in the valley may not meet jurisdictional wetland criteria. Alluvial terraces close to the creek also may not meet jurisdictional wetland criteria, however, such areas are normally considered Waters of the United States and therefore also subject to Section 404 of the Clean Water Act.

The four port easement alternatives appear to have better drainage than the valley bottoms, and no terrestrial jurisdictional wetlands were identified at any of the sites.

Tidelands seaward of the mean high tide line, however, are classified as wetlands and occur at each port alternative.

3.8 Climate

Climatic data specifically for the Johnson River area are not available. Such data are available for the Kenai Peninsula on the east side of Cook Inlet. Temperatures are undoubtedly cooler in the upper Johnson River drainage than those reflected in the relatively low-lying western Kenai Peninsula. The coastal climate of the western Kenai Peninsula, however, may be quite similar to most of the Bear Creek and lower Johnson River drainage (Three Parameters Plus, 1993).

The Soil Conservation Service (SCS, 1962) indicates that precipitation in the Kenai area consists of approximately 18 in of rain and 66 in of snowfall annually. The mean temperature in the area is relatively cold, approximately 33° F. Selkregg (1975) reports summer temperatures of 42° to 62° F and winter temperatures of 4° to 43° F, with extremes of -48° and 89° F. The growing season on the Kenai Peninsula typically falls between May 27 and September 3 (SCS, 1962).

The upper Johnson River drainage receives considerably more snowfall than the western Kenai Peninsula. Smith (1993) reported that 3 to 4 ft of dry snow are typically on the ground at the Johnson Tract exploration camp in December, and that between February and early April 14 ft of snow at the camp are not uncommon.

3.9 Water Quality

Surface waters in the Johnson River area exhibit acceptable quality for most uses, but the large glacial-fed streams such as Johnson River have high sediment concentrations, especially during summer. Most of the water is of the calcium bicarbonate type and is low in dissolved solids content.

Water samples were collected at 15 locations throughout the Johnson River area in late August 1993 and analyzed for total and dissolved metals as well as several other parameters (Westmin, 1993). Analyses of a suite of 30 metals for total dissolved metals content showed that only aluminum exceeded Alaska water quality standards at

most of the sites. Iron, zinc, and manganese exceeded the standards only in the samples taken in or directly below the small creek draining the area where the ore body outcrops. All other metals concentrations did not exceed water quality standards. The results of other parameters analyzed are shown in Table 3.9-1.

Table 3.9-1

Non-Metal Water Quality Parameters
from the Johnson River Area

Parameter	Units	Results
Total suspended solids	mg/l	<2.0 to 50
Hardness as $CaCO_3$	mg/l	12.9 to 107
Nitrate-N	mg/l	<0.03 to 0.79
Nitrite-N	mg/l	<0.03
Sulfate	mg/l	1.36 to 41.4
Alkalinity as $CaCO_3$	mg/l	<1 to 43

Surface water temperatures in the Johnson River area were not taken, but temperatures for similar areas in southcentral Alaska range from an apparent winter low of near 32 °F to summer highs in the low to high-40s° F near the river mouths. Shallow ponds have summer temperatures higher than streams and may reach 60°F (Selkregg, 1975).

3.10 Fish

The extent of freshwater fish resources in the Johnson River area is not well known. Figure 3.10-1 shows the streams in the Johnson River area that are listed in the Alaska Department of Fish and Game's (ADF&G) Anadromous Fish Stream Catalog (ADF&G, 1982). No formal fish survey of this area, however, has been made by ADF&G. In August 1993 a helicopter and ground fish reconnaissance survey was conducted in the area to determine the relative potential impacts of each of the transportation easement alternatives (Morsell, 1993).

Salmon spawning and rearing habitat on the north side of the Johnson River drainage is limited primarily to the valley bottom. Most northern tributaries are steep and cannot be considered fish habitat. As is often the case with wide glacial river valleys in Alaska, the drainage on the valley floor is complex, with water contributed by the Johnson River, sidehill drainages, and ground water. Actual surface drainage courses are in some cases discontinuously influenced by wetlands, beaver ponds, and subsurface porosity.

The reconnaissance survey found portions of two streams in the valley bottom with apparently good salmon spawning habitat, and pink and chum salmon were seen in two valley bottom northern tributaries in the lower valley (Fig. 3.10-1). It is likely that salmon use any clear water steams on the valley floor that connect with the Johnson River (Morsell, 1993).

Dolly Varden are generally distributed throughout the Johnson River area (ADF&G, 1985). Kona Creek, that enters the Johnson River from the north near the mining exploration camp on the Johnson Tract (Fig. 3.10-1), contains resident Dolly Varden (Morsell, 1993). In the past, Dolly Varden have been caught by exploration workers in the clearwater lower reaches of Kona Creek (Smith, 1993).

No fish were observed within the Hungryman, Bear, or other creeks crossed by the Fossil Point, Deep Water, or Mudflats alternatives, although very muddy conditions within lower Hungryman and Bear creeks prevented any conclusions regarding fish presence. Both streams are listed in the Anadromous Fish Stream Catalog (Morsell, 1993).

3.11 Wildlife

3.11.1 Birds

The bird groups of primary concern in this analysis are waterfowl, shorebirds, seabirds, and raptors.

Waterfowl. Coastal wetlands on the west side of Cook Inlet from Redoubt Point to Chinitna Bay provide a combination of shallow ponds, delta mudflats, and sedge/grass

meadows that are known to concentrate swans, geese and ducks. Numerous sightings have been made in late summer of flightless Canada and White-fronted geese at the head of Tuxedni Bay, to the northwest of the Johnson River area. Tuxedni Bay is also known to support large numbers of sea and diving ducks in late fall and winter, especially scoters and scaup (Bennett, 1992a).

Waterfowl use in the Johnson River area is limited primarily to the middle and lower Johnson River Valley and Tuxedni Channel. The large wetland area in the Johnson River Valley, with its small ponds, oxbows, and beaver impoundments, provides good breeding and moulting habitat for several species of ducks, and for Trumpeter Swans. The swans likely represent the most important waterfowl species potentially affected by the choice of a transportation easement alternative.

Use of the lower reaches of the Johnson River Valley by breeding, nonbreeding, and migrant swans has been known for at least 10 years. Swan nesting was documented in Johnson River Valley by Twitchell (1984) in 1984. More recently, Bennett (1992a) surveyed the Johnson River Valley by helicopter in July-August of 1992 and found 9 adult pairs, 4 adult nonbreeders, and 2 cygnets. He attributed the very low number of cygnets to poor productivity caused by an unusually deep winter snowpack and a late spring thaw. In late August 1993, Bennett (1993a) conducted a fixed-wing survey and reported 5 adult pairs with young, 1 pair without young, five other adults, and 23 cygnets (Fig. 3.10-1).

In early September 1993, Three Parameters Plus (1993) conducted a helicopter survey of swans in the Johnson River Valley and reported 9 adult pairs, 2 nonbreeders, and 17 cygnets. Both these late 1993 summer surveys probably understate swan use of this area because some unsuccessful nesting adults likely had left the area by the time of the surveys. Regardless, these surveys show that the Johnson River Valley below the confluence of Red Creek is a highly productive Trumpeter Swan nesting area.

Waterfowl use of Tuxedni Channel is not well documented. Bennett (1992a) reported 314 Surf Scoters, 75 Black Scoters, and 5 Common Loons in the channel in mid-August 1993.

Shorebirds. The intertidal mudflats from Tuxedni Bay to Chinitna Bay along the coast of LCNP are among the most productive habitats for migratory shorebirds in Cook Inlet. Arctic nesting shorebirds depend on migratory stopovers to gain energy reserves for reproduction. Food availability during both spring and fall migrations is important because of increased energy requirements during breeding, moulting, and long distance movements. Fall food availability may be critical for survival of juveniles (Bennett, 1993b).

Four coastal shorebird surveys, conducted by LCNP personnel from April 29 to May 20, 1993 between Redoubt Point and Chinitna Bay, found that the Tuxedni Channel mudflats between Fossil Point and the Deep Water port site opposite the Snug Harbor Cannery accounted for 28 percent of all birds counted (Fig. 3.10-1) (Bennett, 1993b). Considering the large number of shorebirds that migrate along the west side of Cook Inlet, this percentage extrapolates to high migratory shorebird use of this area.

Seabirds. The Johnson River area mainland does not provide important nesting habitat for seabirds. Only one small colony of 15 Glaucous-winged Gulls has been reported on the coast of Slope Mountain just north of Iliamna Point (Sowls et al., 1978). On the north side of Tuxedni Channel on Chisik and Duck islands, however, there are large seabird colonies. Sowls et al. (1978) reported almost 78,000 individuals, primarily Black-legged Kittiwakes, Common and Thick-billed murres, Horned and Tufted puffins, and Glaucous-winged Gulls. More recently, in 1986 Nishimoto et al. (1987) estimated the status of kittiwakes and murres on Chisik and Duck islands as 26,500 and 3,500, respectively. Species composition and abundance of these colonies may have substantially changed since that survey (Nishimoto, 1992).

The waters of Tuxedni Channel provide important feeding habitat for seabirds. Bennett (1992a) reported 9,400 kittiwakes and 440 large gulls in Tuxedni Channel in mid-August 1992. Most of these birds were feeding at the mouth of the unnamed creek entering the southeast end of the channel approximately one-half mile south of the Deep Water port site opposite the Snug Harbor Cannery (Fig. 3.10-1) (Bennett, 1993c). He also reported 20 Pigeon Guillemots, 90 Horned Puffins, and 85 cormorants in the area.

Raptors. The Johnson River area provides good habitat for raptors. Aerial surveys of Bald Eagle and other raptor nests in LCNP were begun in 1983 and have been conducted annually since then. During that period, nests of nine Bald Eagles, one Red-tailed Hawk, and one Peregrine Falcon have been identified in the Johnson River Valley and along the mainland coast of Tuxedni Channel from Cook Inlet to a point 3 miles northwest of Fossil Point (Bennett, 1993d). Figure 3.10-1 shows these nest locations in relation to the transportation and port alternatives.

3.11.2 Mammals

Moose. Moose are found throughout the Johnson River area below the vegetation line (ADF&G, 1973). With the exception of the Johnson River Valley, however, the area generally does not provide particularly good habitat. The middle and lower Johnson River Valley, with its relatively numerous stands of willow, provides good winter habitat for moose. In late December 1992, Bennett (1992b) counted 45 moose in the valley, 30 of them in one aggregation adjacent to the Johnson River about 4 mi upstream from its mouth (Fig. 3.10-1).

During summer, moose disperse to higher elevations throughout the Johnson River area, returning to the valley bottoms in early winter when forced to lower elevations by snowfall.

The December 1992 composition counts showed a ratio of 35 bulls per 100 cows. No previous measurements of moose abundance or herd composition have been made in this area. Local residents claim that moose numbers were much greater 10 to 15 years ago. Bennett (1992b) concluded that it seems apparent that limited and marginal moose habitat, notoriously deep overwinter snow conditions, and locally high bear densities are major factors in regulating moose numbers in this area.

Bears. Both brown and black bears are found throughout the Johnson River area. The Johnson River itself from Lateral Glacier to Cook Inlet is listed as a fish stream concentration area for brown bears (ADF&G, 1973). Smith (1993), however, stated that from 1983 to 1993 he only had seen three or four brown bears in or immediately adjacent to the Johnson River, and none appeared to be attempting to catch or eat salmon.

Very little information exists about bear population numbers and distribution for this area. Bennett (1993c) reported that black bears are more common than brown bears. Smith (1993) reported that in 10 years of operation at the Johnson Tract exploration camp, black bears were common in the camp vicinity during the July through September period, but that brown bears were virtually never seen until late September or early October when one or two sightings would occur.

Brown bear sightings may be highly variable from year to year. Smith (1993) reported that from 1983 to 1992 several sightings of brown bears were usually made each year in the lower part of the Johnson River Valley and at its mouth. In August 1992 Smith reported seeing nine brown bears at one time on the flats near the mouth of the river. During the entire 1993 summer, however, Smith reported seeing no brown bears in the Johnson River Valley. He stated that a local commercial fisherman in the area had remarked that he had made only two brown bear sightings during the 1993 summer (Smith, 1993).

Some brown bear den site data are available for the years 1985-87 (Twitchell, undated). These sites are shown in Figure 3.10-1. Smith (1993) reported several dens on the eastern slopes of Triangle Peak just above Silver Salmon Lakes approximately 3 mi southwest of the mouth of the Johnson River.

Beaver. Beaver appear to be increasing in numbers relatively rapidly in the Johnson River Valley based on a comparison of aerial photos taken in 1985 and conditions today (Three Parameters Plus, 1993). Beaver dams have formed large impoundments that have significantly increased wetlands in several areas. These impoundments provide excellent habitat for Trumpeter Swans and other waterfowl.

Marine Mammals. Harbor seals are found throughout Cook Inlet adjacent to the Johnson River area. The nearest concentration area is to the northwest at the head of Tuxedni Bay. Beluga whales also are found throughout Cook Inlet. The Johnson River area is at the extreme northern end of the range of sea otter, and a sighting of this species that far north in Cook Inlet would be very rare (Caulkins, 1993). The following section discusses threatened and endangered marine mammals.

3.12 Threatened and Endangered Species

Under the provisions of the Endangered Species Act (ESA), the U. S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) periodically list animal and plant species (or subspecies) that are threatened or endangered, and identify candidate species that are likely to be listed.

A species (or subspecies) classified as *endangered* is one which is in danger of extinction throughout all or a significant portion of its range. A *threatened* species is one which is likely to become endangered in the foreseeable future throughout all or a significant portion of its range. A *category 1* (C1) species is one for which FWS has on file sufficient data to warrant listing as threatened or endangered. A *category 2* (C2) species is one for which the best available scientific and commercial information indicates the species might qualify for protection under the ESA, but the agency needs status survey information, evaluation of threats, or taxonomic clarification before the need for listing can be determined.

Fifty-two species (or subspecies) are found in Alaska or adjacent marine waters that fall into the three categories of endangered, threatened, or candidate. The FWS has jurisdiction for the 40 terrestrial vertebrate and plant species in this group. The NMFS has jurisdiction for the 12 marine mammals and marine fish species in this group.

FWS currently lists 3 vertebrate species (or subspecies) as endangered and another 3 as threatened, all birds. There are no Alaska freshwater fish or mammal species in these three categories. One plant species is listed as endangered.

FWS has identified 16 animal species as candidates for listing: 1 (C1) species (a bird), and 15 (C2) species (4 mammals, 10 birds, 1 amphibian). Seventeen plant species (or subspecies) have been identified as candidates for listing -- all (C2).

NMFS currently lists 12 marine species as endangered. Nine are marine mammals (8 whales and the Steller sea lion), and 3 are marine fish.

In response to an informal ESA Section 7 consultation, FWS (1993) stated that it has no records for any candidate, listed or proposed threatened or endangered species

under its jurisdiction in the Johnson River area (Appendix C). The American Peregrine Falcon (*Falco peregrinus anatum*), however, could migrate through the area. The Harlequin Duck (C2) may occur along the rapidly flowing upper Johnson River.

The marine waters of Cook Inlet adjacent to the Johnson River area are at the extreme northern end of the range of the threatened Steller sea lion. The closest sea lion haul out area is in Kamishak Bay, approximately 80 miles south, southwest. A sighting of this species as far north as the Johnson River would be uncommon (Caulkins, 1993; Bennett, 1993). It is possible that the endangered Gray and humpback whales could reach the waters adjacent to the Johnson River area, but neither species has been reported that far north in Cook Inlet (Caulkins, 1993).

3.13 Air Quality

There are no significant air pollutant sources in the vicinity of the Johnson River area. Therefore, background air pollutant levels in the area are assumed to be negligible.

3.14 Noise

The Johnson River area is located in a relatively remote region on the west side of Cook Inlet. The closest sizable community is Ninilchik, 36 miles to the east of the mouth of the Johnson River on the east side of Cook Inlet (Fig. 1.1-1). Data from similar areas indicate that typical natural noise levels usually range from 15 to 45 dB(A), which is considered quiet (see Section 6.9 [Noise] for comparison values). Natural noise levels up to 65 dB(A) may be associated with storms, rock and snow avalanches, and wildlife. Areas along the coast would have the highest noise level due to strong winds, breaking waves, ice movements, and bird calls. Maximum natural noise levels along the transportation easement alternatives would be caused by wind, rain, wildlife, and rare thunder (EPA, 1984).

Noise associated with the limited human use of the area is generally not discernable in most of the Johnson River area, except that resulting from use of boats and airplanes. These types of activities generate noise levels up to 85 dB(A) at at distance of 50 ft. Small, local human noise sources include a few year around residences near the coast, and seasonal use of small recreational cabins or camps, shore fishery set

net sites, and the old cannery at Snug Harbor on Chisik Island. Noise is also generated by helicopters, fixed-wing supply aircraft, and drilling equipment on the Johnson Tract during the annual eight-week exploration period from mid-July to mid-September. Infrequent helicopter and light fixed-wing overflights at low altitudes for other purposes also occur over portions of the Johnson River area. These flights generate ground noise levels up to 90 dB(A) (EPA, 1984).

3.15 Subsistence

Lobdell (1993a) reported in detail on subsistence uses in the Johnson River area. This section is drawn from that report.

Subsistence is best defined, in accord with ANILCA, Section 803, as:

> ...the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.

On the west side of Cook Inlet many traditional subsistence practices continue for a diversity of species. There also are ethnohistoric accounts of subsistence practices, but critical for determining potential impacts of the transportation and port easements alternatives are those practices that are ongoing today. While many animals and plants may be taken for subsistence, it is the most common practices that are recorded and reported, especially for the west side of Cook Inlet (Fall et al., 1984). But there have been recent sweeping changes, especially for fisheries in Cook Inlet (Fall, 1993).

Subsistence tends to occur in areas in close proximity to settlement. These practices also tend to occur at places where ease of access is a consideration. Areas of high biomass concentration that exist in and around the Johnson River area are prime subsistence areas except insofar as their distance to communities. Subsistence frequently takes place in conjunction with recreational activities, but again proximity and access are moderating factors. Local subsistence values are critical in that house-

holds feel their subsistence activities are important, necessary, and satisfying with their overall cultural context, but again proximity to resources is critical within these value systems. The Johnson River area is distant to subsistence users. Little, if any, subsistence procurement may occur there (Calloway, 1993; Fall, 1993). Past use patterns, as suggested by archæological sites, known linguistic boundaries, and settlement groups, indicate that the Johnson River area has not been a primary area of resource procurement focus in the prehistoric or historic past (Lobdell, 1993b).

The closest area of subsistence focus to the Johnson River area is Tyonek, approximately 80 miles northeast (Fig. 1.1-1). At present a state-regulated subsistence fishery exists in that area and five species of salmon are locally available to the Tyonek people (Foster, 1982a; Fall et al., 1984). The fish are kept for both personal use and commercial sale. Rainbow trout, Dolly Varden char, eulachon, herring, whitefish and tomcod are other fish species of some, albeit lesser, economic importance. Shellfish are harvested along the tidal flats south of the village. Beluga whales are still taken and harbor seals are harvested coincidentally during other subsistence activities.

Land hunting in the Tyonek area centers on moose and bear. Moose, however, are the most important and constitute the primary source of meat for the village (Foster,1982b; Fall et al., 1984). Roads constructed to facilitate timber harvest and oil and gas development in the 1960s and 1970s are also used to travel to inland locations. Waterfowl are hunted in the tidal marshes of Trading Bay. Small game and birds, furbearers, berries and other wild plants are harvested from the interior portions of the territory (Fall et al., 1984). In total, the Tyonek subsistence use coastal area extends from the mouth of the Susitna River southwestward to Tuxedni Bay, but seldom if ever farther south along the west side of Cook Inlet to the Johnson River area (Fall et al., 1984).

In summary, although many usable subsistence species and resources exist in the Johnson River area, no present use is recorded. Past use of the area does not appear to have been extensive for subsistence purposes. There are only a few ethnohistoric reports of specialized bird species subsistence pursuits in the area (e.g., seabirds and snow buntings), none of which has continued into modern times. The Johnson River area has been overshadowed by other places, because subsistence practices now

occur in areas much closer and accessible to the present village and town centers of southcentral Alaska.

3.16 Cultural Resources

Lobdell (1993b) discussed in detail the theoretical approaches, research methodologies, existing knowledge, and the results of a field investigation of cultural resources of the Johnson River area. This section, which presents the results and conclusions of that field investigation, is drawn from that report.

Transportation easement. These alternatives all display little soil development as noted from surface examination of stream cuts. The vegetation cover is alder-dominated and impenetrably thick. There are few benches or terraces in the Johnson River U-shaped glacial valley where early habitations might be found. Over the passes and flanking the streams are areas of exposed bedrock. Closer to the stream the increased velocity and mass from spring breakups likely have eradicated any cultural resources in either Johnson River or Bear Creek valleys. Johnson River is sometimes braided and sometimes displays old meanders. In short, it is an active and frequently changing glacially charged stream.

Port easement. No cultural resources were identified at the three port alternatives investigated. The Mudflats port site was not surveyed.

Iliamna Point. The high energy beach is affected by strong inlet currents and open to storm tides, as is obvious from the large cobble to boulder sized beach matrix. The absence of gravels or sands rules it out as an armored beach. The narrow beach is backed by slopes over 75° and choked with alders .

Certainly there is no place where a cultural resource could survive such exposure and no evidence of any past use was noted during survey. The elevated Iliamna Point promontory held some developing soil and was examined from the air, but no evidence of cultural resources was seen. The habitable area is so small and soils so shallow that no additional field consideration was given.

Fossil Point. The beach immediately to the south of Fossil Point displays flat beach stones, likely due to the slaty siltstone fracture planes and appearance that the beach may have been semi-armored prior to channel siltation. Shallow examination of these beach deposits showed larger materials on the surface, typical of armored beaches.

A beach-filled cove just south of Fossil Point, vegetated in beach grasses and salt rye, is the only place that holds moderate potential for cultural resources. Getting above the beach to less potential areas proved impossible due to the impenetrable alders.

Deep Water. The site is directly across Tuxedni Channel from Snug Harbor, site of an occasionally-used abandoned cannery. The beach fronting the port site is well protected from strong currents, although larger pebble matrix is notable at the beach. Backing the beach is the steep northeast side of Slope Mountain. These slopes approach 60° and the narrow beach provides little past human habitat. There is a fragment of a second beach that contains a modern house. The underlying matrix appears to be unconsolidated beach deposits no different from the active beach. This area was examined as best as permissible by alder and devilsclub and found not to contain any cultural resource sites.

3.17 Paleontological Resources

The rock outcrops at Fossil Point are well known and relatively common paleontological resources. Listed on the Alaska Heritage Resources Survey as 49-KEN-042, the location has been reported in more detail by Detterman and Hartsock (1966). The majority of finds are large, now-extirpated mollusks (Mollusca) or brachiopods (Brachiopoda), although other fossil forms have been reported (Lobdell, 1993b). Fossil Point is a popular destination for groups such as the Chugach Gem and Mineral Society and the Alaska Prospectors Club.

No paleontological resources were found along the transportation easement alternatives or at the Iliamna Point and Deep Water port sites.

3.18 Visual Quality

No analysis of the visual quality of the Johnson River area has been done by the NPS. Basic methods to determine the value of visual resources, however, have been developed by the NPS and other land managing agencies. The visual characteristics of a landscape include the visual variety, the number and interest of viewers, and the land's ability to visually change without losing its inherent character. Visual variety has been shown to be a good predictor of viewer preference. The number, interest, and location of viewers are also factors used to identify visually important resources (EPA, 1964).

For any particular area, visual variety classes are determined based on the relative value of the surrounding area. For example, lands with visual variety typical of the region are classified as "common" or Class B lands. Areas with special patterns or vegetation, water, or landforms are considered "distinctive" or Class A lands. Areas with very little variety or interest are considered "minimal" or Class C lands (EPA, 1984).

The Johnson River area is highly scenic (when visible) relative to most of the lower 48 states. Because of its forested and rugged shoreline, the frontal mountains such as Triangle Peak and Slope Mountain, features such a Tuxedni Channel and Chisik Island, and the spectacular backdrop of the Alaska Range dominated by Iliamna Volcano, the entire area is rated variety Class A. The area is remote and the number of visitors and use areas are low, therefore the visual sensitivity of the Johnson River area is considered relatively low.

3.19 Recreation

Recreational use of the Johnson River area is limited largely to the coastal fringe south of the Johnson River. Freshwater and salt water sport fishing, wildlife viewing, and photography are the major recreational uses in this area. No sport fishing occurs in the Johnson River itself, probably due to the silty nature of the water (Smith, 1993).

Recreational clamming occurs on the north shore of Tuxedni Bay, but no significant clamming occurs on the south side of the bay (ADF&G, 1985). The very accessible

fossil rocks in the vicinity of Fossil Point are a popular attraction, being a favorite destination for the Chugach Gem and Mineral Society and the Alaska Prospectors Club. Some bird watching may occur in the vicinity of the bird cliffs on Chisik Island.

3.20 Commercial Uses

Three types of commercial resource use occurs in the Johnson River area. The first is associated with the shore fishery set net sites near the mouth of the Johnson River, at the southeast end of Tuxedni Channel in the vicinity of the Deep Water port site, and at Fossil Point at the northwest end of Tuxedni Channel. Other set net sites are located across the channel on Chisik Island. The Snug Harbor Cannery is no longer in operation as a commercial enterprise.

The second type of commercial use is represented by the Silver Salmon Lodge 3 mi southwest of the mouth of the Johnson River. This lodge operates during the summer and caters to salmon and halibut fishermen, birdwatchers, bear watchers, and photographers.

The third commercial resource use is the mining exploration that is occurring on the Johnson Tract at the head of Johnson River Valley.

Chapter 4

Alternatives

This chapter describes how the transportation and port easements alternatives that are considered in this document were identified. Then, based on the environmental analysis presented in Chapter 6, it describes the process by which these alternatives were evaluated and the preferred alternative selected.

4.1 Alternative Identification

Three criteria were used to identify the transportation and port easements alternatives; they had to be technically feasible, environmentally reasonable, and economically viable.

Because of the topography of the Johnson River area and the location of the ore deposit, identification of transportation easement alternatives that fit these criteria was relatively straightforward. Any easement from the ore deposit to tidewater initially would have to proceed down the Johnson River for at least the first 7.9 mi, logically remaining on the north side of the valley to avoid crossing the river (Fig. 4.1-1). Thus, this 7.9-mi segment is common to all the alternatives. From that point there were two options: continue down the Johnson River Valley to a port on Cook Inlet itself, or turn north to cross Bear Creek Pass and proceed to a port site somewhere on Tuxedni Channel.

There were three primary technical criteria for selection of a port alternative. First, the site had to be adjacent to, or within a reasonable distance of, sufficiently deep water to provide clearance for ocean-going ships. Second, it had to be sheltered sufficiently from the major effects of strong currents, tides, storms, and ice movements. Third, it had to provide enough room for upland port facilities such as ore and fuel storage.

For the transportation easement alternative continuing down Johnson River, the most logical port site is at Iliamna Point approximately 1.5 mi north of the mouth of the Johnson River (Fig. 4.1-1). This transportation and port easements combination was labeled the *Iliamna Point Alternative*.

For the transportation easement through Bear Creek Pass there were initially two port sites that met the criteria. The first was at Fossil Point at the northwest end of Tuxedni Channel. This site is reached by a route down the west side of Bear Creek Valley that crosses Hungryman Creek (Fig. 4.1-1). This transportation and port easements combination was labeled the *Fossil Point Alternative*.

The second port site is near the southeast end of Tuxedni Channel across the channel from the old Snug Harbor Cannery on Chisik Island. This site is reached by a route down the east side of Bear Creek Valley to Tuxedni Channel, and then southeast along the coast to the port site. This transportation and port easements combination was labeled the *Deep Water Alternative.*

Further investigation identified a third site for consideration on Tuxedni Channel. It is located approximately 1.6 miles northwest of the Deep Water port site at a small creek outwash fan (Fig. 4.1-1). While this site is approximately 2,100 ft across mudflats from deep water at low tide, it is more sheltered than the Deep Water port site and would not require the additional 1.6 mi of road construction through difficult terrain required to reach the Deep Water port site. This transportation and port easements combination was labeled the *Mudflats Alternative*.

The preliminary road engineering survey also identified an optional alignment from Johnson River Valley over Bear Creek Pass (Fig. 4.1-1) to be investigated in more detail in 1994.

Table 4.1-1 shows the approximate total length of each alternative and a breakdown of mileage and percent by land ownership. The table assumes that the Native village selections along Tuxedni Channel and near the mouth of Johnson River will be transferred to the village corporations. The first 4.6 mi of the 7.9-mi segment common to all alternatives, in the upper Johnson River Valley, are on the privately owned Johnson Tract.

Table 4.1-1

Approximate Total Length, and Mileage and Percent by Land Ownership, for the Four Transportation and Port Easements Alternatives

Alternative	Total Length Mi	LCNP Mi	Lands %	Private Mi	Lands %	Port Site Land Status
Iliamna Point	16.2	9.1	56	7.1	44	Private
Fossil Point	15.2	7.0	46	8.2	54	Private
Deep Water	15.7	8.2	52	7.5	48	LCNP
Mudflats	14.1	7.0	50	7.1	50	Private

4.2 No Action Alternative

In the no action alternative, no transportation and port easements would be identified or conveyed to CIRI. This alternative may be used as a baseline for comparison with the other alternatives.

PL 94-204, however, states that "The Secretary shall also convey to CIRI an easement for a port... [and] ...a transportation easement..." for shipping and transporting minerals from the Johnson Tract to Cook Inlet. For the Secretary not to fulfill this obligation would require extenuating circumstances which are not known to exist.

4.3 Alternatives Evaluation

This evaluation describes the process by which one alternative was dropped from further consideration and how the other three alternatives were evaluated *relative to each other* to arrive at the preferred alternative. The impacts discussed here are described in more detail in Chapter 6 (Environmental Analysis), and are summarized in the table in Chapter 5 (Impacts of Alternatives Matrix).

Three criteria were used to identify the transportation and port easements alternatives. They had to be technically feasible, environmentally reasonable, and economically viable. Although it appeared early in the evaluation process that the technical feasibility and economic viability of the Iliamna Point Alternative were problematic, this alternative was retained through the evaluation process because it offered the only alternative to a road through Bear Creek Pass and a port on Tuxedni Channel.

Iliamna Point Alternative. Following completion of the 1993 environmental and technical studies, the inability of this alternative to meet any of the three criteria became obvious. From a technical perspective the port site is completely exposed to the forces of Cook Inlet, and therefore would curtail ore loading and fuel transfer operations significantly. For the same reason, the cost of developing and operating this alternative made it nonviable. Environmentally, this alternative would have greater impacts than any other alternative on a majority of resources, particularly wetlands, wildlife, noise, land use, recreation, and commercial uses. For these reasons the Iliamna Point Alternative was dropped from further consideration.

All three remaining alternatives were found to be economically viable.

Fossil Point Alternative. From a technical perspective, this alternative is deficient in that the rocky shoals located beyond the mudflats preclude the site from being accessible by ocean-going ships. The shoals also would make it dangerous to routinely attempt barge loading and fuel transfer operations at the location.

From an environmental perspective the Fossil Point Alternative compared favorably with the Deep Water and Mudflats alternatives. For most resources its impacts relative to the other alternatives were expected to be similar or less severe. The ore-loading facility, however, would cross 850 ft of marine wetlands (mudflats). Because of its paleontological resources, development of this alternative would have a direct impact to an undetermined portion of those resources, and the presence of a port facility would have aesthetic impacts to fossickers in the area.

Economically, this alternative would be the second most expensive, somewhat more costly than the Deep Water Alternative.

Overall evaluation of the Fossil Point Alternative determined that its environmental impacts compare favorably in relation to the other alternatives. Careful design, construction, and operation of the port likely could minimize impacts to paleontological resources and their related recreational use. The technical problem of the rocky shoals, however, meant that this alternative did not meet the technical feasibility criterion.

Deep Water Alternative. This alternative's port site also has a technical problem in that its location near the southeastern end of Tuxedni Channel means it is exposed to the current, tide, wind, and ice forces of Cook Inlet, though not as seriously as Iliamna Point. The degree of this exposure and its consequences on development and operation of this port alternative are subject to ongoing evaluation.

Environmentally, the Deep Water Alternative compares favorably relative to the other alternatives in that it is only a short distance from deep water and would not impact marine wetlands. The ore-loading structure would have a low visual impact. There are several resources, however, for which this alternative would have relatively higher impacts. The road to the port would be visible from offshore at several points along the 2.5 mi stretch adjacent to Tuxedni Channel. The road would pass close to a Bald Eagle nest tree and would require some blasting in the final 1.6 miles. The port site would be on LCNP rather than privately owned land, and would have the highest potential for damage from a fuel spill. The port is located close to two shore fishery set net sites, and development and operation of the port might conflict with those sites.

Economically, this alternative is considered to be the least expensive because of the short length of the ore-loading structure.

Overall evaluation of the Deep Water Alternative determined that while it is the least expensive alternative, it may have unacceptable technical problems from exposure to the forces of Cook Inlet, and it would have several small to moderate environmental impacts relative to the other alternatives.

Mudflats Alternative. This alternative has no known technical problems and is sheltered from Cook Inlet. From an environmental perspective the Mudflats Alternative compares favorably relative to the other alternatives in that its road follows the coast for only 1 mi and the port site is on privately owned land. It also has a lower potential

for damage from a port fuel spill. There are a few resources, however, for which this alternative would have relatively higher impacts. It is the farthest port from deep water, and the ore-loading structure would cross 2,100 ft of marine wetlands and have the highest visual impact. The road and port also are located in the vicinity of a Bald Eagle nest tree.

Economically, this alternative is considered to be the most expensive, primarily because of the length of the ore-loading structure. The transportation easement, however, would be the shortest.

Overall evaluation of the Mudflats Alternative determined that while it is the most expensive, it is the only alternative without a known or potential technical problem, and it would have only a few small to moderate environmental impacts relative to the other alternatives.

4.4 Selection of Preferred Alternative

Because the Fossil Point Alternative does not meet the technical feasibility criterion, it was not considered for the preferred alternative. The capability of a port alternative to handle ocean-going ships, or to be capable of expansion to do so, was considered important because the transportation and port easements selected as a result of this analysis will be expected to serve the future needs of the Johnson Tract. If a port site were to be developed now that could not handle such ships in the future, another port site would have to be developed at a later date if a larger mining project requiring such ships were to emerge.

While the Deep Water Alternative has several resources for which it would have relatively higher impacts than the other alternatives, it is also the least expensive alternative to develop and operate. It may, however, have a technical problem with its exposure to the current, tide, wind, and ice forces of Cook Inlet. The potential for this latter problem is the subject of ongoing evaluation. The Mudflats Alternative has no known technical problems and only a few small to moderate environmental impacts relative to the other alternatives, but it is the most expensive alternative to develop and operate. None of the potential environmental impacts associated with either of these alterna-

tives is considered serious enough to eliminate one or the other from further consideration, and most of those impacts can be mitigated.

In final analysis, on the basis of existing information, it was determined that at this point neither the Deep Water nor the Mudflats alternative is sufficiently superior to the other as to be designated as the preferred alternative. Nor is such a determination necessary now. **Thus, identifying both the Deep Water and the Mudflats alternatives as co-preferred alternatives would be in the best interests of CIRI, Westmin, and the NPS at this time.**

In practice, the transportation easement part of both alternatives is identical, save for the additional 1.6 mi to the Deep Water port site. Therefore, almost the entire preferred transportation easement is known. Selecting co-preferred alternatives will allow the three parties to conduct necessary studies on the selected transportation easement as well as to more fully investigate each port alternative and the additional 1.6 mi of road between the Mudflats and Deep Water port sites during the 1994 field season. This will allow maximum flexibility for all parties and yet maintain a schedule compatible with the overall timeframe for continued exploration, identification and conveyance of the easements, and the environmental permitting program.

Chapter 5

Relative Impacts of Alternatives Matrix

This chapter presents in matrix form a resource-by-resource summary of the relative impacts for each transportation and port easements alternative. The impacts listed in the matrix are a condensation of those discussed in greater depth in Chapter 6 (Environmental Analysis). The No Action Alternative is not listed in the matrix since in all cases that alternative would result in the status quo.

Resource	Iliamna Point	Fossil Point	Deep Water	Mudflats
Surface Water Hydrology	No significant impact provided that prudent stream crossing design and construction practices are adhered to for the road	No significant impact provided that prudent stream crossing design and construction practices are adhered to for the road	No significant impact provided that prudent stream crossing design and construction practices are adhered to for the road	No significant impact provided that prudent stream crossing design and construction practices are adhered to for the road
Floodplain Management	No significant impact	No significant impact	No significant impact	No significant impact
Wetlands	Crosses only ~21,000 ft of wetlands, but highest secondary impacts. Minimal marine wetlands impact	Crosses ~26,000 ft of wetlands. Second highest marine wetland impacts (3.9 ac)	Crosses ~26,000 ft of wetlands. Minimal marine wetlands impact	Crosses ~26,000 ft of wetlands. Highest marine wetlands impact (9.5 ac)
Water Quality	Highest potential for road impact because of location next to high value coho rearing habitat in Johnson River Valley	Higher potential for port fuel spill damage because of location amid mudflats and shore fishery set net site	Highest potential for port fuel spill damage because of location near shorebird feeding area, mudflats, and shore fishery set net sites	Moderate potential for port fuel spill damage because of location amid mudflats

Relative Impacts of Alternatives Matrix (cont'd.)

Resource	Iliamna Point	Fossil Point	Deep Water	Mudflats
Fish	No significant impact provided a properly designed ore-loading structure is used to permit fish movements	No significant impact provided a properly designed ore-loading structure is used to permit fish movements	No significant impact provided a properly designed ore-loading structure is used to permit fish movements	No significant impact provided a properly designed ore-loading structure is used to permit fish movements
Wildlife	Greatest impacts for direct habitat loss, indirect habitat loss, and for animal movements	No significant impact	Transportation easement passes close to a Bald Eagle nest tree	Transportation and port site easements close to a Bald Eagle nest tree
Threatened/Endangered Species	No significant impact	No significant impact	No significant impact	No significant impact
Air Quality	No significant impact	No significant impact	No significant impact	No significant impact
Noise	Greatest impacts to wildlife and people from road and port activities. Greatest impacts to marine mammals from underwater noise	Moderate impacts to wildlife and people from road and port activities. Least impact to marine mammals from underwater noise	Moderate impacts to wildlife and people from road and port activities. Moderate impacts to marine mammals from underwater noise	Moderate impacts to wildlife and people from road and port activities. Moderate impacts to marine mammals from underwater noise

Relative Impacts of Alternatives Matrix (cont'd.)

Resource	Iliamna Point	Fossil Point	Deep Water	Mudflats
Land Use & Coastal Zone Management (CZM)	5.8 mi (70%) of non-common transportation easement segment on LCNP lands. Port site on private lands. Conforms with CZM	3.7 (50%) mi of non-common transportation easement segment on LCNP lands. Port site on private lands. Conforms with CZM	4.9 mi (63%) of non-common transportation easement segment on LCNP lands. Port site on LCNP lands. Conforms with CZM	3.7 mi (60%) of non-common transportation easement segment on LCNP lands. Port site on private lands. Conforms with CZM
Subsistence	No significant impact	No significant impact	No significant impact	No significant impact
Cultural Resources	No significant impact	No significant impact	No significant impact	No significant impact
Paleontological Resources	No significant impact	Direct impact to undetermined portion of the resources because of construction of road and port site	No significant impact	Not surveyed
Visual Resources	Up to 1.5 mi of road visible from Cook Inlet. Port would have a relatively small visual impact	Road would be difficult to see. Port would have a moderate visual impact	Up to 2.5 mi of road visible from Tuxedni Channel. Port would have a relatively small visual impact	Up to 1 mi of road visible from Tuxedni Channel. Port would have highest visual impact

Relative Impacts of Alternatives Matrix (cont'd.)

Resource	Iliamna Point	Fossil Point	Deep Water	Mudflats
Recreation	Aesthetic impacts from noise on recreational use at Silver Salmon Lodge and Creek	Aesthetic impacts to fossickers at well known fossil site	No significant impact	No significant impact
Commercial Uses	Aesthetic impacts from noise on recreational uses at Silver Salmon Lodge	No significant impact	Possible conflict with shore fishery set net sites	No significant impact
Technical Considerations	Port completely exposed to current, tide, wind, and ice forces of Cook Inlet, significantly curtailing ore loading and fuel transfers. Short distance to deep water. Road requires some blasting	Port sheltered, but rocky shoals make dangerous for barge maneuvering and unsuitable for future expansion for ocean-going ships. Deep water 850 ft from shore. Road presents no technical difficulties	Port exposed to some current, tide, wind, and ice forces of Cook Inlet, potentially limiting ore loading and fuel transfers. Short distance to deep water. Road requires some blasting	Port sheltered, but deep water 2,100 ft from shore. Road presents no technical difficulties
Economic Considerations	Not economically viable	Second most expensive economically viable alternative	Least expensive economically viable alternative	Most expensive economically viable alternative

Chapter 6

Environmental Analysis

The purpose of this chapter is to analyze the transportation and port easements alternatives to evaluate the relative magnitude, intensity, duration, and incidence of environmental impacts between those alternatives.

Each resource section begins with a brief *summary* of the major relative impacts of the alternatives, then describes the generic impacts that likely would be caused by construction and operation of a road and port and, where appropriate, discusses the specific impacts of each alternative. Because the first 7.9 mi of all transportation easement alternatives is a common segment, the comparisons between alternatives concentrate on their non-common segments and port sites. For certain resources some of the mitigation measures that would be used to lessen impacts are described.

6.1 Surface Water Hydrology

Development of any of the transportation and port easements alternatives would have no significant impact on surface water hydrology provided that prudent stream crossing design and construction practices are adhered to for the road.

None of the alternatives crosses the Johnson River or any other large drainage. The streams that would be crossed all have relatively small drainage areas, and crossing locations and methods would not present any difficult problem areas.

6.2 Floodplain Management

Development of any of the transportation and port easements alternatives would present no significant floodplain management problems.

With the exception of a short portion of the Iliamna Point transportation easement alternative, none of the road or port structures for any alternative would be within or

close to an active floodplain other than at stream crossings. The transportation easement segment common to all alternatives would follow the north side of the Johnson River Valley, as would most of the Iliamna Point Alternative (Fig. 4.1-1). These easement segments, however, would be outside the active floodplain of the Johnson River. As well, the transportation easement alternatives that traverse Bear Creek Pass would be outside the active flood plain of that creek.

One short stretch of the Iliamna Point Alternative approximately 2 mi from the mouth of the Johnson River would be immediately adjacent to the river. A road at this location would have to blasted from the steep side of Slope Mountain and would be constructed high enough above the river to avoid being in the floodplain.

6.3 Wetlands

Each of the transportation easement alternatives would impact jurisdictional wetlands. The Fossil Point, Deep Water, and Mudflats alternatives would cross approximately the same distance and number of major and minor wetlands. The Iliamna Point Alternative would cross approximately 19 percent fewer wetlands, but likely would have higher secondary impacts because it would be directly adjacent to high value coho rearing and swan nesting habitat. None of the port alternatives would have significant terrestrial or marine wetlands impacts. The Iliamna Point and Deep Water ports would have the fewest marine (tidelands) impacts while the Mudflats and Fossil Point ports would have higher impacts.

Table 6.3-1 presents a comparison of the wetlands that would be crossed by the alternatives.

The Fossil Point, Deep Water, and Mudflats transportation easement alternatives cross approximately the same distance and number of major and minor wetlands. The Iliamna Point Alternative crosses approximately 5,000 ft (19 percent) fewer wetlands than the other alternatives, although it crosses twice as many minor wetland areas. While Table 6.3-1 appears to indicate that the Iliamna Point Alternative would have lower wetland impacts, because the type of wetlands it crosses are directly adjacent to important coho rearing and trumpeter swan nesting and rearing habitats, the sec-

ondary impacts to these high value wetlands likely would be higher than alternatives.

Table 6.3-1

Comparison of Wetlands Crossed by the Transportation Easement Alternatives

Attribute	Iliamna Point	Fossil Point	Deep Water	Mudflats
Length (mi)	16.2	15.2	15.7	14.1
Number of Major Wetland Crossings	4 (~14,000 ft)	4 (~23,000 ft)	4 (~23,000 ft)	4 (~23,000 ft)
Number of Minor Wetland Crossings	8 (~ 7,000 ft)	4 (~3,000 ft)	3 (~3,000 ft)	3 (~3,000 ft)
Total linear feet	~21,000	~26,000	~26,000	~26,000

None of the port alternatives would have significant impacts on terrestrial wetlands, but each would have some impact on marine (tideland) wetlands. The Iliamna Point and Deep Water port sites would have the fewest impacts since they are adjacent to relatively deep water and are not associated with mudflats. Development of the Fossil Point port site would require crossing approximately 850 feet of mudflats, and development of the Mudflats port site would require crossing approximately 2,100 ft of mudflats. If a rock-fill causeway were constructed at these sites, it would cover approximately 9.5 and 3.9 ac of mudflats, respectively. At the Mudflats port site this would represent approximately 0.7 percent of the area of all the mudflats between the Deep Water port site and the Fossil Point port site, and would not be significant.

6.4 Water Quality

Impacts to water quality from development of any of the transportation and port easements alternatives would be small. The Iliamna Point Alternative, however, would have the highest potential for impacts to water quality because the road would cross the most streams and many of them drain into the high value coho rearing habitat in

the middle and lower Johnson River Valley. The three port alternatives in Tuxedni Channel would have the highest potential for damage from a fuel spill, but standard permit stipulations, operating procedures, and scheduling would reduce the potential for damage substantially.

A properly constructed and maintained road in any of the alternative transportation easements would minimize water quality degradation from siltation. Some siltation and erosion would occur during construction, but standard mitigation measures would reduce their impacts substantially.

The risk of a fuel spill occurring would be similar for any of the transportation easement alternatives, but the potential for damage would be different. Because the Iliamna Point Alternative crosses more streams and would be adjacent to the high value coho rearing habitat in the middle and lower Johnson River Valley, potential for damage would be greater for this alternative.

The risk of a fuel spill occurring likely would be greater at the Iliamna Point port site since it would be exposed to the full force of Cook Inlet currents, tides, storms and ice movements. The potential for damage from a spill, however, would be greater at the other three port alternatives. The Deep Water port site is only 0.5 miles from an area heavily used by feeding kittiwakes and other sea birds, and is adjacent to the Tuxedni Channel mudflats. The Mudflats and Fossil Point port sites are surrounded by mudflats. These mudflats are important to migrating shorebirds in early and mid-may, and a spill during that period could be serious to those migrants. All of these alternatives are also in the vicinity of commercial shore fishery set net sites.

The risk of a spill at any port would be reduced very substantially by proper design, construction, and operation of the site. The port facility would be required to have a Spill Prevention, Containment, and Countermeasure (SPCC) Plan. All fuel would be transferred from a barge to an upland storage facility under U.S. Coast Guard regulations. These include use of a permanent fuel header hookup and hoses that are not suspended directly over water at any point. The fuel storage facilities would be located on uplands in lined, diked and bermed areas capable of holding at least 115 percent of the facility's full capacity. Fuel barges likely would visit the port no more than four times per year, and would specifically avoid the April 20 through May 20 pe-

riod of shorebird migration. It is likely that fuel barge visits also could be scheduled to avoid peak fishing periods at the commercial shore fishery set net sites.

6.5 Fish

Development of any of the transportation and port easements alternatives would have no significant impact on fish resources provided prudent stream crossings design and construction practices are used for the road, and that a properly designed ore-loading structure is constructed to permit coastal fish movements.

The Iliamna Point, Fossil Point, and the Deep Water and Mudflats alternatives would cross, respectively, only two, one, and no streams listed by ADF&G as important to the spawning, rearing, or migration of anadromous fish.

The most important freshwater fish habitat in the Johnson River area is in the Johnson River itself. All transportation alternatives follow the north side of the Johnson River Valley, while salmon spawning and rearing habitat on the north side of the valley is limited primarily to the valley bottom which is not traversed by any of the alternatives. Most northern tributaries to the main river are steep and cannot be considered fish habitat.

Fisheries considerations should not be a major determining factor in the selection of a transportation easement (Morsell, 1993). None of the alternatives is in direct association with high value fish habitats, and all could be constructed without significant damage to fish resources by employing prudent stream crossing design and construction practices. The Iliamna Point Alternative that follows the lower Johnson River would, perhaps, involve more complications related to fish than the other alternatives because of its closer proximity to known salmon spawning areas and because of engineering difficulties associated with avoiding the north channel of the Johnson River where it flows against the steep base of Slope Mountain approximately 2 miles from its mouth (Morsell, 1993).

The barge loading structures at the Iliamna Point and Deep Water port alternatives would be short and would not have a significant impact on fish movements along the coast. The respective 2,500 ft and 1,275 ft ore-loading structures at the Mudflats and

Fossil Point alternatives, however, could impede fish movements unless they are properly designed. A structure on pilings, periodic sheet pile conveyor foundations, or a periodically breached rock-fill causeway at either site would not affect fish movements significantly.

6.6 Wildlife

Direct habitat loss, both quantitatively and qualitatively, would be greatest for the Iliamna Point Alternative. Indirect habitat loss also would be greatest for the Iliamna Point Alternative. Both the Deep Water and Mudflats alternatives pass close to a Bald Eagle nest tree. The Iliamna Point Alternative would have the greatest affect on animal movements because it traverses winter moose habitat and likely would cause the highest number of winter road kills.

Three types of wildlife impacts would occur from constructing a road and port: (1) direct habitat loss, (2) indirect habitat loss (the effective loss of habitat through avoidance because of human activities and associated noise), and (3) effects on animal movements (by directly or indirectly altering traditional movement patterns).

6.6.1 Direct habitat loss

Transportation easement. Quantitatively, total direct habitat loss from construction of a road within the non-common transportation easement alternatives segments would be least for the Mudflats alternative (6.2 mi long). Direct habitat loss from the Iliamna Point (8.3 mi), Deep Water (7.8 mi), and Fossil Point (7.3 mi) alternatives would be, respectively, 34, 25, and 18 percent greater than from the Mudflats Alternative.

Qualitatively, direct habitat loss from the Iliamna Point Alternative would be greatest because it traverses the north side of the high value wildlife habitat in the middle and lower Johnson River Valley. The other alternatives traverse lower value wildlife habitat in Bear Creek Valley and would have approximately the same relative qualitative impacts.

Port easement. Each of the port alternatives would impact directly approximately the same area of terrestrial habitat. The Mudflats Alternative would have a barge loading structure extending across approximately 2,100 ft of mudflats, and at the Fossil Point Alternative the structure would cross approximately 850 ft of similar mudflats. If a rock-fill causeway were constructed at these alternatives, the area of mudflats filled by these structures would be approximately 9.5 and 3.9 ac, respectively. At the Mudflats port site, this would represent approximately 0.7 percent of the area of all the mudflats between the Deep Water port site and the Fossil Point port site and would not be significant.

6.6.2 Indirect habitat loss

Transportation easement. From an indirect habitat loss perspective, the Iliamna Point Alternative also would have the greatest impact because of its location adjacent to the high value wildlife habitat in the middle and lower Johnson River Valley. Of particular concern would be the noise and activity impacts from a road on nesting trumpeter swans in summer, and on moose in winter. The proposed route would pass immediately adjacent to the area in which 30 moose were aggregated in December of 1992 (Fig. 3.10-1).

The other alternatives avoid the middle and lower Johnson River Valley and do not traverse high value wildlife habitat or concentration areas. The Deep Water and Mudflats alternatives, however, pass close to a Bald Eagle nest tree (Fig. 3.10-1). The Mudflats port site itself is close to the tree. This nest was active in 1993 and construction of a road or port site in its vicinity likely would be subject to time and distance constraints.

For all alternatives, the activity and noise generated by a road likely would cause some avoidance of a road corridor by brown bears. Because documented bear denning sites are all at substantially higher elevations than any of the transportation easement alternatives, direct denning habitat loss is unlikely. If brown bears do avoid the road corridor, however, there could be indirect loss of denning habitat. Because of the nature of the topography of the Johnson River area, and the relatively low to moderate brown bear population, denning habitat is unlikely to be a limiting factor.

Port easement. With the exception of the Bald Eagle nest tree adjacent to the Mudflats Alternative, indirect terrestrial habitat loss would be low and similar for all four port alternatives. On tidelands, the Mudflats Alternative would have a barge loading structure extending across approximately 2,100 ft of mudflats in an area that annually receives high shorebird use during migration from late April to mid-May. The Fossil Point Alternative would cross approximately 850 ft of similar mudflats. If necessary, suspension of barge loading activities during this short-term intensive use period would avoid disturbance to shorebirds at these sites.

Underwater noise generated by barge loading activities would be similar for all port alternatives (see Section 6.9, Noise). Noise generated at the alternatives closest to Cook Inlet (e.g., Iliamna Point), however, likely would be heard by more marine mammals than those more distant from the inlet (e.g., Fossil Point). Because barge loading would occur only approximately twice each month during the year, it is unlikely that any of the port alternatives would cause significant indirect habitat loss to marine mammals due to underwater noise.

6.6.3 Animal movements

Transportation easement. None of the transportation easements physically would prevent movements by any species. Brown bears, however, would tend to avoid the activity of the road corridor and their traditional movement patterns might be altered to some extent. This likely would apply equally to all alternatives.

Because it is adjacent to moose winter habitat, the Iliamna Point Alternative likely would attract considerably greater numbers of moose to its plowed road corridor in winter. These animals would be subject to being killed by vehicles at a higher rate than for the other alternatives.

Port easement. The Iliamna Point and Deep Water port alternatives would have no impact on terrestrial or marine wildlife movements. The Mudflats and Fossil Point port alternatives, with their mudflats barge loading structure, would pose only minor impediments to marine mammal or shorebird movements.

6.7 Threatened and Endangered Species

Selection of any of the transportation route and port easements alternatives would have no significant impact on threatened or endangered species.

In the Johnson River area, the FWS (1993) has no records for any candidate, listed, or proposed threatened or endangered species under its jurisdiction. The American Peregrine Falcon (*Falco peregrinus anatum*) could migrate through the area, however, the proposed mining activities and operation of a road and port would not affect this species adversely . The Harlequin Duck may occur along the rapidly flowing upper Johnson River, but the proposed activities likely would not affect this species adversely (FWS, 1993).

The threatened Steller sea lion is uncommon in the Johnson River area, and the endangered Gray and humpback whales have not been reported that far north in Cook Inlet. Therefore, operation of any of the port alternatives, and the related ore and fuel barge traffic, would not affect these species significantly (Faris, 1993).

6.8 Air Quality

Selection of any of the transportation and port easements alternatives would have no significant impact on air quality.

For any of the alternatives, the primary impacts to air quality would be from exhaust emissions and dust generation from road vehicles and port activities. The exhaust emissions would be very small, virtually identical for all alternatives, and insignificant given the remote nature of the Johnson River area.

Fugitive dust impacts from road operations, and possibly from stockpiled ore at the port site, likewise would be similar for all alternatives. If dust became a problem, particularly in dry weather, control measures could be used to lower fugitive dust levels. For the road, these measures might include: constructing the road surface of a harder crushed rock; water spraying on dry days; use of chemical stabilizers (e.g., calcium chloride [$CaCl_2$] and magnesium chloride [$MgCl_2$], and binders); use of wind screens

and berms; and revegetation of road shoulder embankments and cuts and fills (EPA, 1984).

Adequate sources of water exist along all the routes so dust control spraying would not significantly reduce surface water flows or impact biological resources. If applied properly at the beginning of a dry period, common dust palliatives such as calcium or magnesium chloride could effectively prevent suspension of up to 90 percent of visible dust. These stabilizers might have to be reapplied after rain storms or during heavy traffic periods, but they would have no significant impact on surface water quality. Revegetation procedures would include mulching and, where necessary, fertilization. Use of these dust control measures as appropriate would reduce potential impacts to roadside vegetation to insignificant levels (EPA, 1984).

At the port site, proper orientation of the ore stockpile, and use of wind screen berms and water sprays, could be used to protect fine grained material. In dry, windy weather, ore could be water sprayed to prevent fugitive dust during front-end loader or conveyor barge loading operations.

6.9 Noise

Selection of any of the transportation and port easements alternatives would have some impacts on human and wildlife receptors. The Iliamna Point transportation easement would have significantly higher impacts on wildlife and people. The other transportation easement alternatives would have relatively moderate impacts on wildlife and people. The underwater noise sources at each of the port site alternatives would be similar. Because barge loading would occur an average of only twice each month of the year, it is unlikely that any of the port alternatives would generate enough noise to cause more than an insignificant impact to marine mammals.

Transportation easement. During construction of the road, noise disturbance would occur from drilling and blasting activities at the borrow sites, and from trucks hauling borrow material for road building. Blasting sound pressure levels are normally thought of as relatively loud noises. Blasting noise, however, propagates in lower frequencies somewhat like a thunderclap. Low frequency sound of this type usually is tolerable since it would occur infrequently (EPA, 1990).

During operations, up to 25 to 30 round trips per day would be made by ore trucks between the mine and the port site. A few additional daily round trips would occur by tanker or supply trucks and light utility vehicles. In summer a grader would maintain the road, and in winter snow plows or snow blowers would operate to keep the road cleared.

Sources of noise along the road route would be as follows:

Ore truck/trailer units	90 dB(A) at 50 ft
Tanker/supply trucks	90 dB(A) at 50 ft
Utility/passenger vehicles	80 dB(A) at 50 ft
For comparison (EPA, 1990):	
OSHA regulation (15 min. exposure)	115 (max. allowable)
Jackhammer	95 dB(A) at 50 ft
OSHA regulation (8 hour)	90 dB(A) @ ear
Automobile (65 mph)	71 dB(A) at 50 ft
Typical outdoor noise (wind, rain)	40 dB(A) at 50 ft
Soft whisper	25 dB(A) at 6 ft

Maximum road sound levels would be approximately 90 dB(A) at 50 ft. Sound from the road would be intrusive (to human conversation) under optimum propagation conditions (low temperature inversion) out to a distance of 0.5 mi, and noticeable above normal background sound levels of wind and rain to approximately 5 mi from the road (EPA, 1984). Noise disturbance to visitors to the Johnson River area would be unavoidable within 5 mi of the road; however, there are very few visitors to the area. Wildlife, which is generally more sensitive to noise than humans, likely would notice sound at a greater distance (EPA, 1984).

Iliamna Point. This alternative would have the greatest noise impacts on wildlife because it follows the north side of the Johnson River Valley for its full length, skirting the high value wildlife habitat in the middle and lower valley. In this area, noise emanating from the road would be of particular concern to nesting trumpeter swans in summer, and to moose in winter. The proposed route would pass immediately adjacent to

the area in which 30 moose were aggregated in December of 1992. This alternative also would cause the greatest noise disturbance to people, particularly to fishermen and other recreational users and residents in the Silver Salmon Creek and Silver Salmon Lodge areas south of the mouth of Johnson River.

Fossil Point. This alternative avoids the middle and lower Johnson River Valley and does not pass through high value wildlife habitat. The road would pass near one trespass cabin that is located close to the port site. Noise from this road would be audible to commercial fisherman on the west side and northwest end of Chisik Island, and possibly to users of the old Snug Harbor Cannery at the southeast end of the island.

Deep Water and Mudflats. These alternatives avoid the middle and lower Johnson River Valley and do not pass through high value wildlife habitat. The road would pass near four trespass cabins located along the edge of the channel. Noise from this road would be audible to commercial fisherman on the west side and northwest end of Chisik Island, and to users of the old Snug Harbor Cannery at the southeast end of the island across the channel from the Deep Water port site.

Port easement. Noise sources at the port site and barge loading facility would be propagated through the air and the water. Onshore air-propagated noise sources would include:

Ore truck/trailer units	90 dB(A) at 50 ft
Tanker/supply trucks	90 dB(A) at 50 ft
Front-end loaders	90 dB(A) at 50 ft
Conveyor	78 dB(A) at 33 ft
Diesel power generator	85 dB(A) at 50 ft

The combined sound level at 50 ft would be approximately 94 dB(A) assuming all sources were operating simultaneously. During normal wave and wind conditions (generating 30 to 50 dB[A]), such a sound level would be discernable at a distance of 1 to 2 mi (EPA, 1984).

The air-propagated noise levels at each port alternative essentially would be the same as described above for their respective road alternatives. Since there only would be approximately two barges loaded each month, the noise generated by ongoing ore

truck hauling and ore deposition at the port sites likely would have a greater impact than the short term ore-loading operations.

Offshore underwater noise sources would be:

Barge/tug operations (moving)	106 dB at 1,000 ft
Barge/tug generator (stationary)	102 dB at 1,000 ft
Ore transfer operations	92 dB at 1,000 ft

Noise levels are stated in dB rather than dB(A) since the characteristics of marine mammal hearing are different than those of humans. Non-winter natural underwater sound levels range from 30 to 75 dB. Natural ambient sound levels underwater with moving ice present range from 75 to 85 dB. In comparison, moderate to heavy shipping noises range from 70 to 75 dB (EPA, 1984).

Background underwater noise sources would include ice action, waves, wind, rain, and marine life. Potential noise sources from the port and transfer facilities would be discernable above natural background sound levels for approximately 5 to 10 mi underwater.

The underwater noise sources at each of the port alternatives would be similar. The Iliamna Point site, however, is more exposed to the open waters of Cook Inlet and noise therefore would be more likely to reach marine mammals traveling in the inlet. This would be somewhat attenuated by the higher natural background sounds associated with this site's more exposed location. Because of their progressively greater distance from Cook Inlet proper, sounds from the Deep Water, Mudflats, and Fossil Point port sites would have progressively less impact on marine mammals, respectively. Because barge loading likely would occur only approximately twice a month during the year (approximately 20 to 24 ore barge trips per year), it is unlikely that any of the port alternatives would generate enough underwater noise to cause more than an insignificant impact to marine mammals.

6.10 Land Use and Coastal Zone Management

The land use impacts from developing any of the transportation and port easements alternatives would differ primarily with respect to the control that could be exerted by

the underlying landowner. For all transportation easement alternatives, at least 50 percent of the non-common route segment crosses LCNP lands (Fig. 4.1-1). Only the Iliamna Point port site is on LCNP lands. The other three port sites, Fossil Point, Deep Water, and Mudflats, are on lands to be conveyed to Native village corporations. Mining and related transportation activities in the Johnson River area are permitted under the Kenai Peninsula Borough Coastal Management Program.

A major portion of the transportation easement would cross LCNP lands regardless of the alternative chosen. Excluding the first 7.9-mi segment of the transportation easement, which is common to all transportation easement alternatives, Table 6.10-1 shows the approximate mileage and percentage of the non-common segment for each transportation and port easements alternative that would be on LCNP and privately owned lands. The table assumes that the Native village land selections along Tuxedni Channel and near the mouth of Johnson River will be transferred to the village corporations.

Table 6.10-1

Approximate Mileage and Percent of the Non-Common Segment of Each Transportation and Port Easements Alternative Across LCNP and Private Lands

Alternative	Total Length	Non-Common Segment Length	LCNP Lands Mi	LCNP Lands %	Private Lands Mi	Private Lands %	Port Site Land Status
Iliamna Point	16.2	8.3	5.8	70	2.5	30	Private
Fossil Point	15.2	7.3	3.7	50	3.6	50	Private
Deep Water	15.7	7.8	4.9	63	2.9	37	LCNP
Mudflats	14.1	6.2	3.7	60	2.5	40	Private

The six trespass cabins along the southwestern shore of Tuxedni Channel would not be affected by the Iliamna Point Alternative, but would be affected by the other alternatives. The Fossil Point Alternative would impact one trespass cabin that is located close to the port site (Fig. 4.1-1). The Deep Water Alternative passes near four tres-

pass cabins/houses located along the edge of the channel. The Deep Water port site itself is within approximately 0.4 miles of two of those four cabins/houses, as well as within the same distance of still another cabin/house just southeast of the port site. The transportation easement to the Mudflats port site would impact only the one cabin/house at the port site itself.

All four port sites would be partially built on state tidelands and would require a tidelands lease for that part of the port facility.

The Johnson River area is under the purview of the Kenai Peninsula Borough Coastal Management Program, and mining activities on the Johnson Tract and related transportation activities in the area must be conducted according to its provisions. Since mineral exploration and logistical support activities began on the Johnson Tract in the early 1980s, they have been found consistent with the coastal management program.

6.11 Subsistence

Selection of any one of the transportation and port easements alternatives would have no significant impact on subsistence resources, or access to them, because there is no present use of subsistence resources in the Johnson River area.

6.12 Cultural Resources

Selection of any one of the three transportation and port easements alternatives would have no significant impact on cultural resources.

No cultural resources were identified along any of the transportation easement alternatives nor at any of the port easement alternatives. Only the Fossil Point port site holds any reasonable potential of containing cultural resources. If this location were selected for the port site and cultural resources were found, potential impacts could be mitigated by avoiding those resources or, if necessary, excavating the site under a plan approved by the State Historic Preservation Office and the American Council on Historic Preservation.

Transportation easement. The transportation easement alternatives are of very low potential for containing cultural resources. The nature of cultural resources inland along any of the routes would be of a diminutive nature. Any past inland hunting might only be recognized by the rare chance finding of an ephemeral encampment by one or two individuals or a solitary hunting implement left from a kill. Finding sites of this type is unlikely in this area of heavy spring runoff, neoglaciation, and impenetrable vegetation (Lobdell, 1993b).

Port Easement. No cultural resources were found at any of the three port sites investigated.

Iliamna Point. This site holds no potential for containing discoverable cultural resource sites. A very narrow high energy beach is backed by nearly vertical slopes and the only near-level elevated ground is too small and exposed for any serious consideration as a place for human use.

Fossil Point. This site holds only moderate potential of containing cultural resources on vegetated secondary beaches immediately south of Fossil Point near an existing cabin.

Deep Water. This site holds little, if any, potential for discoverable cultural resources. A very narrow active beach is backed by steep slopes.

6.13 Paleontological Resources

Paleontological resources are found only at Fossil Point. Development of this alternative would have an undetermined, but likely small, impact on these resources.

The paleontological resources at Fossil Point would be impacted by development of a port site. Though likely small, it is not possible to determine the degree of impact until a more detailed design of a port facility is developed. No paleontological resources were found along the transportation easement alternatives or at the Iliamna Point or Deep Water port sites. The Mudflats port site was not surveyed.

The paleontological resources at Fossil Point are common types, but may need further management consideration as to their significance. Considerations should include the ease of study of these resources in the greater context of the geology of Cook Inlet, rather than just the commonality of the fossils themselves (Lobdell, 1993b).

6.14 Visual Quality

The variety and scale of the landscape is such that visual impacts from development of any of the alternatives would occur only to viewers relatively close to the road or port site. The Iliamna Point Alternative would have 1.5 mi of road visible from Cook Inlet, and the port would have a relatively small visual impact. The Fossil Point Alternative road would be difficult to see, but the port site would have a relatively moderate visual impact. The Deep Water Alternative would have up to 2.5 mi of road visible, but the port site would have a relatively small visual impact. The Mudflats Alternative would have only 1 mi of road visible, but its port site would have the highest relative visual impact. Most port-related impacts could be mitigated by use of natural screening, earth-tone coloring of structures, and dust control measures.

The vantage point of the large majority of viewers of the Johnson River area is from the Kenai Peninsula or from the adjacent marine waters of Cook Inlet or Tuxedni Bay and Tuxedni Channel. A few terrestrial based viewers would see the road and port easements from shore fishery set net sites on Chisik Island and along Tuxedni Channel, as would viewers at the old Snug Harbor Cannery. None of the development associated with construction and operation of a road and a port site would be visible from the Kenai Peninsula, and the ability of viewers to see such improvements from adjacent marine waters or set net sites would depend on distance and specific viewing angles.

Transportation easement. All transportation easement alternatives would be located in areas of relatively high visual variety. Road construction would meet visual subordinate criteria if surfacing material were selected which would not contrast with the natural landscape. Local gravel borrow sites would be selected in areas with minimal visual impacts, and would be contoured and revegetated, while rock quarries would be made to resemble surrounding rock outcrops.

The Iliamna Point Alternative road would be visible for a distance of approximately 1.5 mi from the mouth of the Johnson River to the port site by viewers on Cook Inlet. A road to the other port alternatives would be visible for greater distances. As the road descended to the north from Bear Creek Pass, portions of it might be visible to viewers on Chisik Island or from the waters of Tuxedni Channel. At lower elevations in Bear Creek Valley, the road itself generally would not be visible, but the altered vegetation line from land clearing might be visible. These visual changes, however, would be in the background, small, and of minor importance to viewers given the sweep and variety of the backdrop.

For the Fossil Point Alternative, the road likely would be constructed away from the shoreline for virtually its entire length until it reached the port site. The road to the Deep Water port site, however, would be forced by terrain to be close to the edge of Tuxedni Channel for approximately 2.5 mi and likely would be visible at several locations in the foreground to viewers on Tuxedni Channel or Chisik Island. For the Mudflats alternative, the road distance along the shore would be only approximately 1 mi. These visible portions of the road would cause low to moderate visual impact, ameliorated to some extent by the presence of five existing cabins/houses along the same stretch of shoreline.

For all of the transportation alternatives, dust plumes raised by road traffic or from the road surface by winds, including locations not otherwise visible, could be visible at substantial distances. Mitigation measures would be used to control such fugitive dust. (see Section 6.8, Air Quality)

Port easement. Depending on port location, required water depth, and the distance from shore necessary to reach that depth, the ore-loading facility could be a relatively short nearshore structure or a long structure reaching 2,500 ft from shore. Because of their location close to deep water, the Iliamna Point and Deep Water port sites would have a relatively short nearshore bulkhead that would have a relatively small visual impact. The Fossil Point and Mudflats port sites, however, would require a longer structure to cross mudflats.

Such a longer structure could be built on pilings, periodic sheet pile conveyor foundations, or a periodically breached rock-fill causeway. These facilities would be visible in

the foreground to viewers on Tuxedni Channel or Chisik Island. The impact of a long structure would be lessened to some extent because it would be close to the water and offer little silhouette. Those portions of the structure using metal or wood would be darkened to decrease contrast. A rock-fill causeway would tend to blend naturally with the surroundings.

The ore stockpile would gradually increase in size between barge visits, becoming more obvious over time to viewers on Tuxedni Channel or Chisik Island. The color of the ore, however, is such that it would tend to blend naturally with the backdrop of the coastal uplands.

The fuel storage facilities would be located on uplands above the vegetation line, and if site conditions permit would be screened from Tuxedni Channel by natural vegetation. If that were not possible, the facilities would be painted earthen tones to minimize contrast.

Under dry and windy conditions, the ore storage pad and stockpile could produce dust plumes. The stockpiled ore, however, would have relatively few fines and under most conditions dust plumes are not expected. If such plumes were to become a problem, the ore pad and stockpile would be sprayed with water or chemical stabilizers as described in Section 6.8 (Air Quality).

6.15 Recreation

Development of the Iliamna Point Alternative would impact aesthetically sport fishermen and other recreational users at Silver Salmon Creek and Silver Salmon Lodge because of the noise from road traffic and the facilities at the port site. Likewise, development of the Fossil Point alternative would impact aesthetically the recreational fossickers drawn to the location's well known paleontological resources. Neither the Deep Water nor the Mudflats alternatives likely would have any discernable effect on recreation.

6.16 Commercial Uses

The Iliamna Point, Fossil Point, and Mudflats port sites likely could be constructed and operated without directly affecting use of any shore fishery lease. The Deep Water port site, however, is located in the immediate vicinity of two shore fishery leases. Construction and operation of a port site at this location might conflict with operation of these leases. Development of the Iliamna Point Alternative likely would have an aesthetic impact on clients at Silver Salmon Lodge because of noise from the road, and possibly the port site, that would be audible at the lodge.

6.17 Technical Considerations

All the transportation easement alternatives are technically feasible. The Iliamna Point Alternative port is technically unfeasible because it is completely exposed to the forces of Cook Inlet which would curtail ore loading and fuel transfer operations significantly. The Fossil Point Alternative port has rocky shoals that make it unsuitable for ocean-going ships. The Deep Water alternative also is exposed to Cook Inlet forces, though less so than Iliamna Point. Only the Mudflats Alternative has no known technical problems.

Iliamna Point. This alternative is technically unfeasible because the port site is located on a point completely exposed to the full force of currents, tides, storms, and ice movements of Cook Inlet. Because of these conditions, ore loading and fuel transfer operations at the port likely would be curtailed with significantly greater frequency than for the other port alternatives. It has the advantage of a short distance to deep water. Construction of a road to the port would require blasting through a steep face of Slope Mountain along a stretch immediately adjacent to the Johnson River.

Fossil Point. This alternative's port site is relatively sheltered, but has rocky shoals beyond the mudflats that make it unsuitable for future expansion to accommodate ocean-going ships. These shoals also would make maneuvering barges near the port dangerous. The 1,275-ft ore-loading facility would have to extend across approximately 850 ft of mudflats to reach deep water. Construction of the road would present no technical difficulties.

Deep Water. This alternative's port site also is exposed to the effects of currents, tides, storms, and to some extent ice movements from Cook Inlet proper, although less so than Iliamna Point. This could restrict ore loading and fuel transfer operations at the port. The port's location would make maneuvering barges near the port difficult. The site has the advantage of a short distance to deep water. Construction of a road to the port site would require blasting along portions of Slope Mountain.

Mudflats. This alternative's port site is sheltered, but the 2,500-ft ore-loading facility would have to extend across approximately 2,100 ft of mudflats to reach deep water. Construction of the road would present no technical difficulties.

6.18 Economic Considerations

The Iliamna Point Alternative is not economically viable. Of the viable alternatives, the Mudflats Alternative is clearly the most expensive largely due to the cost of the 2,500-ft ore-loading structure necessary to reach deep water. The Fossil Point Alternative is the second most expensive alternative largely due to the cost of the 1,275-ft loading structure necessary to reach deep water. The Deep Water Alternative is the least expensive because of the short distance to deep water.

While the economics of a particular alternative are only one of several factors used to arrive at the preferred alternative, it is an important one. The final cost of each transportation and port easements alternative has not been determined with accuracy. Even the cost of the preferred alternative, once selected, will not be known with reasonable assurance until after the 1994 field season. Current approximations of the capital and operational costs for each alternative, however, allow a relative comparison of the alternatives from an economic perspective.

The Iliamna Point Alternative is by far the most costly. This is because overcoming the severe technical problems of construction and operation due to the port's exposure to the forces of Cook Inlet would be very expensive. This alternative is not economically viable.

The Fossil Point Alternative likely is the second most expensive viable alternative, but probably only marginally more than the Deep Water alternative. The relatively

straightforward construction of the road would be offset by the more expensive port facilities, particularly the 1,275-ft long ore-loading structure necessary to reach deep water.

The Deep Water Alternative likely is the least expensive viable alternative. The somewhat higher road costs due to blasting parts of the last 1.6 mi of road would be offset by the port's close proximity to deep water

The Mudflats Alternative is the most expensive viable alternative. The relatively straightforward construction of the road would be offset by the considerable expense of the 2,500-ft long ore-loading structure necessary to reach deep water. This long distance also would add to the operational costs of loading ore barges.

Chapter 7

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Chapter 8

Acronyms and Abbreviations

ac	acres
ADF&G	Alaska Department of Fish and Game
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
$CaCl_2$	calcium chloride
$CaCO_3$	calcium carbonate
cfs	cubic feet per second
COE	U.S. Army Corps of Engineers
CIRI	Cook Inlet Region, Inc.
d(B)A	decibel A-weighted
dB	decibel
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ft	feet
FWS	U.S. Fish and Wildlife Service
KPB	Kenai Peninsula Borough
LCNP	Lake Clark National Park and Preserve
$MgCl_2$	magnesium chloride
mg/l	milligrams per liter
mi	mile(s)
min	minutes

mph	miles per hour
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
NWR	National Wildlife Refuge
SPCC	spill prevention, containment, and countermeasure

Chapter 9

Coordination and Consultation

The analyses in this document incorporate preliminary input from many sources. These include meetings, correspondence, or conversations with the following individuals.

Organization

Alaska Department of Fish and Game

Donald Caulkins (Marine mammal biologist/Anchorage)
Cevin Gilleland (Habitat biologist/Anchorage)

Alaska Department of Natural Resources

Kim Kruse (Tidelands manager/Anchorage)

Alaska Natural Heritage Program

Rob Lipkin (Endangered plant species/Anchorage)
Edward W. West (Endangered animal species/Anchorage)

Boyles Brothers Drilling Company

Michael R. Smith (Johnson Tract exploration camp operations manager)

Cook Inlet Region, Inc.

Larry Kimball (Land and resources consultant)

Crowley Maritime

Peter Saunders (Barging specialist/Seattle)

Lake Clark National Park and Preserve

Alan Bennett (Wildlife biologist, Port Alsworth)

National Marine Fisheries Service

Tamra Faris (Biologist/Protected Resource Management Division/Juneau)
Jean Hanson (Wetlands biologist/Anchorage)

U.S. Fish and Wildlife Service

Jean Cochrane (Biologist/threatened and endangered species/ Anchorage)
Leslie Slater (Biologist/AK Maritime National Wildlife Refuge/Homer)
Phil Schempf (Biologist/bald eagle-raptor program/Juneau)
Sandy Tucker (Biologist/threatened and endangered species/ Anchorage)

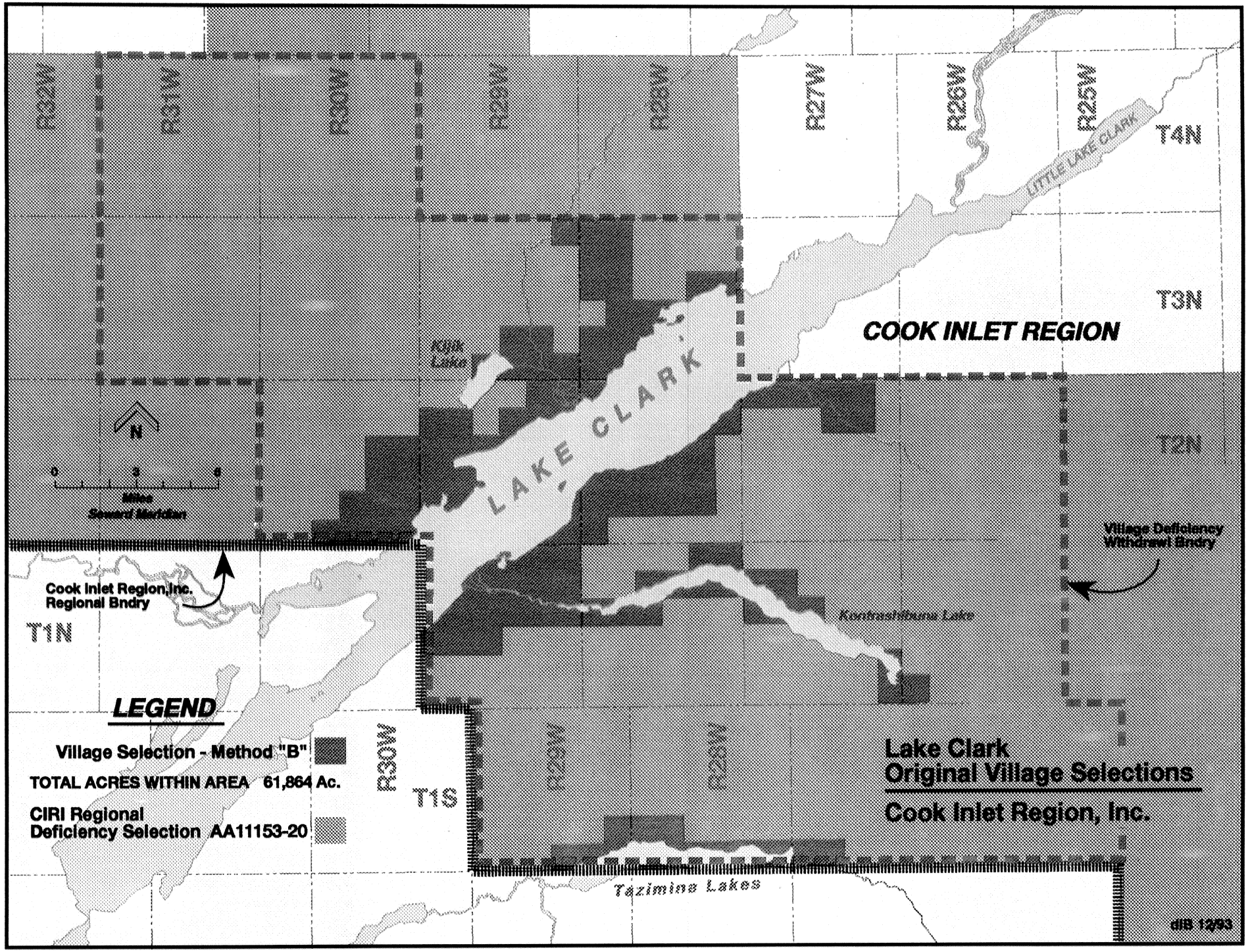
Chapter 10

List of Preparers

Name	Responsibility/Discipline
Michael C. T. Smith, Ph.D. (Terra Nord)	Editor, wildlife, other disciplines not listed below
Debra Bissett (Cook Inlet Region, Inc.)	Cartography
Carlos Johansen, P. Eng. (Delcan Corporation)	Port and marine engineering
Jack E. Lobdell, Ph.D. (Lobdell and Associates)	Cultural resources, subsistence, paleontological resources
Cheryl A. Moody, B.S. (Three Parameters Plus)	Vegetation, wetlands, soils, wildlife
John W. Morsell, B.S., M.S. (Northern Ecological Services)	Fish
Dennis Nottingham, P.E. (Peratrovich, Nottingham & Drage)	Civil engineering
C. J. Rockingham, M. Sc. (Westmin Resources, Ltd.)	Geology, economic considerations

Appendix A

Lake Clark Original Village Selections Map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T3N
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R30W
R29W
R28W
LITTLE LAKE CLARK
LAKE CLARK
COOK INLET REGION
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N
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6
Miles
Seward Meridian
Cook Inlet Region, Inc.
Regional Bndry
Village Deficiency
Withdrawl Bndry
Kontrashibuna Lake
Tazimina Lakes
LEGEND
Village Selection - Method "B"
TOTAL ACRES WITHIN AREA 61,864 Ac.
CIRI Regional
Deficiency Selection AA11153-20
Lake Clark
Original Village Selections
Cook Inlet Region, Inc.
dlB 12/93

Appendix B

Easements Conveyance Excerpt From

Terms and Conditions for Land Consolidation and Management in the Cook Inlet Area

PL 94-204

Appendix B

Excerpt From

Terms and conditions for Land Consolidation and Management in the Cook Inlet Area

PL 94-204

I. The United States shall convey to Cook Inlet Region, Inc. (CIRI), the following lands:...

D. Seward Meridian, Alaska
T. 1 N., R. 21 W.,
Secs. 13-15, all;
Secs. 22-28, all;
Secs. 32-36, all.

The Secretary shall only convey the rights to metalliferous minerals in the land herein described. All activities related to the extraction of such minerals shall be subject to a surface use plan submitted by CIRI and approved by the Secretary. Surface use for the purposes of exploration, extraction, access and beneficiation shall be conducted in accordance with the most advanced technology commercially available at the time, consistent with the exercise of the rights conveyed under this subparagraph. CIRI, its successors and assigns, shall be required to repair and reclaim any surface damage as rapidly as practicable consistent with the reasonable exercise of such mineral rights.

(3) Seward Meridian, Alaska
T. 1 N., R. 21 W.,
Secs. 3-10, all;
Secs. 15-22, all;
Secs. 29-30, all.

The Secretary shall transfer to CIRI the above-described lands in fee simple. Such conveyance shall be subject to a restrictive covenant, running with the land, providing that the surface shall only be used for the purposes reasonably incident to mining and mineral extraction, including processing and transportation. The Secretary shall also convey to CIRI an easement for a port which shall reasonably provide for receiving, shipping, storage and incidental handling, and incidental facilities thereto, of the minerals extracted from the lands conveyed under subparagraphs I.D.(2) and I.D.(3). The Secretary shall also convey to CIRI a transportation easement to provide for transportation by road, rail or pipeline, of the minerals from the above-described lands to the port easement. The Secretary and CIRI shall mutually agree upon the location of these two easements."...

Appendix C

Threatened and Endangered Species

Informal Section 7 Consultation Letter

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Anchorage Field Office
Ecological Services and Endangered Species
605 West 4th Avenue, Room 62
Anchorage, Alaska 99501

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
WAES

NOV 17 1993

Mr. Michael C.T. Smith
Terra Nord Natural Resources Consulting
8640 Round Tree Drive
Anchorage, Alaska 99516

Dear Mr. Smith:

This responds to your November 12, 1993, telephone conversation with Ms. Jean Cochrane of our office, during which you requested clarification on our Endangered Species comments on the proposed Johnson River Tract road and port project. Our September 3, 1993, letter to Cheryl Ann Moody stated that we have no records for any candidate, listed or proposed threatened or endangered species under U.S. Fish and Wildlife Service (Service) jurisdiction in the proposed project area. This statement is correct. Similarly, the letter to Cheryl Ann Moody from the Alaska Natural Heritage Program (ANHP) stated that their database contained no such records. We concur with ANHP that endangered American Peregrine Falcons (*Falco peregrinus anatum*) could migrate through the area, however, the proposed activities will not adversely affect this species.

Candidate Species

The Service maintains a list of species considered to be candidates for listing under the Endangered Species Act of 1973 (Act), as amended. Candidate species are not protected under the Act. Category II candidate species are those species for which the Service has some information indicating listing may be warranted, but more data are needed to determine the species' status. The ANHP letter mentioned several species as candidate or possible candidate species in the Johnson River project area. We provide the following clarification on Category II species:

Harlequin Duck	*Histrionicus histrionicus*	May occur in the project area; project not likely to adversely affect
Northern Goshawk	*Accipiter gentilis*	Subspecies *A.g.laingii* of Queen Charolette Island is primary concern in Alaska
North American Lynx	*Felis lynx canadensis*	Removed from candidate list (10/93)
Swainson's Thrush	*Catharus ustulatus*	Not a candidate species
Gray-cheeked Thrush	*Catharus minimus*	"
Blackpoll Warbler	*Dendroica striata*	"
Wilson's Warbler	*Wilsonia pusilla*	"

No further consultation on the proposed project pursuant to Section 7 of the Act is required. Attached for your reference is a current list of the threatened, endangered and candidate species in Alaska. If you have further questions, please call Sandy Tucker or Jean Cochrane at 271-2888.

Sincerely,

Ann G. Rappoport
Field Supervisor

Attachment