3.0 AFFECTED (BASELINE) ENVIRONMENT

This section describes the baseline conditions present prior to implementation of the proposed project. The baseline or affected environment has been grouped into the following categories:

- Physical Environment: geology and soils (Section 3.1); meteorology and air quality (Section 3.2); physical oceanography (Section 3.3); marine water quality (Section 3.4); and freshwater resources (Section 3.5).
- Biological Environment: marine biological resources (Section 3.6); threatened and endangered species (Section 3.7); and terrestrial biological resources, including wetlands (Section 3.8).
- Cultural, Social, and Economic Environment: socioeconomic conditions (Section 3.9); subsistence harvesting (Section 3.10); land use and management (Section 3.11); transportation systems (Section 3.12); visual environment/aesthetics (Section 3.13); recreation (Section 3.14); and cultural, historical, and archaeological resources (Section 3.15).

3.1 GEOLOGY AND SOILS

3.1.1 Regional Setting

The Cook Inlet Basin is an elongated depression of the earth's crust between two major parallel mountain ranges: the Kenai Range to the southeast and the Alaska/Aleutian Range to the northwest (Figure 3-1). The basin is underlain by thick sedimentary deposits; layers of sediment dating back 65 million years exceed 30,000 feet in places (Wilson and Torum, 1968). Conglomerates, sandstones, siltstones, limestone, chert, volcanics, and clastics make up the sedimentary rocks of the Cook Inlet basin. Tectonism, or plate movement, is responsible for creating the basin and mountain ranges, active volcanoes, and earthquakes that are common to the area (USCOE 1993).

In more recent times, several major glaciations have altered the landscape of the region. During the Pleistocene age (2 million to 10,000 years ago) glaciers pushed beyond the mountain fronts into the lowlands, depositing sediment and debris up to several thousand feet thick. As the glaciers receded, Cook Inlet assumed its present form (USCOE 1993).

3.1.2 Soils/Sediments

Soils in the onshore portion of the proposed pipeline have not been delineated, but based on conditions observed near the West McArthur River Unit Production Facilities, they would typically include a surface layer of organic-rich soil that extends to a depth of several feet throughout most of the onshore route. The surface layer is typically either wet organic soils or loess (windblown silt) and fine-grained glacial outwash (silts and sands). Underlying materials would typically consist of densely-packed soils of the Beluga Formation. These soils consist of silts with beds of sand, coal, and clay (NCG 2001).

Soils of potential concern would primarily include soils occupying wetlands areas. Specifically, the presence of thick accumulations of organic soils at the surface normally result in poor foundation properties for access roads. Most of these problems can be avoided by placement of thicker layers of fill (normally 4 feet of fill instead of 2 feet of fill). The occurrence of organics is normally not a major consideration for pipelines.

The entire region is generally classified as a non-permafrost area, and there are no known observations of permafrost occurring in the area. The maximum depth of seasonal frost is expected to be about 10 to 12 feet (NCG 2001).

Seafloor sediments in upper Cook Inlet typically consist of silts, sands, gravels, cobbles, and boulders. Underlying sediments are commonly highly-consolidated glacial till. Occasional bedrock outcrops can occur. Beaches surrounding the inlet may also be covered by glacial silts and muds. Most of the seafloor is covered by a gravel, cobble, and boulder armor layer as a result of the high tidal currents. Other features of high current regimes, including sand and gravel waves, are also common in the upper inlet. Table 3-1 provides a grain size distribution for surficial sediments in the vicinity of the Osprey Platform location; this sample is believed to be generally representative of sediments in the subtidal areas (NCG 2001).

3.1.3 Geologic Hazards

Geologic hazards potentially present in the Cook Inlet area include earthquakes, volcanoes, seafloor sediment instability/mobility, and shallow gas-charged sediments. These are addressed in the following paragraphs.

3.1.3.1 Earthquakes

Cook Inlet is situated in one of the most active seismic zones along the Pacific Ocean (MMS 1995). The area is located along the boundary of the Aleutian trench, which is the site of subduction between the Pacific and North American plates. Over 100 earthquakes of magnitude 6 (Richter scale) or greater have occurred in the Cook Inlet area since 1902 (Hampton 1982). The last great earthquake occurred in March 1964 and is now estimated to have an estimated magnitude of 9.2. It caused uplift, subsidence, ground cracking, landslides, and horizontal movements that affected areas in and around Cook Inlet. Estimates of the recurrence interval of great earthquakes (greater than 7.8 on the Richter scale) range from 33 to 800 years (MMS 1996b).

Earthquakes are normally associated with fault locations. Major faults in the Cook Inlet area include the Bruin Bay and Castle Mountain faults to the northwest and the Border Ranges Fault to the southeast (Figure 3-1). Lesser faults also occur throughout the area.

3.1.3.2 Volcanoes

The western boundary of Cook Inlet is one of the most active volcanic regions in the world (MMS 1995). Five volcanoes border the west side of Cook Inlet and have been active for some time, as indicated by numerous buried ash layers in the surrounding soils. These volcanoes are indicated on Table 3-2. All have erupted in historic time, and all are considered likely to erupt in the future (Riehle 1985).

Since 1980, there have been three volcanic eruptions in the Cook Inlet basin. The main effect of these eruptions was widespread distribution of airborne ash, which caused disruptions to air traffic and resulted in closure of oil platforms and public facilities. The most recent eruption was Mt. Spurr in 1992. The volcanoes in the area are andesitic and are capable of violent eruptions (MMS 1995).

Hazards associated with volcanism include severe blast effects, turbulent clouds of ash and gases, lightning discharge, volcanic mudflows, pyroclastic flows, debris flows, corrosive rain, flash floods, outburst floods, earthquakes, and tsunamis.

3.1.3.3 Tsunamis and Seiches

Both tsunamis and seiches are possible in this area of high seismic and volcanic activity (MMS 1995). Tsunamis can be generated when large volumes of seawater are displaced by tectonic movement of the seafloor or by large rockfalls or landslides or volcanism. Seiches start in partially or completely enclosed bodies of water by seismic activity or by large rock or landslides in coastal areas.

3.1.3.4 Seafloor Stability/Movement

Cook Inlet surficial sediment ranges from sandy silt to gravel and appears to possess favorable engineering conditions (MMS 1995). This conclusion is based on the nature of the sediment, the generally low accumulation rates, and the low seafloor slopes that are present throughout most of the area. No evidence of gravitationally unstable slopes or soft, unconsolidated sediment has been found (MMS 1995). Subsurface layers of liquefiable silt or fine sand may exist, and their presence can be determined by drilling. Mean grain size in the inlet generally decreases from north to south. Sand-size sediment is most abundant in the central inlet area (MMS 1995). Measurements of vane shear strength, water content, and plasticity of the shallow marine sediments indicate no unusual geotechnical problems (MMS 1995).

High currents present in Cook Inlet result in the formation of sand, gravel, and cobble wave-like bottom features. These features are believed to be somewhat mobile and are documented to exist both in the upper and lower inlet. The heights of these features are commonly 5 to 10 feet, but higher waves have been documented. The primary hazard associated with pipelines through these features will be the creation of long spans of unsupported pipe that is subjected to vibrations and possible failure.

Large boulders are also common in the upper inlet. Under high currents, they can be undermined. The primary hazards of these features would be to pipelines. In this case a boulder could either rest against a pipeline, or a pipeline could wrap itself around a boulder. In both cases, the pipeline would be subjected to high stresses that could result in failure.

3.1.3.5 Shallow, High Pressure Gas

The upper Cook Inlet area is prone to deposits of shallow (1,000 to 2,000 feet) high pressure natural gas. These cause potential problems to drilling operations. In the past two decades, at least two offshore blowouts have occurred in upper Cook Inlet as a result of drilling operations encountering shallow, high-pressure gas. The Grayling Platform experienced a short-term natural gas blowout in May 1985. The Steelhead Platform encountered natural gas in December 1987; the blowout lasted until June 1988.

3.2 Meteorology and Air Quality

3.2.1 Climate

The climate of the central Cook Inlet area is characterized as transitional between maritime and continental regimes. Regional topography and water bodies heavily influence area climate. The Kenai Mountains to the south and east act as a barrier to warm, moist air from the Gulf of Alaska. The Cook Inlet precipitation averages less than 20 percent of that measured on the Gulf of Alaska side of the Kenai Mountains (NCG 2001). The Alaska Range to the north provides a barrier to the cold winter air masses that dominate the Alaska Interior. Cook Inlet waters tend to moderate temperatures in the area. Occasionally, short periods of extreme cold and/or high winds occur when strong pressure gradients force cold air southward from the Interior. Temperature and precipitation data for various locations adjacent to the project area are summarized in Table 3-3.

Winds in the area are strongly influenced by mountains surrounding the Cook Inlet basin. During the months of September through April, prevailing winds are typically from the north or northwest. During May through August, winds prevail from the south. Mean speeds range from 5 knots in December to 7 knots in May (Brower et al. 1988). Site-specific, short-term data confirm the general trends described above. For example, winds measured at the West Foreland in 1999 and 2000 indicate that during September through April, prevailing winds are from the north-northeast and northeast. During June and July, winds prevail from the south-southwest and southwest. May and September are transition periods for these patterns (HCG 2000 a, b, c, d).

Extreme winds are commonly out of the northeast or south. Extreme wind estimates for Anchorage International Airport (with return periods) are indicated in Table 3-4.

3.2.2 Air Quality

Air quality in the project area is generally considered to be good. Several industrial and energy facilities located onshore and offshore emit air pollutants, including particulate matter (PM), sulfur oxides (SO_x), carbon monoxide (CO), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). Impacts from these emissions tend to be localized (NCG 2001). The largest sources of emissions are in the industrial areas and population centers of Kenai (Nikiski) and Anchorage.

One year of ambient air quality data was collected during 1993 and 1994. A monitoring station was established on the west shore of Cook Inlet near Beluga and collected information on CO, hydrogen sulfide (H_2S), ozone (O_3), NO_x, sulfur dioxide (SO_2), total suspended particulate matter (TSP), and respirable particulate matter with aerodynamic diameters less than or equal to 10 microns (PM_{10}). These data are summarized in Table 3-5.

EPA has established National Ambient Air Quality Standards (NAAQS) for NO_x, CO, O_3, SO_2, and PM10, which are also listed on Table 3-5. ADEC has not established any additional or more stringent standards. As shown on Table 3-5, the ambient levels of regulated air pollutants in the project vicinity are well below the applicable NAAQS, and the air quality is generally considered good.

The operation of a new major stationary source in an area which is in attainment for all NAAQS, such as the Cook Inlet area, is governed by the Prevention of Significant Deterioration (PSD) Program of the Clean Air Act. Areas in Alaska are currently designated as PSD Class I or Class II. The Class I air quality designation is the most restrictive and applies to certain national parks, monuments, and wilderness areas. Tuxedni National Wildlife Refuge (about 50 miles from the project site) is designated as a National Wilderness Area and is the only Class I area in the general Cook Inlet area; remaining areas are classified as Class II.

3.3 PHYSICAL OCEANOGRAPHY

3.3.1 Bathymetry

Cook Inlet is a tidal estuary approximately 180 miles long and 60 miles wide at its mouth, with a general northeast-southwest orientation. It is divided naturally into the upper and lower inlet by the East and West Forelands, at which point the inlet is approximately 10 miles wide. The project area is located in the vicinity of the West Foreland (see Figure 2-1).

The upper Cook Inlet is typically about 17 to 19 miles wide and has relatively shallow water depths. Water depths are 100 to 200 feet (below mean lower low water-MLLW), but can exceed 500 feet in deeper channels closer to the Forelands. Water depths at the Osprey Platform location and along the proposed pipeline route are 45 feet (below MLLW) or less.

3.3.2 Tides

Tides in Cook Inlet are classified as mixed, having strong diurnal and semi-diurnal components, and are characterized by two unequal high and low tides occurring over a period of approximately one day, with the mean range increasing northward (MMS 1995). Tidal data are available for various locations in the upper inlet and are summarized in Table 3-6.

3.3.3 Currents

Currents in the upper Cook Inlet are predominantly tidally driven. Current speeds are primarily a function of the tidal range, and their directions typically parallel the bathymetric contours. Near the mouths of major rivers, such as the Susitna River, currents may locally influence both the current speed and direction by the large volume of fresh water inflow.

Surface currents in the general vicinity of the Osprey Platform are expected to have mean peak velocities of approximately 4 knots, with flood tides flowing generally in a northeasterly direction and ebb currents flowing in a southerly direction. Surface currents along the pipeline route will have current speeds decreasing toward the landfall at the West Foreland (NCG 2001). Current directions will generally parallel the bathymetric contours. Higher peak currents may occur with high tidal ranges and lower peak currents will occur with lower tidal ranges. Because of bottom friction, currents near the seafloor will be lower, possibly 10 percent of the surface currents within a foot of the seafloor.

Strong tidal currents also produce pronounced and persistent tidal rips at various locations in the inlet. It is believed that these features occur primarily at locations of relatively abrupt bathymetric changes. Tidal rips can be marked by surface debris and steep waves. They can also be hazardous to small boat traffic, however tidal rips would not typically be a significant problem for platform, pipeline, or rig boat operations. It has also been hypothesized that the tidal rips are important habitat to marine species. A consistent rip area occurs within a half mile east of the platform; the platform was originally sited to avoid the rip area and deeper waters to the east (NCG 2001).

A general circulation pattern is also present throughout the inlet. Limited circulation information for the upper inlet suggests that there may be a net southwesterly flow along the western side of the inlet, primarily as a result of freshwater inflows near the head of the inlet (Susitna River and from the Knik and Turnagain Arms). Below the Forelands, oceanic waters most commonly flow up the eastern side and turbid and fresher waters flow southward along the western side.

3.3.4 Waves

Waves in upper and central Cook Inlet are fetch and depth limited, and wave heights are usually less than 10 feet. In storms, waves in the upper inlet (Beluga area) can reach 15 feet (USCOE 1993) with wave periods estimated up to 6 to 8 seconds.

3.3.5 Ice Conditions

Ice is present in Cook Inlet for up to 5 months each year, but can vary greatly from year to year. Dates of first significant ice (defined as 10 percent ice coverage at the Tyonek Platform, located in the upper inlet) and ice-free conditions are summarized on Table 3-7. On the average, ice will be present in the inlet from late November through early April.

Three forms of ice normally occur in the inlet: sea ice, beach ice, and river ice. Sea ice is the predominant type and is formed by freezing of the inlet water from the surface downward. Because of the strong tidal currents, ice does not occur as a continuous sheet but as ice pans. Pans can form up to 3 feet thick and be 1,000 feet (or greater) across. They can also form pressure ridges reportedly up to 18 feet high (Gatto 1976). Sea ice generally forms in October or November, gradually increasing from October to February from the West Foreland to Cape Douglas, and melts in March to April (Brower et al. 1988). The primary factor for sea ice formation in upper Cook Inlet is air temperature, and for lower Cook Inlet is the Alaska Coastal Current temperature and inflow rate (Poole and Hufford 1982).

Beach ice, or stamukhi, forms on tidal flats as seawater contacts cold tidal muds. The thickness of beach ice is limited only by the range of the tides and has been noted to reach 30 feet in thickness. During cold periods, beach ice normally remains on the beach; however, during warm weather in combination with high tides, it can melt free and enter the inlet. Blocks of beach ice that enter the inlet are normally relatively small (less than several tens of feet across) and have relatively low strengths.

River ice also occurs in Cook Inlet. It is a freshwater ice that is similar to sea ice except that it is relatively harder. It is often discharged into the inlet during spring breakup.

3.4 Marine Water Quality

Water quality in upper Cook Inlet is influenced by high currents and the large volumes of seasonally varying freshwater inflows. The high tidal currents tend to keep the entire water column well mixed with little vertical stratification except in the vicinity of the mouths of major rivers. Large, glacier-fed rivers that flow into the inlet, particularly near the head of the inlet, contribute large amounts of freshwater and suspended sediments. Additional sources of pollutants entering the marine environment include discharges from municipal wastewater treatment systems and industrial activities (e.g., petroleum industry, chemical manufacturers, seafood processing), and stormwater runoff from urban, agricultural, and mining areas. Some data for general water quality parameters (salinity, sediment, and temperature) in the vicinity of the East Foreland are summarized in Table 3-8. Other water quality parameters have been summarized from baseline studies by the Institute of Marine Science (Hood, et al. 1968 and Rosenberg, et al. 1969).

3.4.1 Salinity

In the vicinity of the Forelands, the more oceanic waters from the lower inlet mix with the more brackish estuarine waters of the upper inlet. As such, large variations in water quality may occur seasonally or even within a single tidal cycle. Near the mouths of major rivers, it would not be unusual for waters to shift from near oceanic to freshwater within a period of several hours (NCG 2001). Salinities in the East Foreland area are generally higher (27 to 31 parts per thousand-ppt) in the late winter when freshwater inflows are lowest. During the late summer, salinities are generally in the range of 20 to 25 ppt (Table 3-8), whereas toward Anchorage at the head of the inlet, salinities in the range of 6 to 15 ppt are more common (Britch 1976).

3.4.2 Sediment

The upper inlet is generally characterized by high suspended sediment concentrations. Sediments are derived from numerous glacial-fed rivers that flow into the inlet; high currents in the upper inlet tend to keep these sediments in suspension. Near the Forelands, suspended sediment concentrations of 100 to 200 mg/l are common, whereas near Anchorage, suspended sediments in excess of 2,000 mg/l have been measured (Britch 1976). Silicate (sand) concentrations have been measured in the range of 9 to 90 parts per billion (ppb) and appear to be related to the sediment load.

The deposition of crude or refined petroleum products from accidental spills or discharges to the sediments of Cook Inlet is a major concern. The historical frequency of oil spills to Cook Inlet from oil and gas operations is discussed further in Section 4.1.4. However, sediment sampling conducted in Cook Inlet and Shelikoff Straits during the period of 1993 to 1997 have indicated that suspended and bottom sediments are relatively free of man-induced contaminants (Lees et al. 1999). The results of the study are summarized as follows:

- Total polycyclic aromatic hydrocarbon (TPAH) levels in sediments ranged from 6 to 469 ug/kg with an average level of 83 ug/kg. TPAH levels did not appear to follow any predictable pattern but they were lowest in the areas closest to oil production activities.
- Total aliphatic hydrocarbons (TAHC) levels varied from about 50 to 2,816 ug/kg and exhibited no apparent spatial trend.

3.4.3 Temperature

Water temperatures in the upper inlet are primarily influenced by the air temperatures. During winter, water temperatures are typically at or near the freezing point of seawater (-1.8°C). In the summer, water temperatures can exceed 15°C.

3.4.4 Dissolved Oxygen

Dissolved oxygen levels varied from 11 ppm at the surface to 7.2 ppm at a depth of approximately 100 feet. None of the water in Cook Inlet has been found to be oxygen deficient.

3.4.5 Nutrients

Phosphate (as phosphorus) concentrations ranged from 0.31 to 2.34 ppb and nitrate (as nitrogen) concentrations ranged from 0.0 to 23.5 ppb. Both phosphate and nitrate concentrations generally decreased from the north end of Cook Inlet to the south. However, nitrite (as nitrogen) concentrations, which ranged from 0.02 to 3.1 ppb, did not show a general trend in the distribution of data points.

3.4.6 Ammonia

Ammonia (as nitrogen) concentrations varied from 0.2 to 3.1 ppb and appeared to be lower in the area of the Forelands.

3.4.7 Organic Carbon

Particulate organic carbon concentrations have been measured in the range of 20 to 4,800 ppb carbon, whereas dissolved organic carbon concentrations varied from 0.31 to 13 ppm carbon and generally decreased from the north to the south.

3.5 FRESHWATER RESOURCES

Freshwater inflows to the upper Cook Inlet affect marine water quality in the project area. Table 3-9 summarizes the discharges measured at gauging stations located in major upper inlet drainage basins. Overall, the mean annual volume of freshwater discharged by streams to Cook Inlet exceeds 18.5 trillion gallons with an estimated 80 percent coming from the Susitna, Knik, and Matanuska Rivers in the upper inlet (MMS 1996b). These rivers are also the primary source for the high suspended sediments that occur in the inlet.

Freshwater resources in the volumes required for the proposed project (initially up to 800,000 gallons per day) are generally limited in the immediate vicinity of the proposed onshore production facility. Local drainage basins are generally too small to support withdrawals at rates much in excess of about one to 10 percent of the anticipated water requirements. The same is expected for shallow groundwater sources that may be closely tied to surface water features (i.e. lakes and wetlands).

ADNR is responsible for monitoring groundwater use in Alaska, and grants both temporary (via a permit system) and permanent rights to use of groundwater and surface waters. No water rights have been granted to anyone but Forest Oil within about 5 miles of the proposed onshore production facility (Amundsen 2000a).

It is anticipated that the only readily available water source would be deep groundwater (at depths greater than several thousand feet) in the general area. The currently planned source is from the Tomcat Exploration Well that was drilled in the fall of 2000. Withdrawals from depths of 12,000 feet are believed to contain sufficient water to support the production operations. Water sources from these depths also typically have high chlorides (in excess of 10,000 ppm) and are not considered to be potable water sources (NCG 2001), but are of adequate quality for pressure maintenance in the Redoubt Shoal Unit.

3.6 MARINE BIOLOGICAL RESOURCES

3.6.1 Lower Trophic Level Marine Organisms

Lower trophic level marine organisms can be categorized as planktonic (floating or drifting in the water column) or benthic (living on or in the sea bottom). These are discussed in the following sections.

3.6.1.1 Plankton

Planktonic communities typically consist of both phytoplankton and zooplankton. During summer months, lower Cook Inlet is among the most productive high-latitude shelf areas in the world (MMS 1996b). However, marine productivity in northern Cook Inlet is limited by severe turbidity and extreme tidal variations. The silt-laden waters that enter Upper Cook Inlet load the inlet with sediment and retard its primary (phytoplankton) productivity (Kinney et al. 1970). Larrance et al. (1977) found that lower Cook Inlet marine productivity decreased in a northerly direction. At a station immediately south of the Forelands, the euphotic zone (the upper limit of effective light penetration for photosynthesis) was extremely shallow, ranging from 1 to 3 meters. The suspended material limits light penetration and probably causes reduced surface nitrate utilization in the spring (Sambrotto and Lorenzen 1987).

Zooplankton are used as food for fish, shellfish, marine birds, and some marine mammals. Zooplankton feed on phytoplankton, and their growth cycles respond to phytoplankton production. In the lower inlet, zooplankton populations vary seasonally with biomass reaching a low in the early spring and a peak in late spring and summer. Zooplankton is abundant in the lower Cook Inlet, but occurs at much reduced levels in the upper inlet.

Impacts on the plankton communities that form the base of the marine food web may result in impacts on higher trophic organisms.

3.6.1.2 Benthic Communities

In addition to high turbidity, Cook Inlet is characterized by extreme tidal fluctuations of up to 12.2 meters (NOAA 1999) that produce strong currents in excess of eight knots (Tarbox and Thorne 1996). The amount of protected benthic habitat is likely reduced by the periodic scouring or substrate movement caused by Cook Inlet currents that bottleneck at the Forelands, near the Osprey Platform.

Mollusks, polychaetes, and bryozoans dominate the infauna of seafloor habitats in Cook Inlet. Feder et al. (1981) found over 370 invertebrate taxa in samples from lower Cook Inlet. Substrates consisting of shell debris generally have the most diverse communities and are dominated by mollusks and bryozoans (Feder and Jewett 1987). Muddy-bottom substrates are occupied by mollusks and polychaetes, while sandy-bottom substrates are dominated by mollusks. Nearshore infauna, where sediments are fine and sedimentation rates are high, consists mostly of mobile deposit-feeding organisms that are widely distributed through the area. Infaunal organisms are important trophic links for crabs, flatfishes, and other organisms common in the waters of Cook Inlet.

Epifauna are dominated by crustaceans, mollusks, and echinoderms. The percentage of sessile organisms in Cook Inlet is relatively low inshore and increases towards the continental shelf (Hood and Zimmerman 1987). Rocky-bottom areas consist of lush kelp beds with low epifaunal diversity, moderate kelp beds with well-developed sedentary and predator/scavenger invertebrates, and little or no kelp with moderately developed predator/scavenger communities and a well-developed sedentary invertebrate community (Feder and Jewett 1987).

A 16-inch diameter, 3-foot long pipe dredge was used at the Osprey Platform to collect six benthic samples. Organisms were collected after the samples were washed through a 1-mm screen, and sent to Dr. Steve Jewett at the University of Fairbanks for identification. From the samples, one complete anemone (*Metridium* sp.) and fragments of unidentified bivalves, mollusks, barnacles, hydroids, and gastropods were identified – less than 20 grams (wet weight) from a total sediment volume of 0.075 m^3 (NCG 2001).

Table 3-10 provides a list of benthic organisms potentially present in Upper Cook Inlet.

3.6.2 Fish

Few studies of marine fish in upper Cook Inlet have been published. The fish of central and lower Cook Inlet have been better studied, due in part to the numerous commercial fisheries in the area. Because of low phytoplankton productivity and the severe tidal currents, it is thought that upper Cook Inlet does not provide a plentiful primary food source or much safe habitat for fish. However, recent studies of beluga utilization of Cook Inlet may warrant further investigation of Cook Inlet forage fish (NMFS 2000a). A list of fish species that have been documented in marine waters of central Cook Inlet, and are likely present near the Osprey Platform, is presented in Table 3-11.

3.6.2.1 Anadromous Fish

Anadromous fish migrate through northern Cook Inlet towards spawning habitat in rivers and streams, and juveniles travel through Cook Inlet toward marine feeding areas. The Susitna River drainage is a primary source of these anadromous fish in upper Cook Inlet. Table 3-12 presents the timing of anadromous fish migrations in Cook Inlet.

Salmon. All five Pacific salmon species: pink salmon (*Oncorhynchus gorbuscha*); chum salmon (*O. keta*); sockeye salmon (*O. nerka*); coho salmon (*O. kisutch*); and chinook or king salmon (*O. tshawytscha*) are found in Cook Inlet. Run timing and migration routes for all five salmon species overlap. In upper Cook Inlet, adult salmon inhabit marine and estuarine waters from early May to early November (ADFG 1986).

Pink salmon is typically the smallest salmon species in Cook Inlet, averaging between 3 and 5 pounds. Pink salmon enter their spawning streams between late June and October and typically spawn within a few miles of the shore, often within the intertidal zone. The eggs are buried in the gravel of stream bottoms and hatch in the winter. In spring the young emerge from the gravel and migrate downstream to salt water. Pink salmon stay close to the shore during their first summer, feeding on small organisms such as plankton, insects and young fish. At about one year of age, pink salmon move offshore to ocean feeding grounds where their food consists mainly of plankton, fish and squid. Return migration to fresh water takes place during the second summer with few exceptions. The even-year pink salmon return is typically stronger than the odd-year return in Cook Inlet (ADFG 1986).

Chum salmon grow to an average weight of between 7 and 18 pounds. Chum salmon remain nearshore during the summer where their diet consists of small insects and plankton. In the fall, they start moving offshore where they feed on plankton. They return to fresh water in the fall and spawn late in the year. Most chum salmon spawn in areas similar to those used by pink salmon, but sometimes travel great distances up large rivers (e.g. up to 2,000 miles up the Yukon River). Chum salmon usually return to streams to spawn after 3 to 5 years at sea.

Sockeye salmon spawn in stream systems with lakes; fry may reside up to three years in freshwater lakes before migrating to sea. Most sockeye spend two to three winters in the North Pacific Ocean before returning to natal streams to spawn and die. Sockeye salmon is the most important commercial salmon species in Cook Inlet (ADFG 1999a).

Coho salmon return to spawn in natal stream gravels from July to November, usually the last of the five salmon species. Fry emerge in May or June and live in ponds, lakes and stream pools, feeding on drifting insects. Coho salmon may reside in-stream up to three winters before migrating to sea where they typically remain for two winters before returning to spawn (ADFG 1986).

Chinook salmon are the first of the five species to return each season. They reach the Susitna River in approximately mid-May (ADFG 1986). Soon after hatching, most juvenile chinook salmon migrate to sea, but some remain for a year in fresh water. Most chinook salmon return to natal streams to spawn in their fourth or fifth year. The Susitna River supports the largest chinook salmon run in upper Cook Inlet, which includes systems below the Forelands to the latitude of N 59° 46’ 12’’, near Anchor Point (ADFG 1986).

Other Anadromous Fish. Bering cisco (*Coregonis laurettae*) have been reported in the Susitna River drainage (Barrett et al. 1985). Bering cisco enter river systems in the late summer. In 1982, spawning peaked mid-October in the Susitna River. Egg incubation occurs over winter and larvae move into northern Cook Inlet after ice-out in the spring from late April to May (Morrow 1980).

Dolly Varden (*Salvelinus malma)* that inhabit Cook Inlet can be anadromous or reside in fresh water. Non-resident Dolly Varden cycle seasonally between freshwater and marine environments. They often overwinter in freshwater drainages, then disperse into coastal waters during summer to feed on small fishes and marine invertebrates (Morrow 1980). In Cook Inlet, Dolly Varden spawn annually in rivers during the fall from late August to October (Scott and Crossman 1973; Morrow 1980). Like other salmonids, Dolly Varden lay eggs in hollowed out redds (shallow cavities dug into streambeds where salmonids spawn) located in swift moving water; hatching occurs the following spring. Juvenile Dolly Varden remain in their natal streams for 2 to 3 years.

White sturgeon (*Acipenser transmontanus*) are anadromous fish found in northern Cook Inlet. They are believed to spend most of life near shore in water depths of 30 meters or less. Although little is known about white sturgeon migrations while in salt water, one tagged specimen was captured 1,056 km from where it was tagged (Morrow 1980). In the spring, most mature white sturgeon enter the estuaries and lower reaches of river systems. They spawn over rocky bottoms in swift water where the sticky eggs adhere to the river bottom. The amount of time needed for the eggs to hatch is not known. After spawning, the adults return to sea (Morrow 1980).

3.6.2.2 Pelagic Fish

Eulachon (*Thaleichthys pacificus*) are small anadromous forage fish (up to approximately 23 cm long; MMS 1995) found throughout Cook Inlet. Mature eulachon, typically three years old, spawn in May soon after ice-out in the lower reaches of streams and rivers. The Susitna River supports a run of eulachon estimated in the millions (Barrett et al. 1985). Females broadcast their eggs over sand or gravel substrates where the eggs anchor to sand grains. Eggs hatch in 30 to 40 days, depending on the water temperature. Eulachon larvae are then flushed out of the drainage and mature in salt water. As juveniles and adults, they feed primarily on copepods and plankton. As the spawning season approaches, eulachon gather in large schools at stream and river mouths. Most eulachon die after spawning (Hart 1973). Eulachon is most important as a food source for other fish, birds and marine mammals. The Cook Inlet population also supports small dipnet fisheries in upper Cook Inlet.

Pacific herring (*Clupea pallasi*) are a larger forage fish (up to 38 cm in Alaska; Hart 1973) that enter lower Cook Inlet to spawn in early April and possibly into the fall (MMS 1995). Female herring lay adhesive eggs over rock and seaweed substrates. Depending on water temperature, eggs hatch in three to seven weeks. Herring stay nearshore until cold winter water temperatures drive them offshore to deeper, warmer waters. Herring have been harvested for bait in Cook Inlet as far north as the Forelands (Blackburn et al. 1979). The Cook Inlet herring fishery now targets Kamishak Bay on the west side of lower Cook Inlet. A small herring sac roe fishery has been suspended since the 1998 season because of low herring abundance. Alaska Department of Fish and Game biologists observed about 8,100 tons of herring in the Kamishak Bay District in 2000; biomass must exceed a threshold of 8,000 tons before a commercial sac roe harvest can be considered for Kamishak Bay.

Pacific sand lance (*Ammodytes hexapterus*) is a schooling fish that sometimes bury themselves in beach sand (Hart 1973). Pacific sand lance spawn within bays and estuaries, typically between December and March. Eggs are demersal, but will suspend in turbulent waters (Williams et al. 1964). Pacific sand lance larvae are found both offhsore and in intertidal zones (Fitch and Lavenberg 1975, Kobayashi 1961). Early juvenile stages are pelagic, while the adult burrowing behavior develops gradually (Hart 1973). Major food items of the juvenile sand lance include copepods, other small crustaceans, and eggs of many forms (Hart 1973; Fitch and Lavenberg 1975). This species is commonly preyed upon by lingcod, chinook salmon, halibut, fur seals, and other marine animals (Hart 1973), and appears to be an important forage species. Pacific sand lance have been caught off Chisik Island, southwest of West Foreland (Fechhelm et al. 1999).

3.6.2.3 Groundfish

The Pacific halibut (*Hippoglossus stenolepis*) is a large flatfish that occurs throughout Cook Inlet. Halibut concentrate on spawning grounds along the edge of the continental shelf at water depths of 182 to 455 meters from November to March. Significant spawning sites in the vicinity of lower Cook Inlet are Portlock Bank, northeast of Kodiak Island, and Chirikof Island, south of Kodiak Island (IPHC 1998). Temperature influences the rate of development, but typically eggs hatch in 20 days at 5º Celsius (ADFG 1986). As eggs develop into larvae, they float in the water column and drift passively with ocean currents. Halibut larvae's specific gravity decreases as they grow. Three to five month old larvae drift in the upper 100 meters of water where they are pushed by winds to shallow sections of the continental shelf. At six months old, juveniles settle to the bottom in nearshore waters where they remain for one to three years (Best and Hardman 1982). Juvenile halibut then move further offshore (IPHC 1998). Halibut migrate seasonally from deeper water in the winter to shallow water in summer. Accordingly, the fishery is most active in deep areas early in the season (i.e. May) whereas activity can be as shallow as 20 meters during mid-summer.

A recreational fishery in central Cook Inlet targets Pacific halibut. The Sport Fish Division of the Alaska Department of Fish and Game estimate that 75,709 halibut were caught by sport fishermen in central Cook Inlet between May 1 and July 31, 1995 (McKinley 1996).

Pacific cod (*Gadus macrocephalus*) are distributed over lower Cook Inlet. They are fast-growing bottom-dwellers that mature in approximately three years. They may reach lengths of up to one meter (Hart 1973). Cod spawn during an extended period through the winter and eggs may hatch in one week, depending on water temperature. Cod are harvested offshore in the Gulf of Alaska by trawl, longline, pot, and jig gear. Cod move into deep water in autumn and return to shallow water in spring. Pacific cod populations sustain a rapid turnover due to predation and commercial fishing. The Gulf of Alaska stock is projected to decline as a result of poor year-classes produced from 1990 through 1994 (Witherell 1999).

Starry flounder (*Platichthys stellatus*) have been caught in central Cook Inlet (Fechhelm et al. 1999) and are likely to occur in northern Cook Inlet. Starry flounder spawn from February through April in shallow water (Hart 1973). They generally do not migrate, although one starry flounder was caught 200 km from where it had been tagged (Hart 1973). Starry flounder tolerate low salinities and some have been caught within rivers.

Arrowtooth flounder (*Atheresthes stomias*) and yellowfin sole (*Pleuronectes asper*) may also extend into Cook Inlet. Little is known about the life history of these flatfish. Arrowtooth flounder larvae have been taken from depths of 200 meters to the surface in June off British Columbia (Hart 1973). Both have been caught off Chisik Island in central Cook Inlet (Fechhelm et al. 1999).

3.6.2.4 Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Act (MSA), PL-104-267, which regulate fishing in U.S. waters, included substantial new provisions to protect important habitat for all federally managed species of marine and anadromous fish. The amendments created a new requirement to describe and identify "essential fish habitat" (EFH) in each fishery management plan. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Federal agencies are required to consult with the National Marine Fisheries Service (NMFS) on all actions undertaken by the agency that may adversely affect EFH.

This mandate was intended to minimize adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of this habitat. Cook Inlet contains EFH for a total of 35 species including walleye pollock, pacific cod, and salmon (Table 1, Appendix C). Routine operations and accidents can affect EFH by damaging habitats used for breeding, spawning, feeding, or growth to maturity.

Fishery management plans are obliged to identify habitat areas of particular concern (HPC) within EFH. HPCs include living substrates in shallow water that provide food and rearing habitat for juvenile fish, and spawning grounds that may be impacted by shore-based activities. Estuarine and nearshore habitats of Pacific salmon (e.g. eel grass [*Zostera* sp.] beds) and herring spawning grounds (e.g. rockweed [*Fucus* sp.] and eel grass) are HPCs that can be found in Cook Inlet. Offshore HPCs include areas with substrates that serve as cover for organisms including groundfish. Areas of deepwater coral are also considered HPC, but populations are concentrated off southeast Alaska, out of the proposed project area. All anadromous streams qualify as HPC.

An Essential Fish Habitat Assessment has been performed for the wastewater discharges from the Osprey Platform. This assessment is provided as Appendix C.

3.6.3 Marine Birds

This section describes seabirds and shorebirds. Threatened and endangered species of marine and coastal birds are discussed in Section 3.7. Waterbirds (including loons) and waterfowl (swans, geese and ducks) occur as breeding birds and migrants in the Cook Inlet region. Because waterbirds predominantly use freshwater habitat (i.e., lakes and wetlands) rather than marine habitat, they are discussed in Section 3.8 (Terrestrial Biological Resources).

3.6.3.1 Seabirds

Lower Cook Inlet is one of the most productive areas for seabirds in Alaska. Approximately 27 species, comprised of an estimated 100,000 seabirds (USFWS 1992), occur in Cook Inlet, and about 18 species breed in the Inlet (Table 3-13). Seabird breeding colonies occur along the coastline of the Gulf of Alaska and the lower Cook Inlet (DeGange and Sanger 1987, USFWS 1992). Approximately 71 colony sites have been recorded throughout Cook Inlet (USFWS 1992). The largest seabird colonies occur on Chisik and Duck Islands in lower Cook Inlet (USFWS 1992). Species breeding in lower Cook Inlet include glaucous-winged gulls, black-legged kittiwake, common murre, pigeon guillemot, horned and tufted puffins, parakeet auklet, and red-faced, double-crested, and pelagic cormorants.

Large concentrations of seabirds occur in Cook Inlet and the Gulf of Alaska during the spring when returning breeding species and migrants from breeding grounds in the southern hemisphere move into the area. The numbers remain high throughout the summer and decline in the fall as they begin to migrate to their wintering grounds (DeGange and Sanger 1987). Seabird numbers in Cook Inlet are lowest during the winter.

3.6.3.2 Shorebirds

Approximately 30 shorebird species occur as breeding birds and migrants in Cook Inlet (Table 3-14). Although shorebirds nest in Cook Inlet, the most important areas for shorebird use in the region of the proposed project are the migratory stop-over areas in the northern Gulf of Alaska/lower Cook Inlet where birds stop to rest and feed. An important location for shorebirds during migration is western Cook Inlet (DeGange and Sanger 1987). These include the intertidal zones of Drift River, Iniskin Bay, and Chinitna Bay. Kachemak Bay in lower Cook Inlet is also an important feeding and resting area for shorebirds during migration.

The Pribilof Islands rock sandpiper (*Calidris ptilocnemis*) winters along the intertidal mudflats from the Susitna River south to Redoubt Bay (Gill and Tibbets 1999). The sandpipers, which begin arriving in November and remain through mid-April, feed on a small bivalve (*Macoma balthica*) found in high densities in the intertidal area. The mean count of the Pribilof Islands rock sandpiper during aerial surveys conducted in winter (1997 to 1999) was 17,530 birds.

During spring migration, millions of shorebirds congregate at coastal intertidal mudflats to feed before continuing their northward migration. Most birds pass through the area between late April and mid May with the peak of the migration in early May. The two most common species are dunlin and western sandpiper. Turnover is high and individual birds probably only stop to feed and rest for a few days before continuing.

3.6.4 Marine Mammals

Marine mammals that range throughout the Gulf of Alaska, including Cook Inlet, are listed in Table 3-15 and desribed below (Table 3-15). These species are protected under the Marine Mammal Protection Act (MMPA) and are managed by the U.S. Fish and Wildlife Service (USFWS) and NMFS. Threatened and endangered species of marine mammals are discussed in Section 3.7.

3.6.4.1 Minke Whale

Minke whales (*Balaenoptera acutorostrata*) occur in the North Pacific from the Bering and Chukchi Seas south to near the equator (Leatherwood et al. 1982). Minke whales are relatively common in the nearshore waters of the Gulf of Alaska (Mizroch 1992), but are not abundant in any other part of the eastern Pacific (Brueggeman et al. 1990). Minke whales are unlikely to migrate into Cook Inlet, but it is possible.

Minke whales breed in temperate or subtropical waters throughout the year (Dohl et al. 1981). Peaks of breeding activity occur in January and in June (Leatherwood et al. 1982). Calving occurs in winter and spring (Stewart and Leatherwood 1985). Females are capable of calving each year, but a two-year calving interval is more typical (Leatherwood et al. 1982).

Minke whales in the North Pacific prey mostly on euphausiids and copepods, but also feed on schooling fishes including Pacific sand lance, northern anchovy, and squid (Leatherwood et al. 1982, Stewart and Leatherwood 1985, Horwood 1990).

No estimates of the number of minke whales in the north Pacific or Alaskan waters have been made, nor are there data on trends in the minke whale population in Alaskan waters (Hill and DeMaster 2000). The annual human-caused mortality is considered insignificant. Minke whales in Alaska are not listed as depleted under the MMPA, or considered a strategic stock (Hill and DeMaster 2000).

3.6.4.2 Gray Whale

Gray whales (*Eschrichtius robustus*) historically inhabited both the North Atlantic and North Pacific oceans. A relic population survives in the western Pacific. The eastern Pacific or California gray whale population has recovered significantly, and now numbers about 23,000 (Hill et al. 1997). The eastern Pacific stock was removed from the Endangered Species List in 1994 and is not considered a strategic stock by the NMFS.

The eastern Pacific gray whale breeds and calves in the protected waters along the west coast of Baja California and the east coast of the Gulf of California from January to April (Swartz and Jones 1981; Jones and Swartz 1984). At the end of the breeding and calving season, most of these gray whales migrate about 8,000 km (5,000 mi.) north, generally along the west coast of North America, to the main summer feeding grounds in the northern Bering and Chukchi seas (Tomilin 1967; Rice and Wolman 1971; Braham 1984; Nerini 1984).

Gray whale occurrences in Cook Inlet are most likely uncommon. As they move through the Gulf of Alaska on their northward and southward migrations, gray whales closely follow the coastline (Calkins 1986). They generally tend to by-pass Cook Inlet as they pass through the Barren Islands and the waters south of Kodiak Island (Calkins 1986). However, a cow and a calf were observed in lower Cook Inlet as recently as the summer of 2000 (Eagleton 2000).

3.6.4.3 Killer Whale

Killer whales (*Orcinus orca*) occur along the entire Alaska coast (Dahlheim et al. 1997) from the Chukchi Sea, into the Bering Sea, along the Aleutian Islands, Gulf of Alaska, and into Southeast Alaska (Braham and Dahlheim 1982). Seasonal concentrations occur in Shelikof Strait and the waters around Kodiak Island (Calkins 1986). Killer whales are known to inhabit Cook Inlet waters during the summer and have been observed pursuing beluga whales in Cook Inlet (Eagleton 2000). Killer whales utilizing Cook Inlet are most likely from the Eastern North Pacific Northern Resident stock of killer whales, which is estimated at 717 individuals (Hill and DeMaster 1999). Currently, there are no reliable data describing the population trend for this stock (Hill and DeMaster 1999).

3.6.4.4 Harbor Porpoise

The harbor porpoise (*Phocoena phocoena*) is distributed in waters along the continental shelf, and is most frequently found in cool waters with high prey concentrations (Watts and Gaskin 1985). The range of the harbor porpoise within the eastern North Pacific Ocean is primarily restricted to coastal waters and extends from Point Barrow, along the coast of Alaska, and the west coast of North America to Point Conception, California (Gaskin 1984). Harbor porpoise densities are much greater in their southern range (Washington, northern Oregon and California) than in Alaskan waters (Dahlheim et al. submitted). Harbor porpoises are not migratory. Little information on the population dynamics of harbor porpoises is known. However, harbor porpoise occur in Cook Inlet (Calkins 1983). The most recent population estimate for the harbor porpoise in Alaskan waters is 30,000 (Hill and DeMaster 1999).

The major predators on harbor porpoises are great white sharks and killer whales. Unlike other delphinids, harbor porpoises forage independently (Würsig 1986) feeding on small schooling fishes such as northern anchovy and Pacific herring, as well as squid.

3.6.4.5 Dall's Porpoise

Dall's porpoises (*Phocoenoides dalli*) are widely distributed along the continental shelf (Hall 1979) as far north as 65ºN (Buckland et al. 1993) and are abundant throughout the Gulf of Alaska (Calkins 1986). Dall's porpoises prefer water depths greater than 20 m deep (Hall 1979) and are commonly found in lower Cook Inlet (Calkins 1983). The only apparent gaps in their distribution in the Gulf of Alaska are in upper Cook Inlet and Icy Bay (Consiglieri and Braham 1982). The current estimate for the Alaska stock of Dall's porpoise is 83,400 (Hill and DeMaster 1999).

3.6.4.6 Harbor Seal

Harbor seals (*Phoca vitulina richardsi*) range from Baja California, north along the western coast of the United States, British Columbia, and Southeast Alaska, west through the Gulf of Alaska and the Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. Hill and DeMaster (2000) estimated 29,000 individuals in the Gulf of Alaska stock. The Gulf of Alaska populations around Kodiak and Tugidak Islands have grown since the early 1990's (Small 1996; Withrow and Loughlin 1997) but overall the stock numbers are in decline (Hill and DeMaster 2000).

Harbor seals inhabit estuarine and coastal waters, hauling out on rocks, reefs, beaches, and glacial ice flows. They are generally non-migratory, but move locally with the tides, weather, season, food availability, and reproduction activities (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969; Bigg 1981). Female harbor seals give birth to a single pup while hauled out on shore or on glacial ice flows. The mother and pup remain together until weaning occurs at 3 to 6 weeks (Bishop 1967; Bigg 1969). Little is known about breeding behavior in harbor seals. When molting, seals spend the majority of the time hauled out on shore, glacial ice, or other substrates. Harbor seals consume a variety of prey in estuarine and marine waters. Prey type varies regionally and seasonally in the Gulf of Alaska. Walleye pollock are the dominant prey in the eastern Gulf, and octopus is the dominant prey in the western Gulf.

No harbor seal haulout areas have been documented in the vicinity of the West Foreland. The closest harbor seal haulout area observed during a 1996 NMFS aerial survey is located just north of Big River, about 15 miles south of the West Foreland (Rehberg 2001).

3.6.4.7 Sea Otter

Sea otters (*Enhydra lutris*) occur in the coastal waters of the North Pacific Ocean and the southern Bering Sea. Typically, sea otters inhabit nearshore waters less than 35 m deep with sandy or rocky bottoms that support abundant populations of benthic invertebrates (Rotterman and Simon-Jackson 1988). In some areas, sea otters occur far from shore (e.g. further than 8 km in Prince William Sound); large aggregations are found more than 30 km north of Unimak Island (Rotterman pers. obs. from Rotterman and Simon-Jackson 1988). Canopy-forming kelp beds are used for resting and foraging although sea otters may also use areas void of kelp beds (Rotterman and Simon-Jackson 1988). Typical haul out habitat includes rocky points, sandy beaches, spits, islets, sandbars, rocks, and ice flows (Rotterman and Simon-Jackson 1988).

More than 90 percent of the world sea otter population is located in coastal Alaskan waters (Rotterman and Simon-Jackson, 1988). The south central Alaska stock of sea otters was estimated in 1998 to have a minimum population size of 20,948 (Gorbics et al. 1998). Sea otters consume an array of sessile and slow-moving benthic invertebrates including sea urchins, clams, mussels and crabs, octopus, squid, and epibenthic fishes (Rotterman and Simon-Jackson 1988).

In Cook Inlet, sea otters are primarily found in lower Cook Inlet (Calkins 1983). Population numbers are unknown, but it is thought that the Cook Inlet population is expanding. They have been observed in Tuxedni Bay on the west side and north of Anchor Point on the east side (Calkins 1983).

3.7 THREATENED AND ENDANGERED SPECIES

Section 7 of the Endangered Species Act (ESA) requires federal agencies to conserve endangered and threatened species. It also requires all federal agencies to consult with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS) if they determine that any action they fund, authorize, or carry out may affect a listed species or designated critical habitat. The endangered and threatened species that may be present near the proposed project are listed in Table 3-16, and are discussed below. A biological assessment (BA) was prepared to assess the impacts of wastewater discharges from the Osprey Platform on threatened and endangered species of marine mammals or birds that may be present near the project area (Appendix B); the BA provides additional details about the distribution, life history, diet, predators, population status, critical habitat, and factors affecting survival for each of the identified species.

3.7.1 Birds

3.7.1.1 Steller's Eider

The USFWS listed the Alaskan breeding population of Steller's eiders (*Polysticta stelleri*) as threatened under the ESA on June 11, 1997. The Alaskan population of Steller's eiders nests along the western Arctic Coastal Plain in Alaska from approximately Point Lay east to Prudhoe Bay, with a known concentration in some years near Pt. Barrow, and in low numbers along the Yukon-Kuskokwim Delta (65 FR 49). Historically, nesting ranged from St. Lawrence Island and the Hooper Bay area north to Barrow (AOU 1997), and was rare east of Point Barrow. The current population trend for the Alaskan breeding population of Steller's eiders is unknown. USFWS estimates that hundreds or thousands of Steller's eiders may occur on the North Slope during the breeding season in early to mid-June.

In late June through August, Steller's eiders migrate southward along the northwest coast of Alaska (Gabrielson and Lincoln 1959) to the Alaska Peninsula, where they undergo a flightless molt for 10 to 14 days (65 FR 49). The geographic range of their wintering grounds remains unknown. However, Steller's eiders are thought to over-winter in relatively ice-free marine waters from Kodiak Island west to Unimak Island, Alaska (Palmer 1976). The timing of spring migration to the nesting grounds is dependent on weather conditions. Kessel (1989) noted that eiders typically move through the Bering Strait between mid-May and early June. Steller's eiders gather in staging areas before beginning their spring migration. These staging areas can contain thousands to tens of thousands of birds and are primarily located along the northern side of the Alaska Peninsula, including Port Heiden, Port Moller, Nelson Lagoon, and Izembek Lagoon (65 FR 49). Staging areas for the spring migration may also be used as winter habitat.

Steller's eiders feed on crustaceans, amphipods and mollusks (Cottom 1939, Peterson 1981). Eiders primarily feed near shore during the winter (65 FR 49). Raptors, gulls, jaegers, ravens, and foxes are their main predators, and where present, gulls are thought to harass eiders in winter feeding grounds, as well as in nesting areas (65 FR 49).

Little is known about the population dynamics of Steller's eiders. The reduction of eiders on historical breeding grounds suggests that Steller's eiders are either abandoning these historic nesting areas or that the population is declining. Currently, the causes of population declines in Steller's eiders are unknown, although possible causes include habitat loss or modification, increased predation in areas where human activities have artificially expanded predator populations by providing shelter and alternative food sources, lead poisoning on the Yukon-Kuskokwim Delta caused by the ingestion of lead shot while feeding, and food availability caused by changes in the Bering Sea ecosystem (USFWS 2000). In Siberia, possible causes of Steller's eider decline could also include habitat loss on the breeding grounds due to oil and gas exploration and unreported subsistence hunting (USFWS 2000).

In January 2001, the USFWS designated 7,330 square kilometers as critical habitat for Steller's eiders into five units (USFWS 2001). These units are located along the coastal areas of the Yukon-Kuskokwim Delta and along the Alaska Peninsula. Although Steller's eiders use areas in lower Cook Inlet, none were designated as critical in the final rule.

Steller's eiders may occur in Cook Inlet as occasional visitors during the winter months. Little information exists on the abundance and distribution of Steller's eiders in lower Cook Inlet. Steller's eiders have wintered in Kachemak Bay and further north along the eastern side of Cook Inlet (Balogh 1999). This area is considered wintering habitat for Steller's eiders. Balogh (1999) also indicated that no Steller's eiders have been observed on the western side of Cook Inlet, but that only a limited number of eider surveys have been conducted on the western side of Cook Inlet. The most recent observations of Steller's eiders in Cook Inlet reported approximately 1,000 Steller's eiders south of Ninilchik in 1999 (Antrobus 2000). In 1997, 650 individuals were seen in the same area near Ninilchik. USFWS plans to conduct Steller's eiders surveys in the future to ascertain abundance and distribution of Steller's eiders in Cook Inlet.

3.7.1.2 Short-tailed Albatross

The short-tailed albatross (*Phoebastria albatrus*) is a pelagic seabird with long, relatively narrow wings adapted for soaring low over the water. The short-tailed albatross is the largest of the three species of Northern Pacific albatross, with an average wingspan of 84 inches and an average body length of 37 inches (Farrand 1983). It has a relatively long life span and may reach 40 years of age (Sherburne 1993). Breeding age is approximately 6 years, at which time they begin nesting every year. The short-tailed albatross is a monogamous, colonial nester and returns to nesting areas. The diet of short-tailed albatross includes squid, small fish, and crustaceans (DeGrange 1981).

Historically, the short-tailed albatross bred only in the western North Pacific (Sherburne 1993) on islands in Japan and Taiwan (63 FR 211). Today, there are only two known active breeding colonies, one on Torishima Island and one on Minami-Kojima Island, Japan. Short-tailed albatross usually arrive at breeding colonies in October and lay eggs by the end of the month. Females lay a single egg, and both parents incubate the eggs for 64 to 65 days. By late May, the chicks are almost full-grown, and the adults depart, leaving the chicks to fledge (63 FR 211). Avian and terrestrial predators of short-tailed albatross chicks include crows (*Corvus* sp.) and possibly introduced black rats and domestic cats on Torishima Island. Sharks may prey on albatross in the open ocean as well (63 FR 211).

The current world population of the short-tailed albatross is estimated to be 500 to 1,000 individuals. Currently, the short-tailed albatross is listed as endangered throughout its range under the 1973 ESA (50 CFR 17). Alaska also lists the short-tailed albatross as endangered under the State of Alaska list of endangered species.

The short-tailed albatross was historically found year-round in the North Pacific from Siberia to the western coast of North America and the Bering Sea to the Hawaiian Islands (Roberson 1980). Documented critical habitat for the albatross occurs outside U.S. jurisdiction. However, important foraging habitat of the short-tailed albatross under U.S. jurisdiction includes the coastal regions of the

North Pacific Ocean and Bering Sea during the non-breeding season and throughout the northwestern Hawaiian Islands during the breeding season. Annual observations of short-tailed albatross have been recorded in the Gulf of Alaska and the North Pacific since 1947. Although Cook Inlet is described as potential habitat for short-tailed albatross, none have been observed in the coastal waters of Cook Inlet since observations began (1947 through 1999; AKNHP 2000, IPHC 1999).

3.7.2 Marine Mammals

Endangered whales, such as the fin, humpback, blue, and northern right whale, could be present in lower Cook Inlet. Any observations of these species would most likely be near the entrance to Cook Inlet (Smith 1999). Most documentation of larger whales in Cook Inlet comes from historical records, mainly strandings (Eagleton 2000). Historical data suggest that small numbers of humpback and fin whales have been observed in portions of lower Cook Inlet on occasion during the summer months and have been documented within one mile of shore (MMS 1996c). Humpback and fin whales are not found regularly above Kachemak Bay (Smith and Mahoney 1999). During the summer of 2000, humpbacks were observed around the entrance of Cook Inlet, near the Barren Islands. Blue and northern right whales are only accidental visitors in lower Cook Inlet.

3.7.2.1 Fin Whale

Fin whales (*Balenoptera physalus*) range from subtropical to arctic waters. The North Pacific fin whale population was estimated at 16,600 individuals in 1991 (NMFS 1991). Current abundance estimates are not available (Hill and DeMaster 2000). There have been no reports of incidental mortality of fin whales related to commercial fishing operations in the North Pacific during this decade. There also has been no reported harvest of fin whales by subsistence hunters in Alaska and Russia (Hill and DeMaster 2000). There are no published reports that indicate recovery of this stock has or is taking place (Braham 1992, Hill and DeMaster 2000).

The summer distribution of fin whales extends from central California to the Chukchi Sea. In Alaskan waters, some whales spend the summer feeding in the Gulf of Alaska, while others migrate farther north. Fin whales feed throughout the Bering and Chukchi Seas from June through October. Fin whales usually occur in high-relief areas where productivity is probably high (Brueggeman et al. 1988). Fin whales winter in the waters off the coast of California. Migration southward occurs from September through November. Northward migration begins in spring with migrating whales entering the Gulf of Alaska from early April to June (MMS 1996a). Most sightings of fin whales in southcentral Alaskan waters have been documented in the Shelikof Strait, near Kodiak Island and lower Prince William Sound (Montgomery Watson 1993). Authenticated sightings of fin whales are rare in Cook Inlet as most documentation has been based on carcass sightings (Eagleton 2000). No critical habitat in Alaska has been designated for this species.

Fin whales usually breed and calve in the warmer waters of their winter range. Breeding can occur in any season, but the peak occurs between November and February (Tomilin 1967, Ohsumi 1958). Fin whales are opportunistic feeders, taking euphausiids, copepods, fish and squid (Lowry et al. 1982).

3.7.2.2 Humpback Whale

Humpback whales (*Megaptera novaeangliae*) in the North Pacific are seasonal migrants that feed in the cool, coastal waters of the western United States, western Canada, and the Russian far east (NMFS 1991). The Western North Pacific stock of humpback whales spends winter and spring in waters off Japan and migrates to the Bering Sea, Chukchi Sea, and Aleutian Islands in the summer and fall (Berzin and Rovnin

1966, Nishiwaki 1966, Darling 1991). The current estimate of the Western North Pacific humpback whale stock (the stock most likely utilizing the Cook Inlet area) is 394 animals (Calambokidis et al. 1997). Sightings of humpbacks are rare in Cook Inlet, although they are common around the Barren Islands, south of Cook Inlet in the summer months. No critical habitat in Alaska has been designated for this species.

Breeding and calving occur on the wintering grounds near Japan. Most births occur between January and March (Johnson and Wolman 1984). Humpbacks feed on euphausiids, amphipods, mysids, and small fish, such as Pacific herring, capelin, anchovies, sardines, cod, and sand lance (Wolman 1978, Wing and Krieger 1983). Humpback whales are thought to feed mainly during the summer months (Wolman 1978).

Reliable information on the trends in abundance for the Western North Pacific humpback whale is not available. No commercial fishery related mortalities have been observed during 1990 to 1997 monitoring. The annual estimated mortality rate due to commercial fisheries is 0.2 whales per year. However, this is considered a minimum rate since no data are available from Japanese, Russian, or international waters (Hill and DeMaster 2000).

3.7.2.3 Blue Whale

Summering blue whales (*Balenoptera musculus*) from the North Pacific stock are present in waters from California to Alaska. Blue whales occur in a narrow area just south of the Aleutian Islands from 160º W to 175º W (Berzin and Rovnin 1966, Rice 1974). The species is also distributed in an area north of 50º N latitude extending from southeastern Kodiak Island across the Gulf of Alaska and from southeast Alaska to Vancouver Island (Berzin and Rovnin 1966). Whaling records indicate that large concentrations of this species once occurred in the northern part of the Gulf of Alaska southwest of Prince William Sound in the Port Banks area (Nishiwaki 1966). However, recent sightings in Alaskan waters have been scarce (MMS 1996a). No critical habitat in Alaska has been designated for this species.

Blue whales usually begin migrating south out of the Gulf of Alaska by September (Berzin and Rovnin 1966). Migration routes are thought to be along the western coast of North America. The North Pacific blue whale population winters from the open waters of the mid-temperate Pacific south to at least 20º N (MMS 1996a). The northward spring migration begins in April or May, with whales traveling in the eastern Pacific (Berzin and Rovnin 1966). Mating and calving are thought to take place over a five-month period during the winter (Mizroch et al. 1984). Blue whales feed principally on krill, small euphausiid crustaceans, primarily in their summer range (Nemoto 1959, Berzin and Rovnin 1966).

There is relatively little information about the abundance or mortality of blue whales since hunting ceased in 1967 (MMS 1996a). The most recent estimate of the North Pacific blue whale population was approximately 1,700 individuals (Barlow and Gerrodette 1996). There is no evidence that the blue whale population is recovering (MMS 1996a, Mizroch et al. 1984).

3.7.2.4 Northern Right Whale

Northern right whales (*Eubalaena glacialis*) can grow up to 50 feet in length. These large, slow swimming whales tend to congregate in coastal waters. Little is known about the life history of the right whale. No calving grounds have been found in the eastern North Pacific (Scarff 1986). Consequently, right whales are thought to calve in southern coastal waters of their distribution during the winter months (Scarff 1986). Scarff (1986) hypothesized that right whales summering in the eastern North Pacific mate, calve, and overwinter in the mid-Pacific or Western North Pacific. The migration patterns of the North Pacific stock are also unknown. During summer, it is assumed that right whales migrate to their summer feeding grounds in the higher latitudes of their range. In winter, they migrate to the more temperate waters (Braham and Rice 1984). The location and type of critical habitat for right whales is unknown due to the rarity of this species. Right whales feed primarily on zooplankton, copepods and euphausiids (MMS 1996a).

Whaling records indicate that right whales in the North Pacific range across the entire North Pacific north of 35° N. Commercial whalers hunted right whales nearly to extinction during the 1800s. From 1958 to 1982, there were only 32 to 36 sightings of right whales in the central North Pacific and Bering Seas (Braham 1986). In the eastern North Pacific south of 50° N, only 29 reliable sightings were recorded between 1900 and 1994 (Scarff 1986, Scarff 1991, Carretta et al. 1994). Wada (1973) estimated a total population of 100 to 200 in the North Pacific. In 1996, a right whale was sighted off Maui (Hill and DeMaster 2000) and a group of 3 to 4 right whales was sighted in Bristol Bay. In 1997, a group of 5 to 9 individuals was seen in approximately the same Bristol Bay location (Hill and DeMaster 2000). A reliable current estimate of abundance for the North Pacific right whale stock is not available (Hill and DeMaster 2000). Although they may travel through the Gulf of Alaska, it is highly unlikely that right whales use Cook Inlet.

3.7.2.5 Steller Sea Lion, Western Stock

Steller sea lions (*Eumetopias jubatus*) range along the North Pacific Rim from northern Japan to California (Loughlin et al. 1984). The centers of abundance and distribution are located in the Gulf of Alaska and the Aleutian Islands. At sea, Steller sea lions commonly occur near the 200-m depth contour, but are seen from nearshore to well beyond the continental shelf (Kajimura and Loughlin 1988).

In 1997, NMFS designated the Western stock of Steller sea lions as endangered under the ESA (62 FR 30772). Aerial and ground based surveys suggest a minimum population size of approximately 39,000 Steller sea lions in the western U.S. in 1998 (Sease and Loughlin 1999). The first reported trend counts of Steller sea lions in Alaska indicated at least 140,000 sea lions in the Gulf of Alaska and Aleutian Islands (Kenyon and Rice 1961, Mathisen and Lopp 1963). Counts in 1976 and 1979 estimated 110,000 sea lions and suggested a major population decrease in the Aleutian Islands beginning in the mid 1970s (Braham et al. 1980). The largest declines occurred in the eastern Aleutian Islands and western Gulf of Alaska, but declines have also occurred in the central Gulf of Alaska and the central Aleutian Islands. Counts at trend sites from 1990 to 1996 indicate a 27 percent decline. Counts at trend sites in 1998 suggest a further 7.8 percent decline since 1996 (Hill and DeMaster 2000).

Adult female Steller sea lions usually breed annually (Pitcher and Calkins 1981). Females reach sexual maturity between three and six years of age and can produce young into their early 20s (Mathisen et al. 1962, Pitcher and Calkins 1981). Females produce a single pup each year. Pups are born from late May to early July. Young are usually weaned by the end of their first year but may continue to nurse until age three (Lowry et al. 1982). Males reach sexual maturity between three and seven years of age.

Steller sea lions eat a variety of fish and invertebrates. Harbor seals, spotted seals, bearded seals, ringed seals, fur seals, California sea lions and sea otters are also occasionally eaten (Tikhimirov 1959, Gentry and Johnson 1981, Pitcher 1981, Pitcher and Fay 1982, Byrnes and Hood 1994). Walleye pollock is the principal prey in most areas of the Gulf of Alaska and the Bering Sea (NMFS 1995). In the Aleutian Islands Atka mackerel was the most common prey followed by walleye pollock and Pacific salmon (NMFS 1995).

Steller sea lions use specific locations along the coast of Alaska as rookeries and haul-out sites. All sea lion haul-out sites are considered critical habitat because of their limited numbers and high-density use.

Alteration of these areas through disturbance or habitat destruction could have a significant impact on the use of these sites by sea lions. Although no rookeries or haul-out sites have been identified in the Cook Inlet area, Steller sea lions may range and forage throughout Cook Inlet during salmon runs (Smith 1999). For example, one male Steller sea lion was observed at the mouth of the Susitna River (Eagleton 2000). However, only a small number of animals are present at any particular time and they would not be present in any significant concentrations in Cook Inlet. The nearest reported Steller sea lion rookery is the Sugarloaf Islands rookery located in the Barren Islands (58º 53.0" N, 152º 2.0" W) (NMFS 2000c). The nearest major Steller sea lion haul-out is located on Ushagat Island (58º 55.0" N, 152º 22.0" W) also in the Barren Islands.

Declines in juvenile survival appear to be an important proximate cause of the decline in the Alaskan population of Steller sea lions from the early 1980s to the present. Since 1985, researchers have noted a reduced abundance of juvenile animals in declining rookeries (Merrick et al. 1987; NMFS and ADFG unpublished data cited in NMFS 1995). York (1994) suggested a 10 percent to 20 percent decrease in juvenile (ages 0 to 4) survival in the Kodiak Island population, and Pascual and Adkinson (1994) concluded that juvenile survival could have declined as much as 30 percent to 60 percent. Despite the apparent declines in juvenile survival, the large-scale declines which occurred in the Aleutian Islands during the 1970s and from 1985 to 1989 are too large to be caused solely by changes in juvenile survival. NMFS (1995) suggests that acute declines in adult survival were overlaid on an ongoing, chronic decline in juvenile survival.

Steller sea lion pup mortality occurs from drowning, starvation caused by separation from the mother, crushing by larger animals, disease, predation, and biting by females other than the mother (Orr and Poulter 1967; Edie 1977). Juvenile and adult Steller sea lions are eaten by sharks and killer whales, but the rates and significance of this predation is not known.

A number of factors do not appear to be important in the decline of Steller sea lion populations, including the effects of toxic materials, parasites, entanglement, commercial and subsistence harvest, disturbance, and predation (NMFS 1992). Factors that remain under consideration are shooting, incidental take in fisheries, disease, and changes in the quantity or quality of the prey base. Increased disturbance that may result from activities such as oil exploration and production, although not responsible for their decline, could have subtle but significant impacts on the recovery of the sea lion population (NMFS 1992).

3.7.2.6 Cetacean of Special Concern -- Beluga Whale

Beluga whales (*Delphinapterus leucas*) are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980). The Cook Inlet stock of beluga whales was listed as depleted under the Marine Mammal Protection Act (MMPA) on May 31, 2000 (65 FR 105; 50 CFR 216.15). After the completion of the status review, NMFS denied a petition to list the Cook Inlet stock of belugas as endangered (65 FR 121).

Klinkhart (1966) first surveyed Cook Inlet beluga whales in 1963 and 1964, at which time the minimum population was estimated to be between 300 and 400 whales. In 1979, 1982, and 1983, Calkins performed extensive aerial surveys of the inlet and reported sighting as many as 479 belugas in 1979 (Morris 1992) and estimated the stock at 1,300 animals. However, these surveys were not designed to estimate abundance throughout the entire Cook Inlet. Most past surveys have concentrated only on the upper inlet when belugas are congregated at the mouths of rivers for calving and feeding (Morris 1992). However, information on breeding and reproduction specific to the Cook Inlet belugas is generally lacking.

NMFS initiated population surveys in 1993 to estimate the abundance of Cook Inlet belugas. Surveys between 1994 and 1999 produced abundance estimates of 653, 491, 594, 440, 347, and 357 whales, respectively (65 FR 105). These numbers indicated more than a 40 percent decline in population size over the last 6 years. Beluga distribution data also suggest a reduction in offshore sightings in both upper and lower Cook Inlet during the summer (Rugh et al. 2000).

During the 2000 Cook Inlet beluga whale surveys, 184 individuals were sighted (Rugh et al. 2000). This was the lowest median raw count (the number of whales actually observed and not corrected for missed whales) of belugas since NMFS initiated the surveys in 1993. However, correcting for whales missed results in a population estimate of 435 (O'Harra 2001). Beluga whale concentrations in Cook Inlet are shown in Figure 3-2.

Beluga whales occupy different parts of Cook Inlet throughout the year (Sheldon 1993). Concentrations occur nearshore in the northwestern upper inlet from April through June (Calkins 1989). The largest counts of belugas have occurred during May and June (Morris 1992), particularly between the West Foreland and Knik Arm (Sheldon 1993). Withrow et al. (1994) report large aggregations of up to 260 near the mouths of the rivers. By August, beluga concentrations disperse along the coastline of the upper and central inlet. Groups of less than 10 animals distributed along the coastline north of Kalgin Island have been reported in late September (Withrow et al. 1994). With the return of ice in late fall, the population likely moves into the lower inlet (Sheldon 1993), although it appears that some belugas remain in the upper Cook Inlet during the winter if conditions are appropriate (NMFS 2000a). The tracking of two satellite-tagged belugas from September 2000 to January 2001 indicates that these whales were spending a portion of the winter in upper Cook Inlet (NMFS 2000a).

Current data on mortality and serious injury from all fishery related activities are not available for the Cook Inlet stock of beluga whales. In Cook Inlet, belugas may contact purse seines, drift gillnets, and set gillnets. However, it is currently thought that commercial fisheries in Cook Inlet have little, if any, interaction with belugas. Between 1981 and 1983, in Cook Inlet an estimated 3 to 6 belugas were killed per year from interactions with fishing gear in Cook Inlet (Burns and Seaman 1986). Self-reports of beluga mortalities from commercial fisherman throughout the 1990s were considered incomplete and unreliable. Since 1999, observers have been used to document beluga mortalities from the Cook Inlet gillnet fisheries. No beluga mortalities or interactions with fisheries have been observed during the present observer program (Hill and DeMaster 2000).

The decline of Cook Inlet belugas has been primarily attributed to subsistence harvest by Alaska Natives (NMFS 2000b). Mean annual subsistence take of beluga whales from the Cook Inlet stock averaged 87 whales between 1993 and 1997. Currently, there is a moratorium on harvesting Cook Inlet belugas. Future harvest levels have yet to be determined. Because of the extremely low population numbers, cumulative harvest over a number of years would likely affect the recovery rate of the Cook Inlet population. During 1998, local Alaska Native organizations and NMFS began to formalize a specific agreement for management of the Cook Inlet beluga stock, and it was finalized in 2000.

Beluga whales feed seasonally on a variety of fishes, shrimps, squids, and octopus (Burns et al., 1985). Fish species that Cook Inlet belugas feed on during the summer include salmon, herring, eulachon, capelin, smelt, and arctic cod (Calkins 1989). Pacific tomcod may be an important food source for Cook Inlet belugas in autumn and winter when salmon and eulachon are not available (Calkins 1989).

Large groups of belugas congregate at river mouths in the upper drainages of Cook Inlet to feed on migrating prey species, such as the eulachon and salmon (Morris 1992). Belugas generally feed in the upper 30 feet of the water column (Morris 1992), with most feeding dives thought to be between depths of 20 and 100 feet and to last 2 to 5 minutes (ADFG 1999a).

The killer whale is the beluga whale's only natural predator. Killer whales are common visitors to Cook Inlet and have been known to pursue belugas in Cook Inlet (Eagleton 2000).

3.8 TERRESTRIAL BIOLOGICAL RESOURCES

3.8.1 Vegetation and Wetlands

Approximately 1.8 miles of pipeline and access road will be located onshore for the proposed project. The pipeline/access road will traverse areas of low hills, relatively small drainage basins and interspersed wetlands (see Figure 3-3). Drier upland areas support a mixed evergreen-deciduous forest consisting mostly of white spruce and birch. Wetter muskeg/wetlands areas include grasses, sedges, shrubs, and black spruce. There are numerous ponds and small lakes in the muskeg areas, and surface drainage to and from these water bodies is usually poorly defined or non-existent.

A wetlands survey of the proposed onshore route was conducted on September 14, 2000 (HLA 2000). The survey area is within the Cook Inlet-Susitna Lowlands; 28 percent of the Cook Inlet-Susitna Lowlands are wetlands (2,645 acres) (HLA 2000). Within the survey area, the upland black spruce-paper birch forest was interspersed with ponds, saturated shrub bogs, emergent wetlands, and upland meadows. Seven wetland sites were identified within the survey area (Figure 3-4). The wetlands typically had a distinct boundary with a slight elevation rise and change in vegetation (HLA 2000). Soils in wetland areas ranged from decomposing organic material with very little soil formation to peat soils. Sand pockets and sand grains mixed with the peat were common.

Common dominant plants in the wetlands sampled included black spruce shrubs (*Picea mariana*), dwarf arctic birch (*Betula nana*), crowberry (*Empetrum nigrum*), Labrador tea (*Ledum palustris decumbens*), sweetgale (*Myrica gale*), and sedges (*Carex* spp.). Upland forests were dominated by paper birch (*Betula papyrifera*) and black spruce trees, with devil's club (*Echinopanax horridum*), high bushcranberry (*Viburnum edula*), and other shrubs in the understory. Upland meadows were dominated by fireweed *(Epilobium angustifolium*), cow parsnip (*Heracleum lanatum*), and other herbaceous and low shrub plants.

Four wetlands areas, totaling approximately 772 lineal feet of wetland crossings (Figure 3-4), are crossed by the proposed trail route (HLA 2000). Footage for each wetland crossed is as follows:

- FOR1: two crossings at 65 feet and 125 feet
- FOR2: 177 feet
- FOR3: 363 feet
- FOR7: 42 feet

There are no new stream crossings required for the proposed onshore pipelines and access road.

3.8.2 Terrestrial Birds

Upper Cook Inlet provides a variety of terrestrial habitats for birds. Major species groups that occur in the upper inlet during some portion of the year include those associated with freshwater and marine habitats (waterfowl) and those associated with more terrestrial habitats (raptors, grouse, woodpeckers, and passerines). These are addressed in the following paragraphs.

3.8.2.1 Waterbirds

Waterbirds (including loons) and waterfowl (swans, geese and ducks) occur as breeding birds and migrants in the Cook Inlet region. Because waterbirds predominantly use freshwater habitat (i.e., lakes and wetlands) rather than marine habitat, they are discussed in this section. Nineteen species of waterbirds are common or abundant in the Cook Inlet/Shelikof Strait area, either as residents or migrants (MMS 1996b). Species include pintail, oldsquaw, common eider, common goldeneye, common merganser, red-breasted merganser, harlequin duck, greater scaup, mallard, gadwall, American widgeon, green-winged teal, arctic loon, common loon, red-throated loon, horned grebe, Canada goose, Pacific black brant, and emperor goose (Table 3-17).

Waterbird density peaks in the region during the spring (April-May), when large numbers of waterbirds migrate through the area. The Cook Inlet area supports large populations (>200,000) of staging waterfowl on tidal flats (Susitna Flats, Portage Flats, Palmer Hay Flats, and Chickaloon Flats in the upper inlet and Bachatna Flats in the lower inlet), along river mouths, and in bays, particularly on the west side of the inlet (Redoubt, Trading, Tuxedni, and Kamishak bays). Areas of particularly high concentration are Tuxedni Bay, Kachemak Bay (especially sea and diving ducks), Kamishak Bay (sea ducks), Redoubt Bay (geese and ducks), and Iniskin-Iliamna Bay (diving ducks; Arneson 1980, MMS 1996b). The highest diversity and abundance of waterbirds are found in exposed inshore waters and various habitats associated with bays and lagoons, including open water, tidal mudflats, deltas, floodplains, and salt marshes (MMS 1984). Loons, grebes, and sea ducks are typically found on bays and exposed inshore waters; geese and dabbling ducks are primarily found on river floodplains and marshes; diving ducks mostly use bay waters (MMS 1984).

Waterbird density declines in summer as many birds leave the area. However, relatively high concentrations of sea ducks remain in Iniskin/Iliamna Bay and outer Kachemak Bay (MMS 1996b). During July and August, a molt migration of all three scoter species concentrates tens of thousands of birds in the coastal areas from Kotzebue Sound to Cook Inlet (MMS 1996a). Important staging areas used prior to fall migration are Kachemak Bay, Douglas River mudflats, Kenai River mudflats, Tuxedni Bay, Drift River, Chinitna Bay, Iliamna Bay, Ursus Cove, and other parts of lower Cook Inlet (Erikson 1976). On the west side of Shelikof Strait, Katmai Bay is important for several species of sea ducks, including white-winged scoter, greater scaup, Barrow's goldeneye, and harlequin ducks (Cahalane 1944).

In the fall, sea ducks depart the area, partially accounting for the overall decline in bird density relative to spring and summer densities (MMS 1996b). However, densities of dabbling duck and geese increase during this time, as migrants move into the area. In fact, 47 percent of all birds remaining in the coastal region are sea ducks (MMS 1996b). Four areas of Cook Inlet retain high bird densities: inner Kachemak Bay, southwestern Kamishak Bay, Tuxedni Bay, and northwestern Kachemak Bay; dabbling ducks, sea ducks, and gulls comprise 85 percent of all birds observed (MMS 1996b). Habitat use is similar to spring and summer patterns, with habitats associated with bays and lagoons being most heavily used (Arneson 1980).

Common winter residents along the southern Alaskan coast include oldsquaws, common and king eiders, harlequin ducks, and scoters. Over one million scoters winter in the Bering Sea, and several hundred thousand winter from the eastern Aleutians east to Kodiak Island, Cook Inlet, and Prince William Sound (Arneson 1980, Forsell and Gould 1981; Agler et al. 1995).

About 30 to 35 species of waterfowl regularly occur in the Cook Inlet area, including two species of swans (trumpeter and tundra swans), six species of geese, about 25 duck species, and 6 species of loons/grebes (see Table 3-17 and Figure 3-5). The distribution of waterfowl within the region varies between the upper and lower inlet on a seasonal basis, and waterfowl are distributed differently between the eastern and western sides of Cook Inlet. Wintering populations of waterfowl are confined primarily to the lower inlet because of limited open water north of the Forelands.

Several waterfowl species occurring in the Cook Inlet area are of particular concern due to their limited breeding distribution, small population size, or use of critical habitats: trumpeter swan, Tule white-fronted goose, and snow goose. These are discussed in greater detail in the following paragraphs.

Trumpeter Swan. Trumpeter swans arrive in Cook Inlet in early April and move to their breeding areas by late April (ADFG 1985). Nesting and brood rearing continue through late August and early September, and migration commences in late September and early October. Nesting swans are found on both sides of the central and upper inlet with major concentrations on the western side in Trading Bay, along the Kustatan River, and in Redoubt Bay. The 1990 census for trumpeter swans counted 1,661 swans in the Cook Inlet area, which is approximately 12 percent of the estimated total population in the state.

Tule White-Fronted Goose. The Tule white-fronted goose breeds on the western side of Cook Inlet in Redoubt Bay (Timm 1980). They arrive in Cook Inlet in early April, begin nesting in May, and most have departed the area by late August. The nesting population in Cook Inlet is estimated at about 1,500 (total population estimated at 5,000) and the presence of nesting areas in the Redoubt Bay area was a primary reason for the creation of the Redoubt Bay State Critical Habitat Area.

Snow Goose. Snow geese stage in large numbers on the Kenai River flats in mid-April (Rosenberg 1986). Total numbers of snow geese using the area vary annually, based on spring weather conditions, but counts have ranged between 2,000 and 15,000 birds each spring (Campbell and Rothe 1985, 1986; Rosenberg 1986). In addition to the Kenai River flats, snow geese stage in spring on the Kasilof River flats, the Susitna Flats, and Redoubt Bay (Campbell and Rothe 1986). An estimated 30,000 to 35,000 snow geese move through Cook Inlet in spring (Campbell and Rothe 1986) before they leave for their breeding grounds by early May.

3.8.2.2 Terrestrial Species

Most terrestrial birds species found in the Cook Inlet region are migratory and only occur during the summer months (April to September) when temperatures and food availability are conducive for breeding. Major species groups found in the area include owls (7 species), raptors (20 species), grouse (6 species), woodpeckers (5 species), and passerines (58+ species). Most species are widely distributed in the area and are relatively abundant. Only two species, the bald eagle and peregrine falcon, have been identified as species of concern due to their sensitivity to human disturbance during nesting or because of limited populations.

Bald eagles commonly occur in coastal habitats in Cook Inlet and along inland rivers and lakes where fish are abundant (Bangs et al. 1982). Bald eagles are present in the general area, but nests are not known to exist in the general vicinity of the onshore production facility or the proposed pipeline. Aerial surveys by Forest Oil did not reveal the existence of bald eagle nests within ½ mile of the existing and proposed road systems (NCG 2001).

Peregrine falcons, which were previously list as threatened and endangered, may occur in the general area while migrating to other locations in Alaska.

3.8.3 Mammals

At least 31 species of terrestrial mammals are known or suspected to inhabit the lowland areas bordering the west side of upper Cook Inlet in the general vicinity of the proposed project (Table 3-18). The general area along the onshore pipeline and access road route is sparsely developed and could provide habitat for terrestrial mammals. Terrestrial mammals most likely to interact with or be affected by the proposed operations include river otters, black bears, and brown bears.

River otters frequently occur in nearshore waters along the coast, where they forage on small fish, clams, crustaceans, and other invertebrates. They also use the beaches and intertidal areas. Sculpins and rockfish were reported to be the predominant prey items of river otters occurring along the coast of southeastern Alaska.

Brown bears use the coastal areas from about April to November. During spring, bears rely heavily on coastal meadows, beaches, and shorelines while foraging on newly emergent plants, carrion, and intertidal infauna such as clams (MMS 1995). During the summer and early fall, brown bears congregate along coastal streams (including the Kustatan River) to feed on salmon and other spawning fish. They intensively use the area to the west of the proposed Kustatan Production Facility from spring through fall (Fink 2001).

Black bears are most abundant in wooded areas, and along the Cook Inlet shoreline in the vicinity of streams, bogs, and clearings. A black bear feeding concentration area has been documented along the shore between Kustatan and the Kustatan River (Fink 2001).

3.9 SOCIOECONOMIC CONDITIONS

The proposed project, including all facilities, is located within the Kenai Peninsula Borough. The communities most likely to be affected by the project include Tyonek, Kenai, Nikiski, and Soldotna, and these communities will be the primary focus of this evaluation.

Tyonek is a Dena'ina (Tanaina) Athabascan Indian Village. Various settlements in the area included Old Tyonek Creek, Robert Creek, Timber Camp, Beluga, and the Moquawkie Indian Reservation. In the mid-1700s, some trading with the Russians occurred. Between 1836 and 1840, half of the region's Indians died from a smallpox epidemic. The Alaska Commercial Company had a major outpost in Tyonek by 1875. In 1880, "Tyonok" station and village, believed to be two separate communities, had a total of 117 residents, including 109 Athabaskans, 6 "creoles", and 2 whites. After gold was discovered at Resurrection Creek in the 1880s, Tyonek became a major disembarkment point for goods and people. A saltery was established in 1896 at the mouth of the Chuitna River north of Tyonek. In 1915, the Tyonek Reservation (also known as Moquawkie Indian Reservation) was established. The devastating influenza epidemic of 1918-1919 left few survivors among the Athabascans. The village moved to its present location atop a bluff when the old site near Tyonek Timber flooded in the early 1930s. Currently Tyonek is an unincorporated city.

The Kenaitze Indians (Dena'ina) historically occupied the Kenai Peninsula. The City of Kenai was founded in 1741 as a Russian fur trading post. In the early 1900s, cannery operations and construction of a railroad spurred development. It was the site of the first major Alaska oil discovery (1957), and has been a center for oil and gas exploration and development since that time. The Kenai Peninsula Borough was formed in 1964.

Prior to Russian settlement, Kenai was the site of the Dena'ina Indian village of Shk'ituk't. At the time of Russian settlement in 1741, about 1,000 Dena'ina lived in the village. In 1791, a fortified Russian trading post, Fort St Nicholas, was constructed for fur and fish trading. In 1869, the U. S. military established a post for the Dena'ina Indians in the area, called Fort Kenay, which was abandoned after Alaska was purchased by the United States. Through the 1920s, commercial fishing was the primary activity. In 1940, homesteading enabled the area the further develop. The first dirt road from Anchorage was constructed in 1951. In 1957, oil was discovered at Swanson River, 20 miles northeast of Kenai; and in 1965 offshore oil discoveries in Cook Inlet fueled a period of rapid growth, Kenai has been a center for areawide oil and gas exploration, production, and services since that time. Kenai currently has a home rule form of government.

Both Nikiski and Soldotna were developed (by non-Natives) in the 1940s when the land was opened to homesteading. The Nikiski area was further developed as a result of oil and gas activities; by 1964, oil-related operations there included Unocal, Phillips/Marathon, Chevron, Shell, and Tesoro. Soldotna's growth occurred as a result of construction of the Sterling Highway from Anchorage in the late 1940s, and again in the 1950s and 1960s with the discovery and development of oil in the region. Currently Nikiski is an unincorporated city, and Soldotna is headquarters for the Kenai Peninsula Borough.

3.9.1 Regional Population and Employment

Table 3-19 provides population data for communities and regions potentially impacted by the proposed project. Between 1980 and 1990, Tyonek had a sharp decrease (35 percent) in population; however, during 1990 to 2000, the population recovered somewhat, increasing by 25 percent. Since 1980, Kenai has experienced a 61 percent increase in population, Nikiski has had a 290 percent increase, and Soldotna has had a 62 percent increase. By comparison, the Kenai Peninsula Borough population has increased by 97 percent and Anchorage's population has increased by 49 percent in those two decades.

Table 3-20 provides a summary of employment by occupation based on 1990 census data (2000 census data on employment were not available at the time this EA was prepared). The leading occupation category in the Kenai Peninsula Borough was precision craft or repair (16 percent), followed by administrative support (13 percent), professional specialty (13 percent), other professional services (11 percent) and executive/administrative (9 percent). Occupation rankings for Kenai, Nikiski, and Soldotna roughly followed the same general trends. At Tyonek, 42 percent of the occupations were classified under the professional specialty category, with other professional services accounting for 24 percent of the occupations.

Table 3-21 summarizes employment by industry. For the entire Kenai Peninsula Borough, retail trade provided the largest employment (17 percent), followed by education services (9 percent), petroleum/mining (8 percent), public administration (8 percent), construction (8 percent), fishing/forestry/farming (7 percent), and non-durable manufacturing (6 percent). The top three industries for the general area are probably petroleum, fishing, and tourism and are supported by a number of industry sectors indicated in Table 3-21.

Table 3-22 provides some additional economic indicators for the general area (also based on the 1990 census data). In Tyonek, employment was about equally split between private and government employment. At Kenai and Nikiski, over 80 percent of the people employed were employed in the private sector. At Soldotna, 77 percent were employed in the private sector and 23 percent by some form of government (local, state, or federal). Unemployment in 1990 ranged from 8.7 percent in Soldotna to 37.7 percent in Tyonek with an average of 10.3 percent for the entire Kenai Peninsula Borough.

3.9.2 Oil and Gas Industry

The petroleum industry has been a strong part of the Kenai Peninsula since 1957 with the discovery of the Swanson River Field. Extensive exploration for additional oil and gas reserves followed during the 1960s and 1970s with a number of new oil and gas fields going into production (see Table 3-23). Field development tapered off in the 1980s and early 1990s, but exploration of new fields and possible development of old fields is either underway or in planning stages.

Alaska Division of Oil and Gas production summaries for the Cook Inlet area are provided on Table 3-24. Since 1958, approximately 1.2 billion barrels of oil, 11 million barrels of natural gas liquids (NGLs), and 5.1 trillion cubic feet of natural gas have been produced in the Cook Inlet area. Oil production peaked in 1970 with an annual production of 82 million barrels. Oil production has since declined steadily to current levels of about 11 million barrels annually. Natural gas production increased through the mid-1980s and then continued to climb more gradually to current production levels of about 220 billion cubic feet per year. Reserve estimates as of the end of 1996 were 95 million barrels of oil and 3.2 trillion cubic feet of natural gas.

Since 1958, the petroleum industry has constructed an extensive local infrastructure including extensive onshore and offshore developments and pipelines to transport oil and gas from the various fields to points of use or shipment.

The Nikiski area currently supports major industrial facilities associated with oil and gas development. Unocal Agricultural operates a world class petrochemical plant for processing natural gas into urea and liquid ammonia. Phillips operates a major natural gas liquefaction plant, and Tesoro operates a 75,000 barrel per day oil refinery and oil terminal.

The Nikiski-Kenai-Soldotna area has also developed an extensive service industry to support industrial development. This has resulted in the general area having a relatively high level of trained skilled labor (Tables 3-20 and 3-21). The oil and gas industry currently provides approximately 80 percent of the tax base for the Kenai Peninsula Borough (Amundsen 2001).

3.9.3 Commercial Fisheries

Commercial fishing has long been a major economic sector for the Cook Inlet area. The Alaska Department of Fish and Game (ADF&G) is responsible for management of the commercial fisheries in Alaska. ADF&G divide the inlet into the Central and Northern District for purposes of fisheries management. The proposed project straddles the boundary between the Northern and Central District, which is a line that extends from West Foreland to Boulder Point (Figure 3-6).

Commercial fishing operations in the Northern District are limited to set net fishing from shore. Set net fishing sites are located along most of the upper inlet from the West Foreland to Pt. Mackenzie on the west side of the inlet and from the East Foreland to Point Possession on the east side of the inlet. Openings for set netting are typically on specific days, intermittently occurring between early June and early September.

There are two known areas of set net fishing activities near the tip of the West Foreland. One site is located at Kustatan and the other is located at the southeasternmost tip of the West Foreland. The Kustatan site is registered with the Alaska Department of Natural Resources, while the other is not.

Table 3-25 summarizes the commercial catches for salmon in the Northern District for the past 10 years of available records, and Table 3-26 summarizes the estimated ex-vessel costs of the fishery. All five Pacific salmon species are caught in the Northern District set net fishery. Pink salmon during the even-year runs are the most abundant numerically, although they have very little value to the commercial fishery. Sockeye salmon are the second most frequently caught salmon and they account for over 50 percent of the ex-vessel value of the fishery.

In general, salmon catches by the commercial fisheries have remained relatively stable (Table 3-25). Price of the fish have dropped dramatically over the past 10 years and the industry in the Northern District, which had a value of about $3 to 4 million in the late 1980s, is now valued at a little over $1 million annually.

3.10 Subsistence Harvesting

Subsistence is defined by the Alaska National Interest Lands Conservation Act (ANILCA). Section 803 defines subsistence 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 non-eatable by-products of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."*

This section discusses practices by households that may be altered or affected by the proposed project. However, the use areas and practices differ as greatly as the size and socioeconomic character of each area's populations. Local subsistence values are critical in that households feel their subsistence activities are important, necessary, and satisfying within their overall cultural context. 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 the inlet.

Subsistence tends to occur in areas of close proximity to settlements. These practices also tend to occur at locations where there is easy access and where the biomass concentration is high. The increasing population on the east side of the inlet has created limitations to subsistence practices, while on the west side of the inlet, many traditional practices continue with a greater diversity of species. Some subsistence practices are frequently conducted in conjunction with recreation (and should not be confused with recreational activities) on both sides of the inlet.

Tyonek is a critical subsistence focus area due to its proximity to the project. The following discussions also center on marine-related activities. Although terrestrial subsistence activities do occur, they are distant from and highly unlikely to be impacted by the proposed development. Table 3-26 provides information on the use of local resources for Tyonek.

3.10.1 Anadromous Fish

Many fish are harvested through subsistence and related activities, although salmon are the most important. The Alaska Department of Fish and Game (ADFG) has a number of established subsistence and educational fisheries in Cook Inlet. Within the upper inlet, these include the Tyonek subsistence salmon fishery, the Native Village of Eklutna educational fishery, and the Knik Tribal Council educational fishery. These are discussed in the following paragraphs. There are several other subsistence and educational fisheries in the inlet below the Forelands; however, they are not addressed because it is unlikely that fish potentially involved in these fisheries would encounter the project area.

3.10.1.1 Tyonek Subsistence Salmon Fishery

The subsistence fishery in the Tyonek area was created by court order in 1980. It was originally open only to those individuals living in the Village of Tyonek but has subsequently been changed to allow any Alaskan to participate. Fishing is allowed only in the Tyonek Subdistrict of the Northern District (Figure 3-7). Only one permit is allowed per household and each permit holder is allowed a single ten-fathom gillnet having a mesh size no greater than 6 inches. Fishing is allowed on specific days between May 15 and June 15, or until 4,200 Chinook salmon are taken. The permit allows 25 salmon per permit holder and 10 salmon for each additional household member. Chinook salmon harvests have ranged form 797 in 1990 to 2,750 in 1983 (Table 3-28).

3.10.1.2 Native Village Educational Fisheries

In 1993, the ADFG issued permits to Alaska residents accompanied by an Eklutna Native village member or a Knik Tribal Council Member to participate in this fishery. The permit allows each village to operate a single 10-fathom set gillnet having a mesh size no greater than 6 inches. The net may be set in Knik Arm adjacent to the village or in those waters within one mile from mean high water in an area from Goose Bay Creek north to Fish Creek. Total catch was 200 and 275 salmon for the Eklutna and Knik fisheries, respectively, in 1996 (NCG 2001).

3.10.2 Other Fish

Eulachon (hooligan) are taken in set nets and by dip netting along the west side of the upper inlet from Tyonek south to Shirleyville for both subsistence and personal use. About a quarter of all Tyonek households seek hooligan (Fall et al. 1984). Other species of fish are taken in small numbers. Rainbow trout are occasionally taken. Dolly Varden char are incidental to the taking of salmon in nets but are also taken in fresh water. About 15 percent of Tyonek households seek freshwater species (Fall et al. 1984).

3.10.3 Shellfish

Approximately 18 percent of the Tyonek households collect shellfish as subsistence activities. Cockles and razor clams are both taken in the lower inlet from between Drift River and Tuxedni Bay. These areas are well out of the project area.

3.10.4 Marine Mammals

Two types of marine mammals are taken. Beluga whales are actively sought and harbor seals are usually taken incidentally. Only 11 percent of Tyonek households attempt to take marine mammals and the actual contribution to the Tyonek diet is low (Fall et al. 1984).

3.10.4.1 Beluga Whales

Beluga whales are taken for subsistence, especially by urban Alaska Natives from the greater Anchorage area. The focus of the harvest is at the mouth of the Susitna River (Fall 1993). Some have also been shot just outside the mouth of the Kenai River, as local firearms ordinances limit the discharge of guns within the city limits.

Prior subsistence harvests of belugas has resulted in a substantial decline in their population to the extent that they are currently listed as a depleted species under the Marine Mammal Protection Act. Under the depleted status, future subsistence take is proposed to be limited to two belugas annually (NMFS 2000b).

Table 3-29 provides estimates of subsistence take of belugas from 1988 to 1998 (NCG 2001).

3.10.4.2 Harbor Seals

Harbor seals are normally taken only incidentally. They may be harvested while in pursuit of other subsistence interests or in transit to subsistence areas. Most frequently harbor seals are taken around set net sites during salmon season.

3.10.5 Birds

Waterfowl, including many species of ducks and geese, are taken around the Trading Bay area. As many as 47 percent of the Tyonek households seek waterfowl in the nearshore marshes (Fall et al. 1984, Fall 1993).

3.11 LAND AND SHORELINE USE AND MANAGEMENT

Most of the area surrounding the upper inlet is in public ownership, including large tracts of federal and state lands (Figure 3-8). Specific land uses include federal parks and wildlife refuges, state game refuges, critical habitat areas, and recreational use areas. The west side of the upper inlet is primarily held by Native groups or by the State of Alaska. There are large blocks of land owned or selected under the Alaska Native Claims Settlement Act (ANSCA) by various native corporations, as well as several Native Allotments. The proposed onshore pipeline route generally lies within Native lands with surface rights held by the Salamatof Natives and subsurface rights held by Cook Inlet Region, Inc. The proposed onshore production facility is located on lands owned by Forest Oil.

3.11.1 Current Land Use

Current land users in the vicinity of the onshore pipeline route are primarily associated with the oil and gas industry with only a limited use by local residents. The beach area around the West Foreland may be used for set net fisheries during the summer (mostly as a Native subsistence activity). The shore area is backed by 50- to 250-foot high bluffs, and the area on top of the bluff is primarily used by the oil and gas industry, although some cabins are located on top of the bluff and Native subsistence activities may occur here also.

3.11.2 Land Management Policies

This section describes the various land management policies and regulations that could apply to onshore and offshore development associated with development of the Redoubt Shoal Unit. The project area lies entirely within the Kenai Peninsula Borough (KPB). It is also in the general vicinity of special areas managed by federal, state and local authorities.

Figure 3-9 shows the location of borough boundaries and special management areas relevant to this project.

3.11.2.1 Kenai Peninsula Borough

The project will fall under the provisions of the KPB Coastal Management Program (CMP). The KPB CMP (KPB 1990) includes issues, goals, objectives, and policies directly related to energy and industrial development. These policies are implemented through local review of state and federal permit applications and through borough land use planning and zoning regulations. In addition, the KPB CMP has identified two potential Areas Meriting Special Attention (AMSA) in the general area. The Chuitna Potential AMSA (Figure 3-9) was nominated to recognize, encourage, and plan for major resource and related development while protecting the traditional lifestyle and natural environment of this area. The Nikiski Industrial Area (Figure 3-9) was nominated as a potential AMSA due to increasing potential for land use conflicts between existing industrial uses and other uses. The CMP recommends that the KPB initiate a comprehensive development program for future development in the AMSA. The proposed project is not located within either of these AMSAs.

3.11.2.2 State of Alaska

The State of Alaska manages several special areas within the immediate vicinity of the proposed project. These include the Trading Bay State Game Refuge to the north of the project area and the Redoubt Bay Critical Habitat Area (Figure 3-9), which are both managed by the Alaska Department of Fish and Game. The proposed project is not located within any of these areas.

3.12 TRANSPORTATION SYSTEMS

In comparison to the rest of Alaska, the Cook Inlet area has a well-developed transportation system, including a highway network, airports, and marine ports (Figure 3-10). This section focuses on the marine transportation aspects, which will be the primary transportation system used for construction and operation of the proposed project.

Facilities for handling larger vessel traffic in the inlet are located at Homer, Kenai, and Nikiski on the east side of the inlet, Drift River and North Foreland on the west side of the inlet, and Anchorage at the head of the inlet. In addition, there are a number of barge landings and docks located both on the east and west side of the inlet. These are discussed in the following paragraphs.

3.12.1 Homer

The Port of Homer includes a small boat harbor, a State ferry terminal, a general purpose dock, and numerous private barge landings. The dock is capable of handling vessels up to a 40-foot draft. Primary use of the area includes State ferry traffic to points further south (about twice weekly during summer and fall months), U. S. Coast Guard vessels (usually one is in the general area at all times), and cargo vessels (bulk wood pulp ships visit the area year-round to load wood chips). Smaller cargo vessels, fishing boats, and numerous pleasure craft use the adjacent small boat harbor area.

The general Homer area also serves as a point of embarkation and debarkation for marine pilots that are required for larger vessels operating in Cook Inlet.

3.12.2 Kenai

The Port of Kenai includes a number of docks located along the Kenai River near its mouth. Vessel use is limited to those generally less than 10 feet in draft. It is used primarily by the commercial fishing industry.

3.12.3 Nikiski

The Nikiski area includes three docks for deeper draft vessels. These include, from south to north, the Unocal Agricultural dock, the Phillips Marathon dock, and the Tesoro dock. The Unocal dock is dedicated to loading urea and ammonia from Unocal's onshore petrochemical plant to various locations worldwide. The Phillips/Marathon dock is also a dedicated dock that loads two dedicated LNG tankers for shipment of LNG to the Tokyo area. The Tesoro dock is primarily used to handle tanker and oil barge traffic associated with Tesoro's refinery located near the dock area. These docks can typically handle vessels having drafts of 40 to 42 feet.

There are also several commercial docks that are used primarily for handling barge and supply vessel traffic, primarily associated with oil and gas or construction activities in the general area. These include the Rig Tenders Dock located immediately north of the Tesoro dock and the OSI dock located several miles north of the East Foreland in Nikishka Bay.

3.12.4 Drift River Terminal

The Drift River Terminal is owned and operated by Cook Inlet Pipe Line Company and is dedicated to loading oil produced from the west side of Cook Inlet. Vessel traffic is limited to oil tankers that travel either to the Nikiski area or to points outside of Cook Inlet.

3.12.5 West Side Barge Landings

There are a number of barge landings located on the west side of Cook Inlet that are primarily used in support of oil and gas operations. These include those at the Trading Bay Production Facility (oil/gas), Shirleyville (local residents and oil/gas), Ladd (local resident and oil/gas in the Beluga area), and Beluga River (local residents).

3.12.6 North Forelands

The North Forelands dock was originally constructed for bulk loading of wood chips from timber operations in the general Tyonek area. These operations were discontinued in the 1980s and the dock is currently operated by the Tyonek Native Corporation. The dock and immediate area is being promoted as a site for industrial development.

3.12.7 Port of Anchorage

The Port of Anchorage is the largest port in Cook Inlet and is located at the head of the inlet. It currently has capabilities to handle containerized and bulk cargo, refined petroleum products, general cargo, and passenger traffic. Current traffic at the dock includes container vessels (SeaLand and Tote), oil tankers and barges carrying refined products, and some cruise ship traffic in the summer months (Table 3-30).

There are also several private wharves in the area that are used by barges and smaller cargo vessels, in addition to facilities to handle small recreational and commercial fishing boats in the area.

3.13 Visual Environment/Aesthetics

The Cook Inlet region is distinctive in its variety of visual environments. The western side of the inlet features towering volcanic peaks with distinctive cone shapes. Massive glaciers are visible and the shoreline is simple with few complex lines or forms. The eastern side of the inlet features a broad expansive lowland with a background of snow-covered peaks of the Kenai Mountains. Significant rivers entering the eastern inlet include the Kenai River and Kasilof River. Much of the eastern side is also marred slightly by the presence of dead and dying spruce trees (a result of spruce bark beetle infestation). Utility lines, including electrical lines and pipelines, provide existing evidence of disturbances on both sides of the inlet.

Waterforms consist of the broad expanse of Cook Inlet waters, which is turbid as a result of inflows from large glacier-fed rivers. In the upper inlet, there are 15 oil and gas production platforms that are visible both during the daylight and at night (Figure 3-11).

3.13.1 Viewing Populations

3.13.1.1 Kenai Peninsula Residents/Visitors

The primary viewing audiences include residents of Nikiski and visitors to the shoreline, including visitors to the Captain Cook State Recreation Area. The viewing public probably exhibits a variety of sensitivity levels relative to industrial development. While some may perceive the presence of development structures as intruders to scenic resources, others may not.

Residents of Nikiski have been exposed to the infrastructure effects of oil development for many years. Also, to a great degree, the livelihoods of many in the community are tied directly to the oil industry. Visitors are likely to be more sensitive to the presence of man-made structures in Cook Inlet.

3.13.1.2 Tyonek/Beluga Area Residents

The viewing audience from this area has been exposed to the views of oil development activities for many years, though they are probably a sensitive viewing public (particularly in Tyonek). Villagers from Tyonek are exposed to the impacts of existing platforms and utility corridors within the proximity of the village. Residents in the Beluga area are more likely to be directly employed by the industry and share similar traits to residents of Nikiski.

3.13.1.3 Cruise Ship Traffic

Cruise ship traffic begins in the upper inlet with travel primarily to the Port of Anchorage. During the 1990s, there were an average of four to five cruise ships travelling to Anchorage annually. In 1997, there was no cruise ship traffic; however, 11 ships were scheduled to call on Anchorage during 1998 (Hinman 1998). In 2001, only one cruise ship called on the Port of Anchorage (Alaska.com 2001). Cruise ship passengers are typically a sensitive viewing public with high regard for visual quality. While this generally correlates to a high regard for the preservation of natural beauty, there is also a desire to visit and investigate developments such as the Alyeska Pipeline and other development project that are integral to Alaska's history.

Views of existing platforms from cruise ships are distant. Platforms are subordinate to focal points and utility corridors related to existing development are indiscernible at the low viewing angle from on board a cruise ship.

3.13.1.4 State Critical Habitats and Game Refuges

The predominant visitors to game refuges are hunters during periods when seasons are open for waterfowl, or fishermen during the salmon runs. These users generally view development within the refuges only when they are airborne while entering and leaving the area. Views of existing development are generally distant except at times when viewers are within existing clearings related to utility development.

3.13.1.5 Aircraft

The general area is within a heavily used air corridor. Pilots and passengers would be within viewing distance of both onshore and offshore development. The viewing audience would include those traveling to villages on the Alaska Peninsula and to recreation areas and lodges in southwest Alaska. While ground-level viewers see most development at a distance and at low angles, aircraft-borne viewers have direct views of landscape disturbances associated with utility development.

3.13.1.6 Anchorage

Only distant views of platforms are available from Anchorage, and those are only available from the Anchorage Hillside. The platforms are very minor elements in the viewshed, except possibly at times of flaring.

3.14 RECREATION

This section addresses those recreation interests that may be affected by development of the Redoubt Shoal Unit Development Project. Potentially affected recreation uses include fishing, hunting, camping, and urban recreation.

3.14.1 Fishing

The drainages of the northern inlet support some of the most intense sport fisheries in Alaska because of their proximity to Anchorage. This area consistently supports over 20 percent of the total annual sport fishing effort expended in Alaska (Mills 1992). Sport fishing in the northern and central inlet has been increasing steadily, with almost 500,000 angler days expended on northern inlet streams (Mills 1992). The Kustatan River located immediately southwest of the West Foreland supports a relatively active sports fishery for chinook, sockeye, pink and coho salmon and for dolly varden (ADFG 1994); access to the river is primarily by small fixed wing aircraft. The majority of sports fishing occurs during the summer and fall months.

A recreational fishery in central Cook Inlet targets Pacific halibut. The Sport Fish Division of the Alaska Department of Fish and Game estimate that 75,709 halibut were caught by sport fishermen in central Cook Inlet between May 1 and July 31, 1995 (McKinley 1996).

3.14.2 Waterfowl Hunting

Cook Inlet accounts for well over 30 percent of the state hunter days for waterfowl. It is valued for the abundance of waterfowl as well as the proximity of the area to Anchorage. Much of this harvest occurs during the fall and in the Susitna Flats and the Palmer Hay Flats, north of the general project location. Together these areas account for over 20 percent of the state's total harvest of geese and ducks.

Other areas of Cook Inlet also provide ample supply of hunter days and game. Other important harvest locations within the upper and central inlet include Portage, Chickaloon Flats, Trading Bay, and Redoubt Bay.

3.15 CULTURAL, HISTORICAL, AND ARCHAEOLOGICAL RESOURCES

The Kustatan area has been identified as an area rich in cultural resources with possible burial cache pits. The land for the proposed Kustatan Production Facility was sold to Forcenergy (now Forest Oil) by the Salamatof Native Corporation. The Tribal Governments that have claimed cultural or religious significance to the Kustatan area are the Keniatze Tribe, Tyonek Tribe, and Salamatof Tribe.

Forest Oil conducted various archaeological reviews and investigations at the proposed onshore production facility site and new access roads over the period of 1998 to 2000. As part of these efforts it was determined that the historic Dena'ina Athapaskan village of Kustatan is located within Forest Oil's land (Pipkin 1998). Ethnohistory suggests that Kustatan was inhabited between 1800 and 1928, and archaeological remains at the site suggest that it may have been at least periodically occupied during the last two thousand years. According to discussions between Forest Oil and the Alaska State Historic Preservation Officer (SHPO), the site is eligible for inclusion on the National Register of Historic Places (NCG 2001).

The onshore production facility and access roads as presently defined avoid known locations of archaeological or cultural resources. One small site was located on an access road alignment, but the road was subsequently relocated approximately 50 meters to the southwest to avoid the site.

Investigations are currently underway on site in order to identify any artifacts of historical/cultural significance within Forest Oil's property. The appropriate method of handling any artifacts found in the area will be discussed with the Alaska State Historic Preservation Officer (SHPO) and EPA. Appendix E of this document provides a Programmatic Agreement (PA) between EPA, the Alaska SHPO, Forest Oil, and various Tribes and Alaska Native corporations regarding implementation of the Redoubt Shoal oil exploration and production program.

Additional investigations have been conducted to ensure that the pipeline alignment avoids all archaeological resources. These investigations were coordinated with the Alaska SHPO (NCG 2001).

Final reports on investigations at and near the site were still in preparation at the time this EA was prepared. The PA prepared for the Redoubt Shoal Unit Production Oil and Gas Development Project (Appendix E) is a planning tool for EPA and Forest Oil to follow on how to appropriately handle archaeological resources in the project area upon discovery.