CHAPTER 3

DESCRIPTION OF THE AFFECTED ENVIRONMENT

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CHAPTER 3

DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Preview of this Section

This chapter provides an overview of the Planning Area's physical, biological, and social features that would be affected by the alternatives under consideration. This chapter focuses on the resource concerns that were identified in Chapter 1 (Introduction), and is useful in understanding the environmental, cultural, and social consequences of the alternatives. Much of the information in this chapter is taken from the 1998 Northeast IAP/EIS (Section III), Northwest IAP/EIS (Section III), and *Alpine Satellite Development Plan Final EIS* (Section 3; USDOI BLM and MMS 1998, 2003; USDOI BLM 2004c). Other information that has become available since the completion of the Northeast IAP/EIS in 1998 has also been included.

3.2 Physical Environment

3.2.1 Climate and Meteorology

Winters are long and cold, and summers are short and cool in the Planning Area. The area is one of the harshest environments in North America, where snow may fall even in August. The average daily temperature falls below freezing more than 200 days per year in Nuiqsut. Seasonal snow cover on the North Slope can begin in late September to early October and may not disappear until mid-June.

The annual mean temperature in the Planning Area is about 10 degrees Fahrenheit (°F). Temperatures on the North Slope are typically below freezing from mid-October into May. Construction work and oil exploration are conducted in winter in many areas because both the ground and the streams are frozen enough to allow the use of heavy equipment on them. February is the coldest month, with an average temperature of about –21 °F. July is the warmest month, with an average temperature of 46 °F. Average snow depth from January through April is 10 inches in Barrow and 15 inches in Umiat, which is in the foothills. Snowfall is greatest in October but can occur during each month of the year.

Because winters in the Planning Area are long, most streams and lakes are frozen for much of the year. Summers, while short and relatively cool near the coast, are longer and warmer inland. The onset of snowmelt and subsequent runoff often begins earlier in the foothills than in the rest of the area and moves north as the summer season progresses. Similarly, freeze up usually begins first on the coastal plain and proceeds southward.

Prevailing winds blow cold air off the frozen Arctic Ocean and are strongest during winter, often creating blizzard conditions. Southerly winds may break this pattern on occasion. The annual mean wind speed in the region is approximately 13 miles per hour. Nuiqsut typically exhibits bimodal wind direction climatology dominated by northeasterly through easterly directions about 45 percent of the time, and west-southwesterly through westerly directions the remainder of the time (SECOR International, Inc. 2003).

3.2.1.1 Climate Change on the North Slope

Carbon dioxide (CO_2) is a greenhouse gas, along with other gases such as methane. Greenhouse gases are vital because they maintain global ambient temperatures within ranges suitable for life on earth. However, excess greenhouse gas emissions increase the concentration of these gases in the atmosphere and contribute to overall global climatic changes, typically referred to as global warming. Carbon dioxide emissions are a product of fossil fuel combustion and tropical forest destruction, human activities that contribute to global climatic changes. Large quantities of greenhouse gas emissions may decrease the amount of infrared or heat energy radiated by the earth back to space and upset the global temperature balance. Global warming may ultimately contribute to a rise in sea level, destruction of estuaries and coastal wetlands, and changes in regional temperature and rainfall pattern, with major implications to agricultural and coastal communities (Arctic Climate Impact Assessment [ACIA] 2004).

Global mean surface temperatures have increased 0.5 to 1.0 °F since the late 19th century (Figure 3-1). The 20th century's 10 warmest years all occurred in the last 15 years of the century. Of these, 1998 was the warmest year on record. The snow cover in the Northern Hemisphere and floating ice in the Arctic Ocean have decreased, and globally, the sea level has risen 4 to 8 inches over the past century. Worldwide precipitation over land has increased by about 1 percent. The frequency of extreme rainfall events has increased throughout much of the U.S.

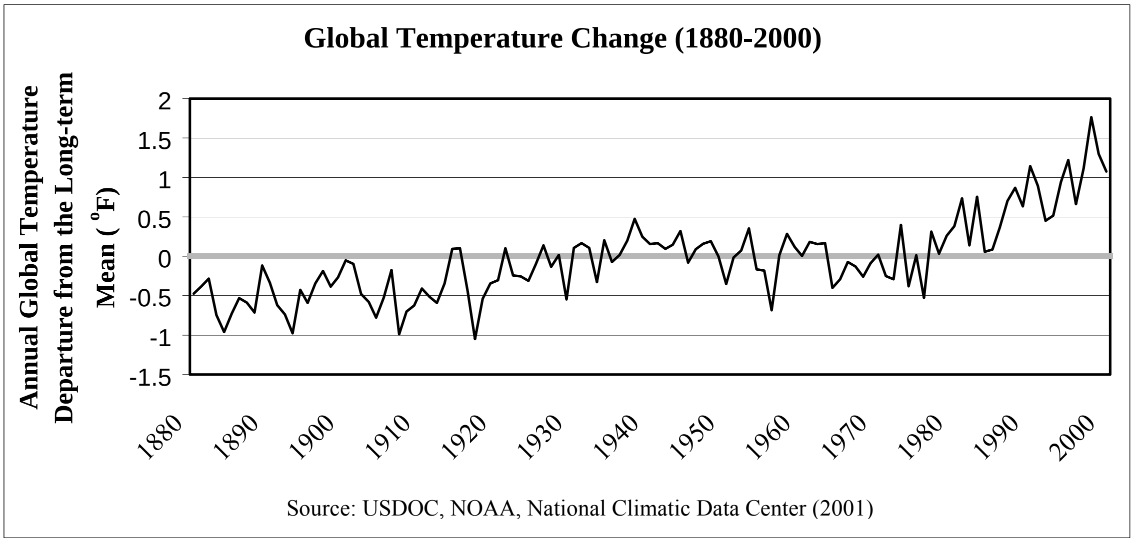


Figure 3-1. Global Temperature Change (1880-2000).

Increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change. Scientists speculate that the average global surface temperature could rise 1 to 4.5 °F in the next 50 years, and 2.2 to 10 °F in the next century, with significant regional variation. Evaporation would increase as the climate warms, which would increase average global precipitation. Soil moisture is likely to decline in many regions, and intense rainstorms are likely to become more frequent. Sea level is likely to rise 2 feet along most of the U.S. coast (USEPA 2003).

Calculations of climate change for specific areas are much less reliable than global ones, and it is unclear whether regional climate will become more variable. Computer models indicate that such increases in temperature will not be equally distributed globally but are likely to be accentuated at higher latitudes, such as in the Arctic, where the temperature increase may be more than double the global average. Warming during the winter months is expected to be higher than during the summer. Northern areas would also likely experience increased precipitation (USDOI BLM and MMS 1998).

Temperatures in Alaska and throughout the Arctic appear to have fluctuated over the last few centuries. Changes in permafrost are an important indicator of climate change. Temperature data for the permafrost in Alaska have been collected from borings over the last 2 decades. Using oil exploration wells distributed in the Arctic coastal plain and foothills, Lachenbruch and Marshall (1986) measured the temperatures of permafrost to depths of more than 600 feet and showed that the mean surface temperature is likely to have warmed 4 to 8 °F during the last century.

The assessment of the impacts of climate change is in its formative phase, and it is not yet possible to know with confidence the net impact of such change. Possible impacts of global climate change on the North Slope include negative effects on the ecology of the Arctic tundra, sea ice, and changes in the permafrost depth. Reduction in sea ice as a result of global climate change would affect marine mammals (particularly polar bears), fish, and birds, with related implications for Native subsistence harvests. A reduction in sea ice would likely increase marine transport and allow increased offshore extraction of oil and gas. Species ranges are predicted to move northward. Due to loss of habitat, or from competition from other species whose ranges shift northward, some Arctic species may be pushed toward extinction. Treeline is expected to move northward, with forests replacing tundra and tundra vegetation moving into unvegetated areas. Early thawing of rivers may impact caribou migrations to calving grounds. In addition, potential sea level rise, increases in severe weather, and thawing of tundra could have negative effects on oil and gas-related infrastructure. Elevated ultraviolet radiation levels could lead to higher levels of skin cancer, cataracts, and immune system disorders in Alaska Natives. However, some Arctic fisheries are expected to become more productive.

3.2.2 Air Quality

The Planning Area is in an area that is in attainment of the National Ambient Air Quality Standards (NAAQS) and the Alaska Ambient Air Quality Standards (AAAQS) for all criteria pollutants (Table 3-1). There are no federally protected Prevention of Significant Deterioration (PSD) Class I Wilderness Areas or National Parks within 60 miles of the Planning Area. The air quality in the Colville River Delta is generally good as a result of few pollution sources and good dispersion created by frequent high winds and neutral to unstable conditions in the lower atmosphere. Particulate entrainment (wind blown dust) tends to occur more in the summer months from sandbars along the riverbeds in the Colville River Delta, resulting in temporary increases in concentrations of airborne particulates. Existing onshore air quality in the Planning Area is relatively pristine, with concentrations of regulated air pollutants considerably lower than the maximum concentrations allowed under NAAQS and state air quality standards. Emission sources in the Planning Area consist mainly of diesel-fired generators in small villages, snowmachines, and small amounts of local vehicle traffic. Emissions sources at the Alpine field production and drilling areas include gas-fired turbines and heaters, incinerators, diesel-fired power generators, storage tanks, fugitive hydrocarbon emissions, and mobile sources (vehicle traffic and aircraft).

At Nuiqsut, existing emission sources consist of diesel-fired electric generators and home heaters, open burning, occasional small aircraft, and vehicle traffic. Regional sources of emissions consist of oil and gas production facilities 8 to 70 miles east of the Planning Area, including Kuparuk, Milne Point, Prudhoe Bay, North Star, Endicott, and Alpine fields.

An Ambient Air Quality Monitoring Station has operated at Nuiqsut since 1999 as a permit condition of the Alpine field. The condition required collection of at least 1 year of ambient nitrogen oxides (NO_X), sulfur oxides (SO_X), particulate matter less than 10 microns in diameter (PM_{10}), and dispersion meteorological data (Table 3-2). Data collected at Nuiqsut are representative of background or regional air quality in the Alpine field area. These data indicate that air quality is in compliance with both the NAAQS and the AAAQS for all pollutants and averaging periods. Particulate concentrations exceeded AAAQS on 1 day in 1999 as a result of wind-generated dust from the dried exposed banks of the Nigliq Channel. This measured high value at Nuiqsut does not mean that the AAAQS was violated. The AAAQS is attained when the expected number of days in a calendar year with a 24-hour average concentration above 150 micrograms per cubic meter is less than or equal to 1 day. (18 AAC § 50.010, Title 18 Environmental Conservation Chapter 50 Air Quality Control Article 1 Ambient Air Quality Management).

3.2.3 Physiography

Physiography can be described as the classification of large-scale landforms within a given area. The Planning Area contains two of the three primary physiographic regions of the National Petroleum Reserve – Alaska, the Arctic Coastal Plain and the Arctic Foothills of the Brooks Range (Map 3-1; Wahrhaftig 1965).

Table 3-1. Maximum Concentrations of Ambient Pollutants Monitored at Kuparuk River Unit (KRU) and Nuiqsut.

Air Pollutant	Federal and State Standards	Maximum Monitored Concentration ($\mu g/m^3$)[1]		
	Concentration/Averaging Time	KRU[2]		Nuiqsut[3]
		CPF-1	DS-1F	
Ozone (O_3)	0.12 ppm, 1-hr average (235 $\mu g/m^3$)	115.6	100.0	NA
Carbon monoxide (CO)	9 ppm, 8-hr average (10,000 $\mu g/m^3$) 35 ppm, 1-hr average (40,000 $\mu g/m^3$)	920 1,265	575 1,035	NA NA
Nitrogen dioxide (NO_2)	0.053 ppm, annual arithmetic mean (100 $\mu g/m^3$)	16.0	4.9	5.6
Sulfur dioxide (SO_2)	0.030 ppm, annual arithmetic mean (80 $\mu g/m^3$) 0.14 ppm, 24-hr average (365 $\mu g/m^3$) 0.5 ppm 3-hr average (1,300 $\mu g/m^3$)	5.2 26.2 44.5	2.6[4] 13.1 55.0	0.0 2.6 7.8
Particulate matter (PM_{10})	50 $\mu g/m^3$, annual arithmetic mean 150 $\mu g/m^3$, 24-hr average	13.6 108	11.2 63	8.2 223[5]
Reduced sulfur as SO_2	50 $\mu g/m^3$, 30-minutes No federal standard	18.1	8.3[6]	15.7
Lead	1.5 $\mu g/m^3$, calendar quarter	NA	NA	NA

[1] National and State Standards, other than those based on annual average, are not to be exceeded more than once a year.
[2] Kuparuk River Unit; maximum concentrations measured during November 1990 to October 1992.
[3] Maximum concentration measured during July 1999 to June 2001.
[4] Minimum instrument detection level.
[5] PM_{10} exceedance was due to wind-generated dust on a very windy day in early fall 1999.
[6] Maximum 1-hour average.
$\mu g/m^3$ = micrograms per cubic meter.
ppm = parts per million.
NA = not applicable.
Sources: 40 CFR § 50; Alaska Administrative Code (1997); and Phillips Alaska, Inc. (2002).

3.2.3.1 Arctic Coastal Plain Province

The Arctic Coastal Plain (ACP) Province covers approximately 85 percent of the Planning Area; it extends inland from the coast of the Arctic Ocean. The coastline is irregular and contains many small bays, lagoons, spits, beaches, and barrier islands (Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope 2003). Periglacial features (e.g., thaw lakes, marshes, and polygonal patterned ground), providing little topographic relief and poor drainage, dominate the ACP. Polygonal patterned ground forms from ice wedges that freeze within contraction cracks of the soil. Throughout the year, these cracks fill with water and snow, then freeze and expand.

During the warmer months, the surface ice melts and water remains. This process repeats annually resulting in a polygonal patterned surface. The ACP extends southward from the shoreline approximately 30 miles into the coastal lowlands. The lowlands are a vast treeless area of tundra, meandering streams, drained and undrained lagoons, and thousands of shallow thaw lakes. Freshwater lakes cover approximately 26 percent of the ACP lying within the Planning Area.

The lake-filled coastal plain fades into an area of large rounded lakes and a numerous very small lakes at an elevation of about 100 feet above mean sea level and about 40 miles inland. Dunes and ridges, such as the Pik Dunes, appear. At an elevation of 200 feet and about 60 miles inland, streams begin to replace the smallest lakes.

Table 3-2. Nuiqsut Ambient Air Quality Monitoring Program NO_2, SO_2, and PM_{10} Concentrations during April 2002 through December 2002.

Monitoring Period	Average NO_2 Conc. (ppm)	Maximum 3-hour SO_2 Conc. (ppm) [1]	Maximum 24-hour SO_2 Conc. (ppm)	Average SO_2 Conc. (ppm)	Maximum 24-hour PM_{10} Concentration (µg/m^3)[2]		Average PM_{10} Concentration (ug/m^3) [3]	
					Standard[3]	Actual	Standard[3]	Actual
Quarterly Reporting Data								
April through June 2002	0.009	0.002	0.000	0.000	39.0	43.0	11.2	12.3
July through September 2002	0.004[4]	0.003	0.002	0.000	43.6[5]	45.6[5]	8.2	8.7
					30.0[6]	31.3[6]		
October through December 2002	0.007	0.001	0.000	0.000	26.9	30.8	8.9	10.1
Alaska Ambient Air Quality Standards	0.053	0.5	0.14	0.03[7]	150	NA	50[8]	NA

[1] Running 3-hour average.
[2] Based on continuous particulate (tapered element oscillating microbalance) data.
[3] Standard refers to measured concentrations based on a flow rate corrected from actual conditions to USEPA-designated standard conditions by using a pressure of 1 atmosphere and a temperature of 25 °C.
[4] Based on only 76 percent data recovery.
[5] Onsite observations indicate this elevated daily concentration was affected by particulate emissions from a tundra fire near Point Lay, Alaska.
[6] Maximum measured 24-hour concentration not affected by particulate emissions from a tundra fire near Point Lay, Alaska.
[7] Based on only 65.9 percent data recovery.
[8] Annual average.
µg/m^3 = micrograms per cubic meter.
ppm = parts per million.
Source: SECOR International, Inc. (2003).

3.2.3.2 Arctic Foothills Province

The Arctic Foothills Province becomes evident at about 90 miles inland and south of the coast. Elevations start at about 500 feet. While the Arctic Foothills Province extends to the Brooks Range (about 180 to 200 miles inland), the Planning Area boundary is the Colville River, which is about 120 miles south of the coastline.

The Arctic Foothills Province consists of tundra-covered rolling hills, low east-west trending ridges, and occasional small pingos. The highest elevation within the Planning Area is 1,150 feet, which is just southeast of Square Lake. The Colville River is the southern boundary of the Planning Area. It is also the longest river in the Arctic Foothills Province at 220 miles long. Although there are no glaciers, the area is underlain by continuous permafrost. Waterbodies in the Arctic Foothills Province cover approximately 7 percent of the area.

3.2.4 Geology and Minerals

The regional geology and minerals found in the Planning Area are described below. Information on the petroleum resource potential, and past oil and gas exploration efforts is provided in Section 3.2.5 (Petroleum Resources).

3.2.4.1 Geology

Northern Alaska and the adjacent continental shelf are underlain by sedimentary rocks that represent approximately 360 million years of geologic time (Figure 3-2). Three thick stratigraphic sequences were deposited in overlapping geologic basins that now lie beneath the present North Slope. The older basin flanked a continental landmass that once lay north of the present Beaufort coastline. The Ellesmerian Sequence, deposited in the older basin, contains rock units that grade from proximal (near source terrain) facies (all the characteristics of a particular rock unit) in the north to deepwater marine facies in the south. The youngest basin was formed as a deep trough (Colville Basin) on the north side of a mountain belt whose present expression is the Brooks Range. The Brookian Sequence, deposited in

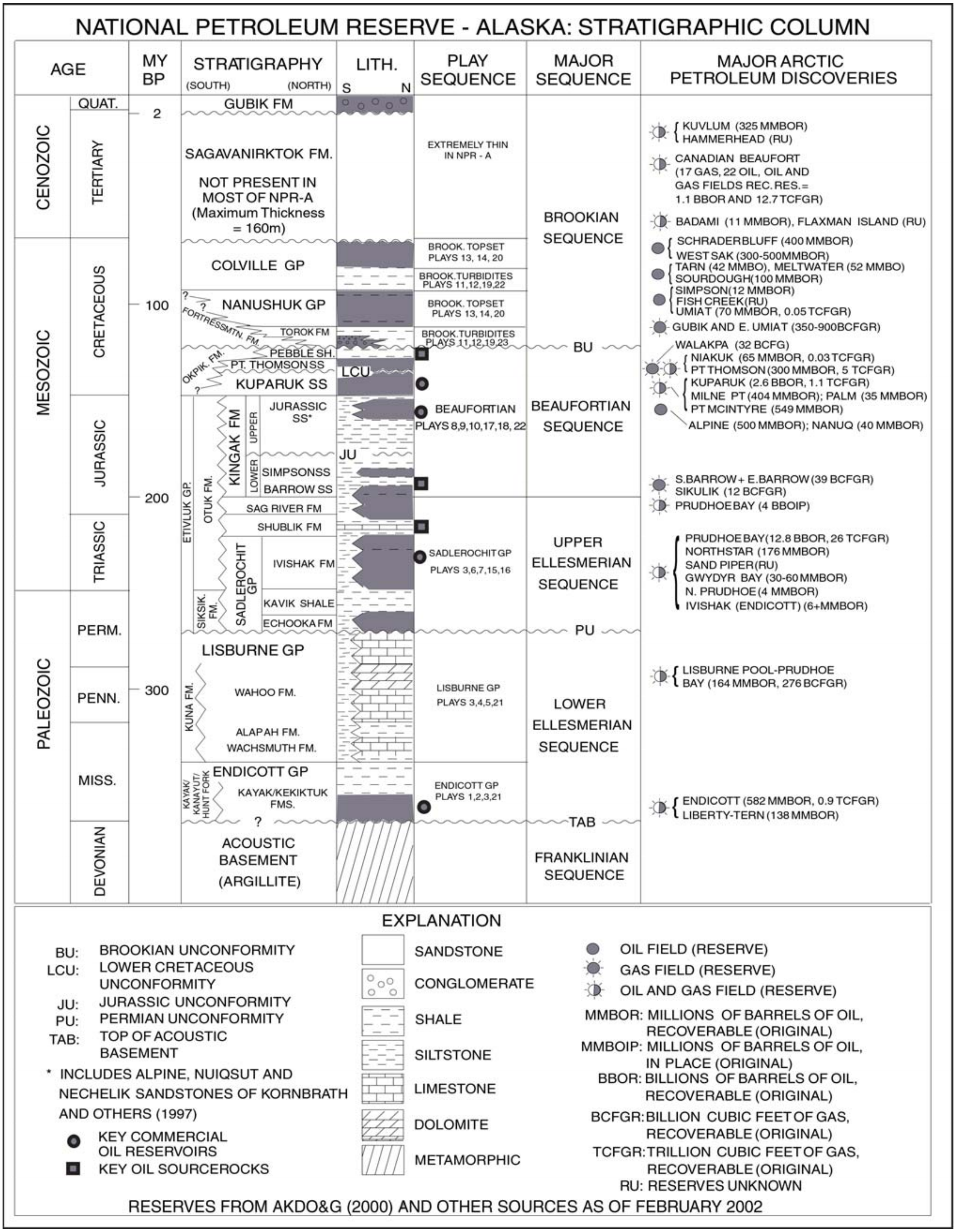


Figure 3-2. Stratigraphic Column for National Petroleum Reserve – Alaska.

the younger basin, contains deltaic and marine deposits shed off the mountain belt into the Colville Basin. The transitional period between these two overlapping tectonic events is represented by rocks of the Beaufortian Sequence, which were deposited in a low-relief rift zone marking the southern edge of the present Arctic Ocean basin. The geologic history and stratigraphy of the Planning Area are discussed in detail in Gryc (1988) and previous environmental impact statements (USDOI BLM and MMS 1998, 2003).

The primary structural features in northern Alaska are shown in Map 3-2. Of particular importance to later discussions of petroleum potential are the Brooks Range, Colville Basin, and Barrow Arch (progressing south to north). Numerous literature references describe the stratigraphy and tectonic evolution of northern Alaska and its adjacent continental margins. For additional information, readers should refer to the following general references: Brosge and Tailleur (1971); Grantz and May (1982); Craig et al. (1985); Hubbard et al. (1987); Kirschner and Rycerski (1988); and Moore et al. (1994).

3.2.4.2 Minerals

As stipulated in the NPRPA, lands within the National Petroleum Reserve – Alaska are reserved and withdrawn from all forms of entry and disposition, including mining and mineral leasing and extraction. However, Congress has authorized the leasing of oil and gas, and the NPRPA does allow the Secretary of the Interior to grant mineral material (salable minerals) permits as necessary to carry out his responsibilities. Clay, which is classified as mineral material, can be removed at the discretion of the Secretary. Other minerals (hardrock, uranium, and coal) are not available for resource exploitation unless authorized by Congress.

Hardrock Mineral Potential

The northeast corner of the National Petroleum Reserve – Alaska ACP contains no identified hardrock mineral potential. This area was included as part of the Colville Mining District Mineral Assessment study conducted by the U.S. Bureau of Mines during 1991 through 1993 (Meyer 1995). All of the hardrock mineral potential of the National Petroleum Reserve – Alaska occurs south of the Colville River into the northern flank of the Brooks Range and includes the Drenchwater and Story Creek deposits.

Clay Potential

Three deposits of bentonite clay are located in the Umiat quadrangle on the south-southeastern side of the Colville River. Bentonite is used in drilling muds, civil engineering and sealing applications, pet absorbents, and iron-ore palletizing.

Uranium Potential

Potential uranium deposits may occur along the entire North Slope of Alaska, including the ACP of the National Petroleum Reserve – Alaska. Sampling and analysis of rock, soil, and sediment within the Planning Area has indicated that small amounts of uranium are present, approximately 4289 parts per million (USGS 2004).

Coal Resources

Coal in the northeastern NPR-A occurs within the eastern extent of the Northern Alaska coal province, the largest coal province in Alaska. This coal province contains the largest coal resource in the United States and ranks with the top two or three coal provinces in the world. The resource is estimated to range from 120 to 150 billion short tons of coal (Flores et al. 2003; ADNR 1983). In the Planning Area, coals occur in two formations. Subbituminous to bituminous coal is found in the lower Cretaceous Nanushuk Formation which outcrops in the southern portion of the planning area (Mull et al. 2003). Another coal bearing unit is the Prince Creek Formation (Mull et al. 2003). The Prince Creek Formation contains relatively thin seams of subbituminous coal beds, but these coals have not been studied extensively. The Prince Creek Formation coals are best exposed along the banks of the Colville River and its eastern tributaries in the northern part of the planning area. The coal and potential coalbed methane resources in the planning area are not well defined.

3.2.4.3 Seismicity

The National Petroleum Reserve – Alaska is not located near any tectonic plate boundaries where the relative motion between plates may generate earthquakes (USDOI BLM 1978a). Most earthquake activity in Alaska occurs along an arc extending east from the western edge of the Aleutian Islands, through south-central Alaska and into the central part of Interior Alaska. From 1960 through 2000, no earthquakes of 4.0 magnitude or greater (Modified Mercalli Intensity Scale of 1931) have been reported in the National Petroleum Reserve – Alaska. Areas east and south of National Petroleum Reserve – Alaska have reported many earthquakes of 4.0 magnitude or greater (Alaska Earthquake Information Center 2003).

3.2.5 Petroleum Resources

3.2.5.1 Petroleum Geology

The North Slope is an incredibly rich petroleum province, with an estimated in-place endowment of 63 Bbbl of oil and proven commercial oil reserves of 21 Bbbl (Alaska Department of Revenue 2002). The oil-in-place estimate is based on the total oil estimated to be present in discovered producing and non-producing fields of the North Slope. Another undiscovered 10.3 Bbbl may be recoverable in onshore and offshore areas. Gas resources may be as much as 100 trillion cubic feet (Tcf). Of the proven commercial reserves, about 13.9 Bbbl have been produced through 2002 (Alaska Department of Revenue 2003a). Exploration in northern Alaska has located 32 or more oil and gas fields, but most reserves are located in a few very large oil fields near Prudhoe Bay (Map 3-3). The key oil source-rock and reservoir sequences present in these commercial oil fields extend across much of the North Slope, including the National Petroleum Reserve – Alaska. Because of these geologic trends and the abundance of untested potential traps, northern Alaska and the adjacent continental shelf are considered to hold high potential for new oil and gas fields (Map 3-4).

3.2.5.2 Petroleum Activities in Northern Alaska

Past Exploration Efforts

Petroleum exploration in northern Alaska began in the early 1900s with field parties sponsored by the USGS. From 1944 to 1952, the U.S. Navy drilled exploration wells near oil seeps and on surface anticlines, resulting in several oil and gas discoveries. Umiat was the first oil field discovered in northern Alaska (1946). However, it remains undeveloped because development costs are prohibitive. The South Barrow gas field was the first significant gas discovery (1949) on the North Slope, and it was developed in 1958 by the federal government to supply fuel to the village of Barrow.

A second phase of National Petroleum Reserve – Alaska exploration started in the 1970s. It began under the auspices of the U.S. Navy, but was later coordinated by the USGS, with the passage of the Naval Petroleum Reserve Production Act in 1976. This exploration effort resulted in 28 exploration wells (Husky Oil Company) and 14,800 miles of seismic data (Geophysical Services, Inc.). Numerous oil and gas shows were reported, but no commercial fields were discovered. Gas fields near Barrow (Barrow and Walakpa) were developed through government subsidies and currently are produced for local use.

The discovery of the Alpine field in the Colville River Delta has helped renew exploration interest in the National Petroleum Reserve – Alaska. The Alpine field was discovered by ARCO and partners in the winter of 1994-1995 (Alaska Report 1996). Development and appraisal drilling has confirmed its reserve potential of 429 MMbbl, and in the fall of 2003 the Alpine field recorded 100 MMbbl of production (Alaska Oil and Gas Reporter 2003). The field may even have economically recoverable reserves as high as 500 MMbbl (Gingrich 2001). The Alpine field is the largest field discovered in Alaska since the discovery of the Point Mclntyre field in 1988 and is one of the largest fields discovered in the U.S. in recent decades. Of particular significance is that the Alpine field discovery has revealed a new geologic play in previously unknown sands in the Jurassic section. An oil and gas play has been defined by the USGS (1995) National Oil and Gas Assessment Team as "a set of known or postulated oil and (or) gas accumulations sharing similar geologic, geographic, and temporal properties, such as source rock, migration pathway, timing, trapping mechanisms, and hydrocarbon traps." The new Jurassic play is likely to extend westward into the National Petroleum Reserve – Alaska and will be a principal target for future exploration on the western North Slope (Kornbrath et al. 1997). Although the initial field discovery and development was outside of the Planning Area, delineation of the reservoirs in the field have resulted in a proposal to build satellite production sites that are in the National Petroleum Reserve – Alaska (USDOI BLM and MMS 2003). The Alpine field play has been the principal target for exploration on leases acquired in the Planning Area.

To date, 17 exploration wells and one sidetrack well have been drilled in the Planning Area on leases acquired since 1999 (Map 3-5). At least seven of these 17 wells encountered oil or gas and condensate. Long-term flow testing at the Spark 1A well produced 1,550 barrels of liquid hydrocarbons and 26.5 million cubic feet per day (MMcfd) of gas after fracture stimulation. Long-term flow testing at the Rendezvous "A" well produced 360 barrels per day of liquid hydrocarbons and 6.6 MMcfd of gas. Flow tests at the Lookout 2 well recovered 4,000 barrels per day of liquid hydrocarbons and 8 MMcfd of gas. All of these exploration wells targeted the Alpine field reservoir formation, which occurs within the "Beaufortian" play group. These wells are located 15 to 25 miles southwest of the Alpine field that is now producing more than 100,000 barrels (bbl) of oil per day (Alaska Oil and Gas Reporter 2003).

Leasing and Development

Leasing Activities

Petroleum leasing activities began in northern Alaska shortly after statehood in 1959. In the years following the 1968 Prudhoe Bay discovery, the State of Alaska has had many lease sales (USDOI BLM and MMS 1998). The BLM conducted four lease sales between 1981 and 1984. These sales offered tracts across the entire National Petroleum Reserve – Alaska; on the coastal plain, the foothills, and mountain front. Approximately 1.3 million acres were leased with bonus bids of about $83.5 million. Only one well was drilled before all the leases expired.

In 1999, the BLM offered 425 tracts (approximately 3.9 million acres) for lease within the Planning Area. A total of 133 tracts (867,000 acres) were leased, with successful bids totaling $104,635,728. Six oil companies (British Petroleum [BP], Anadarko Petroleum, Chevron, Phillips Petroleum, Atlantic Richfield Company [ARCO] Alaska, and R3 Exploration Corp) submitted 174 bids that concentrated in the northeast corner of the Planning Area. The highest bid for a single tract (5,756 acres) was $3,655,100, offered by ARCO Alaska and Anadarko Petroleum.

The BLM conducted another lease sale in June 2002 in the Planning Area. The 2002 lease sale generated winning bids totaling $63,811,496 on 60 tracts totaling 579,269 acres. Phillips Alaska and Anadarko Petroleum, the companies that have been most active in National Petroleum Reserve – Alaska, were awarded 34 tracts, with successful bids of $9.6 million. Two companies that have not been active in the National Petroleum Reserve – Alaska to date also submitted winning bids. TotalFinaElf E&P USA was awarded 20 tracts with successful bids totaling $53,532,000. TotalFinaElf submitted the six highest bids of the sale, bidding more than $10 million on each of two tracts and more than $7 million on a third. EnCana Oil and Gas (USA) Inc. also submitted successful bids for leases in the 2002 sale.

The BLM held an oil and gas lease sale on June 2, 2004 for 484 tracts in the Northwest National Petroleum Reserve – Alaska, and for 22 tracts that combine lands from the Northwest and Northeast National Petroleum Reserve – Alaska along the Ikpikpuk River that have not been offered to date. About 5.8 million acres were offered. The BLM may also hold lease sales in the Planning Area in 2005, depending upon the outcome of the Amended IAP/EIS.

Leasing and exploration activities in the Outer Continental Shelf (OCS) areas in the Beaufort Sea are summarized in USDOI BLM and MMS (2003). Seven lease sales have yielded 35 exploratory wells, which were drilled in Arctic federal waters between 1980 and 2003 (30 Beaufort Sea wells and five Chukchi Sea wells). Encana drilled the 35th exploration well in the winter of 2002-2003 at the McCovey prospect in the Beaufort Sea. The MMS classifies nine of these wells as capable of producing paying quantities (sufficient to pay for operating costs; not necessarily sufficient for commercial development). All wells have been plugged and abandoned because field economics have not favored production. Five prospects have been unitized for possible development (Northstar, Sandpiper, Hammerhead, Kuvlum, and Liberty; however Hammerhead and Kuvlum have lapsed without development) and commercial oil production began at Northstar in October 2001. In January 2002, BP-Amoco postponed commercial development at Liberty (Tern) pending project design changes. The latest sale in the Beaufort Sea, Sale 186, was held in September 2003.

In May 2004, the MMS held a sale in Cook Inlet in conjunction with the State of Alaska's Cook Inlet area-wide sale. As a result of the sale, relatively unexplored areas within Cook Inlet that have good potential for oil and gas will be opened. The sale was held in conjunction with the State of Alaska's Cook Inlet area-wide sale. The sale area is located in Alaska's Cook Inlet in federal waters between 3 and 30 nautical miles offshore. The area covers about 2 million acres extending from just south of Kalgin Island to just northwest of Shuyak Island, in water depths ranging from about 30 to 650 feet.

Historical leasing patterns offer a perspective on the possible scale of activities associated with future National Petroleum Reserve – Alaska lease sales. In the previous National Petroleum Reserve – Alaska leasing programs, nearly 20.5 million acres were open to leasing and 1.32 million acres were leased (approximately 18 percent). Currently, private companies have drilled 17 exploratory wells. In the OCS, 35 exploration wells were drilled from a lease inventory of 5.5 million acres (averaging one well per 27 leased tracts). There have been significantly higher levels of drilling on state leases, where it is estimated that approximately half of all the offered tracts have been leased during the more numerous state sales (Kornbrath 1994). Approximately 10 percent of the available prospects have been tested. Historically, the success rate for commercial fields on the North Slope has been slightly less than 5 percent.

Alpine Field

The Alpine field is on the Colville River Delta between the Nigliq and Sakoonang channels and approximately 8 miles north of Nuiqsut. Production pads Colville Delta-1 (CD-1) and CD-2 began oil production in November 2000 and 2001, respectively.

Infrastructure at CD-1 pad fully supports the ongoing drilling and production operations, including activities at the CD-2 site. Facilities and equipment currently installed include processing facilities, production wells, camp facilities, sanitation utilities (water and wastewater), drilling mud plant, airstrip, maintenance complex, warehouse buildings, disposal wells, emergency response center, communications, power generation, and various mobile equipment (USDOI MMS 2004c).

The CD-2 production pad is a satellite approximately 3 miles to the west of CD-1. Access to the site is by a gravel road, of which approximately 5,000 feet nearest CD-1 is coincident with the edge of the airstrip. A temporary camp provides support for ongoing drilling operations.

Pipelines consist of a gathering pipeline that transports unprocessed produced oil and water from CD-2 to the Alpine Processing Facility at CD-1 and a 34-mile-long oil sales pipeline connects the processing facility to the Kuparuk River oil field. Pipelines are elevated above the tundra by vertical support members, except at the main channel crossing of the Colville River, where the oil sales pipeline is underground.

The USDOI BLM (2004c, d) has completed and issued a ROD in November of 2004 that analyzed a proposal to develop five new satellite pads—two in the Colville River Delta and three in the Planning Area. The pads are termed CD-3, CD-4, CD-5, CD-6, and CD-7. In the Colville River Delta, CD-3 is on State of Alaska land and CD-4 is on land owned by Kuukpik Corporation, the Native Corporation created under the authority of the Alaska Native Claims Settlement Act (ANCSA) for the village of Nuiqsut. Colville Delta-5 is on land conveyed to Kuukpik Corporation within the Planning Area. Colville Delta-6 and CD-7 are on lands administered by the BLM in the Planning Area. ConocoPhillips Alaska, Inc., proposes to place 20 to 30 wells on each pad and to transport the unprocessed, three-phase (oil, gas, and water) drilling product to the existing Alpine Processing Facility at CD-1 for processing. Processed oil would be placed in the existing pipeline system for transport to the Trans-Alaska Pipeline System.

Petroleum Potential

The "total petroleum system" concept is used to assess oil and gas potential. The concept takes into account all the petroleum generated by related source rocks. The total petroleum system resides in a volume of mappable rocks and includes sources, reservoirs, seals, and overburden. Geologic processes act upon the petroleum system and "control the generation, expulsion, migration, entrapment, and preservation of petroleum" (Charpentier et al. 2001). The most hydrocarbon prolific petroleum system of the northern Alaska is the Ellesmerian petroleum system (Map 3-2). Oil generated and trapped in the Ellesmerian petroleum system includes Prudhoe Bay and many of the other North Slope fields.

The Alaska North Slope produced 351 MMbbl of oil in 2002 (Alaska Department of Revenue 2003a). Eighty percent of this oil was produced from reservoirs in the Ellesmerian Sequence. The Ellesmerian petroleum system has been estimated to have a total oil generative potential of 8 trillion bbl of oil. Fields in the Beaufortian Sequence account for slightly less than 20 percent of North Slope production. At present, Brookian Sequence reservoirs contribute less than 1 percent of the total production, although this proportion may increase in the future with new development activities at West Sak, Milne Point (Schrader Bluff pool), Tarn, Meltwater, Badami, Nanuq, Tabasco, and other Brookian-Sequence fields.

Most oil production has been associated with Ellesmerian Sequence, largely because of the exceptional reservoir qualities in the Sadlerochit (Ivishak Formation) and Endicott (Kekiktuk Formation) sandstones in this sequence (Figure 3-2). Because of their proven performance as commercial petroleum reservoirs, Ellesmerian Sequence prospects have traditionally formed the chief exploration objectives in northern Alaska. Reservoir qualities comparable to the Ellesmerian reservoirs are rarely found in the younger Beaufortian and Brookian sequences. These younger reservoirs are typically thinner and laterally discontinuous, with lower porosity and permeability. For this reason, these sequences have been viewed as secondary objectives in the past. That focus is now changing however, in light of the recent discoveries in Beaufortian rocks in the Colville River Delta area and Northeast National Petroleum Reserve – Alaska. Since 2000, Beaufortian Sequence reservoirs, particularly the Alpine field sandstone, have formed the chief exploration target for the wells drilled in the Northeast National Petroleum Reserve – Alaska (PI/Dwight's Plus Drilling Wire 2001).

Future Petroleum Exploration

Although few geologists genuinely expect to find more Prudhoe Bay-sized fields in northern Alaska, many see a high potential for undiscovered fields of more modest sizes. Today, oil fields of 100 to 200 MMbbl are routinely developed, and satellite fields (sharing existing infrastructure) of only 30 to 50 MMbbl are seriously considered for commercial development. With the minimum commercial-field thresholds lowered to these levels because of technological advances in drilling and reservoir development, it is clear there are abundant exploration opportunities throughout northern Alaska. This perception will likely encourage exploration for decades to come.

Industry strategy has also shifted from exploring completely untested (wildcat) geologic plays in remote areas to detailed re-examination of proven plays in areas near existing infrastructure. This strategy is based on two assumptions: 1) exploration that focuses on proven plays is more likely to be successful; and 2) the economics for development are more favorable if existing infrastructure is used. Consequently, new development is likely to expand incrementally from current North Slope infrastructure rather than appear as widely scattered startup projects.

The Alpine field is a key factor in the resurgence of industry's interest in the National Petroleum Reserve – Alaska. The Jurassic reservoirs constitute a new exploration play that is likely to extend over the northern third of the National Petroleum Reserve – Alaska. During the development of the Alpine field, the estimated recoverable reserves have gone from around 340 to 370 MMbbl (Montgomery 1998) to over 400 MMbbl, so that economic recovery of 500 MMbbl is certainly possible. Alpine-sized fields in remote areas might have been considered sub-economic as recently as a decade ago. The new Alpine field infrastructure (processing, support facilities, and pipeline) and it's proximate location to the National Petroleum Reserve – Alaska will undoubtedly fit into plans for future developments of commercial discoveries in the Planning Area.

Oil and Gas Resource Assessment

Resource assessments are built on a constantly changing database and most, therefore, should be viewed as updates of previous work. Numerous oil and gas resource assessments have been conducted for the National Petroleum Reserve – Alaska, the most recent of which were completed in 2002 by the USGS (Bird and Houseknecht 2002a, b; Garrity et al. 2002). The 2002 USGS assessments updated the National Resource Assessment conducted in 1995 (Attanasi and Bird 1995, Bird 1995), which included all of northern Alaska. The reader is referred to Chapter III and Appendix 7 of the Northwest IAP/EIS for a detailed discussion of the assessments (USDOI BLM and MMS 2003).

The assessment of oil or gas potential in the National Petroleum Reserve – Alaska evaluates two general categories of hydrocarbon resources:

- Conventionally recoverable resource potential, including pooled oil and gas accumulations recoverable by current technology without regard to economic viability; and
- Economically recoverable resource potential, including pools that could be developed and produced profitably under a given set of engineering and economic assumptions.

The 2002 petroleum resource assessment of the National Petroleum Reserve – Alaska focused on 22 recognized geologic plays (see Northwest IAP/EIS Maps 99-104; USDOI BLM and MMS 2003). Sixteen individual geologic plays are recognized within the Planning Area. One or more plays can exist within a petroleum system.

Of the 22 plays within the National Petroleum Reserve – Alaska, three plays consist entirely of gas reservoirs, and the remaining 19 plays consist of mixed oil and gas reservoirs. The conventionally recoverable resources amount to a total oil potential ranging from 6,817 to 11,817 MMbbl (95 percent and 5 percent probability levels), with a risked mean estimate of 9,111 MMbbl. Conventionally recoverable gas resources range from 23.00 trillion cubic feet (Tcf) to 56.21 Tcf (95 percent and 5 percent probability levels), with a risked mean estimate of 37.31 Tcf. For the Planning Area, the risked mean estimate of conventionally recoverable oil is 5,273 MMbbl of oil and 16.41 Tcf of gas, or 58 and 44 percent, respectively, of the total for the National Petroleum Reserve – Alaska.

The estimates for the risked mean economically recoverable oil resources for the National Petroleum Reserve – Alaska range from 634 MMbbl to 5,697 MMbbl ($20 and $30 per bbl prices, respectively, for crude oil plus gas liquids). The risked mean economically recoverable gas resources range from 0.21 Tcf to 15.83 Tcf ($2.56 and $4.27 prices per 1,000 cubic feet of for non-associated gas plus associated/dissolved gas). The fraction of the conventionally recoverable resource volume that could be economic to produce, if discovered, rises from about 1 percent at the lower price to 63 percent (oil) and 42 percent (gas) at the higher price.

The resource potential is not uniformly distributed throughout the National Petroleum Reserve – Alaska (see Maps 99-104 in Northwest IAP/EIS; USDOI BLM and MMS 2003). Three plays hold a majority of the undiscovered resource potential. The highest conventionally recoverable and economic potential lies in the northern third of the ACP below the Barrow Arch (Map 3-2). This structural ridge has been a focus for regional oil and gas exploration, and all currently producing fields on the North Slope are located on or near the Barrow Arch. The high oil potential of plays along the Barrow Arch in the National Petroleum Reserve – Alaska is recognized in this assessment as well as all previous petroleum assessments of the North Slope.

The oil and gas potential of the National Petroleum Reserve – Alaska is dominated by the Beaufortian (or Alpine-correlative) play that contains 52 percent of the undiscovered conventionally recoverable oil resources and 84 percent of the economically recoverable oil resources. The geologic conditions that led to the Alpine field are expected to persist across the northern National Petroleum Reserve – Alaska. Stratigraphic traps similar to the Alpine field are likely to be the principal targets for future exploration in the National Petroleum Reserve – Alaska.

In the south, two plays are identified with significant oil and gas potential—the Brookian Foldbelt and Fortress Mountain Formation-Deep Detached Foldbelt plays. Because these plays are gas-prone, they offer modest-sized oil pools. These plays are far from existing infrastructure and therefore hold limited economic potential for oil. In the high price case ($4.27 per thousand cubic feet) for gas, the two plays contain 32 percent of the economic gas resources (5.0 Tcf) in the National Petroleum Reserve – Alaska.

3.2.6 Paleontological Resources

Traveling south to north in the National Petroleum Reserve – Alaska, the rocks generally change from Mesozoic (240 to 65 million years ago) to Quaternary (3 million years ago) in age. The earliest fossil record in the National Petroleum Reserve – Alaska is found in sedimentary rocks assigned to the Late Cretaceous (95 million years ago). This marine and terrestrial record is found in the extreme southern portion just southwest of Umiat (Gangloff 1997). The youngest fossils are contained in early Holocene (less than 10,000 years ago) age marine sediments directly underlying the tundra and found along river courses and in the banks of thaw lakes. The most diverse and important collections originate along the Colville, Kaolak, and Ikpikpuk rivers. Teshekpuk Lake has provided late Pleistocene varieties of marine and non-marine mammals.

Significant dinosaur remains lay within the National Petroleum Reserve – Alaska along the banks of the Colville River and other major river drainages. The Ocean Point site on the Colville River marks a globally significant find of dinosaur fossils in upper Cretaceous strata. The fossil specimens are well preserved by varying degrees of mineralization and have been subsequently entombed in permafrost. The Ocean Point fossils represent the northernmost occurrence of dinosaurs in North America (Phillips 1989, Gangloff 1997).

The southern third of the Ikpikpuk River and the northern third of the Colville River have produced abundant remains of late Pleistocene (35,000 to 10,000 years ago) mammals including bison, horse, mammoth, various carnivores, and rare insects. Even more abundant remains of marine mollusks and microfossils have been collected from bluffs cut by these two rivers (USDOI and MMS 1998).

A 10-mile stretch of the Colville River, from the Kikiakrorak River to near Big Bend, has produced the most diverse and extensive high latitude dinosaur collections in either hemisphere (Brouwers et al. 1987). Over 6,000 skeletal elements representing 10 different taxa have been curated over the last 13 years. Most were contained in a series of concentrations called bone beds. In addition, closely associated mammals, fish, and plants have been collected.

3.2.7 Soil Resources

Soils in the Planning Area are underlain by permafrost, or permanently frozen ground, of varying thickness and as a result are continuously cold and wet. Snow and ice typically cover soils for most of the year. Decomposition rates are slow under these environmental conditions and organic matter tends to accumulate over the mineral soil parent materials as thick peat layers, particularly in low-lying areas (Nowacki et al. 2001). Cold temperatures and frozen conditions slow the process of soil formation, resulting in little profile development (Brady and Weil 1999). During summer, the permafrost thaws to varying depths within the active layer (the depth of seasonal thaw), which typically occurs within a few feet of the soil surface. The presence of permafrost inhibits internal water drainage during the summer thaw, resulting in soils that are poorly drained and continuously wet.

The *Exploratory Soil Survey of Alaska* (Rieger et al. 1979) identified five major soil map units within the Planning Area (Map 3-6).

3.2.7.1 Map Unit IQ6

This soil map unit occupies most of the eastern part of the ACP in the northeast Planning Area. Soils are typically shallow over permafrost and are constantly wet and cold. Soils are poorly drained and have developed principally in deep, loamy sediment under a thick cover of sedge tussocks, low shrubs, forbs, mosses, and lichens. Very poorly drained fibrous peat soils occupy broad depressions, shallow drainageways, and lake borders, commonly under a thick cover of sedges.

3.2.7.2 Map Unit IQ21

This unit occupies most of the western part of the ACP in the Planning Area. There are many undulating and rolling sand dunes, especially in areas bordering the floodplains of major streams and some of the larger lakes. Most of the soils in the association consist of sandy eolian, alluvial, and marine deposits, but a few formed in loamy material. Poorly drained soils with a shallow permafrost table occupy most of the nearly level areas and the broad swales between dunes. The soils on dunes consist of eolian sand and, although they are perennially frozen below a depth of 30 to 40 inches, they seldom retain enough moisture for large ice crystals to form.

3.2.7.3 Map Unit IQ2

This unit occupies most of the southern part of the Planning Area in the northern part of the Arctic Foothills Province. Soils vary depending on the landform and landscape features, but all are underlain by continuous permafrost. Most of the soils consist of silty colluvial and residual material weathered from fine-grained, nonacid sedimentary rocks.

3.2.7.4 Map Unit IQ8

This unit occupies a relatively small area in the southern part of the Planning Area on the hills and ridges of the Arctic Foothills Province north of the Brooks Range. The dominant soils in valleys and on long foot slopes formed in loamy colluvial sediment. On hills and ridges, most of the soils consist of very gravelly material weathered from sedimentary rock. A few soils near the Brooks Range formed in very gravelly glacial drift.

3.2.7.5 Map Unit IQ22

This unit occupies the floodplain of the Colville River through both the Arctic Foothills Province and ACP along the eastern boundary of the Planning Area. The dominant soils consist of very gravelly stream deposits underlain by permafrost. A general decrease in grain size is evident along the topographic gradient descending from the Brooks Range, extending laterally from fluvial systems and radially inward from lake shores to center (Jorgenson and Pullman 2002).

3.2.8 Sand and Gravel Resources

Oil and gas development activities require granular mineral materials, such as gravelly sand or sandy gravel, for use in the construction of roads, pads, and airfields. Generally, the high cost of obtaining aggregates (sand and gravel) in the Arctic makes them useful for permanent facilities, whereas other, less expensive options, such as ice techniques, are used for temporary or seasonal needs. Whether to use ice, sand and gravel transported over some distance, or enhanced local materials as construction materials is an economic decision. Mineral materials along beaches are a source used in the past and, depending on the specific needs and location, extraction may occur with minimal concern.

Roads in the Kuparuk River Unit and Prudhoe Bay Unit have had the benefit of good-quality gravel sources that have been relatively inexpensive to develop. West of the Colville River, however, the Planning Area is characterized by an apparent scarcity of suitable gravel for road, pad, and airstrip construction (Peratrovich, Nottingham, and Drage, Inc. 2002). The sand and gravel resources and construction techniques relevant to oil and gas exploration and other construction projects in the National Petroleum Reserve – Alaska are described in the following documents: *Engineering Considerations for Gravel Alternates in National Petroleum Reserve – Alaska* (USDOI BLM 1981); *An Environmental Evaluation of Potential Petroleum Development of the National Petroleum Reserve in Alaska* (USGS 1979); *The National Petroleum Reserve in Alaska, Earth Science Considerations* (Gryc 1985); and *Geology and Exploration of the National Petroleum Reserve in Alaska, 1974-1982* (Gryc 1988).

3.2.8.1 Sand and Gravel Deposits

The surface materials of the Planning Area include marine silts, sands, and clays; beach and deltaic deposits; thaw lake deposits; alluvium and fluvial-lacustrine deposits; eolian sands and upland silts; as well as sandstones and shales. Gravels are found specifically in active and inactive floodplains and low terraces (USDOI BLM and MMS 1998).

Deposits in the ACP are composed of marine sands and silts with depths of 20 to 180 feet. The marine deposits are of two types: silts and clays, or sand over silts and clay, both with high ice content. Beach deposits contain gravely sand and sand with areas of high organic content (wood and peat), that may be well drained when found along low beach ridges. Active ice wedges are well developed, and fossil ice wedges occur locally at depths of a few feet. Alluvium, which consists of deposits of fine to medium sand, silty sand, gravel, and gravelly sand, is probably no more than 15 feet thick along modern channels, and includes floodplain and alluvial terrace deposits up to 24 feet above modern streams. The entire Planning Area is in a zone of continuous permafrost except for an unfrozen area 6 to 18 feet thick beneath larger channels and lakes. It is typical for deposits to be frozen 2 to 3 feet beneath the active layer during the summer months, while the lower depth of permafrost is measured in hundreds of feet.

The surficial deposits of the Arctic Foothills Province of the Planning Area are composed of eolian sand and upland silts and an undifferentiated bedrock of sandstones, shales, and conglomerates. Alluvium is found along the river systems as in the ACP. Eolian sand and upland silts (also wind blown) are the most widespread unconsolidated sediments in the entire National Petroleum Reserve – Alaska. A band of upland silt stretches from east to west across the National Petroleum Reserve – Alaska. The material may contain a high amount of interstitial ice. Locally, the deposits may liquefy when thawed.

3.2.8.2 Gravel Mine Sites

Existing and potential gravel sites within the Planning Area include the Arctic Slope Regional Corporation (ASRC) Mine Site and the Clover Potential Gravel Source. The ASRC Mine Site is approximately 9 miles southeast of Alpine field site CD-1, on the east side of the Colville River across from Nuiqsut. The site contains sandy gravel to gravelly sand with interbedded layers of silt.

The ASRC site is 153 acres (67 acres for the Phase 1 permit area and 86 acres for the Phase 2 permit area). Phase 1 was developed in 1998, with a total of approximately 1 million cubic yards of sand and gravel excavated and hauled for use by the Alpine field (CD-1 and CD-2). Estimated sand and gravel reserves for Phase 2 are 1.9 million to 2.5 million cubic yards (Peratrovich, Nottingham, and Drage, Inc. 2002).

The Clover Potential Gravel Source is on the western edge of the Colville River Delta. The site was identified from exploratory well cuttings and was further investigated during the winter seasons of 2000–2001 and 2001–2002. Exploratory borings identified sandy gravel and gravelly sand beneath approximately 5 to 20 feet of overburden soils (silts and silty sands). The approximate footprint of the site is 77 acres (Duane Miller and Associates 2002), and the quantity of sand and gravel resources is estimated at 2.5 million cubic yards.

3.2.8.3 Regulatory Environment

Sand and gravel in the National Petroleum Reserve – Alaska are treated as subsurface-mineral resources. Unlike other states, Alaska's mineral-material resources are not conveyed with the surface lands. Until the recent transfers of subsurface estate (i.e., Nuiqsut subsurface to ASRC), the federal government controlled all mineral materials in the National Petroleum Reserve – Alaska. The BLM has issued mineral-material permits to the four villages/cities of the NSB for dredging sand and gravel as part of the NSB's Capital Improvement Projects in the 1980s. Nuiqsut dredged material from the Colville River bottom, while Atqasuk used material from the Meade River and the bottom of an adjacent lake. River and ocean-beach materials were used in the 1970s to 1980s for wellsite pad, road, and airfield construction.

3.2.9 Water Resources

Water resources in the Planning Area consist mainly of river, shallow discontinuous streams, lakes, and ponds. Springs are absent in the Planning Area, and useable groundwater is limited to shallow resources beneath rivers and lakes. Deep groundwater is saline and not potable. Climate and permafrost are the dominant factors limiting water availability.

3.2.9.1 Surface Water Resources

While hydrologic data for the Planning Area section of the North Slope is limited, streams and rivers for which data are available share flow characteristics that are somewhat unique to the region (Brabets 1996). Flow is generally nonexistent or so low as to not be measurable most of the winter. Riverflow begins during breakup in late May or early June as rapid flooding that, when combined with ice and snow, can inundate extremely large areas in a matter of days. More than half of the annual discharge for a stream can occur during a period of several days to a few weeks (Sloan 1987). Most streams continue to flow throughout the summer, but at relatively lower discharges. Runoff is confined to the upper organic layer of soil, as mineral soils are saturated and frozen at depths of 2 to 3 feet (Hinzman et al. 1993). Rainstorms can increase streamflow, but they are seldom sufficient to cause flooding within the ACP. Streamflow ceases in most streams shortly after freeze up in September. Streams on the North Slope are generally divided into three types, based on the physiographic province of their origin: those that originate 1) on the ACP, 2) in the Arctic Foothills, or 3) in the Brooks Range (Map 3-7 and Table 3-3).

Table 3-3. Summary of Hydrologic Data for Rivers in the Northeast National Petroleum Reserve – Alaska.

Stream Location	Headwaters	Drainage Area (mi^2)	Peak Flow (cfs)[1]	Year Flow Recorded
Colville River (near Nuisqut)	Brooks Range	20,670	580,000	2000
Fish Creek (mile 32)	Coastal Plain	783	3,700	2001
Miguakiuk River	Coastal Plain	1,460	1,600	1977
Judy Creek (mile 7)	Foothills	647	7,100	2002
Tingmiaksiqvik River (mile 6.8)	Coastal Plain	222	5,300	2003

[1] Cubic feet per second.
Sources: Arnborg et al. (1967); Childers et al. (1979); Shannon and Wilson Consultants (1996); USDOI BLM (2004c); and R. Kremintz (personal communication, BLM).

Arctic Coastal Plain

The ACP is a mosaic of tundra wetlands with extremely low relief. Because the permafrost prevents water from entering the ground and the low relief limits runoff, the ACP is covered with lakes, ponds, and generally slow-moving streams. Shallow water tracks may result from snowmelt draining through the permafrost features, often conveying significant discharge where surface relief is limited (Hinzman et al. 1993). Streams originating in the ACP generally have the latest breakup and earliest freeze up and generally cease flowing by December. The most significant coastal rivers and streams in the Planning Area are the Miguakiak, Kalikpik, and Tingmiaksiqvik rivers and the Fish, Kealok, and Inigok creeks.

Arctic Foothills

Streams originating in these Arctic Foothills have a steeper gradient and consequently more gravel bar and cut bank features than those on the ACP. These streams tend to break up earlier, freeze up later, and have a slightly higher average unit runoff than streams of the ACP. The Ikpikpuk River forms the western boundary of the Planning Area. The Chipp and Alaktak, large distributary channels that separate from the main stem and drain into Admiralty Bay, are unique features of this river. The Ikpikpuk River continues into a separate delta at Smith Bay. Other large rivers originating in the foothills of the Planning Area include Judy Creek and the Kikiakrorak and Kogosukruk rivers.

Brooks Range

The Colville River forms most of the southern and eastern boundaries of the Planning Area. It is the largest river on the North Slope and intercepts all of the streams originating in the Brooks Range that flow northward through the Planning Area. As the only river that includes mountainous and glacial drainage, the Colville River carries the highest sediment load and exhibits the greatest range of geomorphic features of any river in the area. Steep cut bank cliffs, deep pools, and large gravel bars are common to most of the rivers adjoining the Planning Area. Breakup and freezeup are more complex along the Colville River because of the extreme length and range of elevation. Flow generally persists later on the Colville River than on most other North Slope rivers.

Lakes

Lakes and ponds are the most common feature on the ACP. Unlike streams, which only hold large quantities of water during breakup, lakes store water year-round and are the most readily available water source on the North Slope (Sloan 1987). The origin of most lakes and ponds on the ACP is in the thawing of ice-rich sediments (Sellman et al. 1975). This thawing results in a continuum known as the thaw lake cycle, in which lakes form, expand, and then drain in response to disturbances of the permafrost. Because water bodies less than 6 feet deep generally freeze to the bottom most winters, lake depth is the primary factor in winter water supply. Lakes can then be classified by depth, as either shallow (less than 6 feet) or deep (greater than 6 feet) lakes.

Recharge of lakes in the Planning Area occurs through three mechanisms: 1) melting of winter snow accumulations within a drainage basin, 2) overbank flooding from nearby streams, and 3) rainfall precipitation (Baker 2002). Some lakes are completely replenished by these processes within 1 year; water volumes in other lakes have much longer residence times, perhaps as long as 25 years (USDOI BLM and MMS 2003). Lake evaporation is also extensive in this region. From June to August (1994 to 1996), an average of 5.6 inches (14.1 cm) of evaporation was recorded for ponds near Prudhoe Bay (Mendez et al. 1998).

Shallow Lakes and Ponds

Seasonally flooded wetlands, ponds, and shallow lakes (less than 6 feet deep) dominate the ACP of the Planning Area (Map 3-8). These wetlands, lakes, and ponds are thought to originate in the thawing of the shallowest, ice-rich permafrost layer. The shallow lakes and ponds freeze in mid-September and become ice-free in mid-June, about a month earlier than the deep lakes (Hobbie 1984). While ponds and shallow lakes generally lack fish because they usually freeze solid, they can provide important summer rearing fish habitat if they have a channel connecting them to a stream or deep lake that that supports overwintering fish. They also provide important habitat to emergent vegetation, invertebrates, and migratory birds due to the earlier availability of ice-free areas.

Deep Lakes (greater than 6 feet deep)

Teshekpuk Lake and the southern and western areas of the ACP contain numerous deep-lake basins (Mellor 1987). Most deep lakes are less than 20 feet deep, since the depth of thaw lakes appears to be controlled by the ice volume and porosity in the original sediments, which decrease with increasing depth (Sellman et. al. 1975). Teshekpuk Lake, the largest lake on the North Slope with an area of 315 mi^2, provides a great diversity of habitat types. Besides the central basin with a depth greater than 20 feet, the lake has complex shoreline features with bays, spits, lagoons, islands, beaches, and extensive shoal areas that support wildlife. Because they do not freeze to the bottom, deep lakes provide an overwintering area for fish and aquatic invertebrates and are the most readily available supply of water during the winter.

Recent Lake Studies

Oil field activities in the Planning Area use ice roads and pads for access and transportation during the winter months. Each season, millions of gallons of fresh water are withdrawn from lakes to construct ice roads and pads. Water withdrawal begins as early as December and continues through April. Ice roads are usually completed by mid-winter; however, water withdrawals for ice road and pad maintenance continue throughout the exploration season. In addition to ice roads and pads, freshwater lakes are used as potable water supplies for temporary rig and exploration camps and as sources of make-up water for exploration drilling (Baker 2002).

Studies of overwinter water use and lake recharge conducted by BP Exploration (Alaska) and Phillips Alaska, Inc., in conjunction with the BLM have shown that winter withdrawals of freshwater water from lakes for ice roads and pads had no measurable affect on water quality in the lakes studied (Baker 2002, USDOI BLM and MMS 2003). The studies also showed that water elevation changes in the pumped lakes were within the range of changes in water levels seen in reference lakes and that changes in water elevations were correlated with changes in ice thickness (Oasis Environmental, Inc. 2001).

Estuarine Waters

The National Petroleum Reserve – Alaska includes several estuaries. The basic characteristics of the bays and coastal waters are summarized in reports by Barnes et al. (1984), and the OCS Environmental Assessment Program (U.S. Department of Commerce [USDOC] NOAA OCS Environmental Assessment Program [OCSEAP] 1978, 1987, 1988; USDOC NOAA OCSEAP and MMS 1984). These reports state that all of the National Petroleum Reserve – Alaska bays and lagoons are very shallow and are shoreward of the 33-foot (10-meter) isobath (line of equal bathymetry or water depth). The circulation in this shallow water during the summer is wind-driven and rapid. Circulation is very slow under the winter ice cover. When seawater freezes, only the water molecules form ice; the salt is cast off as brine into the underlying water column. The brine does not drain or flush out of the shallow bays. Instead, it collects on the seafloor, gradually raising the salinity level from 32 to over 100 parts per thousand in some seafloor depressions (Schell 1975, Newbury 1983). The coastal waters off the National Petroleum Reserve – Alaska, like all Alaskan coastal waters, have pristine water quality in the estuaries (Arctic Monitoring and Assessment Programme 1997).

Sea Ice

From November through early June, 90 to 100 percent of the Beaufort Sea off the Planning Area is covered with sea ice (USDOI MMS 1996a). The formation of first-year sea ice, signaling the start of freezeup along the Beaufort coast, may start as early as the beginning of September or as late as December. During the first part of freezeup, nearshore ice is susceptible to movement and deformation by modest winds and currents. Movement may be a mile or more per day, and deformation may take the form of ice pileups and rideups on beaches and the formation of offshore rubble fields and small ridges. Ice rideups occur when a whole ice sheet slides in a relatively unbroken manner over the ground; rideups greater than 160 feet are not very frequent. By late winter, first-year sea ice is about 6 to 7 feet thick. In waters 6 to 7 feet deep, the ice freezes to the seafloor and forms the bottomfast-ice subzone of the landfast-ice zone. The landfast-ice zone may extend from the shore out to depths of 45 to 60 feet. The ice in water depths greater than about 6 or 7 feet is floating and forms the floating fast-ice subzone. As the winter progresses, extensive deformation within the landfast-ice zone generally decreases as the ice thickens and strengthens and becomes more resistant to deformation.

Along the Beaufort Sea coast, breakup generally begins about mid-July but may occur in mid-June or late August. River ice begins to melt before the sea ice and, during the early stages of breakup, water from rivers may temporarily flood ice that has formed on deltas.

3.2.9.2 Surface Water Quality

Most freshwaters in the Planning Area are pristine and, like those of Teshekpuk Lake, are soft, dilute calcium-bicarbonate waters. Near the coast, sodium chloride (salt) concentrations predominate over bicarbonate concentrations

(USDOI BLM National Petroleum Reserve – Alaska Task Force 1978a; Prentki et al. 1980). The freeze/thaw cycle in the Arctic plays a controlling role in water quality. In winter, surface waters less than 6 feet deep will freeze solid (Hobbie 1984). In such waters, major ions and other "impurities" are excluded from downward-freezing ice in autumn and forced into the underlying sediment. Most of the ions remain trapped in the sediment after the next spring's meltout, giving these waters a very low dissolved matter concentration. During the summer, dissolved matter concentrations slowly increase as ice in the bottom sediment melts and the sediments compress (Miller et al. 1980).

In waters deeper than 6 feet, ions are forced into the deeper water column with a proportionate increase in concentrations of dissolved materials. As a result, distinct off-flavor and saline taste affect the potability of water from shallower "deep-water" lakes and river pools by late winter.

Potability

Ponds and local streams are highly colored from dissolved organic matter and iron; the water tastes fine but is considered marginally potable to unpotable because of iron staining and fecal contamination in areas with dense avian (Ewing 1997), caribou, and lemming populations. Lemming fecal material generally is abundant in upper coastal tundra soils (Gersper et al. 1980). Cold temperatures, a characteristic of tundra soils and waters, tend to prolong the viability of fecal coliform, the standard water-quality measure for fecal contamination. Thus, some smaller waterbodies in the National Petroleum Reserve – Alaska may exceed State of Alaska standards for fecal coliform in drinking water or water recreation due to local wildlife abundance (there is no state standard applicable to growth and propagation of natural aquatic life or wildlife). Lakes and larger rivers tend to be less colored and would be less likely to be contaminated with fecal coliform. Teshekpuk Lake, the Miguakiak River, the upper Colville River, and the Ikpikpuk River may receive some human fecal coliform contamination because of the increase in unregulated long-term campsites and cabins without adequate sewage disposal; however, impacts would not significantly raise levels in the lake or be measurable except in very localized situations.

Turbidity

Most Planning Area freshwater areas have low turbidity or suspended-solid concentrations. The exceptions are the larger rivers, possibly shallow floodplain lakes, and waters from thermokarst erosional features. Thermokarst is an altering of the terrain caused by melting permafrost that results in subsidence and water poolings.

Approximately 70 percent of the sediment load for the Colville River is carried during breakup, with suspended-sediment concentrations reaching 870 milligrams per liter (USDOI BLM 1978a). Later in summer, suspended-sediment concentrations decrease to as low as 3 ppm. The Colville River, with its origins in the foothills of the Brooks Range, carries a greater suspended load than rivers originating within the ACP, and it is the most turbid river in the ACP of the National Petroleum Reserve – Alaska. Other rivers in the National Petroleum Reserve – Alaska range from about 100-ppm suspended sediment at peak-flow rates down to 3 to 10 ppm at lower rates.

Alkalinity and pH

Alkalinity and pH are important parameters in controlling the susceptibility of freshwaters to acid rain or acid snowmelt. Alkalinity is a measure of the acid-buffering capacity of the water. The pH is a measure of the hydrogen ion concentration in the water. A pH of 7 indicates a neutral balance of acid and base in the water; and a pH between 5.0 and 6.5 indicates slightly acidic water; a pH below 4.5 indicates acidic water. The State of Alaska considers a pH range within 6.5 to 9.0 necessary to protect aquatic wildlife. Most surface waters have a pH ranging from 6.5 to 8.5. Rainwater has a pH of 5.5 due to carbon dioxide in the atmosphere. Plants and aquatic life tend to buffer the pH of surface waters and keep the pH in the range of 6.5 to 8.5.

In the National Petroleum Reserve – Alaska coastal tundra, freshwaters are weakly buffered (USDOI BLM 1978a; Prentki et al. 1980; Hershey et al. 1995; O'Brien et al. 1995). Lake alkalinities also are low, approximately 0.5 milliequivalents/liter (meq/l). Alkalinities in individual National Petroleum Reserve – Alaska coastal rivers are higher, ranging from about 0.3 to 1.6 meq/1 in summer, with higher values at lower flow rates.

In ponds, pH values are often depressed to below a pH of 7.0 due to snowmelt runoff; after snowmelt, their pH values usually increase to between pH 7.0 and 7.5 (Prentki et al. 1980). The initial low pH is due to acidity of snow on the North Slope, which has a median pH of 4.9 (Sloan 1987). This low pH, lower than the pH of 5.5 expected for uncontaminated precipitation, is thought to be a result of sulfate fallout from industrially contaminated Arctic air masses. In lakes, pH values are near neutral (O'Brien et al. 1995). In tundra brown-water streams and some foothill streams, pH values can be less than 6.0, with an acidity attributable to naturally occurring organic acids (Hershey et al. 1995; Milner et al 1995; Everett et al 1996). In tundra rivers, pH values are higher, seasonally ranging between 6.4 and 8.2 in the Colville, Meade, Chipp, and Miguakiak rivers (USDOI BLM 1978a).

Dissolved Oxygen

Most of the world's surface waters are near saturation with dissolved oxygen due to aeration of flowing waters. The concentration of dissolved oxygen in Arctic waters tends to be higher than in other waters because the solubility of oxygen increases with decreasing water temperature. In deeper National Petroleum Reserve – Alaska coastal plain lakes, waters remaining beneath the ice may become supersaturated with oxygen in winter (USDOI BLM 1978a; Prentki et al. 1980; O'Brien et al. 1995). During ice formation, dissolved oxygen is excluded from the ice into the water column. Exclusion adds more oxygen than underwater respiration removes.

Indicator Hydrocarbons

Pond waters away from development in the Prudhoe Bay area contain 0.1 to 0.2 parts per billion (ppb) total aromatic hydrocarbons, similar to concentrations in pristine marine waters (Woodward et al. 1988). Concentrations in National Petroleum Reserve – Alaska waters are expected to be similar. Hydrocarbons derived from the various sources are detectable as elevated levels of saturated and polycyclic aromatic hydrocarbons (PAH) in Colville River sediment and in Harrison Bay sediment (Boehm et al. 1987). Additional pyrogenic PAH compounds are present in tundra soils and form a depositional record of atmospheric fallout from tundra fires. Concentrations of indicator hydrocarbons from these multiple sources are high and chemically similar to those found in petroleum, thus making it difficult to detect or distinguish anthropogenic contamination from natural background due to fires. Similarly, high levels of hydrocarbons found in other major Beaufort Sea rivers and have been attributed to natural sources (Boehm et al. 1987; Yunker and MacDonald 1995).

Trace Metals

Aquatic bodies in the National Petroleum Reserve – Alaska are, in general, low in trace metals compared with most temperate freshwaters (Prentki et al. 1980). In measurements made in ponds near Barrow in 1971-72, dissolved copper concentrations were on the order of 1 ppb, dissolved lead 0.7 ppb, and dissolved zinc 5 ppb.

Federal Contaminated Sites

There are multiple U.S. Department of Defense (USDOD) hazardous waste sites and federal drill sites within the National Petroleum Reserve – Alaska (see Section 3.2.10, Hazardous Materials) that may be point sources for contamination. The federal government has drilled at least 126 wells within the National Petroleum Reserve – Alaska (Bird 1988). At the time these wells were drilled, it was common practice to discharge and leave drilling fluids in open reserve pits. Elevated levels of trace metals in water (zinc and chromium) and sediments (copper, chromium, and lead) have been found in ponds at least 700 feet from reserve pits elsewhere on the North Slope (Woodward et al. 1988). Elevated levels of petroleum hydrocarbons were also found in water and sediment in the same study.

3.2.9.3 Groundwater Resources and Quality

Shallow Groundwater Sources

Lakes and rivers deeper than about 6 feet do not generally freeze to the bottom in winter. This creates a layer of unfrozen sediments, or taliks, beneath the permafrost (Sloan 1987). When the sediments are porous materials, such as sand or gravel, an aquifer suitable for pumping groundwater may exist. Shallow groundwater resources are likely in the Planning Area beneath the Colville River, Teshekpuk Lake, and other deep, large lakes.

Shallow groundwater is also found within permafrost as discontinuous confined water bodies. The presence of dissolved salts depresses the freezing point of water and allows for local accumulations of saline water within the permafrost. The water is unsuitable for drinking and potentially harmful to vegetation when discharged on the tundra surface (USDOI BLM and MMS 2003). The available volumes of this type of shallow groundwater are limited because of the local and restricted nature of the groundwater formation.

Deep Groundwater Sources

Deep wells drilled through the permafrost near Barrow have encountered highly mineralized groundwater at depths of 1,600 to 2,500 feet (Kharaka and Carothers 1988). Temperature logs from 25 wells drilled across the North Slope indicate that the depth to the base of permafrost, and consequently the sub-permafrost water, is generally shallower to the west. Deep wells drilled through the permafrost in the Prudhoe Bay area have encountered highly mineralized groundwater at depths of 3,000 to greater than 5,000 feet (Sloan 1987). Available data suggest that deep groundwater in the Planning Area would probably be similar to that found at Barrow and Prudhoe Bay, and would be too saline for domestic use.

Recharge

Snowmelt provides the major source of water for recharge to the shallow water-bearing zones that occur below large lakes and major streams and to the annual thaw zones that occur beneath ponds and marshy areas (USDOI BLM and MMS 2003). Deeper groundwater zones beneath the permafrost, however, are not as readily recharged. Subpermafrost water may be recharged from areas to the south in the Arctic Foothills and the Brooks Range by infiltration of meltwater.

3.2.9.4 Permafrost

The National Petroleum Reserve – Alaska is underlain by continuous permafrost (USDOI BLM 1978a). The thickness of permafrost in the National Petroleum Reserve – Alaska ranges from about 650 to 1,330 feet (compared to 1,980 to 2,100 feet in Prudhoe Bay; Lachenbruch et al. 1988). Permafrost is defined as soil, sand, gravel, or bedrock that has remained below 32 °F for 2 or more years (Muller 1945). Almost continuous throughout the North Slope, permafrost can exist as massive ice wedges and lenses in poorly drained soils or as a relatively dry matrix in well-drained gravel or bedrock.

Permafrost forms a barrier that prevents infiltration of surface water, maintains a saturated layer of surface soils, and restricts groundwater sources to shallow unfrozen material beneath deep lakes and rivers or very deep wells. The limited amount of groundwater on the North Slope is due largely to the presence of permafrost (Williams 1970). Melting ice-rich permafrost can cause surface subsidence, or thermokarst, resulting in thaw lakes, ponds, or beaded stream channels.

Many permafrost soils contain significant amounts of ice, especially near the surface. Because of seasonal variations in air temperature and solar radiation, a layer of surficial material overlying the permafrost (termed the active layer) thaws and freezes each year. In the National Petroleum Reserve – Alaska, the active layer usually is 1 or 2 feet thick (USDOI BLM 1978a). In coarse-grained soils on the tops of bare ridges or on south-facing slopes with little vegetative cover, the active layer may be as much as 5 feet thick or more. In ice-rich silty soils on north-facing slopes or in marshes having thick vegetative and litter cover, the active layer may be less than 6 inches thick.

Lakes and streams in the ACP of the National Petroleum Reserve – Alaska influence the characteristics of the upper permafrost surface (USDOI BLM 1978a). Shallow lakes and streams that freeze completely in the winter are directly underlain by permafrost. Deep lakes greater than 7 feet in depth, and major rivers, typically do not freeze to the bottom in winter and are underlain by a thaw depression in the permafrost table.

3.2.10 Hazardous Materials

In general, the Planning Area is large and has had relatively limited human or industrial uses that may have introduced hazardous or solid wastes into the environment. Industrial activity has consisted of USDOD sites, including the Distant Early Warning (DEW)-Line stations to provide military satellite and coastline surveillance; oil and gas drilling programs conducted by the U.S. Navy, the USGS, and private companies; and winter petroleum seismic-exploration operations conducted by private companies. Incidental use by the local Alaska Native population for subsistence hunting, fishing, and travel potentially may have created additional solid and fuel waste on a small scale.

3.2.10.1 Oil and Gas Well Sites

Hazardous materials and wastes are associated with areas of abandoned well sites from drilling activities in the 1940s through 1980s, including the drill pad, reserve pit, and flare pit. In some instances, other solid waste may have been buried at these sites. The exploration wells drilled in the past 5 years were drilled using ice pads and/or other removable material and no reserve pits. Upon completion of the drilling activity, all wastes were removed from the sites and pad materials were removed and/or allowed to melt.

Site characterizations were conducted in a joint BLM/USGS effort at the 28 USGS well sites in the National Petroleum Reserve – Alaska; 14 sites are located in the Planning Area. Detailed information concerning the contaminants found at each well site and data summarization can be found in the USDOI (1992) publication titled: *Environmental Status of 28 Oil and Gas Exploration Areas of Operation in the National Petroleum Reserve – Alaska.*

3.2.10.2 Landfills

Solid-waste landfills have been associated with virtually all of the early drilling sites and USDOD sites. Site investigations have been conducted by the USDOD at all 20 sites located along the ACP. Three of these sites are located within the Planning Area: Camp Lonely, Kogru DEW-Line Station (abandoned), and Umiat Airport (abandoned). Contaminates including petroleum, oils, lubricants, polychlorinated biphenols, and pesticides (specifically dicholorodiphenyltrichloroethane [DDT]) were identified at Umiat and Kogru.

Remedial actions currently being conducted by the USACE include excavating or capping contaminated soils, and removing unsafe structures at these abandoned sites. Approximately 16,000 cubic yards of contaminated soil was removed from the sites of Umiat Wells 2 and 5. The hazardous waste at Kogru has been remediated and confirmation monitoring has been performed.

Coastal erosion has impacted the Kogru DEW-Line site and Camp Lonely landfill, resulting in landfill material being released to the Beaufort Sea; and the East Teshekpuk landfill, resulting in landfill material being released to Teshekpuk Lake.

3.2.10.3 Other Uses

Commercial, research, and field-management activities in the Planning Area have included winter overland transportation services along established trail corridors servicing North Slope communities, camping, and helicopter flying. Spills of fuel, oil, and other petroleum products may have occurred in the past as a result of these activities. Currently, state law requires all travelers to be responsible for adequate prevention of spills and for prompt notification and cleanup, should a spill occur.

3.2.10.4 Distribution and Numbers of Sites within the Planning Area

Two hazardous-materials sites (Kogru DEW-Line site and Umiat Airport), six solid-waste-disposal sites, and numerous well sites are found in the Planning Area. The sites are as listed in Section III.A.1.g(2) of the 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998), with the following exceptions:

- Remediation and confirmation monitoring have been completed at the Kogru DEW-Line hazardous materials site.
- The Kogru DEW-line landfill (POW-B) has experienced significant erosion.
- The East Teshekpuk landfill has experienced significant erosion.

3.3 Biological Resources

3.3.1 Special Areas

The NPRPA authorized the Secretary of the Interior to identify areas in the National Petroleum Reserve – Alaska "containing any significant subsistence, recreational, fish and wildlife, historical, or scenic value." Any exploration in these areas shall be conducted in a manner which will "assure the maximum protection of such surface values to the extent consistent with the requirements of the Act for exploration of the reserve." (42 USC § 6504). Federal regulations state that such values may be protected by limiting, restricting, or prohibiting the use of and access to appropriate lands in the National Petroleum Reserve – Alaska, including, but not limited to, rescheduling activities and use of alternative routes; types of vehicles and loading; limited types of aircraft in combination with minimum flight altitudes and distances from identified places; and special fuel handling procedures (43 CFR § 2361.1(e)(1); and 2361.1(c)(1).

The Secretary of the Interior has designated three areas within the National Petroleum Reserve – Alaska as special areas (Map 1-3). The Utukok River Uplands Special Area contains critical calving habitat for caribou and covers about 4 million acres. This area is about 65 miles from the Planning Area.

The Teshekpuk Lake Special Area, which is approximately 1.7 million acres, includes important nesting, staging, and molting habitat for a large number of waterfowl and shorebirds and critical Teshekpuk Lake Herd (TLH) caribou calving, migration, and insect-relief habitat. It also includes the 211,000-acre Teshekpuk Lake, which is the dominant lake feature in the Planning Area. Almost the entire area is within the Planning Area boundary; only a small portion lies west of the Ikpikpuk River, which is the western boundary of the Planning Area.

The Colville River Special Area, which is 2.3 million acres includes the bluff and riparian habitats of the Colville River, which are unique both biologically and geologically in the North Slope. This area has been recognized since the 1950s as one of the most significant regional habitats for raptors in North America (Kessel and Cade 1956, 1958; Cade 1960; While and Cade 1971). The northeastern third of the Colville River Special Area is within the Planning Area; the remainder is primarily within the Northwest National Petroleum Reserve – Alaska.

Special areas were authorized by law and codified by the Secretary of the Interior. Special areas designations remain in effect until the law is amended or repealed, or until the Secretary changes the regulations that codify them.

3.3.2 Vegetation

Efforts to map the vegetation of Alaska's North Slope occurred as early as 1944 (Spetzman 1959). Early efforts used aerial photography and ground reconnaissance, while more recent studies used digital satellite data. Talbot (1996) provides a bibliography and description of these earlier mapping efforts. Most recently, the Circumpolar Arctic Vegetation Map Team (2003) worked to standardize techniques and map the entire Arctic region.

The vegetative cover of the National Petroleum Reserve – Alaska most recently has been summarized in a land-cover classification developed by the BLM from 1994 to 1997 in cooperation with Ducks Unlimited, the USFWS, and the NSB (Kempka et al. 1995; Pacific Meridian Resources 1996). The classification was developed using Landsat Thematic Mapper satellite imagery and identified seven major and 17 minor land-cover classes (Map 3-9). These classes were distinguished from one another based on their relative composition in terms of percent cover of water, bare ground, and plant species (Table 3-4).

Water sedge (common and scientific names of species listed in this Amended IAP/EIS are given in Appendix H) is the dominant species in the Wet Tundra class, both of the Flooded Tundra classes, and one Aquatic class, which bears its name. Pendent grass dominates the other Aquatic class. Other common graminoid species occurring most prominently in the Moist Tundra classes are polar grass, tufted hairgrass, scurvy grass, *Poa lanata*, alkali grass, and tussock cottongrass. Tussock cottongrass is the dominant species of the Tussock Tundra subclass.

Some of the commonly occurring herbaceous species are marsh marigold, fireweed, sweet coltsfoot, and marsh fivefinger, and species of the genera *Draba, Papaver, Pedicularis, Polygonum, Ranunculus, Rumex, Saxifraga, Senecio,* and *Stellaria.*

Common shrub species include alder, dwarf birch, lapland cassiope, crowberry, Labrador tea, cloudberry, alpine blueberry, and lingonberry, and species of the genera *Andromeda, Arctostaphylos, Dryas,* and willow. Willows and, to a much lesser extent, alders, are the dominant species of the Low and Tall Shrub classes. With the exception of birds, the remainder are Dwarf shrubs.

Table 3-4. Northeast National Petroleum Reserve – Alaska Land Cover Classifications.

Land Cover Class/Subclass	Characteristics of Land Cover Class/Subclass	Percent of Planning Area Covered By Class/Subclass
Water	**>80% water**	
Ice	≥60% ice	2.2
Clear water	Depth >3.3 feet (1 meter) and no turbidity	10.8
Turbid water	Depth ≤3.3 feet (1 meter) or turbid	8.4
Aquatic	**>50% but <80% water and > 4 inches (10 cm) deep**	
Water sedge	>15% water sedge	3.8
Pendant grass	>15% pendant grass	0.4
Flooded Tundra	**>25% but <50% water and < 4 inches (10 cm) deep**	
Low centered polygons	≥5% sedge/grass	6.5
Non-patterned	<5% sedge/grass	2.7
Wet Tundra	**>10% but <25% water**	**5.0**
Moist Tundra	**<10% water, <40% shrub (mostly sedges, grasses, rushes, and moss/peat/lichen)**	
Sedge/grass meadow	≥50% sedge/grass and <40% tussock cottongrass	10.1
Tussock tundra	≥40% tussock cottongrass	29.1
Moss/lichen	≥50% moss and/or lichen	1.6
Shrub	**<5% water and >40% shrub**	
Dwarf	≤12 inches (30 cm) in height	15.5
Low	>12 inches (30 cm) but <4.9 feet (1.5 meters) in height	1.7
Tall	≥4.9 feet (1.5 meters) in height	0.1
Barren Ground	**0-30% vegetation**	
Sparsely vegetated	10-30% vegetated	0.5
Dunes/dry sand	<10% vegetation and <10% wet sand, mud, or rock	0.7
Other	<10% vegetation and ≥10% wet sand, mud, or rock	1.0

Key: ≥ - less than or equal to; > - less than; ≤ - greater than or equal to; and < - greater than.

This summary shows that 21.4 percent of the Planning Area is open water, while another 18.4 percent (Aquatic, Flooded and Wet classes) has standing water with varying proportions of plant cover. The single most common cover type is cottongrass tussock. The cottongrass form is more prevalent than it first appears from the table, because the Dwarf shrub class commonly includes tussocks as well. The distinction between the Tussock Tundra and Dwarf shrub classes is based on the relative proportion of shrubs, a dominant life form. Combining these two classes suggests a total cover by tussocks in the Planning Area of up to 44.6 percent.

3.3.2.1 Rare Plants

In describing plant taxa, Lipkin and Murray (1997) have defined rare plants as those species occurring in 20 or fewer locations throughout Alaska. There are three species of rare vascular plants known to occur in the Planning Area. Drummond's bluebell has been found on sand dune habitats along the Kogosukruk River and west of the Planning Area along the Meade River. Five other sand dune sites within the Planning Area have been searched for Drummond's bluebell, but no plants have been found (Lipkin 1994). Stipulated cinquefoil has been found at Umiat. This Asian species is found in sandy substrates, such as sandy meadows, and riverbank silts and sands other than dunes. Sabine grass is an aquatic grass that occurs between the pendant grass and sedge zones in lakes and ponds. This species is known in Alaska from only a few locations north and northeast of Teshekpuk Lake. Sabine grass is an aquatic grass that rarely occurs between the Pendent grass and sedge zones in lakes and ponds. This species is known in Alaska from only a few locations north and northeast of Teshekpuk Lake.

3.3.3 Wetlands and Floodplains

3.3.3.1 Wetland and Floodplain Definitions

The definition of the term "wetland" may vary. Through its National Wetlands Inventory (NWI) program, the USFWS uses ecological characteristics to define wetlands (Cowardin et al. 1979). According to this protocol, the essential attributes of wetlands are the presence of wetland plants (hydrophytes), the presence of wet soils (hydric soils), or soil saturation or flooding. To date, the NWI program has classified little of the National Petroleum Reserve – Alaska. In implementing the Clean Water Act, the USACE also classified wetlands. According to the USACE, wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (22 CFR § 328.3). The definitions of wetlands used by the two agencies are similar; a comparison of these definitions with the land cover classification for National Petroleum Reserve – Alaska in Table 3-4 provides a first order approximation of the amount of the Planning Area that either agency would classify as wetlands.

3.3.3.2 Distribution of Wetlands and Floodplains in the Planning Area

With the exception of thaw bulbs under larger lakes and streams, permafrost is continuous under the Planning Area. Since permafrost forms an impenetrable barrier to water percolation, the soils of the active layer above it remain saturated during summer in all but a few cases. Even "moist tundra" over these saturated soils would be classified as wetlands. Because of the high shrub component, the Dwarf and Low Shrub subclasses are separated from the Moist Tundra class (see Table 3-4). The Dwarf and Low Shrub subclasses also exist on saturated tundra (Kempka et al. 1995; Pacific Meridian Resources 1996) and much of the Dwarf Shrub subclass exists on areas of sedge tussocks. Certain areas of lichen-covered rocks or bare rocks or sand may not qualify as wetlands; however, the remainder of the Planning Area would qualify as wetlands. This suggests that more than 95 percent of the Planning Area would be classified as wetlands by at least one of the three sets of criteria.

3.3.3.3 Functions and Values of Wetlands and Floodplains

Arctic wetlands provide many useful functions and values. The various ponds, lakes, and drainages of the ACP regulate runoff through storage in the active layer, slowly releasing water to streams over extended periods. Arctic wetlands generally are not sites of discharge or recharge for subpermafrost aquifers, but suprapermafrost groundwater can influence wetland communities beneath Arctic slopes in ways comparable to aquifer discharge in temperate regions.

Arctic wetlands retain or distribute sediments, nutrients, and toxicants. At breakup, streams flood adjacent tundra creating extensive wetland complexes that provide sites for suspended solids to settle, and sediment is trapped by riparian wetlands along large Arctic rivers with mountain headwaters. Microbes and plants contribute to nutrient and contaminant retention or transformation in tundra wetlands since Arctic-tundra species are adapted to low temperatures and are biologically active even under harsh conditions.

Net primary production, nutrient export, and food-chain support are important functions of Arctic wetlands. Tundra production is remarkably high—approximately one-half that of temperate grasslands—and supplies the energy (plant biomass) on which animals exist. Nutrient export is an important function of Arctic wetlands. Arctic-tundra wetland supports food chains, both through the herbivore-based trophic system (from living plant tissues to rodents and ungulates and their predators) and through the detritus-based trophic system (from dead plant tissue to invertebrate to shorebirds and their predators). Alaska's ACP is largely wetland and supports both herbivore-based and detritus-based trophic systems (Batzli et al. 1980; Hobbie 1984). Waterfowl, lemming, and caribou are major primary consumers on the ACP, with the muskox playing an important role elsewhere on Arctic ranges (White et al. 1981).

3.3.4 Wildland Fire

Wildland fires include both wildfires and prescribed fires. Wildfires are unplanned fires that occur in wildlands and are caused by natural means (e.g., lightning strikes), whereas prescribed fires are naturally or manually ignited fires that occur in areas where burning is planned. Prescribed fires have not been used as a management tool within the Planning Area for vegetation management purposes nor will prescribed fires likely be used in the future for the management of vegetation (USDOI BLM and MMS 2003). However, wildland fires have infrequently occurred within the North Slope of Alaska.

Large wildland fires are rare in the tundra; most are small and burn less than ½ square mile of land (USDOI BLM 1978a). Because there have been few studies of wildfire on the tundra, it is difficult to document North Slope fire history and fire return intervals. Lightning is the most likely cause of wildland fires, although humans initiate some fires. Tundra fires can appear as early as May, but most occur in July and August. Fires in the northern portions of Alaska, such as the National Petroleum Reserve – Alaska, are more easily stopped by discontinuities in vegetation, wet areas, or physical obstructions (Wein 1976).

Fire behavior is of low to moderate intensity, with low to moderate rates of spread and flame length. The severity of burns in both vegetative communities depends on the amount of moisture in the organic layer. Most fires will be low-severity surface fires. However, a long period of dry conditions can produce fires that remove most of the organic layer, resulting in a moderate- to high-severity fire. Regeneration in burned areas is fast, with the burned area becoming indistinguishable from the surrounding area in 2 to 3 years. However, it may take lichen decades to recover in areas of moderate to high burn severity (USDOI BLM 1978a).

3.3.5 Fish

3.3.5.1 Overview

The seasonal cycle of freezing and thawing creates a nearshore marine habitat that is vital to the many migratory fishes of the North Slope. In summer, river runoff coupled with the melting of coastal ice creates warm, brackish (low to moderate salinities) conditions in nearshore areas, particularly near the mouths of rivers (Craig 1984). Marine invertebrates migrate into this brackish nearshore band where they thrive in the warm, detritus-laden shallows. Freshwater invertebrates that are washed downstream into the coastal zone augment the standing stock of marine prey. Many of the fishes that spend the winter in freshwater habitats and river deltas disperse out along the coast to feed in this prey-rich environment, which may extend several miles offshore. It has been estimated that of all the marine and freshwater habitat available to fishes during summer, coastal waters hold 90 percent of the exploitable prey biomass (Craig 1989b). It is during the brief summer period that coastal fish achieve most of their yearly growth (Fechhelm et al. 1992; Griffiths et al. 1992) and accumulate fat and protein reserves needed to survive the Arctic winter (Fechhelm et al. 1995, 1996).

Freshwater fishes remain within the river and lake systems year round. During summer they feed on terrestrial and aquatic insects, zooplankton, clams, snails, fish eggs, and smaller fish. Individuals may wander within the river and lake systems, but there are usually no defined population migrations.

During winter, the key element for survival in freshwater systems is the availability of overwintering habitat (Craig 1989b). Because water bodies less than 6 feet in depth freeze to the bottom during winter, viable habitat is limited to deep lakes and ponds, and to the deeper channels and holes within streams and river channels. Deeper waters must also be of sufficient area to sustain large numbers of fish for several months. Oxygen depletion, caused by overcrowding, can result in extensive mortality (Schmidt et al. 1989). Flowing waters exceeding 7 to 10 feet in depth (depending on water velocity) generally are considered deep enough to support overwintering fish (USDOI BLM and MMS 2003). For standing waters, depths of 7 feet are considered the minimum required for supporting overwintering freshwater fish (Phillips Alaska, Inc. 2002). Deeper-water lakes shown on Map 3-8 have the greatest potential to contain fish. Rivers with known fish populations are discussed in more detail below.

3.3.5.2 Fish Species

Twenty eight fish species have been identified in the freshwater and coastal marine habitats of the Planning Area (Table 3-5). The following section provides brief life history accounts for these species; more detailed species accounts can be found in the 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998; Section III-B-5), Northwest IAP/EIS (USDOI BLM and MMS 2003; III.B.3), and *Alpine Satellite Development Plan EIS* (USDOI BLM 2004c; 3.3.2).

Freshwater Fish

Freshwater species, and non-migratory components of amphidromous stocks, largely remain within river, stream, and lake systems year-round, although they may venture into coastal areas where waters are brackish during summer. The distribution of fish within the freshwater environment of the Planning Area varies with season. During summer, fish may forage within any waterbody having adequate access via interconnecting waterways or seasonal flooding. Winter distribution and survival depends on water depth, net overwintering area, and oxygen content. Sources of information on freshwater fish in the Planning Area include Kogl (1971); Furniss (1974); Netsch et al. (1977); Bendock (1979b, 1982); Bendock and Burr (1984a, b); Fawcett et al. 1986; Burns (1990); Philo et al. (1993a); Moulton (1996a, b, 1999a, 1999b, 2000, 2001a, b, 2002a, b); MJM Research (2001, 2002); Mecklenburg et al. (2002); and Morris (2003).

While **arctic grayling** are one of the most widespread and abundant species in the Colville River drainage above the confluence of the East and West Delta channels they are far less common in the channels, lakes, and streams of the lower Colville River Delta and in freshwater coastal plain lakes and streams of the Planning Area. Adults and subadults use the Tingmiaksiqvik River in summer and winter. In Fish and Judy creeks, they are associated with tundra drainages and tundra drainage outfalls in main channels.

Burbot are distributed throughout the Colville River watershed and the coastal lakes and streams of the National Petroleum Reserve – Alaska, but are typically taken in small numbers. Spawning has been reported in the Colville River near Umiat in late winter. Rearing areas include the mouths of minor tributaries of the lower Colville River Delta.

Lake trout are extremely rare in the river channels, streams, and lakes of the lower Colville River and delta, and throughout the ACP east and south of Fish Creek. They are widely distributed in ACP lakes north and west of Fish Creek in the Planning Area.

Within the Planning Area, **round whitefish** occur in Fish Creek, Judy Creek, the Tingmiaksiqvik River, and some smaller streams, but are largely absent from many lakes.

The Planning Area and Colville River represent the eastern limit of the **Alaska blackfish** in northern Alaska. Fyke nets surveys conducted in the Colville River Delta caught few blackfish in river channels and tapped lakes. Slightly higher numbers of fish were caught in high and low perched lakes, but they were taken only sporadically.

Table 3-5. Fish Species Found in the Northeast National Petroleum Reserve – Alaska Including the Colville River Drainage, Coastal Streams and Lakes, and Nearshore Coastal Zone.

Common Name	Scientific Name	Iñupiaq Name
Freshwater Species		
Alaska blackfish	*Dallia pectoralis*	Iłuuqiniq
Arctic grayling	*Thymallus arcticus*	Sulukpaugaq
Arctic lamprey	*Lampetra japonica*	Nimigiaq
Burbot	*Lota lota*	Tittaaliq
Lake trout	*Salvelinus namaycush*	Iqaluaqpak
Longnose sucker	*Catostomus catostomus*	Milugiaq
Ninespine stickleback	*Pungitius pungitius*	Kakalisauraq
Northern pike	*Esox lucius*	Siulik
Round whitefish	*Prosopium cylindraceum*	Savigunnaq
Slimy sculpin	*Cottus cognatus*	Kanayuq
Threespine stickleback	*Gasterosteus aculatus*	–
Anadromous Species		
Arctic cisco	*Coregonus autumnalis*	Qaataq
Bering cisco	*Coregonus laurettae*	Tiipuq
Chum salmon	*Oncorhynchus keta*	Iqalugruaq
Pink salmon	*Oncorhynchus gorbuscha*	Amaqtuuq
Rainbow smelt	*Osmerus mordax*	Iłhauġniq
Amphidromous Species[1]		
Broad whitefish	*Coregonus nasus*	Aanaaqłiq
Dolly varden	*Salvelinus malma*	Iqalukpik
Humpback whitefish	*Coregonus pidschian*	Piquktuuq
Least cisco	*Coregonus sardinella*	Iqalusaaq
Marine Species		
Arctic cod	*Boregogadus saida*	Uugaq
Arctic flounder	*Liopsetta glacialis*	Nataaġnaq/Puyyagiaq
Capelin	*Mallotus villosus*	Panmigriq
Fourhorn sculpin	*Myoxocephalus quadricornis*	Kanayuq
Kelp snailfish	*Liparis tunicatus*	–
Pacific herring	*Clupea harengus*	Uqsruqtuuq
Pacific sandlance	*Ammodytes hexapterus*	–
Saffrom cod	*Eleginus gracilis*	Uugaq

[1] Have some components of their populations that remain in freshwater year-round.

Ninespine stickleback and **slimy sculpin** are likely common throughout the lakes and streams of the Colville River watershed. Both serve as forage fish for other species. Fyke net surveys conducted in the Colville Delta reported that ninespine stickleback were found in most river channels, tapped lakes, and perched lakes. They were the overwhelmingly dominant species collected in both high and low perched lakes.

The distribution of **northern pike** in the Planning Area is rather limited, being restricted primarily to the middle and upper reaches of the Ikpikpuk River. In the Colville River, pike are taken incidentally in the lower part of the river, and there is little evidence of occurrence at other places in the Colville River drainage. Pike are rare throughout the channels, lakes, and streams of the Colville River Delta.

Longnose sucker are rare in ACP lakes and streams to the west of the Colville River in the Planning Area.

Threespine stickleback and **Arctic lamprey** are extraordinarily rare throughout the Colville River watershed and the National Petroleum Reserve – Alaska. The only known record of the Arctic lamprey was in the stomach contents of a burbot sampled to determine food habits.

Migratory Fish

Anadromous and amphidromous fishes disperse out into coastal waters during spring breakup. Their distribution is generally confined to the brackish nearshore band that develops along the coast (Craig and Haldorson 1981, Craig 1984). The spatial extent of the summer dispersal depends on species and age. By late summer, rapidly decreasing daylight, decreased river discharge, and mixing with cold, saline ocean water causes the brackish nearshore band to deteriorate. The combinations of thermal and photoperiod cues trigger return migrations to spawning and overwintering areas. Sources of information on migratory fish in the Planning Area include Myers (1949); McPhail and Lindsey (1970); Alt and Kogl (1973); Scott and Crossman (1973); Bain (1974); Craig and Mann (1974); Craig and McCart (1974, 1975); Kogl and Schell (1974); Netsch et al. (1977); Craig (1977a, b, 1984, 1989b); Bendock (1979a, b, 1982); Morrow (1980); Craig and Haldorson (1981, 1986); McElderry and Craig (1981); Griffiths and Gallaway (1982); Smith and Glesne (1982); Gallaway et al. (1983); Griffiths et al. (1983, 1996, 1997); Bendock and Burr (1984a, b); Daum et al. (1984); Fawcett et al. (1986); Moulton et al. (1986a, b, 1989, 1990, 1992, 1993); Cannon et al. (1987); Fechhelm and Fissel (1988); Pedersen and Shishido (1988, *in* Craig 1989a); Moulton and Field (1988, 1991, 1994); Bickham et al. (1989); Burns (1990); Fechhelm and Griffiths (1990); Glass et al. (1990); Reub et al. (1991); Schmidt et al. (1991); Morales et al. (1993); Philo et al. (1993a, b); Moulton (1994, 1995, 1996a, b, 1997, 1999a, b, 2000, 2001b, 2002a, b); Underwood et al. (1995); Colonell and Gallaway (1997); Everett et al. (1997); Fechhelm and Griffiths (2001); and MJM Research (2001, 2002).

Anadromous Fish

Arctic cisco are one of the most abundant and widely distributed white fish found in the coastal waters of the Beaufort Sea during summer. The distribution of Arctic cisco within the Planning Area is limited to coastal waters during summer and the lower Colville River Delta during winter. Most of the Colville River watershed and the lakes, ponds, and stream systems in the Planning Area are not important habitat for this species. It is the principal species targeted in the fall subsistence and commercial fisheries that operate in the Colville River Delta.

The Colville River is the only drainage west of the Mackenzie River, Canada, large and deep enough to support substantial overwintering populations of subadult and adult fish. No spawning areas for Arctic cisco have ever been identified in Alaska. It has been hypothesized that most, if not all, Arctic cisco found in Alaska originate from spawning grounds in the Mackenzie River system of Canada. In spring, newly hatched fish are flushed down river into ice-free coastal waters. Some young-of-the-year are transported westward to Alaska by wind-driven coastal currents. In summers with strong, persistent east winds, enhanced westward transport can carry fish to Alaska's Colville River where they take up overwintering residence. Fish remain associated with the Colville River until the onset of sexual maturity beginning at about age 7, at which point they migrate back to the Mackenzie River to spawn.

The **Bering cisco** are found from Bristol Bay, and possibly Siberia, north and east to the Colville River. Very little is known about Bering cisco in the Beaufort Sea, but there is some speculation that fish may be transients from the Yukon River or from rivers in Russia. They are a relatively important subsistence species at Barrow, but are of minor importance to the Colville River subsistence fishery. Their distribution along the North Slope is likely similar to Arctic cisco, being limited to coastal waters during summer and the lower reaches of the Colville River Delta during winter. Bering cisco are not found in the freshwater coastal plain lakes and streams of the Planning Area.

Rainbow smelt are an anadromous pelagic fish that is found throughout the Beaufort Sea. Unlike other anadromous and amphidromous species, which spawn in the fall and early winter, rainbow smelt spawn in the spring.

Smelt spawn in the lower reaches of the Colville River and probably do not go upstream farther than they have to in order to reach freshwater. Aside from spawning, smelt spend their winters and summers in brackish coastal areas and deltas. Rainbow smelt are not normally found in the freshwater coastal plain lakes and streams of the Planning Area.

Although all five species of Pacific salmon have been reported from the Beaufort Sea, three of these, **chinook**, **sockeye**, and **coho salmon,** are extremely rare and no known spawning stocks have been identified. Small runs of **pink salmon** occur in the Colville River. In recent years, pink salmon have been taken near the Itkillik River as part of the fall subsistence fishery (George 2004). Pink salmon constitute only a minor portion of total subsistence catch and are not a targeted species. Small runs of **chum salmon** also occur in the Colville River drainage. Spawning occurs in the lower river from mid-August to mid-September. In recent years, smolts have been caught in the lower Colville River Delta. Although chum salmon are taken in the fall subsistence fishery, they constitute only a minor portion of total catch. Small runs may also occur in rivers closer to Barrow. Chum salmon and pink salmon are rare in the freshwater coastal plain lakes and streams of the Planning Area.

Amphidromous Species

Amphidromous fishes spawn and overwinter in rivers and streams but migrate from these freshwater environments into coastal waters during the ice-free summer months to feed. Some species, including least cisco and Dolly Varden, consist of both amphidromous and non-amphidromous forms. Other species, like broad whitefish, may forage extensively in both freshwater and coastal habitats during summer.

Dolly Varden spawn in many of the mountain streams between and including the Colville and Mackenzie rivers. Although the Colville River drainage supports major stocks of Dolly Varden, most spawning and overwintering areas are outside the Planning Area. Dolly Varden are rare in freshwater ACP lakes and streams of the Planning Area and in the channels, lakes, and streams of the Colville River Delta. Dolly Varden migrate downriver to the ocean in spring, then return to their upstream overwintering grounds in late summer. The main channel of the Colville River, which runs along the eastern boundary of the Planning Area, thus represents the principal migratory corridor for this species.

Several forms of **least cisco** inhabit the watersheds of the North Slope. Some are amphidromous, while others are strictly freshwater forms. They are found in the lakes and streams of the Planning Area, occur in the river channels and lakes of the Colville River Delta, and are one of the most abundant species found in Beaufort Sea coastal waters. Least cisco spawn in late September and October. Fall spawning runs, most likely of amphidromous forms, occur in the Colville, Ikpikpuk, and Price rivers.

Like least cisco, **broad whitefish** are common in virtually all habitats of the coastal North Slope in summer and early fall. They are found throughout the freshwater ACP lakes and streams of the Planning Area, occur in the river channels, outer channels, tapped lakes, and perched lakes of the Colville River, and are one of the most abundant species found in Beaufort Sea coastal waters. As discussed in Section 3.4.2 (Subsistence), broad whitefish is an important subsistence fishery for people living on the North Slope.

Humpback whitefish spawn in the Colville River Delta, and middle and upper reaches of the Colville River during September and October. Spawners have also been reported in the upper Ikpikpuk drainage in September. Excluding upriver spawning runs, the summer distribution of humpback whitefish within the Planning Area is likely limited to main river channels and low-salinity coastal areas. Although limited numbers of humpback whitefish are distributed throughout the Ikpikpuk River drainage including the Price River, the lower reaches of Fish Creek, and the Kalikpik River, they are rarely found in any of the lakes of the Planning Area. Humpback whitefish are present in low numbers in Teshekpuk Lake. Few humpback whitefish are found in Judy Creek.

Marine Fish

Marine fishes spend their entire lives at sea, although some species may migrate into nearshore, brackish coastal waters during summer. There are some species, such as fourhorn sculpin and Arctic flounder, that explicitly migrate from oceanic-shelf waters onshore during summer and may travel considerable distances upriver (Morrow 1980). Sources of information on marine fish in the Planning Area include Walters (1955); Scott and Crossman (1973); Morrow (1980); Dew and Mancini (1982); Griffiths and Gallaway (1982); Critchlow (1983); Griffiths et al. (1983, 1995, 1996, 1997); Moulton and Fawcett (1984); Moulton et al. (1986b); Cannon et al. (1987); Moulton and Tarbox (1987); Glass et al. (1990); Reub et al. (1991); and Moulton (1996b, 1999b).

Fourhorn sculpin and **Arctic flounder** are demersal (i.e., living on and near the seabed) species that have circumpolar nearshore distributions in brackish and moderately saline nearshore habitats. Neither species is found far offshore, although both species migrate into brackish coastal habitats during summer to feed, and may travel considerable distances up rivers. Fourhorn sculpin have been reported as far as 85 miles upstream in the Meade River. Small numbers of both species occur sporadically in the Colville River Delta, but there is no evidence of major upstream migrations within the Planning Area. Both species are very abundant in coastal waters of the National Petroleum Reserve – Alaska during summer.

The **saffron cod** is found in brackish and marine waters of the Beaufort Sea east to Bathurst Inlet in Canada. The species frequently enters rivers and may go considerable distances upstream. There is no evidence of major upstream migrations in the Planning Area.

Arctic cod is one of the most abundant fish species collected in coastal waters during summer. Cod are associated with highly productive transition layers that separate cold marine bottom water and warm brackish surface water. The onshore movement of such layers is an important factor in coastal aggregations of fish. Arctic cod do not actively move into freshwater or low-salinity habitats.

Commercial Fishing

Commercial and subsistence fisheries operate in the Colville River Delta. The Helmericks family operates an under-ice commercial gill net fishery in the Colville River Delta during fall (Gallaway et al. 1983, 1989). The fishery typically operates from early October through the end of November. Fishing effort is concentrated in the Main (Kupigruak) and East Channels of the river near Anachilik Island. The three principal species targeted in the fishery are Arctic cisco, least cisco, and humpback whitefish.

Arctic cisco is the dominant species harvested in the fishery. Arctic cisco declined markedly between 1996 and 2002. Such declines are not unprecedented, occurring between 1973 and 1980 (this period was followed by a peak year in abundance in 1981) and between 1986 and 1991 (a period again followed by increased catch rates in 1992, and a peak in 1993).

Least cisco harvest also fluctuates among years, partially in response to natural oscillations in population strength. However, this species also responds to physical characteristics of the Colville River Delta, preferring water less saline than that of the cogeneric Arctic cisco.

The harvest of humpback whitefish has changed dramatically over the 35-year period of record. Prior to 1981, annual catch rates were nominal at less than five fish per day per 150-foot net. Following a 5-year data gap from 1982 to 1986, harvest increased to annual levels ranging from four to 44 fish per day per 150-foot net. The reasons for this dramatic change in annual harvest are unclear.

Nuiqsut Subsistence Fishery

The Iñupiat community of Nuiqsut operates subsistence fisheries in the Colville River Delta year-round, although most fishing effort occurs in summer and fall. The summer fishery generally begins in July and extends until freeze-up, which typically occurs in early September (Moulton et al. 1986a). Fishing is concentrated in the Nigliq Channel in the western Colville River Delta, in the Colville River just upstream of Nuiqsut in the Tiragruag area, and in Fish Creek (George and Nageak 1986, Craig 1989b). The summer fishery targets broad whitefish with annual harvests ranging from about 3,000 to 4,000 fish (Moulton et al. 1986a; Nelson et al. 1987). Dolly Varden, humpback whitefish, pink salmon, and chum salmon are also taken incidentally.

The major fishery of the year is the fall under-ice gill net fishery, which begins in late September-early October and typically lasts through late November (Moulton 1997). Fishing effort is concentrated in the upper Nigliq Channel near Nuiqsut, the lower Nigliq Channel near Woods Camp, and the Nigliq Delta (Craig 1989b, Moulton 1999b). Over the past 15 years, effort has shifted downstream and 2000 was the first year in which fishing effort in the Colville River Delta was the highest of the three areas (Moulton 2001). Arctic cisco is the principal species targeted, accounting for nearly 70 percent of the total annual harvest. Other targeted species include least cisco, broad whitefish, and humpback whitefish. The estimated mean annual harvest from 1985 to 2000 was 21,241 Arctic cisco, 7,011 least cisco, 1,860 humpback whitefish, and 667 broad whitefish. Species taken incidentally include Bering cisco, Arctic grayling, rainbow smelt, round whitefish, Dolly Varden, burbot, Arctic flounder, and fourhorn sculpin.

Annual harvests of Arctic cisco in the subsistence fishery fluctuate for the same reasons described above for the commercial fishery. Harvests from 1996 to 2002 were below normal but picked up considerably in fall 2003 with the entry of the 1997-year class (USDOI MMS 2003a). Poor recruitment of fish from Canada over the past three consecutive summers (2001-2003) is expected to result in a decline in Arctic cisco subsistence harvests beginning about 2006 (Fechhelm et al. 2003). Low harvests should continue through at least 2008.

Fish Species of Concern

No fish that inhabit the Planning Area and associated coastal waters are federally listed as threatened, endangered, or sensitive by the USFWS in Alaska.

3.3.6 Birds

About 80 bird species including seabirds, loons, waterfowl, shorebirds, raptors, passerines, and ptarmigans are expected to occur annually in the Planning Area or adjacent nearshore Beaufort Sea habitats. Nearly all of these species are migratory and are present only during the summer breeding season from approximately late May through October. During the remainder of the year, most of these species occupy other areas in Alaska, the lower 48 states, Canada, Russia/Asia, Mexico, or Central and South America. This document briefly discusses the distribution and habitat use of some of the species that are common or occur regularly in the Planning Area. More detailed species and life-history accounts can be found in 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998; III-B-11), the Northwest IAP/EIS (USDOI BLM and MMS 2003; III.B.4), and Johnson and Herter (1989).

3.3.6.1 Seabirds

Six species of seabirds common across the ACP occur in the Planning Area: glaucous and Sabine's gulls, pomarine, parasitic, and long-tailed jaegers, and Arctic tern. In addition, black guillemot may occur in offshore areas (Johnson and Herter 1989). Most seabirds arrive on the ACP in early to late May and leave in September to November. Black guillemot is on the BLM Sensitive Species List for Alaska (See Appendix G).

Glaucous gulls are a common migrant and breeder on the ACP. Glaucous gulls winter along the Pacific coast from the Aleutian Islands to California and along the Atlantic coast from Labrador and Greenland south to the eastern U.S. They nest across the ACP, with areas of high-density located both east and west of Dease Inlet in the Northwest National Petroleum Reserve – Alaska and southeast of Teshekpuk Lake in the Planning Area. The glaucous gull population on the ACP has remained stable since 1992 (Larned et al. 2003). Nests in mainland areas are often on small islands in lakes, and pairs may nest singly or in small colonies.

Sabine's gulls are less common than glaucous gulls on the ACP and nest in single pairs or small colonies on the shores or islands of tundra lakes (Johnson and Herter 1989, Noel et al. 2001). Sabine's gulls winter at sea off the west coasts of Africa and South America (Day et al. 2001). In the Planning Area, Sabine's gulls are most numerous in the area north of Teshekpuk Lake as well as several areas in the Northwest National Petroleum Reserve – Alaska. The ACP population of Sabine's gulls fluctuated between 5,000 and 8,000 birds between 1992 and 2003, except for a low of 2,800 birds in 1998 (Larned et al. 2003).

Jaegers spend the winter at sea, but migrate to tundra breeding grounds during the summer. The ACP population of jaegers has remained relatively stable from 1992 to 2003 (Larned et al. 2003). **Parasitic** and **long-tailed jaegers** have been recorded breeding in the Planning Area in small numbers (Burgess et al. 2002a, 2003b). Although the Planning Area is within the breeding range of **Pomarine jaegers,** these birds are erratic breeders and it is difficult to determine their breeding status in many places (Wiley and Lee 2000). Pomarine jaegers are more common west of the Planning Area, but may be common in the Planning Area during migration or during years of high lemming populations (Johnson and Herter 1989).

The **Arctic tern** is a fairly common breeder and migrant in the Beaufort Sea area that nests most commonly near the coast but may also nest inland (Johnson and Herter 1989). Artic terns winter in the subantarctic and Antarctic waters of the Pacific, Atlantic, and Antarctic oceans. Larned et al. (2003) reported an increasing trend in the Arctic tern population of the ACP from 1992 to 2003.

3.3.6.2 Loons

Pacific, red-throated, and yellow-billed loons breed across the ACP. Loons arrive on the North Slope in late May and establish breeding territories on tundra lakes and ponds as soon as the margins of these habitats are free of ice and snow (Table 3-6). After nesting, loons may move to marine habitats before migration in August and September (Johnson and Herter 1989). Two loon species, the yellow-billed and red-throated, are on the BLM Sensitive Species List for Alaska (Appendix G).

The **Pacific loon** is the most abundant loon species across the ACP. Aerial surveys during the last 10 years have indicated that the Pacific loon population on the ACP is stable (Larned et al. 2003; Mallek et al. 2003). The largest concentrations of Pacific loons in the Planning Area occur west of Teshekpuk Lake and in a small area near the Colville River south of Nuiqsut (Map 3-10). Pacific loons exhibit site fidelity to breeding locations, often returning to the same lake or pond in successive years (Kertell 2000). Pacific loons winter mainly on the Pacific Coast from southeastern Alaska south to Mexico.

Yellow-billed loon is the least abundant loon species on the ACP, and the population has been stable since at least 1986 (Larned et al. 2003; Mallek et al. 2003). Breeding yellow-billed loons are distributed unevenly on the ACP and breeding habitat may be more restrictive than for other loon species. Yellow-billed loon is a species of BLM concern due to its low population level, limited breeding habitat, and low productivity. Mallek et al. (2004) reported a population index of approximately 3,000 yellow-billed loons for the ACP. The largest concentration area for yellow-billed loons in the National Petroleum Reserve – Alaska is located in the Northwest National Petroleum Reserve – Alaska southeast of Dease Inlet, with less dense areas located east and west of Teshekpuk Lake in the Planning Area (Map 3-11). Yellow-billed loons winter along the Pacific Coast from Kodiak Island and Prince William Sound and throughout southeastern Alaska and British Columbia to Vancouver Island, although stragglers may occur further south (North 1994). Recent studies suggest that yellow-billed loons that breed on the North Slope may winter off the coast of Asia.

Yellow-billed loons nest on deep open lakes and deep *Arctophila* lakes that are generally larger than those used by other loon species (Derksen et al. 1981; North 1986; Burgess et al. 2003 a, b; Johnson et al. 2003 a, b), although nests may also occur on smaller wetlands adjacent to large lakes (North 1986; Burgess et al. 2003b; Johnson et al. 2003b). Pairs that nest in small lakes may move broods overland to nearby larger lakes (North 1986).

Red-throated loons are much less common than Pacific loons on the ACP. Mallek et al. (2003) reported an increasing trend in the red-throated loon population on the ACP from 1986 to 2002. However, Larned et al. (2003) reported a decreasing trend in the numbers of red-throated loons observed during the eider breeding population surveys from 1992 to 2003, and Groves et al. (1996) reported declines in the Alaska red-throated loon population since the 1970s. The study area in Alaska included the ACP, the Y-K delta, coastal Bristol Bay, and various locations in the interior. Red-throated loons are common in the Colville River Delta adjacent to the Planning Area (Map 3-12). In the Planning Area, red-throated loons occur in relatively high densities both northeast and southwest of Teshekpuk Lake (Map 3-12), and larger areas of red-throated loon concentration occur in the Northwest National Petroleum Reserve – Alaska. Red-throated loons winter along the Pacific Coast from the Aleutian Islands to northwestern Mexico, and along the Atlantic Coast from the St. Lawrence River south to the Gulf of Mexico.

Table 3-6. Chronology of Activities for Birds Nesting on the Arctic Coastal Plain in the Planning Area.

Species or Groups	Arrival in Planning Area	Egg Laying	Hatch	Brood Rearing	Adult Molt	Fall Migration
Loons	Late May - early June	Mid-June - late June	Mid-July - late July	Mid-July - early September	Winter	Late August - September
Tundra swan	Mid-May - late May	Late May - early June	Late June - mid-July	Late June - mid-September	Mid-July - August	Late September -early October
Brant	Late May - early June	Early June - late June	Late June - mid-July	Late June - early September	Mid-July - mid August	Mid-August - early September
Greater white-fronted goose	Mid-May - early June	Late May - mid-June	Late June - early July	Late June - late August	Mid-July - early August	Mid-August - mid-September
Northern pintail males	Late May	Mid-June - late June	Early July - late July	Early July - early September	Mid-July - early August	Early August - mid-September
King eider	Mid-May - late May	Mid-June - early July	Early July - late July	Early July - early August	Early July - early August[1]	Early August - late October[1]
Long-tailed duck	Late May	Late June - early July	Mid-July - late July	Mid-July - early September	Late July - early September	Late September - October

[1] Males stage in the Beaufort Sea for 2-3 weeks before molt-migration starts in mid-July; and females stage in the Beaufort Sea from mid-July to late August before they begin to depart in early August.
Sources: Johnson and Herter (1989); Burgess and Stickney (1994); Ely and Dzubin (1994); Limpert and Earnst (1994); North (1994); Austin and Miller (1995); King (1998); Dickson et al. (2000); and USDOI BLM and MMS (2003).

3.3.6.3 Waterfowl

Waterfowl, including ducks, geese, and swans, migrate to breeding grounds within the Planning Area and other locations on the ACP from wintering grounds located primarily in Canada, the lower 48 states, and Mexico. Several waterfowl species that occur in the Planning Area, including brant, long-tailed duck, common and king eiders, and black and surf scoters, are on the BLM Sensitive Species List for Alaska (Appendix G).

Swans and Geese

Tundra swans are common in the area surrounding Dease Inlet and Admiralty Bay in the Northwest National Petroleum Reserve – Alaska. In the Planning Area, tundra swan concentrations occur near Nuiqsut and southeast and northwest of Teshekpuk Lake (Map 3-13). Breeding pair surveys have reported an increasing trend in tundra swan numbers on the ACP since 1986; however, numbers declined in both 2001 and 2002 (Mallek et al. 2003). Most tundra swans nesting in the Beaufort Sea area probably winter along the Atlantic Coast from Maryland to North Carolina.

Four goose species commonly nest on the ACP. The greater white-fronted goose is by far the most abundant and widespread species; Canada goose, lesser snow goose, and brant occur in lower densities.

Mallek et al. (2003) reported an increasing trend in the **white-fronted goose** population on the ACP since 1985. The largest concentrations of greater white-fronted geese in the National Petroleum Reserve – Alaska occurs northeast of Teshekpuk Lake in the Planning Area, and northwest of Atqasuk and east of Point Lay in the Northwest National Petroleum Reserve – Alaska (Map 3-14). Derksen et al. (1981) reported that greater white-fronted geese nested on upland sites or polygonal ground near shallow sedge and pendant grass wetlands, while post-breeding birds used deep open lakes during the molting period (Map 3-14). The goose molting area north of Teshekpuk Lake is extremely important for molting white-fronted geese as well as other goose species (Mallek 2004). Mallek (2004) reported a 23-year mean of 11,950 white-fronted geese during surveys in the Goose Molting Area north and east of Teshekpuk Lake. However, the numbers have increased in recent years, with an annual mean of 20,864 white-fronted geese in this area since 1994, and a high of nearly 35,000 geese in 2002 (Map 3-15; Table 3-7). Over 90,000 geese of four species were recorded in this area during the 2001 molting season. White-fronted geese from the ACP winter along the coasts of Texas, Louisiana, and in Mexico. White-fronted geese and other waterfowl species are important to both subsistence and sport hunters, not only in Alaska, but also in other states and countries, such as Canada, Russia, and Mexico.

Canada goose is a common species that nests in low densities in the Prudhoe Bay area, the Colville River Delta, and in the Planning Area. The Canada goose is a much more common breeder in the interior of Alaska than on the ACP. After nesting, small flocks of these interior-nesting Canada geese migrate to the ACP where they aggregate with locally nesting geese to molt. The ACP population of Canada geese has varied from lows near 3,000 in 1989 and 1994 to highs near 47,000 in 1986 and 1999 (Mallek et al. 2003). The 2002 population estimate was 52 percent lower than the 1985 to 2001 mean population size. Mallek (2004) reported a 23-year mean of 12,144 Canada geese during surveys in the Goose Molting Area, north and east of Teshekpuk Lake (Map 3-15; Table 3-7).

Lesser snow goose nest primarily in Arctic Canada and Russia, although a few small colonies nest on Alaska's ACP. The population of snow geese on the ACP has increased in recent years, and a number of scattered nests or small colonies consisting of less than 13 nests have been reported in the Planning Area near the coast from Fish Creek to the Ikpikpuk River Delta (Ritchie et al. 2000). The largest nesting group is the Ikpikpuk colony with 335 nests in 2001. The colony on Howe Island in the Sagavanirktok River Delta, adjacent to the active Endicott oil production field, declined in the late 1990s, apparently as a result of predators, including foxes and bears (Johnson 2000a). Snow geese from the Howe Island colony winter primarily in northern California and southern Oregon (Johnson et al. 1996).

Brant nest in both small and large colonies that are used year after year. These colonies generally are near the coast but may be 18 miles or more inland (Derksen et al. 1981; Reed et al. 1998; USDOI BLM and MMS 1998). The largest nesting concentration of brant on the ACP is located in the Colville River Delta (Johnson et al. 2002), and another sizeable colony is located in the Sagavanirktok River Delta (Sedinger and Stickney 2000). In the Planning Area, Ritchie et al. (2002) reported a brant colony near the coast west of Fish Creek that varied from 25 to 55 nests during surveys conducted from 1995 through 2001. Two other colonies in the Planning Area, one located south of Cape Halkett and the other just west of Teshekpuk Lake, had up to 35 and 40 nests, respectively, during the same period. Several smaller colonies were reported along the coast between Cape Halkett and Smith Bay, as well as numerous colonies near Dease Inlet in the Northwest National Petroleum Reserve – Alaska. Since 1992 the brant population on the ACP appears to be increasing (Larned et al. 2003). Brant winter along the Pacific Coast from the Aleutian Islands south to Mexico. Some birds also winter along the Asian coast, from Japan and southern China

(Bellrose 1976). Pacific black brant populations have experienced slow downward trends in recent years (USFWS 2003). Brant are valued by subsistence users in northern and western Alaska as well as along the West Coast and in Mexico. The Pacific Flyway Council has established a management plan for the brant population that outlines the status of Pacific brant and goals for the population (Pacific Flyway Council 2003).

Although brant are fairly common breeding birds in the Planning Area, the area is even more important as a molting area for brant and other goose species. The largest known concentration of molting and brood-rearing brant on the ACP occurs in the northern portion of the Teshekpuk Lake area (Maps 3-14 and 3-15; Derksen et al. 1982). As many as 30 percent of the Pacific flyway population of brant may be present in the Teshekpuk Lake goose molting area during the molting period. Many are failed breeders and non-breeders that have migrated from breeding colonies in western Alaska, Canada, and Siberia, and arrive in the Planning Area in late June and early July to molt (Bollinger and Derksen 1996. The origin of this molt-migrant population from such distant nesting areas emphasizes the international importance of the Teshekpuk Lake area to molting brant as well as other goose species. Mallek (2004) reported an annual 23-year mean of 17,556 brant during surveys in the Goose Molting Area north and east of Teshekpuk Lake (Table 3-7). When considering only the last 10 years, the annual mean number is approximately 18,500 birds, although as many as 36,817 brant have been reported (Table 3-7). The Teshekpuk Lake Goose Molting Area may be the single most important area for molting brant and other geese in the Arctic, based on information in Mallek et al. (2003) and Mallek (2004).

Table 3-7. Number of Geese Recorded in the Teshekpuk Lake Goose Molting Habitat Area during Aerial Surveys (1982 – 2003).

	All Geese	Brant	Greater White-Fronted Goose	Canada Goose	Snow Goose
1982-2003 mean	42,161	17,556	11,950	12,144	511
1994-2003 mean	52,169	18,541	20,864	11,904	860
Total geese in 2003	63,244	21,182	25,088	15,295	1,438
Maximum number (1 year)	91,238 (2001)	36,817 (2001)	34,929 (2002)	26,681 (1984)	2,674 (2001)
Maximum number (any lake)	11,000	6,255	11,000	2,995	1,191
Source: Mallek (2004).					

Ducks

Fifteen duck species regularly occur on the ACP (Mallek et al. 2003). The two most common species are northern pintail and long-tailed duck, which together comprise about 85 percent of the total ACP duck population. Other species, including four eider species, occur in much lower densities. Two of the eider species, spectacled eider and Steller's eider, are federally-listed as threatened species and are discussed in Section 3.3.8 (Threatened and Endangered Species).

Northern pintail is the most abundant duck in the Planning Area (Table 3-8). Pintail numbers fluctuate from year to year, but no significant population trends have been reported since aerial surveys began in the mid-1980s (Larned et al. 2003; Mallek et al. 2003). Although no significant population trends are evident on the ACP, northern pintail populations in the lower 48 states and Canada have displayed declines (USFWS 2003). In the Planning Area, nesting pintails are concentrated in two areas, one northeast and one southeast of Teshekpuk Lake (Map 3-16). Additional concentration areas are located east of Wainwright, south of Barrow, and southeast of Dease Inlet in the Northwest National Petroleum Reserve – Alaska. Northern pintails winter from southeastern Alaska south throughout much of the central and southern U.S. and into Mexico and the Caribbean.

Long-tailed duck is the second most abundant duck on the ACP (Table 3-8). Mallek et al. (2003) reported a declining trend in the ACP long-tailed duck population from 1985 to 2002, with an annual average growth rate of

0.97. Larned et al. (2003) reported an increasing trend from 1992 through 2002 although numbers were lower in 2003. Over their entire range, long-tailed ducks have shown declining population trends (USFWS 1999). Long-tailed ducks winter along both coasts, with small numbers occurring as far south as California on the west and the Gulf of Mexico on the east.

Table 3-8. Occurrence and Representative Abundance and Density of Selected Birds in the Northeast National Petroleum Reserve – Alaska.

Common Name	Status[1]	Presence on the Arctic Coastal Plain (ACP)[2]	Estimated Northern ACP Population Index	Estimated Proportion Observed in mid- to late June in Planning Area as a Percentage of Total Birds Observed in ACP[3]	Estimated Northern ACP Density Index (birds/mi^2)[4]
Loons/Waterfowl					
Red-throated loon	C	Early June – late September	2,917	25	0.02
Pacific loon	C	Late May – late September	26,673	26	0.17
Yellow-billed loon	U	Mid-May – mid-September	2,780	31	0.02
Tundra swan	C	Mid-May – early October	9,960	26	0.06
White-fronted goose	C	Mid-May – mid-September	121,038	26	0.76
Brant	FC	Late May – early September	8,038	55	0.05
Canada goose	FC	Early June – mid-September	17,375	64	0.11
Northern pintail	A	Late May – mid-September	72,472	26	0.46
Scaup	C	Late May – mid-September	18,901	29	0.12
Common eider	C	Late May – late October	2,682	—	—
King eider	A	Late May – October	12,823	35	0.08
Long-tailed duck	A	Late May – October	56,374	26	0.35
Scoters	C	Late May – early September	6,173	55	0.04
Passerines					
Common raven	U	Resident	66	—	—
Lapland longspur	A	Mid-May – early September	—	—	9.4 - 24.8
Raptors					
Arctic peregrine falcon	U	Mid-April – mid-September	—	—	—
Gyrfalcon	U	Resident	100	—	—
Rough-legged hawk	U	Late April – early October	600 - 1,000	—	—
Snowy owl	FC	Resident	858	—	—
Seabirds					
Glaucous gull	C	Early May – November	10,646	25	0.07
Sabine's gull	FC	Late May – early September	7,516	31	0.05
Arctic tern	C	Late May – early September	15,271	31	0.10
Jaegers	FC	Late May – mid-September	6,947	24	0.04
Other					
Ptarmigan	C	Resident	—	—	—

[1] A = Abundant; C = Common; FC = Fairly Common; and U = Uncommon.
[2] Resident = Present throughout the year.
[3] Values calculated from Breeding Pair Surveys (Platte and Stehn 2004). The Planning Area = 25 percent of the total ACP survey area.
[4] June indices in Breeding Pair Surveys (Platte and Stehn 2004), except ptarmigan and longspur (USDOI BLM and MMS 2003).
mi^2 = Square miles.
— = Data not available.
Sources: Ritchie and Wildman (2000); Swem (2001); Dau and Hodges (2003); Larned et al. (2003); Mallek et al. (2003); and Platte and Stehn (2004).

Nesting concentrations are scattered across the ACP. The largest concentrations in the Planning Area occur southeast and southwest of Teshekpuk Lake, and in the south central portion of the Planning Area (Map 3-17). Other long-tailed duck concentrations occur east of Dease Inlet and in the western portion of the Northwest National Petroleum Reserve – Alaska.

King eider is the most abundant eider species on the ACP (Larned et al. 2003). Evidence from counts of eiders as they pass Point Barrow during migration suggest that the king eider population has declined by approximately 56 percent since 1976 (Suydam et al. 2000). In spite of this, Larned et al. (2003) reported an increasing population trend for king eiders on the ACP from 1993 to 2003 with an annual average growth rate of 1.02. King eider winter as far north as open water is available in the Bering and Chukchi seas south through the Aleutian Islands to Kodiak Island. They are also found along coastal areas of Kamchatka Peninsula.

The largest concentration of king eiders in the Planning Area is in a large area south and east of Teshekpuk Lake (Map 3-18). Noel et al. (2001) reported two flocks of eider hens and ducklings on a lake in the Planning Area southeast of Teshekpuk Lake that contained approximately 800 birds in late July. Only one nest was discovered during ground searches around the entire perimeter of this lake during the incubation period, indicating that important brood-rearing areas may not necessarily be important for nesting. Broods may move some distance from nesting to brood-rearing areas.

Common eider is a seaduck that nests primarily in loose aggregations or colonies on barrier islands, although they also nest on coastal spits or beaches (Goudie et al. 2000). Nearshore coastal distributions during nesting surveys indicate that breeding pairs of common eiders are more numerous along the coast between the Colville River Delta and the Canadian border than they are along the coast of the Planning Area (Dau and Hodges 2003). Common eiders are generally not reported nesting along the coast of the Planning Area due to the lack of barrier islands along the coast. Low nesting densities occur on barrier islands in the Northwest National Petroleum Reserve – Alaska (Dau and Hodges 2003). Most common eiders from the Beaufort Sea population probably winter from the Bering Sea pack ice, south to the Aleutian Islands and Cook Inlet. Suydam et al. (2000) reported declining numbers of common eiders in the Barrow area in recent years.

3.3.6.4 Shorebirds

The North Slope provides some of the most productive shorebird habitat in northern Alaska (Map 3-19). More than 30 species of shorebirds are known to breed on the North Slope, and as many as 6 million shorebirds are thought to spend the summer in the National Petroleum Reserve – Alaska (Cotter and Andres 2000). Shorebirds occur in greater densities than other bird groups across the ACP. Based on observations on the Colville River Delta and near Barrow, about 15 shorebird species could be expected to breed regularly in the Planning Area and another 20 species could occur as migrants (Troy 2000). Cotter and Andres (2000) recorded 13 species nesting near Inigok in the central portion of the Planning Area during 1998. Burgess et al. (2003b) reported 12 shorebird species nesting on intensively searched study plots in the eastern portion of the Planning Area during 2 years of study. Andres (2004) reported that latitude was the best predictor of shorebird density and species richness for all species combined in the National Petroleum Reserve – Alaska with higher densities recorded in more northern latitudes. The greatest densities occurred at sites with high percentages of flooded and wet sedge-moss vegetation types; densities were lower at inland sites which were drier and had more shrubs. The most abundant species were semipalmated and pectoral sandpipers, and red phalarope.

In general, shorebirds are present on the North Slope from May to September. After hatching, brood-rearing shorebirds move to tundra and aquatic habitats adjacent to their nests. Many shorebirds move to coastal habitats to feed before migrating. Adults often migrate before juvenile birds, and juvenile shorebirds may not leave until late August or September (Johnson and Herter 1989, Andres 1994). Fall flocks may sometimes be composed entirely of juvenile birds. Wintering areas for shorebirds vary among species and include locations in the lower 48 states, Mexico, Central and South America, Asia, and Africa. One shorebird species, the buff-breasted sandpiper, regularly occurring in the Planning Area, is on the BLM Sensitive Species List for Alaska (Appendix G).

Shorebird nesting densities on the ACP vary depending on location and habitat (Table 3-9). Cotter and Andres (2000) reported shorebird nest densities of 30 nests per mi^2 on study plots in drained-lake basin habitat, but only 5 nests per mi^2 on tussock/ridge tundra in the central portion of the Planning Area. Johnson et al. (2003b) considered all habitats and reported a greater overall shorebird nest density of almost 35 nests per mi^2 in the Colville River Delta near the Alpine field where nests were associated with two habitat types—wet sedge willow and moist sedge shrub. One of the most important areas for shorebirds in the Planning Area may be the area north of Teshekpuk Lake where Andres (2004) reported shorebird densities as high as 53 pairs per mi^2 in areas northeast and northwest of the lake.

A number of shorebird species that breed or regularly occur in the Planning Area are considered to be species that are highly imperiled or are species of high concern in the Canadian and U.S. Shorebird Conservation Plans (Brown et al. 2001; Donaldson et al. 2001). These species include American golden-plover, whimbrel, bar-tailed godwit, ruddy turnstone, sanderling, western sandpiper, buff-breasted sandpiper, and the *arcticola* subspecies of dunlin.

Plovers

Two plover species are regularly observed in the Planning Area; the **American golden-plover** is a common species while the **black-bellied plover** is uncommon. Black-bellied and American golden-plovers tend to nest on upland sites that are drier than those used by other shorebirds (Johnson and Herter 1989). Black-bellied plovers breed most commonly near the coast and tend to nest in dry tundra habitats next to wet areas (Derksen et. al. 1981; Johnson and Herter 1989). American golden-plovers also nest in dry upland sites where their nests consist of scrapes on the tundra that are lined with mosses and lichens. American golden-plover nest densities generally range from approximately 0.1 to 1.6 nests per mi^2 (Table 3-9; TERA 1992; Cotter and Andres 2000; Johnson et al. 2000, 2003b; Burgess et al. 2003b). Black-bellied plovers winter on the west coasts of North and South America, from southern British Columbia south to Chile and on the east coasts of North and South America from New Jersey to Argentina (Terres 1982). The American golden-plover winters on the plains of central South America (Terres 1982).

Table 3-9. Breeding Season Abundance and Nest Density of Some Shorebird Species on the Arctic Coastal Plain.

Species	Abundance on ACP[1]	Highest Density (nests per mi^2)
American golden-plover	C	1.6
Baird's sandpiper	U	0.1
Bar-tailed godwit	U	0.3
Black-bellied plover	U	0.9
Buff-breasted sandpiper	U	1.1
Dunlin	U/C	3.7
Long-billed dowitcher	FC	2.9
Pectoral sandpiper	C/A	21.5
Red phalarope	C	4.0
Red-necked phalarope	C	5.2
Ruddy turnstone	U	data not available
Semipalmated sandpiper	C/A	14.4
Stilt sandpiper	U	1.2

[1] A = Abundant; C = Common; FC = Fairly Common; and U = Uncommon.
Ranges in nest densities are reported in various studies. Most of the data come from studies conducted in areas outside of the National Petroleum Reserve – Alaska, including the Colville River Delta and Point McIntyre in the Prudhoe Bay area.
Sources: Johnson and Herter (1989); TERA (1992); Cotter and Andres (2000); Johnson et al. (2000, 2003b); and Burgess et al (2003b).

Sandpipers and Phalaropes

Sandpipers and phalaropes considered common to abundant in the Planning Area include dunlin, semipalmated sandpiper, pectoral sandpiper, long-billed dowitcher, red-necked phalarope, and red phalarope. These shorebird species use a wide variety of habitat types but tend to nest in wet and moist sedge meadows, and aquatic sedge and grass marshes. Dunlin, and semipalmated and pectoral sandpipers may also nest in drier habitats including moist tussock tundra (Johnson and Herter 1989; Phillips Alaska, Inc. 2002).

The shorelines of shallow-sedge ponds are important feeding areas for **semipalmated sandpipers** in the Planning Area in late June to early July (Derksen et al. 1981). Semipalmated sandpiper nest density averaged 4.2 nests per mi^2 on study plots in the eastern Planning Area (Burgess et al. 2003b). Cotter and Andres (2000) reported that semipalmated sandpipers in the National Petroleum Reserve – Alaska near Inigok nested exclusively in drained lake basins where their nest density equaled that of pectoral sandpipers. They also reported **pectoral sandpipers** in the National Petroleum Reserve – Alaska near Inigok nested exclusively in drained lake basins where nest density was 11 nests per mi^2, although nest density in the entire study area was only 1.6 nests per mi^2 when all habitats were considered. Semipalmated sandpipers winter from Florida south along coastal areas through Central America to southern Brazil, and from Guatemala to northern Chile (Terres 1982).

Dunlin use a wide range of habitat types, but are more abundant near the coast than inland (Derksen et al. 1981; Johnson and Herter 1989). Average nest density was 0.6 nests per mi^2 in the eastern portion of the Planning Area (Burgess et al. 2003b). During post-breeding shorebird surveys on the Colville River Delta, dunlins comprised about 50 percent of all sightings and were the most abundant species on coastal shoreline silt barrens (Andres 1994). Most dunlin that breed in the Planning Area probably winter along the coasts of China and Japan. Recent evidence suggests that dunlin in Europe and North America are declining (Warnock et al. 1997).

Long-billed dowitcher is a shorebird species that uses a variety of nesting habitats across the ACP, but appears to prefer wet habitats associated with strangmoor (Troy 2000). Long-billed dowitcher nest density ranges from 0 to 2.9 nests per mi^2, averaging 2.2 nests per mi^2 in the eastern portion of the Planning Area (Burgess et al. 2003b) and 1.0 nests per mi^2 in the central portion of the Planning Area (Cotter and Andres 2000). Long-billed dowitchers winter from the southern U.S. south through Mexico to Panama (Terres 1982).

Red phalarope nest density (0.8 nests per mi^2) in the eastern portion of the Planning Area was less than that of **red-necked phalaropes** (2.5 nests per mi^2; Burgess et al. 2003b). Cotter and Andres (2000) did not find red phalaropes nesting in the central portion of the Planning Area, but red-necked phalarope nest density was 1.1 nests per mi^2. Phalarope nest densities may vary considerably from year to year, but have been as high as 4.0 and 5.2 nests per mi^2 for red and red-necked phalaropes, respectively. Phalaropes winter at sea in the Pacific and Indian oceans, and off the coast of west and south Africa (Terres 1982).

Buff-breasted sandpiper is listed as a species of high conservation concern by Partners in Flight and in the U.S. and Canadian shorebird conservation plans (Brown et al. 2000; Donaldson et al. 2001). It is also listed on the BLM Sensitive Species List for Alaska (Appendix G). Historically, buff-breasted sandpiper numbers may have been in the millions, but their populations declined due to hunting and habitat loss (Terres 1982). The current population may number around 15,000 (Donaldson et al. 2001). Buff-breasted sandpiper is the only North American shorebird species that uses a lek mating system (Gotthardt and Lanctot 2002). Leks are areas usually located in drier upland areas where males congregate to attract females (Lanctot and Laredo 1994). Relatively few observations of buff-breasted sandpipers have been reported for the National Petroleum Reserve – Alaska (Gotthardt and Lanctot 2002), although intensive studies in the National Petroleum Reserve – Alaska have been much less frequent than in other portions of the ACP. In recent years, Cotter and Andres (2000) reported buff-breasted sandpipers nesting at Inigok in the central portion of the Planning Area, and Burgess et al. (2003b) reported six nests on study plots in the eastern portion of the Planning Area. Buff-breasted sandpipers winter primarily on the pampas of Argentina, Uruguay and Brazil (Gotthardt and Lanctot 2002). Threats to buff-breasted sandpipers include habitat loss along migration routes and in wintering areas, as well as exposure to pesticides (Lanctot and Laredo 1994).

Bar-tailed godwit is an uncommon breeding species on the ACP east to the Sagavanirktok River (Johnson and Herter 1989). In recent years, bar-tailed godwit nests have been recorded in the Colville River Delta and the eastern portion of the National Petroleum Reserve – Alaska (Burgess et al. 2003a, b; Johnson et al. 2003a). Bar-tailed godwits breeding in the Planning Area probably winter in southeast Asia and on South Pacific islands.

3.3.6.5 Raptors

Raptors are birds of prey that include falcons, hawks, eagles, and owls. The snowy owl and gyrfalcon are the only raptors known to overwinter on the ACP; all others migrate south to overwinter (Johnson and Herter 1989). The Colville River and adjacent wetlands in the southern portion of the Planning Area provide the North Slope's single most important raptor nesting habitat area, with significant proportions of several Alaskan species' populations occupying bluffs and cliffs along its shoreline. In the National Petroleum Reserve – Alaska, cliff-nesting raptors are more common inland than near the coast. The peregrine falcon, gyrfalcon, and rough-legged hawk are regular breeders on cliffs along the Colville River in the Colville River Special Area. The golden eagle occurs regularly in the Planning Area.

The **Arctic peregrine falcon** was removed from the ESA list in 1994, and monitoring of the population was required until 1999 (59 FR [Federal Register] 50796). The peregrine falcon is on the BLM Sensitive Species List for Alaska (Appendix G). Peregrine falcons nest along the bluffs of the Colville River south of Nuiqsut, and recently nests have been reported in the transition zone between the ACP and the Brooks Range foothills (Ritchie et al. 2003; Map 3-20). Suitable substrates for nesting are located within the National Petroleum Reserve – Alaska, and the peregrine falcon population there is apparently increasing (Ritchie and Wildman 2000). Ritchie and Wildman (2000) reported approximately 15 pairs of peregrine falcons in the Planning Area during aerial surveys in 1999. Most of these were in the southern portion of the ACP adjacent to the foothills and along the Ikpikpuk River in the southwest portion of the Planning Area. Numerous nests are also located along the Colville River south of Umiat in the Colville River Special Area. Nigro and Ritchie (2004) reported 25 peregrine falcon nests between Umiat and Ocean Point on the Colville River in 2003.

Gyrfalcon is an uncommon species on the ACP, but is a fairly common nesting species south of the Planning Area in the foothills of the Brooks Range and on cliffs and bluffs along the Colville River south of Umiat. Ritchie and Wildman (2000) did not report any gyrfalcons on the ACP or in the foothills of the Planning Area during aerial surveys in 1999, although the surveys did not include the raptor nesting area along the Colville River south of Umiat. Nigro and Ritchie (2004) reported five gyrfalcon nests between Umiat and Ocean Point along the Colville River in 2003. Although gyrfalcons may remain on the breeding grounds throughout the year, some birds may move south through Canada to the northern U.S (Terres 1982).

Rough-legged hawks nest in the Brooks Range and along the cliffs and bluffs of the Colville River north and south of Umiat in the Colville River Special Area. Ritchie and Wildman (2000) reported three sites occupied by rough-legged hawks in the southern portion of the ACP in the Planning Area in 1999. In addition, Nigro and Ritchie (2004) reported 39 rough-legged hawk nests between Umiat and Ocean Point along the Colville River in 2003. Rough-legged hawks usually nest on cliffs or ledges. Rough-legged hawks winter south, to southern Canada and over much of the lower 48 states (Terres 1982).

Golden eagles nest in the Brooks Range, but they are not known to nest in the Planning Area. Although the main prey of the golden eagle is the Arctic ground squirrel, they are also known to prey on newborn caribou calves during spring (Johnson and Herter 1989). **Bald eagles** are also occasionally observed on the ACP (Johnson and Herter 1989).

Most raptors on the North Slope are cliff-nesting species, but ground-nesting raptors on the ACP include **snowy** and **short-eared owls** and **northern harrier**. These species breed irregularly across the ACP and are most common during years with high microtine rodent populations. Snowy owls are a fairly common resident in the Beaufort Sea area, breeding irregularly in coastal areas from Barrow to the east through northern Canada (Johnson and Herter 1989). Short-eared owl is an occasional breeder on the ACP, and northern harriers occasionally breed in the northern foothills of the Brooks Range(Johnson and Herter 1989). **Merlins** are likely to occur in the Planning Area as stragglers (Hohenberger et al. 1994).

3.3.6.6 Ptarmigan

Willow and **rock ptarmigan** are found in the Planning Area. Ptarmigan are ground-nesting birds in the grouse family that may remain on the ACP as year-round residents. These species are not generally recorded during aerial surveys for birds on the ACP (Larned et al. 2003; Mallek et al. 2003). Noel et al. (2001) reported that willow ptarmigan were far more abundant in the Planning Area than rock ptarmigan, and Johnson et al. (2003a) reported higher nest densities for willow ptarmigan than for rock ptarmigan near the Alpine field. Burgess et al. (2003b) reported only willow ptarmigan nesting at study sites in the eastern portion of the Planning Area, although some unidentified ptarmigan nests were also reported.

3.3.6.7 Passerines

Most passerines found on the ACP winter in temperate and tropical regions in the Americas or southern Asia (USDOI BLM and MMS 1998). They generally arrive on the North Slope from late May to early June and remain until mid- to late August (Johnson and Herter 1989). With the exception of the common raven, passerines on the ACP are tundra-nesting species.

Lapland longspur are the most common species nesting across the ACP. The average nest density on study plots in the eastern portion of the Planning Area was 8.0 nests per mi^2 (Burgess et al. 2003b). Other species, including **savannah sparrow**, **redpoll**, **snow bunting**, and **yellow wagtail** may be fairly common breeders. Snow buntings are very common on the ACP in areas of development where they find nesting sites in crevices of buildings, pipelines, and other man-made structures. They are probably not common in the Planning Area, but numbers would likely increase should development occur.

Common raven, though not abundant, is the only permanent resident passerine on the ACP. Ravens may use man-made structures such as buildings and towers for nest sites. In recent years, common ravens have been reported nesting at the Alpine field (Johnson et al. 2003b). Ravens are common in the foothills and mountains of the Brooks Range south of the National Petroleum Reserve – Alaska. They nest on cliffs where they construct nests that may be used in subsequent years by rough-legged hawks or gyrfalcons (Johnson and Herter 1989). Before human development on the ACP, common ravens were uncommon because of the lack of suitable nesting habitat. However, over the past several decades common ravens have become much more abundant on the ACP as nesting habitat in building and other man-made structures have become more abundant (Hohenberger et al. 1994). Some individuals over-winter on the ACP near human food sources. As their numbers have increased, common ravens have become important predators of tundra-nesting birds on the ACP (Day 1998).

3.3.7 Mammals

3.3.7.1 Terrestrial Mammals

Terrestrial mammals occurring in the Planning Area include caribou, muskox, moose, grizzly bear, Arctic fox, red fox, wolverine, gray wolf, and small mammals such as the Arctic ground squirrel, ermine, least weasel, lemmings, voles, and shrews (USDOI BLM and MMS 1998). These species occur across the North Slope and in many other parts of Alaska. Polar bears occur in the Planning Area in terrestrial and marine habitats, but they are generally considered marine mammals (e.g., they are covered under the Marine Mammal Protection Act [MMPA]) and are described in Section 3.3.7.2 (Marine Mammals). The terrestrial mammals that may be present in the Planning Area are listed in Table 3-10. This Amended IAP/EIS briefly discusses the distribution and habitat use of some of the species that are common or occur regularly in the Planning Area. More detailed species and life-history accounts can be found in 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998; III-B-39) and Northwest IAP/EIS (USDOI BLM and MMS 2003; III.B.5).

Caribou

Caribou herds are defined by the geographic location of their calving areas because cow caribou have high fidelity to calving areas and usually return each year following seasonal migrations (Skoog 1968; Cameron and Whitten 1986; Davis et al. 1986). Genetic data and field observations indicate that fall and winter ranges of different herds sometimes overlap, and that this may result in some interbreeding between herds (Skoog 1968; Whitten and Cameron 1983; Prichard et al. 2001; Cronin et al. 2003).

Table 3-10. Mammal Species Known or Suspected to Occur in the Planning Area.

Common Name	Scientific Name	Iñupiaq Name	Abundance[1]
Large Mammals			
Arctic fox	*Alopex lagopus*	Qusrhaaq/tiġiganniaq/ qułhaaq	Common
Caribou	*Rangifer tarandus*	Tuttu	Abundant
Gray wolf	*Canis lupus*	Amaġuq	Rare or accidental
Grizzly (brown) bear	*Ursus arctos*	Akłaq	Uncommon
Lynx	*Lynx canadensis*	Niutuuyiq/niutuiyiq/ nuutuuyiq	Rare or accidental
Moose	*Alces alces*	Tiniikaq/tuttuvak/ titiniika	Uncommon
Muskox	*Ovibos moschatus*	Umiŋmak/imummak	Uncommon
Red fox	*Vulpes vulpes*	Kavviaq/kayuqtuq	Uncommon
Wolverine	*Gulo gulo*	Qavvik/qapvik	Uncommon
Small Mammals			
Arctic ground squirrel	*Spermophilus parryii*	Siksrik	Abundant
Barrenground shrew	*Sorex ugyunak*	Ugrugnaq	Common
Brown lemming	*Lemmus trimucronatus*	Aviŋŋaq	Uncommon
Collared lemming	*Dicrostonyx groenlandicus*	Qiḷaŋmiutauraq	Common
Ermine (short-tailed weasel)	*Mustela erminea*	Itiġiaq/tiġiaq	Common
Least weasel	*Mustela nivalis*	Naulayuq	Uncommon
Northern red-backed vole	*Clethrionomys rutilus*	Aviññaq	Rare or accidental
Singing vole	*Microtus miurus*	—	Common
Snowshoe hare	*Lepus americanus*	Ukalliuraq/ukalliq	Rare or accidental
Tundra shrew	*Sorex tundrensis*	Ugruŋnaq	Uncommon
Tundra vole	*Microtus oeconomus*	Aviññaq	Uncommon
Other Mammals			
Coyote	*Canis latrans*	Amaġuuraq	Rare or accidental
Mink	*Mustela vison*	Tiġiaqpak	Rare or accidental
Porcupine	*Erethizon dorsatum*	Iḷuqutaq/qiŋaġluk	Rare or accidental
River otter	*Lontra canadensis*	Pamiuqtuuq	Rare or accidental

[1] Abundant – species is present in great numbers in an area; Common – species is very likely to be seen in a given area but in fewer numbers than an abundant species; and Uncommon – a species that is regularly present but it seen infrequently. Species designated as rare or accidental are at the limit of their range.

Source: This table was modified from Phillips Alaska, Inc. (2001).

There are four caribou herds in Arctic Alaska: the Teshekpuk Lake Herd (Map 3-21), the Central Arctic Herd (CAH; Map 3-22), the Western Arctic Herd (WAH; Map 3-23), and the Porcupine Caribou Herd. Caribou of the TLH and CAH have a portion of their ranges in the Planning Area (Maps 3-21 and 3-22). Since the Planning Area is not used by the Porcupine Caribou Herd and is peripheral range for the WAH, these two herds are not discussed further (USDOI BLM and MMS 2003).

Teshekpuk Lake Herd (TLH)

Sources of information on the TLH include White et al. (1975); Davis and Valkenburg (1978, 1979); Silva (1985); Dau (1986); Carroll (1992, 1995, 1997, 1999a, 2001, 2003); Philo et al. (1993c); Brower and Opie (1996, 1997); Whitten (1997); Cronin et al. (1998a); USDOI BLM and MMS (1998, 2003); Noel (1999, 2000); Ballard et al. (2000); Kellyhouse (2001); Pritchard et al. (2001); Jensen and Noel (2002); National Research Council [NRC] (2003); Prichard and Murphy (2004); and Noel and George (In Press).

Population Status and Range. The TLH was recognized as a separate herd from the WAH and CAH in the mid-1970s (Davis and Valkenburg 1978). The primary range of the TLH is the North Slope west of the Colville and Itkillik rivers, with the peripheral range sometimes extending as far south as the Nulato Hills of the Brooks Range and as far east as the Arctic National Wildlife Refuge.

Most of the herd's range is in the northern portion of the National Petroleum Reserve – Alaska (Map 3-21). In one study, the annual range of individual radio-collared caribou varied from 1,388 mi^2 to 80,670 mi^2. Visual estimates of the number of animals in the TLH were recorded in 1978 (3,000 to 4,000 caribou), and 1981-1982 (4,000 caribou; BLM unpublished data). In 1984, the first photocensus of the TLH counted 11,822 caribou. Other photocensus estimates in 1985 (13,406 caribou), 1989 (16,649 caribou), and 1993 (27,686 caribou) documented a steady increase in the TLH. This was followed by a decrease in the herd estimate in 1995 (25,076 caribou). The estimate again increased in 1999 (28,627 caribou) and in 2002 (45,166 caribou). It is most likely that the 1999 photocensus resulted in an underestimate, and the herd has gradually increased since the mid 1990's (Carroll, pers. comm.).

Migration. Most TLH caribou begin migrating from winter ranges across northwestern Alaska to the Teshekpuk Lake area during May. By early June, most of the cows move into calving areas around the lake. After calving, most TLH caribou move north of Teshekpuk Lake, with most parturient cows traveling through the narrow migration corridor between the lake and the Kogru River. Most of the herd uses the area along the coast for insect relief. After the insect-relief period, TLH caribou spread out and can be found across the North Slope coastal plain, primarily within the National Petroleum Reserve – Alaska. Fall movements of the TLH are variable among individual caribou and years. Most TLH caribou winter on the National Petroleum Reserve – Alaska coastal plain, but occasionally some or most of the herd winters in other places such as Anaktuvuk Pass or northwestern Alaska as far south as the Nulato Hills.

Calving Grounds. The calving grounds of the TLH are primarily in the northern portion of the Planning Area near Teshekpuk Lake (Map 3-24). If snowmelt occurs in late spring, more caribou will calve south of the lake than if snowmelt occurs in early spring. Kelleyhouse (2001) reported that the size of the TLH annual calving grounds ranged between 938 mi^2 and 1,861 mi^2.. Recent calving by the TLH has been concentrated southeast and northeast of Teshekpuk Lake (Prichard and Murphy 2004). Carroll (2001) reported that in 2000 calving occurred all around Teshekpuk Lake and that more calves than usual were seen south and west of the lake. Aerial transect data (1999–2001) agree with telemetry data (1990-2004) that during the calving period, caribou use the entire area around Teshekpuk Lake (Carroll, pers. comm.).

The importance of this area to calving caribou is emphasized by observed calving success in abnormal years. The return of pregnant cow caribou to the Teshekpuk Lake area can be delayed in years when the caribou migrate further away during winter, or when snow-pack is deeper than normal and/or spring melt-off is later than normal. When their return to the Teshekpuk Lake area is delayed, more cows than usual drop their calves along the way and this in turn results in lower calving success. During 1996-97 most of the herd migrated much farther south than usual and many cows arrived late to the Teshekpuk Lake area. Only 8 of 21 collared caribou were found in the lake area during calving time and 6 of these calved successfully. Of the other 13 collared cows, only one calved successfully for an overall successful calving percentage of 33 percent. In 2001, heavy snow and a late snow melt-off slowed the migration and only 16 (44 percent) of 36 collared cows calved successfully. Calving success for collared cows that did make it back to the Teshekpuk Lake area in 2001 was much better (88 percent) than ones found outside the area (10 percent).

Summer Distribution and Insect-relief Areas. The Teshekpuk Lake area is important as summer range because of prevailing winds and proximity to the coast, river deltas, and lake edge that provide insect-relief habitat and adjacent forage (Maps 3-25 and 3-26, which show where insect density is greatest). On the ACP, caribou behavior and movements during summer are greatly influenced by harassment from mosquitoes and oestrid flies. During periods with little or no insect activity, summer distribution of caribou may be related to the availability of easily digestible forage.

The TLH summer range is between Barrow and the Colville River. In June and July, caribou are often located around the edges of Teshekpuk Lake and in the area between Teshekpuk Lake and the Beaufort Sea from the Ikpikpuk River to the Kogru River. Many other caribou use habitats as far east as Fish Creek. These areas are used regularly by the TLH for insect relief and foraging. Additionally, small groups of caribou occur at the Pik Dunes (about 18 miles south of Teshekpuk Lake) to avoid insects. Other insect-relief habitats in the summer range include sand dunes and ridges. The relatively narrow land areas on the east and west sides of the Teshekpuk Lake are important travel corridors for caribou moving between habitats north and south of the lake.

Fall and Winter Range Use and Distribution. Some caribou in the TLH are present year-round in the Teshekpuk Lake area. During fall (August-September), many caribou have been observed around the lake and as far east as Fish Creek. Use of this area as winter range may involve from 10 to 100 percent of the herd. During most years, the majority of TLH caribou winter on the coastal plain of the National Petroleum Reserve – Alaska, but portions of the herd may also winter in a variety of other places. In some years, portions of the herd have migrated as far as the Nulato Hills to the south, Point Hope to the west, and the Arctic National Wildlife Refuge to the east.

Harvest. Subsistence harvest of the TLH is year-round, with most occurring between July and October by residents of Anaktuvuk Pass, Atqasuk, Barrow, Kaktovik, Nuiqsut, Point Hope, and Wainwright. It is difficult to determine precise numbers for TLH harvest because not all hunters report their harvest and because most villages harvest caribou from more than one herd. However, by examining village subsistence harvest studies and using radiotelemetry data to determine the percentage of caribou that are in village hunt areas during harvest season, a reasonable estimate can be made of TLH harvest. Approximately 2,500 TLH caribou in 1999-2000, and 2,760 during 2000-2001, were harvested by residents of North Slope villages. Harvest of the TLH by sport hunters is generally low and mostly confined to the Colville River drainage.

Central Arctic Herd (CAH)

Sources of information on the CAH include White et al. (1975); Roby (1978); Cameron and Whitten (1979); Whitten and Cameron (1980); Gavin (1983); Carruthers et al. (1984); Lawhead and Curatolo (1984); Dau (1986); Jakimchuk et al. (1987); Fancy et al. (1989); Pollard et al. (1996a, b); Smith (1996); Noel et al. (1998); USDOI BLM and MMS (1998, 2003); Lenart (1999b, 2003); Lawhead and Johnson (2000); Murphy and Lawhead (2000); Noel and Olson (1999a, b); Olson and Noel (2000); Prichard et al. (2001); Burgess et al. (2002); Lawhead and Prichard (2002); Phillips Alaska, Inc. (2002); Douglas et al. (2002); Lawhead et al. (2003); and NRC (2003).

Population Status and Range. The range of the CAH extends east and west from the Colville River, to the Canning River and north and south from the Beaufort Sea coast to the southern slope of the Brooks Range (Map 3-22). During summer, the CAH may range short distances west of the Colville River in the Planning Area and east of the Canning River in the Arctic National Wildlife Refuge. The calving grounds are between the Colville and Canning rivers within 100 miles of the Beaufort Sea.

The CAH was estimated at approximately 5,000 caribou in 1975 and increased to approximately 23,444 in 1992. The CAH declined to 18,093 in 1995 and then increased again to 19,730 in 1997 and 27,128 in 2000. The most recent photocensus conducted in 2002 documented approximately 32,000 caribou.

Migration. The CAH caribou migrate between winter range in the Brooks Range and summer range on the ACP. In general, pregnant cows arrive on the ACP between early May and early June, calving occurs between the last week of May and the second week of June, and bulls arrive by early July. A gradual southward fall migration generally occurs after the insect-relief season ends in mid-August.

Calving Grounds. The CAH calves between the Colville and Canning rivers to the east of the Planning Area, within 100 miles of the Beaufort Sea, with calving concentrated in areas east and west of the Sagavanirktok River. Calving data in the Colville-Kuparuk region from 1993 to 2002 showed that the greatest calving densities were approximately 12 miles south of the Kuparuk oil field. Lower densities of calving have been reported within and adjacent to the Kuparuk and Milne Point oil fields. Calving has occurred since the oil fields were built in 1980–1981 in these areas, but the proportion of the herd calving in and near the oil fields has decreased since the mid-1980s.

Summer Distribution and Insect-Relief Areas. The summer range of the CAH encompasses the area between the Canning and Colville rivers and between the Brooks Range and Beaufort Sea. When harassed by insects, caribou of the CAH typically use coastal areas, river deltas and bars, and non-vegetated habitats such as gravel roads and pads for relief from insects. During periods of harassment by insects, large groups of caribou have been observed along the Beaufort Sea coastline, near Franklin Bluffs, on oil field roads and gravel pads, and on the deltas of the Canning, Kadleroshilik, Kuparuk, Sagavanirktok, Shaviovik, and Staines rivers. Aerial surveys have documented CAH caribou moving west into the Colville River Delta and the Planning Area. The largest such movement (more than 10,000 caribou) occurred in July 2001.

Winter Range Use and Distribution. Most CAH caribou move south from the summer range to the mountains and foothills of the Brooks Range. Surveys during March 2001 and February 2002 located caribou north and south of the Brooks Range and east and west of the Dalton Highway/Trans-Alaska Pipeline System (TAPS) corridor. As many as several hundred CAH caribou may overwinter on the ACP, some within the Kuparuk oil field. Fall and winter ranges of the CAH, TLH, and WAH may overlap.

Harvest. Local subsistence hunters from Nuiqsut and Kaktovik and non-local hunters harvest between 200 and 900 CAH caribou each year. Non-local subsistence and sport hunters hunt mostly along the Dalton Highway.

Muskox

Muskox occurred throughout northern Alaska, but they were extirpated from the ACP in the mid-1800s (Hone 1934). Muskox were reestablished by translocation to Nunivak Island near the western Alaska coast in 1935 (Spencer and Lensink 1970), to Barter Island and the Kavik River near the Arctic National Wildlife Refuge in 1969 (Jingfors and Klein 1982, USDOI BLM and MMS 2003), and to the west of the Planning Area near Cape Thompson in 1970 and 1977 (Smith 1989). Thereafter, muskox numbers in northeastern Alaska increased and their range expanded to the Colville River on the west and beyond the Babbage River on the east (Reynolds 1998, USDOI BLM and MMS 2003).

An estimated 270 muskox were counted between the Colville River and the ANWR, 91 animals were recorded west of the TAPS near the Colville River (Whitten 1997), and a breeding population has become established in the Itkillik-Colville rivers area (Map 3-27; Johnson et al. 1996). The latter is the closest known breeding population to the Planning Area. A total of about 800 muskox were observed in the 300-mile area between the Itkillik River west of Prudhoe Bay and the Babbage River in northwestern Canada (Reynolds 1998). A transitory number of lone bulls probably frequent the Planning Area, coming from populations that breed east of the Colville River. Currently, there are small numbers of muskox west of the Colville River (Lenart 1999a).

Moose

Moose occur at low densities on the ACP, which is the northern limit of the moose’s range in Alaska. Moose are widely distributed during the summer, ranging from the northern foothills of the Brooks Range to the Arctic Coast (Map 3-27). As snow accumulates during fall, moose move to riparian corridors of large river systems, where they concentrate in winter. The largest winter concentrations of moose occur in the inland portions of the Colville River drainage, with tall shrubs the predominant and preferred browse species (Mould 1979, Carroll 2000b). As snow cover in the foothills decreases in April, moose begin to move away from winter concentration areas, but generally remain in riparian areas.

Grizzly Bear

The ACP is the northern limit of the grizzly bear's range, and is considered marginal habitat because of the severe climate, short growing season, and limited food resources (Shideler and Hechtel 2000). Relatively low densities of grizzly bears (0.2 to 0.8 bears per 1,000 mi^2) use the ACP, with the highest density in the Prudhoe Bay and Kuparuk oil field region (Reynolds 1979, Young and McCabe 1997, Carroll 1998, Shideler and Hechtel 2000, USDOI BLM and MMS 2003). The number of grizzly bears using the Prudhoe Bay and Kuparuk oil fields east of the National Petroleum Reserve – Alaska has increased in recent years—27 bears were captured and marked by ADFG in studies of bear use of the oil fields (Shideler and Hechtel 1995). Foraging bears use the grass meadows on the bluffs along the Colville River during the spring (Swem 1997).

Wolf

Wolf numbers on the ACP and Brooks Range have fluctuated since the 1900s in response to changes in prey populations (caribou and moose), a federal wolf control program in the 1950s, and aerial and snowmachine hunting by the public since the 1960s (Carroll 2000a, Shideler 2000). After bans on aerial wolf hunting in 1970 and land-and-shoot hunts in 1982, the wolf population increased, especially in the mountains and foothills of the Brooks Range. In general, wolves are more abundant in the Brooks Range than on the ACP.

The highest wolf densities in the National Petroleum Reserve – Alaska are along the Colville River. Surveys near Umiat showed that the density of wolves increased from 1 wolf per mi^2 in 1987 to 1.6 wolves per mi^2 in 1994 (Bente 1998). A survey in 1998 estimated 0.6 wolves per mi^2, showing that wolf numbers had declined since 1994 (Bente 1998). This decline may have been related to the decrease in the moose population, which declined by 75 percent between 1992 and 1996 (USDOI BLM and MMS 2003).

The subsistence harvest of wolves is greatest in the southeastern portion of Game Management Unit (GMU) 26A, where residents of Anaktuvuk Pass and Nuiqsut hunt and trap wolves throughout the winter (Carroll 2000a). The annual subsistence harvest throughout GMU 26A has ranged from approximately 50 to 120 wolves.

Wolverine

Wolverines occur throughout the ACP and are considered more common in the mountains and foothills of the Brooks Range (Map 3-27; Bee and Hall 1956; USDOI BLM and MMS 1998, 2003). Magoun (1984) estimated a fall population of 821 wolverines for the western North Slope (GMU 26A), based on a density of 0.5 wolverine per 100 mi^2. From 1991 to 1994, 2 to 14 wolverines were harvested in GMU 26A; however, it is likely that more animals are harvested and not reported (Carroll 2000b). Most harvest of wolverines is by residents of the North Slope.

Arctic Fox

The Arctic fox is the most common furbearer on the ACP in and near the Planning Area and its numbers have probably increased with the decline of pelt harvesting since 1929 (Chesemore 1967). Arctic foxes in the Prudhoe Bay oil field area readily use development sites for feeding, resting, and denning, and their densities are greater in the oil fields than in surrounding undeveloped areas (Eberhardt et al. 1982; Burgess et al. 1993; Burgess 2000). Lemmings and voles are important prey year-round for Arctic foxes. Foxes also forage on carcasses of caribou and marine mammals. Harvest data for the Arctic fox are not available, but low fur prices in the mid-1990s resulted in relatively few foxes being trapped (Carroll 1998).

Other Small Mammals

Other small mammals found in the Planning Area include Arctic ground squirrels, ermine (short-tailed weasel), least weasel, snowshoe hare, two lemming species, three vole species, and two species of shrew (Phillips Alaska, Inc. 2002; USDOI BLM and MMS 2003). Small mammals are important prey for grizzly bears, foxes, wolves, wolverines, and birds of prey. Many small mammals undergo cyclic population fluctuations.

3.3.7.2 Marine Mammals

Marine mammal species that occur regularly in the Beaufort Sea offshore from the Planning Area include the ringed, bearded, and spotted seal (*largha*), polar bear, and beluga (*belukha*) whale. Other species occurring in smaller numbers include the gray whale, harbor porpoise, killer whale, narwhal, hooded and ribbon seals, and walrus. Bowhead whales are listed as endangered under the ESA, and are considered in Section 3.3.8 (Threatened and Endangered Species). All marine mammals in U.S. waters are protected under the MMPA of 1972. In the Act, it was the declared intent of Congress that marine mammals "be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management, and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem."

Table 3-11 lists the marine mammal species of the Beaufort Sea, including their status under the MMPA and the ESA. Ringed seals, bearded seals, and polar bears are present year-round and move extensively throughout the Beaufort Sea region. Beluga whales are normally present from April to October, and spotted seals are present from July through mid-October. Bearded seals, ringed seals, and polar bears are important subsistence species for hunters from Barrow, Nuiqsut, and Kaktovik. Iñupiat hunters take beluga whales sporadically when they are available.

Table 3-11. Marine Mammal Species of the Beaufort Sea Including Common, Scientific, and Inupiq Name, Abundance and Residency Classification, and Status Under the Marine Mammal Protection Act and Endangered Species Act.

Common Name	Scientific Name	Iñupiaq Name	Abundance [1]	Seasonal Residency	Status Under MMPA [2]	Status Under ESA [2]
Bearded seal	*Erignathus barbatus*	Ugruk	Common	Year-round	Protected	Not listed
Beluga whale	*Delphinapterus leucas*	Sisuaq/ kilalugak	Abundant	Seasonal	Protected	Not listed
Bowhead whale	*Balaena mysticetus*	Aġviq	Abundant	Seasonal	Depleted	Endangered
Polar bear	*Ursus maritimus*	Nanuq	Abundant	Year-round	Protected	Not listed
Ringed seal	*Phoca hispida*	Qaiġulik/ qauġutlik	Abundant	Year-round	Protected	Not listed
Spotted seal	*Phoca largha*	Qasigiaq	Common	Seasonal	Protected	Not listed

[1] Modified from TAPS (2001).
[2] Endangered species are classified automatically as depleted; all depleted stocks are strategic stocks.

Ringed Seal

Ringed seals are the smallest and most abundant of the Arctic ice seals (Smith and Hammill 1981, Kingsley 1986). Ringed seals have a circumpolar distribution, occurring in all areas of the Arctic Ocean, and range from approximately 35° North latitude to the North Pole (Kingsley 1986). The Alaska stock of ringed seals occurs in the Bering, Chukchi, and Beaufort seas (Map 3-28). The size of the Alaska population is not currently known (Anglis and Lodge 2002), but estimates range from 1 million to 3.5 million individuals (Frost et al. 1988). The Beaufort Sea population may range from 40,000 in the winter to 80,000 in the summer (Frost and Lowry 1981). Although ringed seals do not occur in large herds, loose aggregations of tens or hundreds of animals do occur, probably in association with abundant prey.

Densities of ringed seals near Prudhoe Bay between 1997 and 2002 ranged from 0.15 to 0.28 seals per mi^2 (Moulton et al. 2003). These are lower than densities calculated in the same area during the 1980s. The differences may be due, in part, to differences in the timing of surveys, the timing of lair abandonment, or a decrease in the abundance of seals since the 1980s (Kelly et al. 2002a, b).

Ringed seals are an important subsistence resource for the Iñupiat of Alaska's North Slope. The number of seals harvested by Alaskan Iñupiat was between 7,000 and 15,000 animals per year from 1962 to 1972, but declined to 3,000 in the 1980s (Kelly 1988a). There is currently no reliable estimate of the total number of ringed seals harvested by Alaska Natives for subsistence use.

Bearded Seal

Bearded seals are present throughout the year in the Beaufort Sea (Map 3-29). They are considered common, but not abundant, during late spring through early autumn, and less common during the months of heavy ice cover. No reliable estimate of the abundance of bearded seals in the Beaufort Sea is currently available (Angliss and Lodge 2002). Their densities in the western Beaufort Sea are highest during the summer and lowest during the winter. The population in Alaska waters is largely migratory, with its center of abundance in the Bering Sea. Their most important habitat during winter and spring is active ice or offshore leads.

Bearded seals are an important subsistence resource for Alaska Natives. The Iñupiat of the North Slope use bearded seal skins to cover their *umiat*, skin boats used for spring whaling. There are currently no reliable estimates of the subsistence harvest, but from 1966 through 1977 Alaska Native hunters harvested an average of 1,784 bearded seals per year (Burns 1981).

Spotted (Largha) Seal

Spotted seals are medium-sized phocids that range along the continental shelf from the central Beaufort Sea through the Chukchi, Bering, and Okhotsk seas to the Sea of Japan. The Alaska stock of spotted seals occurs from the Bering Sea to the Beaufort Sea in the Arctic Ocean. There is currently no reliable estimate of the numbers of spotted seals in Alaska (Rugh et al. 1995; Angliss and Lodge 2002).

Spotted seals are not common in the Beaufort Sea and are present only during the ice-free summer season. Recently, spotted seals also have used Smith Bay at the mouth of the Piasuk River, just west of the Planning Area.

Spotted seals are an important subsistence resource for Alaska Natives, particularly in the Yukon-Kuskokwim (Y-K) and Bering Strait regions, although they are less important to the Iñupiat on the North Slope.

Polar Bear

During the open-water season, polar bears are usually associated with the pack ice, although they may be seen on land or swimming in open water at considerable distances from the ice. During the fall open water period, polar bears commonly swim ashore and scavenge beached carcasses or the remains of bowhead whales taken by subsistence hunters (Klaxdorff and Proffitt 2003). The Beaufort Sea coastline, as well as river drainages and bluffs along lakes throughout National Petroleum Reserve – Alaska, provide important areas used by polar bears for resting, feeding, denning, and seasonal movements. In the last decade, the numbers of polar bears occurring along coastal areas of the Beaufort Sea have been increasing (Stirling and Andriashek 1992, Amstrup and Gardner 1994, Amstrup 2000). The reason for the increase in numbers of polar bears is unknown, but may be related to ice conditions. The USFWS (Schliebe et a1. In Prep) recently compared the distance of the ice edge from shore (during fall months) with the numbers of polar bears observed on land. A significant correlation was found to exist: as distance to the ice edge increased, so did the numbers of bears observed on land. The potential for continued reduction in ice cover from global climate change could result in greater numbers of polar bears occurring along the coastline for protracted periods of time, thereby also increasing potential conflicts with human activity.

Polar bear maternal dens are less common along the ACP of the Planning Area than along the coastal plain of the ANWR (Amstrup and Gardner 1994). Of 35 dens on the ACP of northern Alaska in 2001, all were found along bluffs or along river/creek drainages within 15 miles of the coast (Durner et al. 2003). Polar bear dens have also been found along riverbanks in northeast Alaska and on shorefast ice close to islands east of the Colville River. In the Planning Area, polar bears are known to have denned at or near Cape Simpson, Smith Bay, Lonely, Pogik Bay, Cape Halkett, Eskimo Islands, Atigaru Point, and the Colville River Delta. Recorded den locations are indicated on Map 3-30.

Polar bears prey primarily on ringed seals and bearded seals; they also take walruses and beluga opportunistically (Amstrup and DeMaster 1988). Polar bears also come to shore to scavenge on marine mammal carcasses during the fall open-water period. In fall during recent years, large numbers of polar bears have been concentrated near the villages of Barrow and Kaktovik, and near the Nuiqsut whaling camps on Cross Island.

Historically, polar bears were hunted for subsistence as well as by sport hunters. Between 1960 and 1972, an average of 260 polar bears were harvested annually from the Beaufort Sea, including both subsistence and sport hunters (Amstrup et al. 1986; Schliebe et al. 1995). In 1972, sport hunting in Alaska ended and the subsistence harvest in the Beaufort Sea averaged 111 bears annually between 1980 and 1996 (Schliebe et al. 1995). Between 1995 and 2000, the average annual harvest from the Beaufort Sea stock was 32 bears (Angliss and Lodge 2002).

Beluga (Belukha) Whale

The beluga, or belukha whale, a subarctic and Arctic species, is a summer visitor throughout offshore habitats of the Alaskan Beaufort Sea (Map 3-31). Beluga whales from two stocks, the Beaufort Sea and the eastern Chukchi Sea, may be found in North Slope waters during the summer (Angliss and Lodge 2002). Starting in early spring, beluga whales of the Beaufort Sea stock migrate north from wintering areas in the Bering Sea and are usually seen at Point Barrow by mid-April. Belugas often travel near bowhead whales. Once in the Beaufort Sea, most belugas travel through offshore leads to the eastern Beaufort Sea and Amundsen Gulf, where they spend part or all of the summer (Burns et al. 2001). The Beaufort Sea stock of beluga whales is estimated to include more than 39,000 animals, based on data from an aerial survey conducted in 2002 (Angliss and Lodge 2002).

Iñupiat hunters take belugas from the Beaufort Sea stock in low numbers. The Alaska Beluga Whale Committee reports that between 1993 and 1997, Iñupiat hunters took an average of 61 belugas (Frost and Suydam 1995, Frost 1998).

There are limited records of coastal sightings of beluga whales near the Colville River Delta. Helmericks (*in* Hazard 1988) reported that belugas were common near shorefast ice in the Colville River Delta region until ice moved offshore in July. Seaman et al. (1981) reported sightings of a few groups (ranging up to 100 belugas) during fall migration north and east of the Colville River Delta near Jones, Pingok, and Thetis islands. Recently, Nuiqsut hunters have reported that belugas have been seen in the Nigliq Channel in the Colville River and were seen stranded in shallow water in the Fish Creek Delta (Lampe 2003).

3.3.8 Threatened and Endangered Species

The bowhead whale (endangered), and spectacled and Steller's eiders (threatened) are federally listed under the ESA. No other birds, or marine or terrestrial mammals in the Planning Area are listed under the federal or State of Alaska endangered species acts (USDOI BLM and MMS 1998, 2003; TAPS Owners 2001; Phillips Alaska, Inc. 2002). The only terrestrial mammal species on the Proposed BLM Sensitive Species list that may occur in the Planning Area is the Canada lynx (see Appendix G). Lynx occur at very low densities in the mountains and foothills of the Brooks Range and are generally not found on the ACP, including in the Planning Area (Carroll 1998); therefore, they are not discussed further.

3.3.8.1 Bowhead Whale

The bowhead whale is classified as endangered under the ESA and as depleted under the MMPA. The bowhead whale was listed as endangered in 1970, but no critical habitat has been designated for this species. Shelden et al. (2001) suggested that the Bering Sea population of bowhead whales should be delisted under the ESA.

The Bering-Chukchi-Beaufort Seas (BCBS) stock of bowhead whales is the largest of the five stocks that occur in the Arctic and subarctic (Map 3-32). The size of the stock was estimated at 10,400 to 23,000 animals in 1848, before commercial whaling decreased the stock to between 1,000 and 3,000 animals by 1914 (Woodby and Botkin 1993). This stock has slowly increased since 1921 when commercial whaling ended, and now numbers approximately 10,470 whales (George et al. 2004). The population increased at an annual rate of 3.3 percent from 1978 to 2001.

Bowhead whales occur in seasonally ice-covered seas, generally remaining close to the pack-ice edge. Throughout the winter, bowhead whales frequent the marginal ice zone and polynyas in the western and central Bering Sea (Braham et al. 1984). Moore (2000) concluded that bowhead whales select shallow inner-shelf waters with moderate to light ice conditions, and deeper slope habitat in heavy ice conditions. During the summer, bowhead whales select continental slope waters and moderate ice conditions (Moore et al. 2000). The BCBS stock of bowhead whales are distributed in summer in a broad area from Amundsen Gulf and the Eastern Beaufort Sea to the eastern part of the East Siberian Sea.

Migration

Bowhead whales migrate through the Beaufort Sea offshore of the Planning Area while traveling between wintering areas in the Bering Sea and summer feeding grounds in the Canadian Beaufort Sea. The spring migration typically begins in late March to early April, depending on ice conditions. During the spring migration, bowhead whales follow predictable leads that form along the coast of western Alaska to Point Barrow. From Point Barrow eastward to Amundsen Gulf, the leads and the migration occur farther from shore. From April to June, most bowhead whales are distributed along a migration corridor that extends from their Bering Sea wintering grounds to their feeding grounds in the eastern Beaufort Sea (Moore and Reeves 1993). Some bowhead whales may migrate westward to feeding grounds in the western Chukchi Sea (Bogoslovskaya et al. 1982, Mel'nikov et al. 1997). Bowhead whales arrive on their summer feeding grounds near Banks Island from mid-May through June and remain in the Canadian Beaufort Sea and Amundsen Gulf until late August or early September. Some whales may occur regularly in the Chukchi Sea along the northwestern Alaskan coast in late summer, but it is unclear whether these are "early autumn" migrants or whales that have summered nearby.

During the spring migration, BCBS bowhead whales migrate in pulses composed of aggregations of individuals (Ljungblad et al. 1986). Iñupiat traditional knowledge (summarized in Braham et al. 1980) holds that the pulses are segregated by age and sex; the first two pulses are generally adults without calves or subadults, while cows with calves and large males do not arrive until the third and final pulse. The first migrants are usually seen near Point Barrow in mid-April, but may arrive later in heavy ice years (Krogman et al. 1989). After passing Point Barrow, most of the bowheads travel east through offshore leads in the continuous pack ice to feeding grounds in the eastern Beaufort Sea (Richardson and Thomson 2002).

Bowhead whales that have summered in the eastern Beaufort Sea begin the fall migration in late August to September and are usually out of the Beaufort Sea by late October (Treacy 1988-1997, 2000, 2002a, b; Moore and Reeves 1993). The fall migration route extends from the eastern Beaufort Sea, along the continental shelf across the Chukchi Sea, and down the coast of the Chukchi Peninsula (Moore and Reeves 1993). Bowhead whales often feed opportunistically during the westward migration, sometimes close to shore (Richardson and Thomson 2002, Treacy 2002b).

The extent of ice cover may influence the route, timing, or duration of the fall migration. Miller et al. (1996) observed that whales moving from 147° to 150° West longitude in the central Beaufort Sea, migrated closer to shore in light and moderate ice years (median distance offshore 18 to 25 miles), and farther offshore in heavy ice years (median distance offshore 35 to 45 miles).

Foraging

Bowhead whales apparently feed throughout the water column, including bottom or near-bottom, mid-column, and surface feeding (Würsig et al. 1985). Carbon-isotope analysis of bowhead whale baleen indicates that bowhead whales obtain a significant proportion of their food in wintering areas (Schell et al. 1987; Schell and Saupe 1993). Bowhead whales may feed opportunistically where food is available as they migrate through the Alaskan Beaufort Sea. Examination of stomach contents from whales taken in the Iñupiat subsistence harvest indicates that bowhead whales feed on a variety of invertebrates and small fishes (Lowry 1993).

Survival and Mortality

Commercial and subsistence whaling have been the greatest causes of bowhead whale mortality for the last several centuries. Currently, Alaskan Iñupiat are allowed 67 strikes per year, which, if all were fatal, would result in 0.6 percent mortality of the stock from subsistence activity. The International Whaling Commission considers any strike to be fatal and counts the strike against the quota issued to Iñupiat whalers. The Iñupiat preferentially hunt immature whales (Philo et al. 1993b). Natural annual mortality in bowhead whales has been estimated at 3 to 7 percent (Breiwick et al. 1984; Chapman 1984), although it is difficult to estimate natural mortality since few bowhead whales that die of natural causes are seen. Bowhead whales have no known predators except subsistence whalers, and perhaps killer whales. Attacks by killer whales have occurred, but the frequency is probably low. Likewise, the scarcity of observations of vessel-inflicted injuries suggests that the incidence of ship collisions with bowhead whales is also quite low (George et al. 1994). Some whales likely die as a result of entrapment in ice, but the number is thought to be relatively small (Philo et al. 1993b). Little is known about mortality from microbial or viral disease agents.

Planning Area

Bowhead whales traverse the National Petroleum Reserve – Alaska coast during the fall migration, although they generally travel several miles offshore. During annual aerial surveys conducted in the Beaufort Sea from 1987 to 2001, a few bowhead whale sightings were made in the western Beaufort Sea within about 7 miles of shore, and several whales were seen between Dease Inlet and Smith Bay near the shoreline (Treacy 1988, 1997, 2000, 2002a, b). Occasional groups are seen feeding or milling near the mouth of Dease Inlet (Treacy 2002b), and in 1992, large groups were seen in this area (Treacy 1993). During the spring migration, the nearshore waters are completely ice covered and the migration occurs far from shore. The residents of Nuiqsut harvest bowhead whales from Cross Island, east of the National Petroleum Reserve – Alaska in the fall.

3.3.8.2 Spectacled Eider

Population Status

The spectacled eider is a medium-sized sea duck that breeds along coastal areas of western and northern Alaska and eastern Russia, and winters in the Bering Sea (Petersen et al. 2000). Three breeding populations have been described: one in the Y-K Delta in western Alaska, a second on the North Slope of Alaska, and the third in Arctic Russia. During the 1970s, approximately 50,000 female spectacled eiders nested in western Alaska. Data collected by the USFWS in the Y-K Delta suggested that the number of female spectacled eiders nesting in the Y-K Delta declined by approximately 8 to 14 percent per year from the 1970s to 1992 (Stehn et al. 1993; Ely et al. 1994). By 1992, the Y-K Delta spectacled eider population was reduced to approximately 4 percent of the population that existed there in the 1970s, and it was federally-listed as a threatened species in 1993.

Little information is available describing the status of the North Slope spectacled eider population prior to 1992. Historically, the North Slope population has likely been much smaller than Y-K Delta population. The USFWS began conducting aerial surveys for breeding eiders in 1992, which have continued annually through the 2004 breeding season (Larned et al. 2003). The 1992 survey was flown too late in the season to be included in analyses with subsequent years, but since 1993 the North Slope spectacled eider population has remained relatively stable (TERA 1997). From 1992 to 2002, the population ranged from approximately 5,000 to 9,000 birds (Larned et al. 2003).

Spring Migration

Spring migration routes of spectacled eiders are not well documented. Most of the data are from counts of eiders as they pass Point Barrow in late May and early June. During spring migration, thousands of king and common eiders follow offshore leads and small numbers of spectacled eiders have been recorded during spring counts (Woodby and Divoky 1982; Suydam et al. 1997, 2000). Johnson and Richardson (1981) also reported small numbers of spectacled eiders offshore during spring migration waterbird counts east of the Colville River at Simpson Lagoon, although some of these birds may have been local breeders rather than migrants. Few researchers have conducted inland counts of migrating birds on the ACP, but Myers (1958) reported that spectacled eider was the most abundant eider species migrating along river systems south of Barrow in spring. Since only small numbers of spectacled eiders have been recorded migrating along the coast during spring, it may be that most birds migrate overland across the ACP following river drainages (TERA 1999).

Nesting

Spectacled eiders arrive on the North Slope in late May or early June. They occur in low densities of approximately 0.1 birds per mi^2 across the North Slope from Wainwright to the Prudhoe Bay area (Larned et al. 2003). The highest concentrations occur within approximately 40 miles of the coast in the Northwest National Petroleum Reserve – Alaska between Barrow and Wainwright, and in the Planning Area northeast of Teshekpuk Lake (Map 3-33; USDOI BLM and MMS 1998, USDOI BLM 2002, Larned et al. 2003). Burgess et al. (2003b) reported spectacled eider densities of 0.05 to 0.10 birds per mi^2 during 2 years of surveys on plots in the eastern portion of the Planning Area. Some evidence suggests that spectacled eider density in the Fish Creek Delta may be greater than other portions of the central Planning Area.

In general, on the ACP spectacled eiders breed near large shallow productive thaw lakes, often with convoluted shorelines and/or small islands (Larned and Balogh 1997; Anderson et al. 1999), and nest sites are often located within 3 feet of a lake shore (Johnson et al. 1996). Based on a small sample size of band returns, there is some evidence that spectacled eider males as well as females may exhibit both breeding site and mate fidelity (TERA 1997). In most cases, brood-rearing apparently does not occur in ponds adjacent to nest sites even if suitable habitat is present (TERA 1995), indicating that not only is the nest site location important, but spectacled eider may also require a much larger area in the general vicinity of the nest site for brood-rearing. Spectacled eiders broods sometimes develop crèches where multiple hens and broods may coalesce (Derksen et al. 1981; Ehrlich et al. 1988). Juvenile birds in the Y-K Delta depart the breeding grounds approximately 59 days after hatch (Flint et al. 2000a).

Post-nesting Period

Most males depart the breeding grounds in mid-June after the onset of incubation, moving to coastal bays and lagoons to molt and stage for fall migration. Important molting and staging areas include Harrison Bay and Simpson Lagoon, Smith Bay, Peard Bay, Kasegaluk Lagoon, Ledyard Bay, and eastern Norton Sound (LGL 1992; Larned et al. 1995; Springer and Pirtle 1997; Petersen et al. 1999; TERA 1999; Troy 2003).

Winter

The spectacled eider winters in the Bering Sea south of St. Lawrence Island (Map 3-34; Petersen et al. 1999). Based on counts and aerial photography, spectacled eiders number around 360,000 to 375,000 (Larned and Tiplady 1999). The birds congregate here to forage for invertebrates at depths of 150 to 230 feet in areas of open leads. Petersen et al. (1998) reported that spectacled eiders fed on snails, clams, barnacles, amphipods, and crabs.

Critical Habitat

For the spectacled eider, critical habitat has been designated in molting areas in Norton Sound and Ledyard Bay, breeding areas in central and southern Y-K Delta, and wintering area in waters south of St. Lawrence Island. A total of 38,991 mi^2 is designated as critical habitat for spectacled eiders. There is no designated critical habitat for spectacled eiders on lands administered by the BLM in the National Petroleum Reserve – Alaska.

3.3.8.3 Steller's Eider

Three breeding populations of Steller's eiders are recognized, two in Arctic Russia and one in Alaska. The Alaska breeding populations nest primarily on the ACP, although a very small sub-population remains on the Y-K Delta (Map 3-34). Flint and Herzog (1999) reported single Steller's eiders nests in the Y-K Delta in 1994, 1996, and 1997, and three nests in 1998. Steller's eider density on the ACP is low. Steller's eiders spend most of the year in shallow marine habitats along the Alaska Peninsula and the eastern Aleutian Islands to lower Cook Inlet, with stragglers south to British Columbia. The largest numbers of molting and wintering Steller's eiders concentrate in four areas on the north side of the Alaska Peninsula: Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands. Steller's eider was federally-listed as a threatened species in 1997 due to a reduction in the number of breeding birds and suspected reduction in the breeding range in Alaska.

The range of Steller's eider on the ACP apparently once extended from Wainwright east into the Canada's Northwest Territories (Johnson and Herter 1989; Quakenbush et al. 2002). The species is currently reported east at least to Prudhoe Bay (TERA 1997), but no recent records have been reported east of the Sagavanirktok River (Quakenbush et al. 2002). Steller's eider has not been recorded nesting east of Cape Halkett, other than one recent record inland near the Colville River (Quakenbush et al. 2002). Aerial surveys conducted by USFWS indicate that Steller's eiders are widely distributed across the ACP in low densities (0.001birds per mi^2 in 2003) from Point Lay to the Sagavanirktok River with very few sightings east of the Colville River (Larned et al. 2003). The highest concentrations occur near Barrow, although breeding there does not occur every year and may be related to predator/prey cycles (Quakenbush et al. 1995, 2002; Quakenbush and Suydam 1999; Ritchie and King 2002, 2003). During the 1990s, Steller's eider breeding at Barrow coincided with highs in the lemming population.

Based on aerial breeding pair surveys, Mallek et al. (2003) reported that the ACP Steller's eider population averaged around 1,000 birds from 1986 to 2001. Eider breeding population surveys conducted earlier in the year indicated a lower population, averaging around 170 birds from 1992 to 2003 (Larned et al. 2003). Differences in the two averages are likely related to survey timing. Based on comparisons of historical and recent data, Quakenbush et al. (2002) suggested that a reduction in both occurrence and breeding frequency of Steller's eiders had occurred on the ACP, with the exception of the Barrow area. Larned (2003) also reported a declining trend during annual spring surveys for Steller's eiders in the Bristol Bay area, although some of the variation may have been due to inter-annual variability in the timing of the eider migration that may have precluded portions of the population from being counted during some years.

Steller's eiders nests are located on tundra habitats often associated with polygonal ground both near the coast and at inland locations. Emergent sedge and pendent grass provide important areas for feeding and cover. Nest predators include jaegers, common ravens, glaucous gulls, and Arctic foxes. Avian predators, including snowy owls, and peregrine and gyrfalcons, have been the predominant natural cause of adult Steller's eider mortality. Steller's eider broods apparently are less mobile than those of spectacled eiders and remain in ponds with emergent sedge and pendent grass within about 500 feet of the nest site.

Causes for the decline of the Steller's eider population in Alaska may include increased predation pressure on the North Slope and Y-K Delta breeding grounds, subsistence harvest, ingestion of lead shot, and contaminants (Henry et al. 1995). Bustnes and Systad (2001) also suggested that Steller's eiders may have specialized feeding behavior that may limit the availability of winter foraging habitat. Steller's eiders could be affected by global climate regime shifts that cause changes in prey communities.

Critical Habitat

For the Steller's eider, critical habitat has been designated in breeding areas on the Y-K Delta, staging area in the Kuskokwim Shoals, and molting areas in waters associated with the Seal Islands, Nelson Lagoon, and Izembek Lagoon in Southwestern Alaska. A total of 2,830 mi^2 is designated as critical habitat for Steller's eiders. There is no designated critical habitat for Steller's eiders on lands administered by the BLM in the National Petroleum Reserve – Alaska.

3.4 Social Systems

3.4.1 Cultural Resources

This section discusses the cultural resources and history of habitation of the Planning Area. Cultural resources include sites and materials of prehistoric Native American, historic European and Euro-American, and historic Iñupiat origin (e.g., traditional cabin sites, campsites, and burial grounds).

This section relies on the following sources: Alaska Heritage Resource Survey (AHRS) files located at the Alaska Department of Natural Resources Office of History and Archaeology (ADNR OHA 2003); the NSB's Traditional Land Use Inventory (TLUI; NSB 2003a); a review of literature pertaining to cultural resources in the Planning Area; and the 1998 Northeast IAP/EIS, Northwest IAP/EIS, and the *Alpine Satellite Development Plan Final EIS* (USDOI BLM and MMS 1998 [III-C-4], 2003 [III.C.2]; USDOI BLM 2004c [3.4.5]).

3.4.1.1 Overview of Regional Prehistory (Approximately 12,000 years ago to A.D. 1827)

Researchers and explorers were documenting the human inhabitants and the cultural chronology of the North Slope before the turn of the 20th century. Since 1979, researchers have conducted intensive, but generally project specific, archaeological investigations along the ACP and Beaufort Sea coastline (Brown 1979; Hsu et al. 1979; Davis et al. 1981; Ito-Adler and Hall 1986; Hall and Gal 1988; Hoffman et al. 1988; Impact Assessment Inc. [IAI] 1990a, b; Reanier 1997, 2000, 2002, 2003; Sheehan 1997; Lobdell and Lobdell 1999, 2000). As noted by researchers, interior portions of the ACP are relatively stable; however, an average of 10 feet per year of the Beaufort Sea coastline has been subject to rapid change due to erosion (Lobdell and Lobdell 2000). Landforms such as pingos; bluff overlooks generally located on south-facing bluffs over narrow valleys or canyons adjacent to major river systems; riverine and stream localities with pronounced banks; terraces and lakeshores of especially large lakes (e.g., Teshekpuk Lake); lakes with well-developed basin ridges; and wet or moist meadow tundra where other features may encourage human habitation, have yielded evidence of prehistoric and historic occupation.

The last major glacial period of the Pleistocene, called the Itkillik II phase in Alaska, began approximately 25,000 years ago and lasted for nearly 13,000 years. During this time period, world-wide sea levels were as much as 300 feet lower than today, creating a dry-land connection between the Asian and North American continents, thus allowing the intercontinental passage of human and animal populations. Approximately 12,500 years ago, a warming period brought increased moisture, vegetation, and dune stabilization to this region. This warm period was interrupted approximately 11,000 years ago by a return to ice-age conditions. By approximately 10,000 years ago, the climate began to return to a warm, moist climate regime. Many of the large mammals (e.g., horse, bison, lion) became extinct while others survived into modern times (e.g., musk ox). While mammoths were once thought to have died out also around 12,000 years ago, discoveries in 2003 on the Pribilof Islands (which were once ancient mountains on the Beringian Plain) show that the mammoth survived there for a few thousand years before becoming extinct. It is now believed that dwarf wooly mammoths died out approximately 4,000 years ago, while bison died out approximately 8,800 years ago (MacPhee et al. 2002). In addition, at this time sea and lake levels rose, and the land bridge was inundated by rising waters, closing direct terrestrial routes to Alaska from Siberia.

The physical remains of at least 12,000 years of human occupation may exist at sites in northern Alaska, and it may be the only place where the culture history of the Western Hemisphere can be traced from its origins to the present. Documented human prehistory on the north coast of Alaska is represented at isolated localities along the Beaufort Sea coast from Point Barrow to the Canadian border near Demarcation Point. Several of the most important discoveries in northern archaeology have occurred near the Planning Area, including the nearly 12,000 year-old Mesa site and the approximately 500 year-old *Utqiagvik* site. Table 3-12 depicts a provisional cultural sequence for northern Alaska.

3.4.1.2 Paleoindian/Paleo-Arctic (Approximately. 12,000 B.P. to 7,000 B.P.)

The Paleoindian Tradition is defined as populations belonging to the earliest migrations into the North American Arctic, who developed a stone tool technology specific to procuring the large mammals of the region such as bison, muskox, and caribou. This stone tool industry was based on bifacial technology (e.g., lanceolate projectile points and knives), as well as distinctive unifacial tools (e.g., spurred scrapers and gravers made on flakes rather than blades). Paleoindian sites on the North Slope include the Putu/Bedwell site, the Mesa site, and the Hilltop site. The Putu/Bedwell site, located on the north slope of the Brooks Range, contains the first Paleoindian-related artifacts to be discovered in Alaska, as well as Paleo-Arctic artifacts (Reanier 1996). Early occupation of Putu/Bedwell site may have occurred 9,000 to 10,000 years ago. Close parallels can be seen in the artifact types found at the Putu/Bedwell and Mesa sites. The Mesa site was a hunting lookout used by ice-age hunters. The site is located 200 miles to the west and south of the Putu/Bedwell site and 60 miles southeast of the Planning Area. Mesa artifacts range from 9,700 to 11,700 years ago (Kunz and Reanier 1996). The Hilltop site, which dates to 10,400 yeas ago, is located above the Atigun River and contains Paleoindian artifacts similar to those found at the Mesa site (Reanier 1995).

Table 3-12. Provisional Cultural Sequence for Northern Alaska.

Tradition	Date	Finds	Representative Sites
Historic Iñupiat	A.D. 1826	Stone, metal, trade goods, organic artifacts plus historic, ethnographic and informant accounts	Historic Coastal and Riverine Iñupiat (see Appendix I for historic sites in the Planning Area)
Late Prehistoric (Birnirk, Thule)	2,000 B.P.-A.D. 1826	Lithic, wood, leather, bone artifacts, house ruins	Pingok Island, Thetis Island, Niglik, Birnirk, Walakpa, Point Hope, Cape Krusenstern, Nunagiak, Utqiaġvik, Nuwuk
Arctic Small Tool (Denbigh, Choris, Norton, Ipiutak)	4,500-1,200 B.P.	Diminutive lithic microtools, cores, burins, blades	Putuligayuk River, Central Creek Pingo, Onion Portage, Mosquito Lake, Choris, Walakpa, Iyatayet, Point Hope, Coffin, Jack's Last Pingo, HAR-047, TES-008, TES-009, TES-012
Northern Archaic	6,000-3,000 B.P.	Side-notched points, microblades, bone tools	Putuligayuk River, Kuparuk Pingo, Kurupa Lake, Tuktu
Paleo-Arctic	10,000-7,000 B.P.	Cores and blades, microcores, microtools, bifaces	Putuligayuk River, Jones Pingo, Gallagher Flint Station, Lisburne, Tunalik
Paleoindian	12,000-9,800 B.P.	Extinct fauna, large lanceolate points, bifaces	Mesa, Bedwell, Putu, Hilltop

B.P. = Before Present.
Sources: Lobdell and Lobdell (2000), Reanier (2002), and ADNR OHA (2003).

The Paleo-Arctic Tradition is generally defined as a stone tool industry that utilized a core and blade technology that produced unifacial tools such as burins, scrapers, and drills on blades. The latter is a common trait among late Pleistocene Siberian cultures (see Dikov 1977, 1979, 1996, 1997). Evidence of the Paleo-Arctic Tradition is found scattered across the North Slope (Anderson 1970, Bowers 1982, Gal 1982). Paleo-Arctic sites on the North Slope include the Gallagher Flint Station near Galbraith Lake (Dixon 1975) and the Lisburne Site approximately 5 miles north of the Mesa Site (Bowers 1982). The earliest locality at Gallagher Flint Station was dated to approximately 10,500 years ago, but may be as young as 7,000 years old (Ferguson 1997). The Paleo-Arctic locality at the Lisburne site has been dated to approximately 3,500 yeas ago (Bowers 1999). Additional undated Paleo-Arctic sites are located on the North Slope and include the Tunalik site, KIR-124 at Kurupa Lake, and the Putuligayuk River Delta Overlook site (XBP-007; Gal 1982, Lobdell 1985).

3.4.1.3 Northern Archaic (Approximately 6,000 B.P. to 3,000 B.P.)

The transitional ice-age cultures were followed by a group referred to as Northern Archaic peoples (Anderson 1968). This cultural group inhabited the National Petroleum Reserve – Alaska from about 8,000 years ago to as recently as 2,000 to 3,000 years ago. Most Northern Archaic artifacts found throughout the Arctic Foothills and the Brooks Range are surface finds (Lobdell and Lobdell 2000). The Northern Archaic peoples primarily hunted large terrestrial mammals, specifically the emerging populations of caribou and moose.

Northern Archaic sites in the vicinity of the project area include the Putuligayuk River Delta Overlook site at Prudhoe Bay, the Kuparuk Pingo site, Kurupa Lake in the foothills of the Brooks Range, and the Tuktu site north of Anaktuvuk Pass (Lobdell 1995, Lobdell and Lobdell 2000, Reanier 2002). Two of the oldest archaeological sites that have been documented near the Planning Area, the Putuligayuk River Delta Overlook site discovered on a pingo frost feature near Prudhoe Bay and the Kuparuk Pingo site, contain artifacts associated with the Northern Archaic culture and date to approximately 6,000 years ago (Lobdell 1985, 1986, 1995).

3.4.1.4 Arctic Small Tool Tradition (Approximately 4,500 B.P. to 1,200 B.P.)

The Arctic Small Tool tradition (ASTt) initially appeared in Alaska approximately 4,800 years ago at Cape Denbigh and Kuzitrin Lake in the central Seward Peninsula (Harritt 1994). The ASTt is generally believed to be the earliest archaeological tradition associated with modern Iñupiat people (Reanier 2002). The ASTt-bearing populations expanded into Canada, Siberia, and Greenland, and there is an unbroken record of their use of the North Slope since their first appearance in the archaeological record (Reanier 1997, Sheehan 1997). The ASTt components are characterized by a chipped stone industry of small, often delicate, well-made bifacial projectile points, ground stone implements, a variety of well-made, often decorated bone, ivory, and antler tools and items of personal adornment, and a proliferation of composite tools (Irving 1964, Dumond 1987). The succession of the ASTt phases began with the Denbigh Flint Complex, followed by the Choris, Norton, and Ipiutak cultures.

The youngest dates for Denbigh, approximately 2,500 years ago, comes from the Mosquito Lake site near Galbraith Lake in the northern foothills of the Brooks Range (Kunz 1977). This age appears to some researchers, however, to be too young for Denbigh culture in northern Alaska. Denbigh houses are similar to the contact-period Iñupiat houses observed by Russian and American explorers, thus showing considerable cultural continuity through time. Denbigh people hunted large game (e.g., caribou) and harvested the salmon that appeared in the streams during the summer runs. Coastal Denbigh sites, and some of the technology associated with them, indicate that Denbigh people hunted seals as well (Giddings 1964, Anderson 1984). Documented Denbigh sites near the Planning Area are found from the ACP to the Arctic Foothills and throughout the Brooks Range (Lobdell 1995). Denbigh-related components, ranging in age from 4,000 to 3,500 years ago, were uncovered near Prudhoe Bay at the Putulagayuk River Delta Overlook site and the Central Creek Pingo site, approximately 3 miles from Prudhoe Bay (Lobdell 1995). Denbigh components from Tukuto Lake in the Arctic Foothills radiocarbon-dated to roughly 4,400 to 3,300 and 2,200 to 1,600 years in age (Gerlach and Hall 1988). Dates from the Tukuto Lake Denbigh component indicate that the Denbigh culture persisted in the area between the northern coast and the passes through the Brooks Range from 4,400 to 1,600 years ago.

Following Denbigh, the Choris culture appeared in coastal areas of northwest Alaska from 3,700 to 500 years ago. Choris cultural remains have been documented on the North Slope of the Brooks Range dating from 2,700 to 2,500 years in age.

The Norton culture was first defined at the Iyatayet site on Norton Sound, and spans a time period from approximately 2,500 to 2,000 years ago. Cultural remains documented at Norton sites suggest that the Norton culture has its origins in the Choris culture (Giddings 1964). At Point Hope, cultural remains identified as Near Ipiutak that are identical to those associated with the Norton culture were found.

The Ipiutak site at Point Hope was the type site for the Ipiutak culture. Ipiutak lacked pottery, ground slate tools, and stone lamps, which are associated with the earlier Norton culture and later Iñupiat cultures. Ipiutak sites have been documented both along the coast and inland. Coastal age ranges fall within the period from approximately 2,000 to 1,100 years ago, while those of the interior fall within the period from 1,350 to 550 years ago (Giddings and Anderson 1986, Gerlach and Hall 1988). Ipiutak remains in the Brooks Range and in Anaktuvuk Pass are predominantly those of temporary encampments, but sparse occurrences of small settlements are known, such as those represented by houses at Etivluk and Feniak lakes and the Toyuk site southwest of Anaktuvuk Pass.

3.4.1.5 Late Holocene Cultures (Approximately 2,000 B.P. to A.D. 1827)

Beginning approximately 2,000 years ago, ancestral forms of the historic Native cultures emerged and underwent the final stages of development leading up to the cultural forms that were encountered by European and Euro-American explorers in the 19th century. The Birnirk phase, a direct ancestor of the historic Thule culture, appeared in the Bering Strait by 1,600 years ago. From the Birnirk period onward, the cultural continuity of Arctic peoples into the 21st century is well established. Birnirk peoples lived in semi subterranean winter houses and engaged in the harvest of marine and land mammals, birds, and fish. The Birnirk type-site is located near Barrow at the base of the Barrow spit (*Piġniq*). Other sites that contain Birnirk cultural remains include Walakpa, Point Hope, and Cape Krusenstern. Birnirk-style artifacts have been found from northeastern Siberia to northwestern Canada, indicating a large trade network reminiscent of the extensive Iñupiat trade network in place in the 19th century.

Thule is the immediate prehistoric ancestor of the various historic Iñupiat groups. Approximately 1,000 years ago, a favorable climate, coupled with technological innovations such as the *umiaq* (a large skin boat), the *qataq* (cold trap door for winter houses), and the *umiat* (dog sled), resulted in the rapid expansion of Thule populations from the Bering Strait along the shores of the Beaufort Sea to Greenland, and southeast around the shores of the Bering Sea ultimately to Kodiak Island and Prince William Sound. Thule persisted in the North American Arctic to historic contact, between 1800 and 1850 (Collins 1964, Giddings and Anderson 1986). When the early explorers and whalers arrived on the Beaufort Sea coast in 1826, they encountered people bearing Thule material culture. Thule people hunted sea mammals, including seals and whales, fished, and hunted terrestrial game such as caribou. Thule sites in the vicinity of the Planning Area include *Nuvuk*, *Utqiagvik*, Thetis Island (destroyed), Pingok Island, and Niglik (*Nigliq*).

The *Utqiagviq* site, a village occupied 500 years ago by the whale-hunting Thule people, is located on the Arctic coast at Point Barrow, approximately 65 miles northeast of the Planning Area. *Utqiagviq* is a well-known site, and its cultural significance bears directly on current North Slope residents. *Utqiagviq* was the home of whale hunters who used the bones of these giant mammals to construct semi subterranean houses. Some of these houses date to approximately 1,250 years ago (Dekin et al. 1990). The archaeological excavation of *Utqiagviq* revealed the “Frozen Family,” yielding unmatched information concerning the material culture, architecture, and pathology of the ancient residents and, in the process, strengthened the cultural connection between prehistoric whale-hunters and modern Iñupiat (Hall and Fullerton 1988; Dekin et al. 1990).

At the same time as the Thule were active on the coast, related but less abundant populations continued to exploit the resources of the interior, primarily subsisting on caribou and other large terrestrial mammals and overwintering on the margins of lakes that contained plentiful fish resources (Gerlach and Hall 1988). These people may have been the antecedents of the modern Nunamiut or Inland Eskimo, or may reflect part of an extensive cyclical land use pattern.

3.4.1.6 Prehistoric Resources in the Planning Area

Twenty-eight documented prehistoric sites are located within the Planning Area (Map 3-35; Appendix I; ADNR OHA 2003). These resources include both dated sites and undated sites that have been assigned to the prehistoric period. These undated sites include, but are not limited to, *Uyagagviit* (HAR-155), Niglik (*Nigliq*) (HAR-169), and Paptaun (TES-002), as well as various lithic sites. *Uyagagviit* means "place where one can get many rocks" and is a site that has been used since prehistoric times as a quarry for net weight stones. Uyagagviit represents the only source for net weight stones on the Nechelik Channel (Hoffman et al. 1988; IAI 1990a, b). The site of Niglik (*Nigliq*; HAR-169; TLUI-58/TLUIHAR-084) contains prehistoric artifacts as well as historic artifacts. *Nigliq* was a vital link in the aboriginal trade and commerce network from prehistoric times through the early 20th century (Hoffman et al. 1988; IAI 1990a, b). Davis et al. (1981) reported a large multicomponent site (TES-014) containing cultural resources scattered over the surface of an extensive sand flat near the base of an eroding dune and the remains of two rectangular sod houses (TES-020), and a large sod meat cellar or storage facility located on top of a well-drained, raised point of land near the northeast end of a small captured lake on the southwest shore of Teshekpuk Lake. It should be noted that the Planning Area has not been completely surveyed for cultural resources and the lack of documented prehistoric sites in specific portions of the Planning Area does not preclude the existence of undocumented prehistoric sites.

3.4.1.7 Overview of Regional History (Approximately A.D. 1827 to Present)

Some of the earliest recorded observations of northern Alaska and its inhabitants occurred in the Arctic region in the early to mid-19th century, when contact between Euro-American explorers, as well as the Arctic whaling fleet, and Alaskan Natives first occurred. The following years of continuous contact between commercial whalers and North Slope Iñupiat drastically altered the traditional culture (e.g., populations, subsistence practices, and settlement patterns; Bockstoce 1978, 1995). The following descriptions outline the history in the region.

3.4.1.8 European/Euro-American Expansion, Exploration, and Ethnographic Research

The exploratory period on the North Slope began in 1826 with the first Franklin expedition. Sir John Franklin and his crewmembers sailed westward from the Mackenzie River to the Return Islands just west of Prudhoe Bay and spent 1825-1826 at the Herschel and Barter islands. That same year, Beechey's expedition sailed north from the Bering Strait to Point Barrow. Franklin, as well as other early explorers, noted that the presence of European trade goods (such as tobacco, iron, and copper) preceded their arrival among the Iñupiat on the North Slope. In 1837, Thomas Simpson of the Hudson's Bay Company traveled from the east to Point Barrow. Kashevarov sailed past Nuvuk twice in 1838, but had hostile relations with the Iñupiat (Vanstone 1977). In 1849, Lieutenant Pullen, of the *HMS Plover*, surveyed the Arctic coast from Wainwright Inlet to the McKenzie River. Between 1847 and 1854, contact between Europeans and the Iñupiat increased because of the influx of whalers to the region, and exploration of the region increased as ships searched for the lost Franklin expedition. From 1852 to 1853, R. Maguire, of the *HMS Plover*, wintered at Point Barrow. Richard Collinson, a captain on one of the search ships looking for Franklin's lost expedition, collected Iñupiat place names for areas along the coast from Barrow to the Mackenzie River while wintered off the ice of Camden Bay in 1853-1854 (Schneider and Libbey 1979).

During the commercial whaling period, items such as metal tools and firearms became increasingly important to the Iñupiat material culture. By the 1850s, guns were in use by local Iñupiat people; and by the 1880s, Iñupiat whalers were using commercial whale darting guns and bombs. Beginning in 1881, J. Murdoch and Lieutenant P.H. Ray, members of the International Polar Expedition, collected ethnographic information over the course of 2 years at Point Barrow. During the last quarter of the 19th century, epidemic diseases caused a severe population decline among the North Slope Iñupiat. Declines in caribou populations resulted in famine that caused inland Iñupiat to leave their homes and relocate to coastal communities such as Barrow, where coastal Iñupiat populations had declined from diseases such as smallpox and influenza (Reanier 2002).

Interest in the geology and history of the early culture of the area began in earnest at the beginning of the 20th century, but access was generally limited to coastal or easily accessible areas (e.g., Stefansson 1906–1907, 1908-1912, and 1913-1918; E. de K. Leffingwell [1919] 1906-1914; Rasmussen 1924; Spencer 1952). The initiation of petroleum development has led to intensive investigations of cultural resources on the North Slope. The NSB Commission on History and Culture initiated the TLUI for the North Slope in the 1970s in anticipation of and in response to increased resource development on the North Slope (Schneider and Libbey 1979).

3.4.1.9 Missionary Efforts, Trading Posts, and Reindeer Herding

Christian missionaries first arrived in Barrow in 1890. Because of the efforts of Christian missionaries and evangelization by the Iñupiat, Christianity was nearly universal on the North Slope by 1910 (Reanier 2002). Mission schools were established between 1890 and 1910 at Wales, Point Hope, and Barrow, as well as other places that were not previously occupied year-round. Eventually, the original mission schools split into separate entities: government schools and church-operated missions. Trading posts were set up near the missions and schools. These areas became focal points for the Native population, and settlements grew up around each one (Schneider and Libbey 1979).

At the end of the 19th century, Sheldon Jackson, a Presbyterian missionary, introduced reindeer herding to Alaska Natives. Following the collapse of the commercial whaling industry, reindeer herds were maintained by Iñupiat near Wainwright, Barrow, and Nuiqsut, as well as other settlements on the North Slope (Schneider and Libbey 1979). In 1937, the “Reindeer Act” placed the management of the Alaskan reindeer herds under the jurisdiction of the Bureau of Indian Affairs and legally transferred ownership of all reindeer in Alaska to Native Alaskans. In 1939, the federal government bought the reindeer owned by non-Natives (Stern et al. 1980). Reindeer herding ended in 1938 across much of the North Slope partially due to the collapse of the market for meat and hides (Reanier 2002).

At the beginning of the 20th century, whale oil and baleen decreased in importance. The fur trade filled some of the economic gap left by the collapse of the whalebone (baleen) market and the subsequent demise of commercial whaling. For the Iñupiat, trading traditionally has had social and economic importance. Trading posts in the area began to cease operation in the 1930s due to the Great Depression and reduced fur demand. Most of the trading posts had ceased operations by the 1940s (Schneider and Libbey 1979).

3.4.1.10 Military Presence/DEW-Line Sites

In the early 1950s, the U.S. and Canada, under threat of atomic warfare, planned a DEW-Line that was to expand across the northern regions of Alaska and Canada in order to provide advance warning for interception and counterattack (Denfeld 1994). The DEW-Line was renamed the North Warning System in 1985. Two DEW-Line sites are located in the Planning Area. The Kogru River DEW-Line site (POW-B) was an intermediate DEW station that was activated in 1957. The POW-B site was deactivated in 1963, and all buildings at the site were demolished in 1999 (Denfeld 1994).

Point Lonely (POW-1) is an auxiliary DEW-Line site located within the Planning Area. The POW-1 is a 2,830-acre facility located between Smith Bay and Harrison Bay, on the Beaufort Sea. The USDOD activated the Point Lonely facility in 1953 as an auxiliary radar station in the DEW-Line. The DEW radar at Point Lonely was removed in 1987 and the DEW-Line site was closed in 1989. The Point Lonely Short Range Radar Site was built in 1992 and activated in 1993. The Point Lonely facility is currently used as an Unattended Radar site. The site includes a radar structure, support building, fuel tanks, and a helicopter landing area. The inactive facilities include a 5,000-foot gravel airstrip, one 25-module train, a hangar, a warehouse, a garage, a fuel storage tank, and four communications antennas (Denfeld 1994).

The DEW-Line Alaska Segment has been found to be eligible for inclusion on the NRHP and POW-1 (TES-048), as well as its road system (TES-043), airfield (TES-044) and pad system (TES-045), has been physically surveyed, inventoried, and assessed, and is also considered eligible for the NRHP designation (ADNR OHA 2003).

3.4.1.11 Community History

Anaktuvuk Pass

Anaktuvuk Pass is just south of the continental divide in a low pass connecting the drainages of the Anaktuvuk and John rivers, 60 miles west of the Dalton Highway. The area has been used by the interior Iñupiat people, called the Nunamiut, for at least 500 years and by Iñupiat predecessor groups for at least 4,000 years. The modern village began in 1949 with the establishment of a trading post, followed by a post office in 1951 and a church in 1958. Residents incorporated as a fourth class city in 1959. A permanent school was established in 1961, and the community was reclassified as a second-class city in 1971 (Hall et al. 1985).

Atqasuk

The village of Atqasuk is on the banks of the Meade River, 60 air miles south of Barrow. The name means "the place to dig the rock that burns" (Alaska Department of Community and Economic Development [ADCED] 2003). The Atqasuk area is rich in caribou, fish, and waterfowl, and hunters access areas of the coast for seals and other marine resources through connections with Wainwright and Barrow residents. The Atqasuk area is the location of several former settlements used in prehistoric and historic times. The current village site is near a bituminous coal mine that provided fuel for government and private facilities in Barrow during and after World War II. From 1951 to 1957, the village had a post office under the name of Meade River. The Bureau of Indian Affairs mandate regarding school attendance for children in the 1940s forced most residents in the area to move to Barrow. However, former residents continued to use the Meade River area for subsistence purposes. In 1971, the passage of the ANCSA encouraged Iñupiat people to reestablish the community. Beginning in 1975, the community of Atqasuk was resettled by residents of Barrow and former residents of *Tigalook* (old Atqasuk; Schneider et al. 1980). The Meade River area has traditionally been hunted and fished by Iñupiat. Many residents are from other areas of the North Slope and continue to return to those areas for subsistence hunting and fishing.

Barrow

Barrow has been occupied for approximately 4,000 years, with continuous occupation for the last 1,300 years (Dumond 1987). The earliest occupants of the Barrow area were bearers of the Birnirk culture. The Iñupiat name for the Barrow area is *Utqiagviq*, meaning "the place where we hunt snowy owls." Because Barrow is situated on a point of land where the sea ice is prone to cracking, the main subsistence focus has been marine mammal hunting, particularly whaling. The reliance on subsistence activities remains a key component of the Barrow economy and the local Iñupiat culture. Barrow has been (e.g., trade, commercial whaling, and schools), and continues to be (e.g., NSB administration and wage employment) the population, social, and economic center for the North Slope Iñupiat. As Barrow is a regional center, many residents are from other areas of the North Slope. Because of this, current residents of Barrow, as well as historical residents, commonly travel to traditional subsistence use areas that are in other areas of the North Slope (e.g., Meade River, Teshekpuk Lake, Colville River) for subsistence hunting and fishing.

Nuiqsut

Nuiqsut is on the Nigliq Channel on the west side of the Colville River Delta. The Nuiqsut area provides a diverse seasonal abundance of terrestrial mammals, fish, birds, and other resources, and is a prime area for fish and caribou harvests. The name Nuiqsut recalls prehistoric and historic camps and settlements occupied by many families on the main channel of the Colville River that had been used traditionally as an area for hunting, fishing, trapping, and trading (Hoffman et al. 1988). The people of Nuiqsut call themselves *Kuukpikmuit*, or the "People of the lower Colville River" (Brown 1979). Most residents in the area moved to Barrow when the Bureau of Indian Affairs mandated school attendance for children in the 1940s. However, former residents continued to use the Colville River area for subsistence purposes. The passage of the ANCSA led to the reestablishment of the community. In April 1973, the community of Nuiqsut was resettled by 27 families who embarked on a 150-mile trek from Barrow to the Colville River. Many of these people had lived in the Colville River area 25 to 30 years earlier and were "seeking an alternative to the accelerating urbanization of Barrow" (Libbey et al. 1979).

3.4.1.12 Historic Resources/TLUI Sites in the Planning Area

In general, coastal Iñupiat from the prehistoric period through current times have settled in small villages on peninsulas or points of land where conditions are ideal for sea mammal hunting, and have traveled inland for caribou, fish, and furbearers on the river systems. The relationship of the Iñupiat to their natural environment remains a cornerstone of their personal and group identity (NSB Contract Staff 1979). Signs of past occupation (such as remains of camps or houses) generally mark historical places of significance. Old occupation sites are not regarded by the Iñupiat as being truly abandoned, but are valued by the Iñupiat as the living and dying places of ancestors “no longer recalled but still a part of the surrounding world,” and may have supernatural associations that affect the way they are used by modern populations. Cultural associations with the land may be contained in recollections of the recent past, stories of remote history or “folklore,” and in supernatural beliefs. Oral traditions and supernatural beliefs are connected to specific features of the landscape or “connected to locations where remote historical events involving the people, the animals and the landforms took place.” The Iñupiat believe that “each place is entirely unique and imbued with its own importance.”

Historic sites located in the Planning Area are listed in Appendix I. There are 76 documented historic sites in the Planning Area. It should be noted that undocumented historic sites may be located in the Planning Area, as not all of the Planning Area has been surveyed for cultural resources.

Traditional Land Use Inventory

The NSB’s TLUI is a compilation of subsistence resource/use locations, landmarks, place names, travel routes, and special significance locales that exist in the living memory of the Iñupiat people. Place names and traditional land use sites encompass locations where important events or activities, frequently subsistence use, took place, and place names reflect an “ethnohistoric present” or a living memory of the past. Without written records, this rich component of oral tradition may extend back three to four generations or even beyond” (Lobdell and Lobdell 2000). The number of TLUI locales exceeds the number of recorded archaeological sites in the Planning Area. This demonstrates that the communal cultural memory of the Iñupiat people is an extensive and extremely valuable resource.

A description of TLUI sites for the Planning Area is provided in Appendix I. There are 239 documented TLUI sites in the Planning Area. The existing literature that describes TLUI sites is not consistent in how TLUI sites and their associated numbers are expressed, and many TLUI sites have numbers that were assigned in the 1970s (TLUI [old]) as well as new numbers assigned later (NSB 2003a). Appendix I also provides a description of the TLUI sites using the TLUI (old) and TLUI numbers, the site name/place name (Iñupiaq and English), and the site description when available.

Summary

The modern Iñupiat population that utilizes the Planning Area is as successful today, subsisting in one of the harshest environments on the planet, as that of their prehistoric ancestors. The evidence that supports this statement, the material culture of the North Slope, resides in thousands of archaeological and historical sites distributed throughout the region. These sites contain the physical manifestation of the culture history of the National Petroleum Reserve – Alaska, a nonrenewable resource. This resource has both scientific and cultural value.

To date, in the 2 to 3 percent of the National Petroleum Reserve – Alaska that has been examined for the presence of cultural sites, more than 1,200 prehistoric and historic sites have been located; however, not all have been formally recorded. These sites range in age from nearly 12,000 years ago through the 20th century (Reanier 1997, Sheehan 1997). Much of this inventory work was conducted as part of the 105c studies during the late 1970s and early 1980s by the USGS, the National Park Service and the BLM (Davis et al. 1981; Carter 1982, 1983a, b; Hall and Gal 1988). Additional work by the NSB’s Commission on Iñupiat History, Language, and Culture produced the Nuiqsut and Teshekpuk Lake area TLUI, a compilation of locales of various types of traditional land use through time by the Iñupiat people (NSB 1978, 2003).

To date, 343 (28 prehistoric and 76 historic AHRS and 239 TLUI) cultural resource sites have been recorded in the Planning Area (Map 3-35; Appendix I). These known cultural resource sites are clustered in a few locales within the Planning Area. This distribution does not reflect locational preference of prehistoric and historic people, but rather indicates that only portions of the Planning Area (e.g., well sites, portions of the coast, the Colville River, the Ikpikpuk River, and the Teshekpuk Lake area) have been examined through some type of organized reconnaissance for the presence of cultural sites. The TLUI sites generally cluster in these same areas with greater density on the lower Ikpikpuk River and associated drainages (NSB 1978, 2003). The absence of recorded cultural sites across most of the Planning Area is simply the result of the limited research that has been conducted there (NSB 1978, 2003; Davis et al. 1981; Hall and Gal 1988). In the most general terms, where inventories and surveys have been conducted, cultural sites usually have been found.

3.4.2 Subsistence

Subsistence hunting is an important part of the region's culture. In addition to its cultural significance, subsistence food production can be viewed as import substitution. Because of high transportation costs and a relatively small market size, food costs in North Slope communities are much higher than in Alaska's major urban population areas. According to a NRC (1999) study, young men in Iñupiat communities choosing to balance wage employment with seasonal subsistence activities and higher levels of household cash income are directly correlated with peoples' commitment to natural resource harvesting. Kruse (1986) found that young men participated in major subsistence activities as much as the older generation, and those who had been exposed to Western influences through outside schooling tended to be more interested in subsistence.

The Planning Area is comprised of federal land managed by BLM. Therefore, management of subsistence hunting in the Planning Area is ruled by Title VIII of the ANILCA, which defines subsistence uses 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 inedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter or sharing for personal or family consumption; and for customary trade (16 USC § 3113).

On federal lands in Alaska, federal law grants subsistence priority over other uses, and federal agencies now are managing these hunts and will continue to do so until legislation bringing state law into compliance with federal regulations can be enacted (USDOI USFWS 1992). The USDOI also manages subsistence fisheries on federal lands (Hulen 1996a, b; Kizzia 1996; Whitney 1996).

The NSB Municipal Code defines subsistence as:

> an activity performed in support of the basic beliefs and nutritional needs of the residents of the borough and includes hunting, whaling, fishing, trapping, camping, food gathering, and other traditional and cultural activities (NSB Municipal Code 19.20.020 [67]).

For Alaska Natives, subsistence is more than the harvesting, processing, sharing, and trading of marine and land mammals, fish, and plants. Subsistence embodies cultural, social, and spiritual values that are the essence of Alaska Native cultures (Bryner 1995, ADNR 1997). The Alaska Federation of Natives (2003) describes subsistence as:

> the hunting, fishing, and gathering activities which traditionally constituted the economic base of life for Alaska's Native peoples and which continue to flourish in many areas of the state today... Subsistence is a way of life in rural Alaska that is vital to the preservation of communities, tribal cultures, and economies. Subsistence resources have great nutritional, economical, cultural, and spiritual importance in the lives of rural Alaskans… Subsistence, being integral to our worldview and among the strongest remaining ties to our ancient cultures, is as much spiritual and cultural, as it is physical.

Subsistence resources are highly valued and central to the customs and traditions of many cultural groups in Alaska, including the North Slope Iñupiat. These customs and traditions encompass sharing and distribution networks, cooperative hunting, fishing, and ceremonial activities. Subsistence fishing and hunting are important sources of nutrition and non-traditional employment in almost all rural communities. The ADFG estimates that the annual wild food harvest in the Arctic area of Alaska is approximately 10,507,255 pounds, or 516 pounds per person per year. Subsistence harvest levels vary widely from one community to the next. Sharing of subsistence foods is common in rural Alaska (ADFG 2000).

Subsistence is part of a rural economic system, called a "mixed, subsistence-market" economy, wherein families invest money into small-scale, efficient technologies to harvest wild foods (ADFG 2000). Fishing and hunting for subsistence provide a reliable economic base for many rural regions. Domestic family groups who have invested in gill nets, motorized skiffs, and snowmachines conduct these important activities. Subsistence is not oriented toward sales, profits, or capital accumulation (commercial market production), but is focused toward meeting the self-limiting needs of families and small communities. Participants in this mixed economy in rural Alaska augment their subsistence production by cash employment. Cash (from commercial fishing and trapping) and/or wages (from public sector employment, construction, fire fighting, oil and gas industry, or other services) provides the means to purchase the equipment, supplies, and gas used in subsistence activities. The combination of subsistence and commercial-wage activities provides the economic basis for the way of life so highly valued in rural communities (Wolfe and Walker 1987). As one North Slope hunter observed: "The best mix is half and half. If it was all subsistence, then we would have no money for snowmachines and ammunition. If it was all work, we would have no Native foods. Both work well together" (Alaska Consultants, Inc. [ACI] et al. 1984).

Full-time, year-round wage employment has positively and negatively affected the pursuit of subsistence resources. It has positively affected the subsistence hunt by providing cash for snowmachines, boats, motors, fuel, equipment, and ammunition required for the hunt. Full-time year-round employment limits the time a subsistence hunter can spend hunting to after work hours. Employment in the oil fields or away from the communities further limits the pursuit of subsistence resources, as the primary hunters may be away working at the best times for harvesting certain resources. During midwinter, this time window is further limited by waning daylight. In summer, extensive hunting and fishing activities can be pursued after work without any light limitation, but travel is limited to raised ground and waterways by difficult travel on wet tundra. Speaking at the 2001 meeting in Nuiqsut for the *Liberty Development and Production Plan Draft EIS*, Rosemary Ahtuangaruak, then-acting mayor of the community, put the conflict in these terms: "They require the guns and the snowmachines to allow them to harvest in the narrow windows of time that exist due to commitment to work. They are torn by the traditional needs of providing from the land and the stresses of needing cash to purchase items that save on time" (USDOI MMS 2001).

The following sections briefly describe subsistence harvest activities in and near the Planning Area. A more detailed discussion of contemporary subsistence activities, including activities conducted by the residents of Anaktuvuk Pass, Atqasuk, Barrow, and Nuiqsut, is in Appendix J.

3.4.2.1 Annual Cycle of Harvest Activities

The primary subsistence-harvest areas for Barrow, Atqasuk, Nuiqsut, and Anaktuvuk Pass, communities whose residents harvest or rely on subsistence resources that may spend time in the Planning Area, are shown in Map 3-36. Seasonal movement to hunting sites and camps for subsistence activities involves travel over and use of extensive areas from as much as 70 miles offshore to the mountains of the Brooks Range. Barrow and its environs have a long history of use by Iñupiat hunters, with numerous archaeological deposits attesting to a long and continuous occupation. Atqasuk and Nuiqsut represent seasonally occupied traditional subsistence use areas that were recently reestablished as sedentary villages, as people who had moved to Barrow from these areas after World War II returned to places where they had historic connections. Knowledge of the land and subsistence resource availability in those formerly used areas was part of the web of connections to these areas (IAI 1990a, b).

3.4.2.2 Community Subsistence-Harvest Patterns

Subsistence resources are often harvested from specific camps where multiple resource harvest opportunities are available in each season. Generally, communities harvest resources nearest to them, but harvest activities may occur anywhere in the Planning Area. Harvests tend to be concentrated near communities, along rivers and coastlines at particularly productive sites. The distribution, migration, and the seasonal and more extended cyclical variation of animal populations makes determining what, where, and when a subsistence resource will be harvested a complex activity. Areas might be used infrequently, but they can be quite important harvest areas when they are used (USDOI BLM 1978e).

Species use and harvest success can vary greatly over short periods of time, and short-term harvest data analyses can be misinterpreted as a result. For example, if a particular community did not harvest any bowhead whales in one year, community use of caribou and other species likely would increase in absolute and percent terms to compensate for the loss of that resource. If caribou are not available in one winter, other marine and terrestrial species would be hunted with greater intensity. Similar scenarios have taken place in Kaktovik and Nuiqsut in the last 25 years (Brower and Hepa 1998). In cases such as these, the cultural value of sharing and reciprocity ensures that other communities will contribute subsistence foods to the communities affected. In some cases, communities have sponsored hunts in their vicinity for communities suffering a harvest failure—Anaktuvuk Pass and Nuiqsut have recently participated in such an exchange (Stephen R. Braund and Associates [SRBA] 2003b). The reliance on household survey data could result in underestimation of actual harvests. While the data may suggest how wide an area is being avoided, it does not indicate how Nuiqsut's residents have adjusted or will adjust to the Alpine field or other development near the village. Household surveys may not address people who harvest in all possible geographic areas. However, household surveys provide the best available data at this time.

While subsistence resource harvests differ between communities, the resource combination of bowhead whales, caribou, and fish are the main subsistence resources for Barrow, Nuiqsut, and Atqasuk. Bowhead whale hunting, which includes a great deal of cooperation and preparation year-round, is the impetus and focus of the Iñupiat sociocultural system. The bowhead whale is the preferred meat and the subsistence resource of primary importance because it provides a unique and powerful cultural basis for sharing and community cooperation (Stoker 1983). Caribou is the most important overall subsistence resource in terms of number of animals harvested and consumed, and the greatest frequency of hunting trips taken. Depending on the community, fish is the second or third most important resource after caribou and bowhead whales. Bearded seals and waterfowl are also considered primary subsistence species. Seal meat, oil, and hides are important staples and necessary complements to other subsistence foods. Seal oil, in particular, is desired for use as a condiment. Waterfowl are important during the spring, when they provide the first fresh meat of spring and add variety to the subsistence diet. Migratory birds from the project area are important to Native peoples in western, southwestern, and interior Alaska, and along the Pacific Flyway.

The subsistence pursuit of bowhead whales is of major importance to the communities of Barrow and Nuiqsut, and some Atqasuk men whale with Barrow or Wainwright crews. The sharing of whale *maktak* and meat is important to inland communities. Whaling continues to be the most valued activity in the subsistence economy of these communities, even in light of harvest constraints imposed by International Whaling Commission quotas. Seasonally plentiful supplies of other subsistence resources such as caribou and fish, as well as supplies of retail grocery foods, supplement and support whale harvests. Whaling traditions include kin-based crews, use of skin boats in Barrow for their spring whaling season, onshore preparations for distribution of the meat, and regional and extra-regional participation and sharing. These traditions remain central values and activities for Iñupiat in these North Slope communities. Bowhead whaling strengthens family and community ties and the sense of a common Iñupiat heritage, culture, and way of life. In this way, whaling activities provide strength, purpose and unity in the face of rapid change. Barrow is the only community within the area that harvests whales in both the spring and the fall. Subsistence whaling for the community of Nuiqsut occurs only during the fall season, although some Nuiqsut hunters travel to Barrow to participate with Barrow whaling crews during the spring whaling season (NSB 1998).

3.4.2.3 Traditional Iñupiat Settlement Patterns and Subsistence Use Areas

The North Slope Iñupiat have undergone numerous changes as they adapted to changing cultural, social and physical environments. Before sustained contact with Euro-Americans, the Iñupiat moved seasonally between coastal and riverine environments on the ACP, gathering at communally recognized locations for seasonal bowhead whale hunts or cooperative hunts using caribou drive lines and subsequent celebrations of successful harvests. If the whale harvest was successful, the meat and *maktak* were distributed and a celebration, *Nalukataq*, was held. The Iñupiat would again disperse to coastal and riverine winter residences after whaling (SRBA and Institute of Social and Economic Research [ISER] 1993). Numerous regional groups of Iñupiat and Athabaskans gathered at trading fairs, including one in the Nuiqsut area (Elavgak *in* Brown 1979).

The Iñupiat developed adaptive responses to the variable distribution and availability of subsistence resources, including sociocultural and technological strategies. Sociocultural strategies included an emphasis on sharing and hospitality, non-restrictive land use rules, wide-ranging mobility to extract sparsely distributed resources, and an adaptive set of hunting rules and techniques. Examples of hunting rules included letting caribou herd leaders pass so the main herd follows and taking only as many caribou as necessary. Examples of hunting techniques included the use of caribou drivelines and *allu*, or breathing hole, hunting for seals. Technological adaptations included specialized tools for harvesting subsistence species, innovation as new materials were introduced (e.g., steel, plastic, woven fabrics), and a willingness to adopt new technologies from other cultures if there were clear advantages in their use (e.g., rifles, outboard motors, snowmachines; Brown 1979; IAI 1990a, b).

Euro-American contact began intermittently in the early 19th century and intensified with the shift of commercial whaling north of the Bering Strait in the 1850s. The establishment of a shore-based whaling station at Barrow in 1884 brought Iñupiat from other areas to Barrow in pursuit of wage employment, access to technologically advanced and trade goods, and increased trade opportunities. Eskimo people from as far as Siberia and Saint Lawrence Island moved to Barrow to participate in the commercial whale harvest. After the Pacific Steam Whaling Company ceased shore-based whaling from Barrow in 1896, Iñupiat whalers took over the shore-based whale harvest, with more affluent captains maintaining as many as six crews year-round (SRBA and ISER 1993).

Changes in resource distribution, fluctuations in whale and caribou populations, epidemic disease, and prolonged contact with Euro-Americans caused major changes in the geographic distribution and lifeways of the Iñupiat (SRBA and ISER 1993). The eventual depletion of whales and other marine mammals, as well as the increased hunting pressure caused by the need to provision commercial whaling crews, may have caused critical resource shortages. The promise of jobs and access to trade goods in conjunction with famine and disease caused a decline in the overall population of the region and the relocation of inland peoples to the coastal villages. In response to the famine and a need to feed stranded commercial whalers, the federal government instituted reindeer herding programs in Point Hope, Wainwright, and Barrow, which lasted until the 1930s. The Barrow reindeer herd dispersed by 1952 because of inattention, predation by wolves, and assimilation into wild caribou herds.

Commercial whaling ended by 1910, and fur trapping became an alternative method for the Iñupiat to participate in the cash economy. While commercial whaling had brought Iñupiat from the interior to the coast, specifically to Barrow and Wainwright, trapping encouraged the Iñupiat to disperse along the coast and return to the interior to winter trapping camps. The Depression forced fur prices down and made trapping unprofitable for Iñupiat hunters. Following the Depression, the Iñupiat population again aggregated into centralized communities following the establishment of schools, missions, and churches, and the enforcement of truancy laws. Economic growth presented opportunities that drew Iñupiat to the growing cities of Fairbanks and Anchorage (Hoffman et al. 1988).

During World War II, the U.S. Navy and other federal agencies began exploring the then PET-4, mapping the Beaufort Sea coast, and establishing research stations near Barrow (Ebbley and Joesting 1943). After the war, DEW-Line sites provided employment to Iñupiat people and allowed them to continue to use subsistence resources while providing access to Euro-American goods and services (Hoffman et al. 1988). Wage employment (e.g., National

Petroleum Reserve – Alaska, Naval Arctic Research Laboratory, DEW-Line sites, Federal Aviation Administration, and Weather Bureau) attracted inland and coastal Iñupiat to Barrow (Human Relations Area Files, Inc. 1992).

Not all Iñupiat moved to centralized communities. Many continued to move around on the land much as their ancestors had. Iñupiat who had settled in Barrow for access to education and health care returned seasonally to the areas from where they or their families had come. Following the passage of the ANCSA, groups that had centralized in Barrow and other coastal villages to gain access to education, health care, employment, and other advantages of a more urban life began to return to formerly used subsistence harvest areas near Nuiqsut, Anaktuvuk Pass, and Atqasuk (Brown 1979).

3.4.2.4 Contemporary Subsistence Uses

Contemporary subsistence uses reflect centuries-old seasonal resource harvest patterns based on resource availability and abundance. The Iñupiat have adopted aspects of Euro-American culture and technology while maintaining core elements of Iñupiat culture, values, and identity (IAI 1990 a, b), and have creatively adopted new technologies to further traditional subsistence pursuits and maintain connections to the land (Spencer 1976).

Anaktuvuk Pass

The Nunamiut people of Anaktuvuk Pass are among the few in the NSB without direct access to marine mammals. As a consequence, the Iñupiat of this village rely heavily on terrestrial mammals and fish for subsistence. Caribou is the main terrestrial mammal resource, with moose and Dall sheep also important resources for hunters. Freshwater fish from area lakes and streams are an important supplement to terrestrial mammals. Terrestrial resources are often bartered for marine resources from other communities, particularly Nuiqsut and Barrow (Brower and Opie 1996, Fuller and George 1999).

Contemporary Seasonal Round

Caribou hunting is the mainstay of the Nunamiut subsistence hunt. Caribou are hunted year-round as needed, and heavily from July through November (Figure 3-3). The caribou migrate through the Anaktuvuk Pass area twice a year, in the spring and fall, but the number and timing of the caribou migrating through the area vary from year to year. Dall sheep, brown bear, and moose are hunted in August, September, and October some distance from the village, with Dall sheep the main target. Birds and fish are supplementary to terrestrial mammals but are harvested when available and increase in importance if caribou numbers are low. Berries are seasonally important, with salmonberries and blueberries providing the majority of vegetable foods.

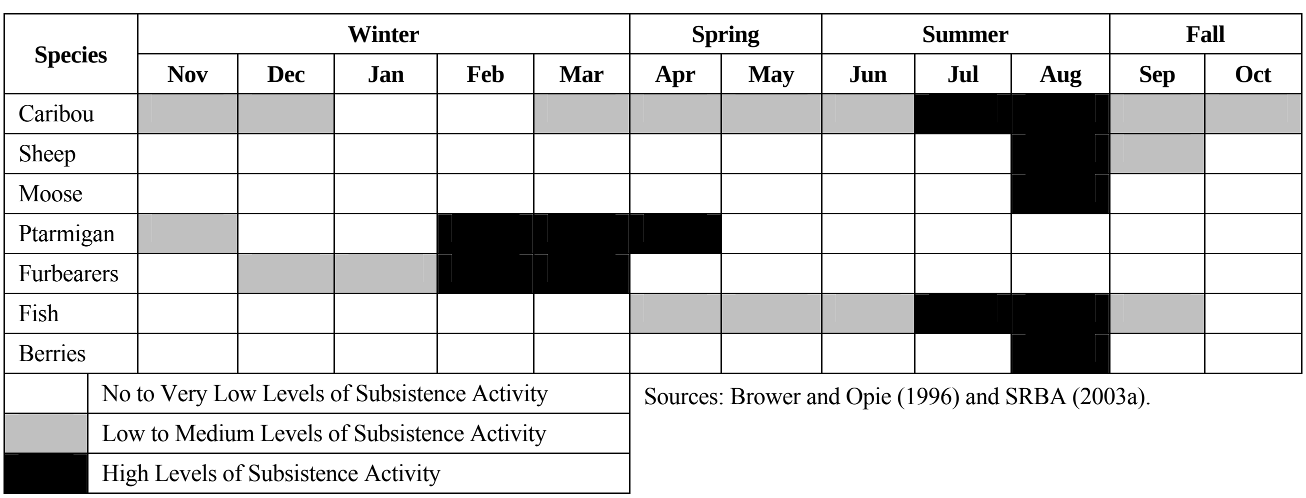


Figure 3-3. Annual Cycle of Subsistence Activities – Anaktuvuk Pass.

Subsistence Harvests

Since resource users in Anaktuvuk Pass have no direct access to marine mammal resources, terrestrial mammals comprise up to 95 percent of the harvest, with nearly three-fourths of the community participating in the harvest. Caribou are the main terrestrial mammal species harvested, with moose and sheep also harvested in small numbers. Fish are a smaller component of the subsistence diet by weight, but are still an important food source. Fish species harvested include grayling, Arctic char, lake trout, burbot, and pike. Birds harvested during the brief migration period include a variety of geese and ducks. Preferred species are white-fronted and Canada geese and several species of small ducks, such as northern pintails. Vegetation harvested includes berries and *masu*, or "Eskimo potatoes" (SRBA 2003b).

Subsistence Use Areas

An important factor contributing to the resettlement of the Anaktuvuk Pass area was the seasonal migration of caribou through Anaktuvuk Pass. Map 3-37 is a partial subsistence use area map for the last 10 years based on interviews conducted in 2003 for the *Alpine Satellite Development Project Final EIS* (SRBA 2003a, b; USDOI BLM 2004c). More detailed and exhaustive mapping of lifetime subsistence use areas for the community were presented in the 1985 report produced by Hall et al. (1985) for the NSB and in the 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998).

A harvest strategy formerly used by residents was herding small groups of migrating caribou into lakes, streams, or valleys to limit their mobility and then harvesting and processing the caribou in a cooperative group undertaking (Spearman 1979). While waiting for the caribou to be herded through these areas, members of the group would fish in the streams and lakes. Many residents recall this way of life from their youth in the smaller communities (e.g. Chandler Lake, Killik River, and Tulugaq Lake), which in the 1950s came together in Anaktuvuk Pass (Rausch 1951, 1988). Nunamiut hunters bartered furs and dried caribou for other resources, such as marine mammal fats and hides, with coastal people at trade fairs in the Colville River Delta, Barrow, and Barter Island. Anaktuvuk Pass people currently trade resources and hunting access with Nuiqsut people in much the same manner as they did during traditional times; however, hunters now use modern means of transportation and hunt on a compressed time schedule (Spearman 1979; Hall et al. 1985; Ahtuangaruak 2001; USDOI MMS 2001; SRBA 2003b).

Highest use areas are within 20 miles of Anaktuvuk Pass, with most hunting trips taken in the immediate vicinity of the community (Brower and Opie 1996). Lifetime subsistence use areas, as depicted in Hall et al. (1985), encompass the entire NSB from Aklavik, Canada, to Kivalina and Kotzebue Sound, and north to Point Barrow and Wainwright. Anaktuvuk Pass residents also traveled to Fort Yukon, Bettles, Wiseman, and Old Crow while trapping or working at seasonal jobs (Paneak 1990, Brower and Opie 1996). Travel corridors and trapping areas included the Sagavanirktok, Killik, Kobuk, Itkillik, John, and Colville rivers and the coast between the Colville River Delta and Demarcation Point (Hall et al. 1985).

Resource users have used the valleys and slopes of the Brooks Range between the Killik River valley and Itkillik Lake, with some resource users having gone farther east and west on occasion. Most resource users did not go farther south than the Alatna, Hunt Fork, and North Fork rivers, although some had made trips to Bettles in the past. North of the Brooks Range, resource users traveled by snowmachine and all-terrain vehicle along the front slope of the mountains east to Itkillik Lake, west to Chandler River, north to Rooftop Ridge, and parallel the Colville River past Umiat to the Chandler and Killik rivers, then heading back south into the mountains. Periodic trips to Nuiqsut were made along the east or west side of the Anaktuvuk River, almost to its confluence with the Colville River, then headed east towards the Kuparuk hills, and north to Nuiqsut along the cat trail that roughly parallels the Itkillik River.

Periodic shortages of caribou and other game have made living inland difficult for Iñupiat people for centuries and have required them to follow the migrating caribou herds year-round. In the late 1940s, the Nunamiut settled into Anaktuvuk Pass from Chandler Lake, Killik River, and Tuluġaq Lake, partially in response to the requirement for children to attend school. A result of sedentary life was the increased difficulty resource users experienced in harvesting adequate amounts of subsistence foods, even with modern transportation and other equipment. An added and more recent complication was the establishment of the Gates of the Arctic National Park and Preserve, which has restricted the use of certain all-terrain vehicles (such as Argos and four-wheelers) at snow-free times of the year, thereby restricting Nunamiut from accessing subsistence areas that they formerly occupied and used during the snow-free months (Hall et al. 1985; SRBA 2003b).

Several times in the 1970s and 1980s, and as recently as 1994 and 1998, Anaktuvuk Pass residents found it necessary to travel great distances to procure enough caribou to feed their community. The NSB has paid for some trips, using charters and float planes to fly hunters from Anaktuvuk Pass to places like Umiat and Schrader Lake (located approximately 60 miles southwest of Kaktovik; SRBA 2003b). More recently, hunters have traveled to Nuiqsut to harvest caribou for Anaktuvuk Pass, and on other occasions Nuiqsut hunters have provided caribou, fish, and other coastal foods during lean times. Anaktuvuk Pass resource users reciprocate with gifts of dry meat and other Nunamiut specialties.

A lifetime Anaktuvuk Pass hunter, describing his winter trail to Nuiqsut, indicated he traveled in February or March, hunting as he traveled. This hunter stated that he generally hunted along the trail, and used his binoculars to look out to the sides of the trail for game. He went to Nuiqsut once or twice a year, but did not do any fishing on the way to Nuiqsut, just wolf and wolverine hunting. He stated that his trips had a dual purpose, to hunt and to visit relatives that include cousins, aunts, and uncles in Nuiqsut, and that he generally stayed in Nuiqsut less than a week. He put 6,000 miles on his snowmachine in 6 months (SRBA 2003b).

There is friendly competition between hunters and communities in the pursuit of wolves, wolverines, and foxes. Several Anaktuvuk Pass hunters have traveled north to Nuiqsut, and hunted wolf, wolverine, and caribou en route. One hunter said, “I hunted everything on my trip to Nuiqsut,” and described the trip to Nuiqsut as “one camp” away. In other words, he left Anaktuvuk Pass, made camp for one night, and then went to Nuiqsut the next day. Other hunters remarked similarly on the route, noting important landmarks and features along the way. One hunter had harvested wolf and wolverine near Ocean Point in 1998. While residents of several communities encounter each other while hunting furbearers, it was often noted that “it is better for them to see your tracks than for you to see theirs,” as often the tracks of other hunters was a sign that the animal being sought had already been taken or run off by the other hunter.

Atqasuk

The area surrounding Atqasuk is rich in caribou, fish, and waterfowl, and hunters access areas of the coast for seals and other marine resources. Some Atqasuk hunters are members of Barrow whaling crews and take part in bowhead whaling and festivities there, returning with shares after a successful harvest.

Atqasuk residents use the same variety of marine resources as Barrow residents, but only a small portion of the marine resources used by Atqasuk residents are acquired on coastal hunting trips initiated in Atqasuk; most are acquired on coastal hunting trips initiated in Barrow or Wainwright with relatives or friends (ACI et al. 1984; SRBA 2003b). These connections with coastal and marine resources are important to the community. As one resident observed: “We use the ocean all the time, even up here; the fish come from the ocean; the whitefish as well as the salmon migrate up here” (ACI et al. 1984).

Contemporary Seasonal Round

Atqasuk subsistence harvests rely on a diversity of seasonally abundant resources that hunters must harvest when available (Figure 3-4). Some species, like ptarmigan and caribou, may be present year-round, but are only harvested when permitted or when encountered. December and January are generally not productive months for subsistence resource pursuits because of the winter weather and seasonal darkness. Between November and April, furbearer harvesters travel substantial distances from the community to harvest wolves, foxes, and wolverines, with peak harvest activity in February or March depending on snow conditions. In late February and through March, some residents may begin fishing under the ice on the Meade River, its tributaries, and any lakes that do not freeze completely, as an adjunct to fur and caribou hunting (SRBA 2003b).

Hunters may harvest caribou if they are encountered at this time, and the need to harvest more caribou may increase through March as late fall food supplies are depleted. The harvest of caribou increases as daylight increases and the weather becomes increasingly moderate. Some residents may travel to Barrow to participate in spring whaling. Beginning in May, hunters pursue migrating birds and caribou. The breakup of river ice and lack of snow in June make travel difficult. After the ice goes out, gill-netters harvest fish near the community as the fish move upriver to spawn. The high water on the rivers and lakes of the area in late spring and early summer allows the most extensive boat travel. Later in the summer, the water levels may be too low to allow long-range travel, so community residents plan their travels for late June through July. Subsistence resources are particularly abundant from July through September. Hunters harvest grizzly bears, moose, squirrels, and migratory birds throughout the summer. By October, migratory birds have left the area, and hunters shift their focus to caribou and fish. In November, hunters attempt to harvest enough caribou for the upcoming winter.

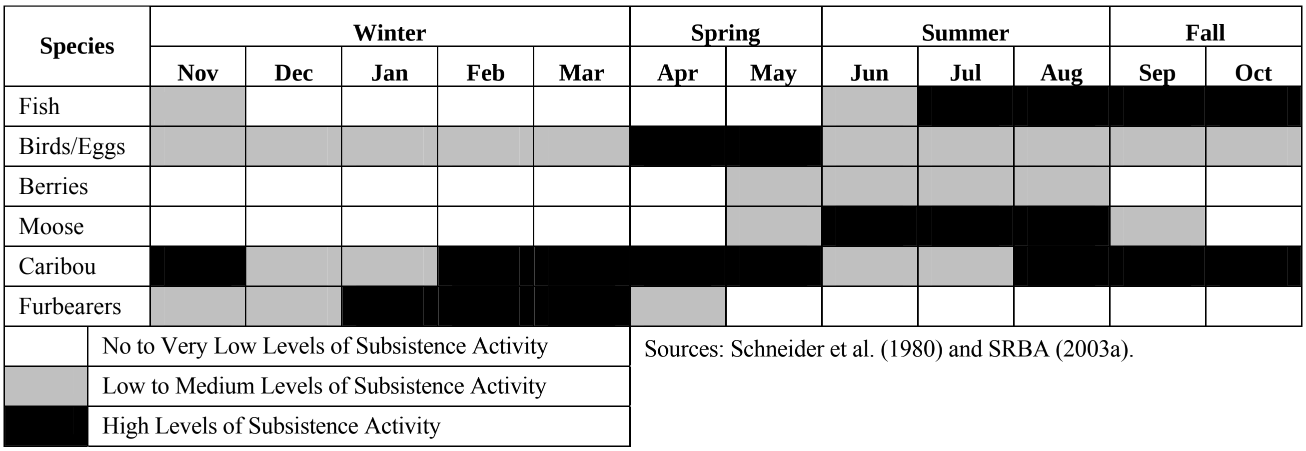


Figure 3-4. Annual Cycle of Subsistence Activities – Atqasuk.

Subsistence Harvests

Atqasuk is similar to Nuiqsut and Barrow in that residents harvest caribou, fish, and birds locally; however, Atqasuk is more connected to Barrow for marine mammal harvests and membership in whaling crews (Hepa et al. 1997). Neither the ADFG nor MMS have collected subsistence harvest data for Atqasuk, and the NSB Department of Wildlife Management has collected only harvest data for 1994–1995 (Hepa et al. 1997) and only participation data for 1992 (Fuller and George 1999). During the 1994–1995 harvest year, 57 percent of the harvest by edible pounds consisted of caribou, with 37 percent fish, 3 percent birds, 2 percent marine mammals, and 1 percent plants.

Contemporary Subsistence Use Areas

Subsistence hunters at Atqasuk use harvest locations relatively close to the community, with some use of the coast west of Barrow and of Dease Inlet, as well (Schneider et al. 1980; Hepa et al. 1997). The main advantages of Atqasuk's location are access to river and lake resources and position in the migration path of the TLH caribou (Schneider et al. 1980). Atqasuk's lifetime subsistence use area, as described in the 1970s and depicted in Map 3-38, extends from northeast of Wainwright to Barrow, along the coast to the vicinity of Smith Bay, south along the Ikpikpuk River to the Titaluk River, and west and north to Peard Bay (Pedersen 1979).

Atqasuk Subsistence Use Areas East of the Community

Based on SRBA interviews of subsistence users in Atqasuk, the recent (last 10 years) use area has expanded, as compared to the use area depicted by Pedersen (1979; Map 3-38). The recent use area extends from the eastern edge of Teshekpuk Lake in the east, to the Kaolak River in the west, to the Inaru River in the north, and beyond the Colville River in the south (Map 3-39). Several Atqasuk residents have ties to the Smith Bay-Cape Halkett–Kogru River areas, and some of these residents intensively used the area north and southeast of Teshekpuk Lake in their youth. One hunter stated that there were "numerous small camps and villages along the coast between Drew Point, Smith Bay, and Dease Inlet. It was a [caribou] grazing area" (SRBA 2003b). He explained that there were many ice cellars in an area between the mouth of the Ikpikpuk River and Teshekpuk Lake, named *Shubjat,* because it was high, dry ground away from the coast. Polar bears, with their keen sense of smell, would find and dig up the coastal ice cellars.

Atqasuk hunters travel east as far as Fish and Judy creeks. Resources sought in the eastern portion of the current Atqasuk use area include fish, wolf, wolverine, and caribou. The harvest of caribou in this eastern area, which is incidental to the pursuit of wolves and wolverines, takes Atqasuk hunters far from the community on several extended trips each winter. Atqasuk hunters encounter furbearer and caribou hunters from other communities on these extensive travels. The Kalikpik and Kogru river area and the Fish and Judy creeks area are occasionally used by in the winter by Atqasuk hunters traveling by snowmachine, primarily in search of wolf and wolverine. The Kalikpik and Kogru river area is a "homeland" for several Atqasuk families, who in the past traveled by boat and harvested caribou, birds, and fish in this area.

During the summer and fall, subsistence use areas for caribou, fish, waterfowl, and berries are primarily centered around Atqasuk, generally within 50 miles of the community. The harvest of resources near Atqasuk, both in the summer and winter, consists of day trips involving snowmachines, all-terrain vehicles, and boats, dependent on season. However, one subsistence user said he would go to one harvest area for a week, and then he would go home for a week or two, gas up, and go to another harvest area (SRBA 2003b).

It is not uncommon for winter hunters on snowmachines to encounter hunters from other communities. One Atqasuk hunter, who took several long winter hunting trips, said that he does not go to the area above Umiat, instead leaving "that country to those guys in Nuiqsut. They come up and hunt all over that area in moose season." Hunters make use of camps and cabins belonging to hunters, often relatives, from other communities to support their hunting trips. Subsistence fur hunters travel to the Inigok area and center their hunts from there, as they may buy fuel for snowmachines at the Inigok camp. Atqasuk hunters do not hunt regularly in the Nuiqsut or Colville River areas, traveling to Nuiqsut only for special occasions, such as funerals.

Barrow

Barrow is situated on a point of land, the demarcation point between the Chukchi and Beaufort seas, where the sea ice is prone to cracking. The main subsistence focus in this area has been marine mammal hunting, and whaling in particular. Barrow is one of 10 Alaska Eskimo bowhead-whaling communities. Bowhead whale hunting is the key activity in the organization of social relations in the community and represents one of the greatest concentrations of effort, time, money, group symbolism, and significance (SRBA and ISER 1993). Other harvested resources, such as caribou, waterfowl, and several varieties of fish, are vital for subsistence and available to residents, but have less influence on the organization of social relations (Maps 3-40 and 3-41).

Contemporary Seasonal Round

Barrow's seasonal round is related to the timing of subsistence resources (Figure 3-5). Preparation for bowhead whaling occurs year-round. Spring bowhead hunting is undertaken by Barrow whalers during April and May, with May generally being the most successful month (SRBA and ISER 1993). Traditionally, whaling crew members opportunistically hunted other marine mammals, such as seals and polar bears, following spring whaling. Beginning with the whaling season of 1978, bowhead whale quotas instituted by the International Whaling Commission altered traditional spring whaling activities by reducing the opportunity for harvesting bowheads and limiting the pursuit of other marine mammals so as not to jeopardize the bowhead whale hunt. Barrow hunters harvest caribou in April but usually refrain from taking caribou during May because of calving and the spring thaw. The harvest of eiders and geese begins in early to mid-May at Shooting Station, weather and ice conditions permitting.

Once the spring whaling season is over, usually in late May or early June, subsistence activities diversify. Some hunters turn their attention to hunting seals, walrus, and polar bears, while others go inland to fish or hunt for waterfowl and caribou. In June, Iñupiat hunters hunt geese and opportunistically harvest caribou, ptarmigan, and eiders. Barrow residents harvest the largest number of caribou in July and August, when they are available to people hunting from boats. In addition, caribou are in peak condition in August, and Barrow hunters prefer to harvest them at that time (Fuller and George 1999). Barrow hunters also harvest marine mammals, eiders, and fish in August, depending on the weather and ice conditions. Barrow hunters harvest ringed seals primarily for their meat. Walrus are harvested in July and August when they drift north with the floe ice, provided the pack ice moves close enough to Barrow. Freshwater fishing occurs from breakup (June) through November. Residents fish for Arctic cod year-round, but broad whitefish, the most heavily harvested species, are harvested from June to October. Fish harvested in August include whitefish, grayling, salmon, and capelin. If the weather turns warm, Barrow residents harvest caribou by boat, as the caribou move to the coast to escape the heat and insects. Residents of Barrow harvest eiders during the “fall migration” in July at *Pigniq* or “Duck Camp.” Families may go up the Colville River to harvest moose and berries during moose hunting season in August and early September.

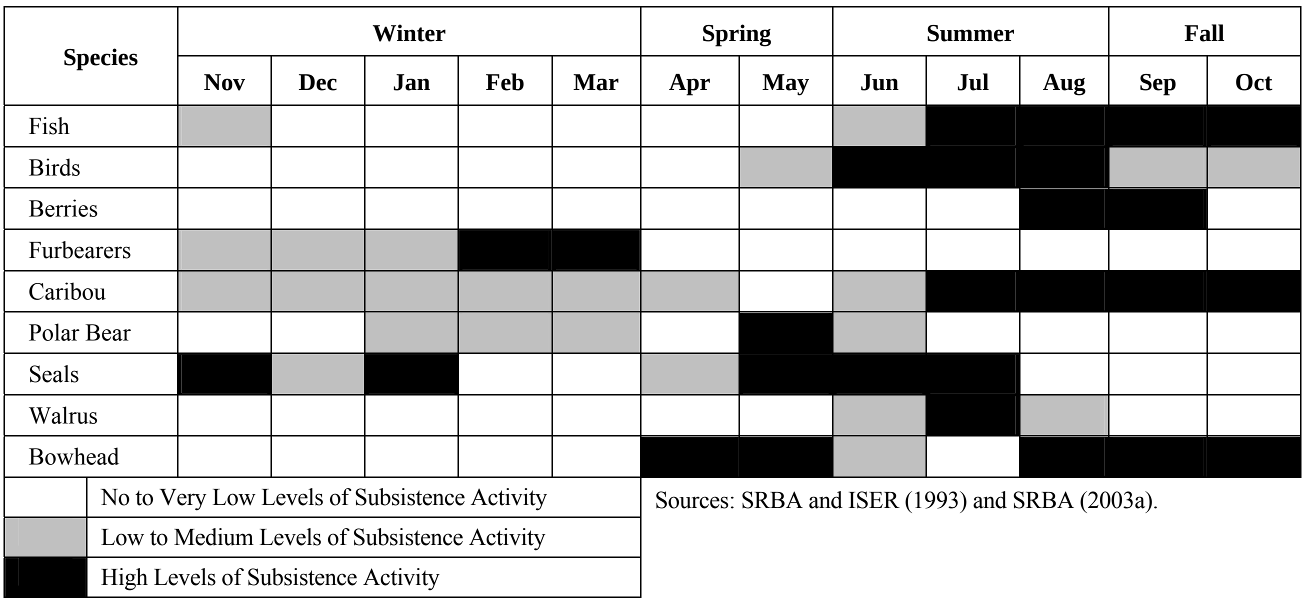


Figure 3-5. Annual Cycle of Subsistence Activities – Barrow.

If ice conditions are favorable, fall bowhead whaling may occur as early as mid-August and continue into October. Residents of Barrow who remain inland hunt caribou if the animals are accessible; otherwise, they concentrate on fishing for grayling and burbot. The subsistence fish harvest generally peaks in October (under-ice fishery), when whitefish and grayling are concentrated in overwintering areas (Fuller and George 1999). Barrow residents also harvest ground (or parka) squirrels and ptarmigan, and, if weather and ice conditions permit and the animals appear close to town, seal and caribou are harvested during November and December (SRBA and ISER 1993). During the winter months, residents of Barrow harvest furbearers.

Contemporary Subsistence Use Areas

The community of Barrow incorporates residents from throughout the NSB. Many residents may hunt in the areas where they were raised, which may include the subsistence harvest areas of other communities. Pedersen (1979) documented Barrow lifetime subsistence use areas in the 1970s, and SRBA and ISER (1993) conducted a 3-year subsistence harvest study in Barrow for the 1987 to 1989 harvest years. With few exceptions, generally associated with offshore and furbearer use, the harvest locations for the 1987 to 1989 study period are located within Pedersen’s (1979) Barrow lifetime community land use area as depicted in Maps 3-40 and 3-41. The documented Barrow subsistence use area represents a large geographic area, extending from beyond Wainwright in the west to the Kuparuk River in the east and south to the Avuna River. Inland use areas go beyond the Colville River to the foothills of the Brooks Range. The Barrow subsistence harvest data from both the 1970s and 1980s and through the 1990s to 2003 (SRBA 2003a, b), show Barrow residents using the Colville River Delta area for subsistence activities.

Contemporary Subsistence Use Areas East of the Community

Hunters interviewed by SRBA (2003b) used the area east of Cape Halkett to pursue wolf, wolverine, and caribou. The winter wolf, wolverine, and caribou hunting area overlapped, as hunters looking for wolf and wolverine tended to travel over great distances and they also harvested caribou on their travels. In summer, the caribou use area extended down the coast from Smith Bay to Cape Halkett, across the coastal areas of Harrison Bay, to the Colville River Delta and up the Colville River as far as Ocean Point. Several Barrow families have relatives living in Nuiqsut, and people commonly move back and forth between the two communities. Many Barrow residents have ancestral ties to areas between Barrow and Nuiqsut, and people continue to return to those areas for subsistence activities at traditionally used places. Barrow hunters use the Planning Area primarily for caribou, moose, and furbearers (wolf and wolverine). One Barrow interviewee indicated he had hunted moose in the Colville River from south of Umiat to approximately Ocean Point. The hunters indicated that they fished as far east as the lakes in the vicinity of Cape Halkett.

Subsistence Harvest Estimates

Barrow's total annual subsistence harvests ranged from 621,067 pounds in 1987 to 1,363,736 pounds in 1992 (SRBA and ISER 1993). The 1992 harvest of 349 pounds per capita of wild resources represents nearly 1 pound per day per person in the community. Barrow residents rely heavily on large land and marine mammals and fish. During a 3-year study by SRBA and ISER (1993), marine mammals comprised approximately 55 percent of the total harvest, and land mammals contributed 30 percent of the total. Fish constituted approximately 7 percent of the total harvest in Barrow, with broad whitefish being the most important fish resource (4 percent of the total harvest). Birds (eiders and geese) contributed less than 2 percent of the total harvest by weight; however, participation in bird hunting was high (Fuller and George 1999).

Several families now living in Barrow have elders who were born and raised along the coast between Smith Bay and the Colville River Delta. These families had moved to Barrow primarily because of the requirement that children attend school, with some moving to take jobs or access medical care. Most moved to Barrow in the late 1940s. Once they resided in Barrow, each family made special efforts to return to the coast from Smith Bay to the Cape Halkett area to continue traditional subsistence activities at traditional family harvest areas. Currently, the third generation of these families continues to use the area, often harvesting resources that are less available in the Barrow area, such as furbearers (wolf, wolverine, fox, and Arctic ground squirrels), caribou, and moose. Seal and fish are harvested closer to Barrow. A Barrow hunter described a recent summer caribou hunt as follows:

> When the Western Arctic Herd are further west from Barrow in Point Lay or Point Hope, that's too far to travel. We had to go east through the ocean to the Cape Halkett area and go into creeks looking for caribou. On nice warm days, you find caribou on the coast and in the water, in the end of July or the first part of August. We go for one week. My uncle has a cabin near Cape Halkett (SRBA 2003b).

Furbearer hunts are unlike subsistence food resource hunts in that they involve friendly competition. Furs are not shared in the same way as food resources, and the hunts are conducted over much larger areas. One hunter stated in good humor, "We fish closest to our own area, we do not try to step on each others toes with fish, but we have no respect (for territory) when it comes to wolf and wolverines" (SRBA 2003b). Barrow residents from the same families, noted for their connections with the Cape Halkett area, use a vast area to the south and east of Teshekpuk Lake for furbearer hunting, and go into the Fish and Judy creeks, Tingmiaksiqvik River, Itkillik River, and Umiat areas while looking for wolves and wolverines. One hunter interviewed said, "I like to go to the south side of Teshekpuk Lake, Inigok, and Umiat before the snow is too soft to get wolves and wolverines for clothing" (SRBA 2003b). Another hunter, explaining his winter hunting by snowmachine, said:

> From February through March, I travel to the east for furbearers. I go down to Price River, then to Fish and Judy creeks, then through Inigok to the Ikpikpuk, back over to the Colville to Umiat, down through the Itkillik, back and forth in a circle, then up to Teshekpuk Lake. I go on both sides of the river. By April the fur isn't so great, so I go home (SRBA 2003b).

Hunters occasionally use the Kalikpik-Kogru rivers area for caribou during the summer, especially if caribou are not available closer to Barrow (SRBA 2003b). The hunters travel by boat as far as Kogru River. It is likely that other Barrow hunters travel further east. This area is both an historic and current use area for several Barrow families. The Colville River Delta is on the eastern edge of Barrow's use area. Barrow residents use snowmachines to hunt for caribou, wolf, wolverine, and fox in winter near Fish and Judy creeks. Hunters use cabins and camps near Teshekpuk Lake (e.g., Puviaq and Inigok) and along the Ikpikpuk and Chipp rivers as bases for snowmachine travel.

In addition to the harvest of resources, use of these areas is important to Barrow residents for maintaining connection to family history, graves, structures, caches, ice cellars, campsites, and traditional harvest areas. Although there are high costs in fuel, time, equipment, and effort for these trips, the cultural connection to these traditional areas is strong.

Nuiqsut

For Nuiqsut, important subsistence resources include bowhead whales, caribou, fish, waterfowl, ptarmigan, and, to a lesser extent, seals, muskox, and Dall sheep. Polar bears, beluga whales, and walruses may be taken opportunistically while in pursuit of other subsistence species. The Iñupiat community of Nuiqsut has subsistence harvest areas in and adjacent to the Planning Area. Nuiqsut's marine subsistence harvest area is in the Beaufort Sea from Cape Halkett in the west to Flaxman Island in the east, and up to 30 miles offshore. Before oil development at Prudhoe Bay, the onshore area from the Colville River Delta in the west to Flaxman Island in the east, inland to the foothills of the Brooks Range, and especially up the drainages of the Sagavanirktok, Colville, Itkillik and Kuparuk rivers, were historically important to the Iñupiat for subsistence harvests of caribou, waterfowl, furbearers, fish, and polar bears.

Nuiqsut Subsistence Activities

A diverse seasonal abundance of terrestrial mammals, fish, birds, and other resources is available in the area immediately surrounding Nuiqsut. Traditional subsistence activities in the Nuiqsut area revolved around caribou, marine mammals, and fish, with moose, waterfowl, and furbearers as important supplementary resources. Nuiqsut's location on the Colville River, some 35 miles upstream from the Beaufort Sea, is a prime area for fish and caribou harvests, but is less advantageous for marine mammal harvests (ADCED 2003). The Colville River is the largest river system on the North Slope and supports the largest overwintering areas for whitefish (Craig 1989a).

Twenty-seven families from Barrow permanently resettled in Nuiqsut in 1973. The Nuiqsut area was formerly a place where Iñupiat and Athabaskan people gathered to trade and fish, maintaining connections between the Nunamiut of the inland areas and the Taremiut of the coast (Brown 1979). The ANCSA allowed Iñupiat from Barrow who wished to live in a more traditional manner to select the site for resettlement, and many of those who moved there had some family connection to the area (IAI 1990a, b). Easy access to the main channel of the Colville River for fishing, hunting, and ease of movement between upriver hunting sites and downriver whaling and sealing sites was the primary reason for selection of the site (Brown 1979).

Nuiqsut is one of 10 Alaska Eskimo whaling communities. Many of those who resettled Nuiqsut were experienced whalers and crew who remembered past whale harvests before the temporary abandonment of the settlement (IAI 1990a, b). Nuiqsut whale hunting is based out of Cross Island, approximately 70 miles northeast of Nuiqsut and approximately 15 miles from West Dock on the west side of Prudhoe Bay. Nuiqsut whalers travel approximately 100 miles from Nuiqsut to the Cross Island whaling camp. Nuiqsut whaling occurs in the fall when the whales migrate closer to shore, because the spring migration path is too distant from shore for effective hunting with small boats. Nuiqsut residents also participate in Barrow's spring whale hunt through close family ties in that community (Fuller and George 1999).

Subsistence activities are important components of the Nuiqsut economy and of local Iñupiat culture and identity (IAI 1990a, b). A 1993 ADFG subsistence study showed that nearly two-thirds of all Nuiqsut households received more than half of their meat, fish, and birds from local subsistence activity (Pedersen 1995). This activity is supported by the cash component of the mixed economy. Nuiqsut is situated closer to current and foreseeable areas of petroleum development than any other community on the North Slope. This development has deterred subsistence resource users from hunting, fishing, and gathering at their former harvest areas east of the Colville River and at coastal areas such as Oliktok Point (IAI 1990a, b; Fuller and George 1999). Subsistence food use and harvest is important for residents of Nuiqsut who have lived in the community for more than 10 years. As employment has increased in Nuiqsut, jobs are being filled by people who move into the community from elsewhere and who may not have the time, knowledge, or inclination to attempt to harvest subsistence foods in the Nuiqsut area. As long-term local residents continue to be underemployed, the value of subsistence foods continues as a lower cost alternative to imported foods (CRA 2002). However, a determinative link between household wage income and household subsistence productivity has not been demonstrated; the former is apparently dependent on education levels, and the latter on the number of capable producers in the household (Pedersen et al. 2000).

Contemporary Seasonal Round

The seasonal availability of many important subsistence resources directs the timing of subsistence harvest activities (Figure 3-6). Fishing may occur year-round, but is most common from breakup (late June) through November (Fuller and George 1999). Beginning in March, Nuiqsut residents hunt ptarmigan. Waterfowl hunting begins in the spring, and hunters typically harvest ducks and geese while participating in other subsistence activities such as fishing for burbot or lingcod (IAI 1990a, b). Caribou are harvested primarily during the late summer and fall months but are hunted year-round. Moose hunting takes place in August and September in boat-accessible hunting areas south of Nuiqsut (Fuller and George 1999). August is the primary harvest month for caribou and moose because water levels are right for traveling upriver or on the coast by boat, the animals are usually in their best condition, and moose are legal to hunt in Game Management Unit 26 for subsistence harvesters. Many Nuiqsut residents participate in subsistence fishing. If weather and ice conditions permit, summer net fishing at fish camps or near the community begins in June or July. Bowhead whaling usually occurs in September when the whales migrate closer to the shore. Nuiqsut hunters harvest few polar bears, but when they are harvested it is often after the fall whaling season. Gill netting at campsites is most productive between October and mid-November. Fishing for grayling also occurs in the fall. Furbearer hunters pursue wolves and wolverines through the winter months, primarily in mid-March and April. Furbearer hunting can be undertaken anytime during the winter; however, most hunters avoid going out in the middle of winter because of poor weather conditions and lack of daylight (IAI 1990a, b).

Subsistence Harvests

Nuiqsut's total annual subsistence harvests ranged from 160,035 pounds in 1985 to 267,818 pounds in 1993. The 1993 harvest of 742 pounds per capita of wild resources represents approximately 2 pounds per day per person in the community. In 1985, fish and land mammals accounted for 86 percent of Nuiqsut's total subsistence harvest, and marine mammals contributed 8 percent. In 1993, fish, land mammals, and marine mammals accounted for approximately one-third each. The importance of subsistence to Nuiqsut residents is further reflected in the high participation rates in 1993 in households that harvest (90 percent), try to harvest (94 percent), share (98 percent), and use (100 percent) subsistence resources.

Contemporary Subsistence Use Areas

Pedersen (1979, In Prep.) documented Nuiqsut "lifetime" and 1973 to 1986 land use areas. Brown (1979) and Hoffman et al. (1988) also documented Nuiqsut subsistence use areas in the 1970s, which are incorporated within the lifetime use areas depicted in Pedersen (1979; Map 3-42).

Even though Nuiqsut is not located on the coast (it is approximately 25 miles inland with river access to the Beaufort Sea), bowhead whales are a major subsistence resource. Bowhead whaling is usually undertaken between late August and early October from Cross Island, with the exact timing depending on ice and weather conditions. Ice conditions can dramatically extend the season up to 2 months or contract it to less than 2 weeks. Unlike Barrow spring whaling, where the hunt is staged from the edge of ice leads using skin boats, Nuiqsut whalers use aluminum skiffs with outboard motors to hunt bowhead whales in open water in the fall. Generally, bowhead whales are harvested by Nuiqsut residents within 10 miles of Cross Island, but hunters may travel much further from the island.

Seals are hunted nearly year-round, but the bulk of the seal harvest occurs during the open-water season. In the spring, seals may be hunted once the landfast ice goes out. Present day sealing is most commonly done at the mouth of the Colville River when it begins flooding after breakup in June. According to Thomas Napageak:

> ...when the river floods, it starts flowing out into the ocean in front of our village affecting the seals that include the bearded seals in the spring month of June. …When the river floods, near the mouth of Nigliq River it becomes filled with a hole or thin spot in [the] sea ice that has melted as the river breaks up. When it reaches the sea, that is the time that they begin to hunt for seals, through the thin spot in the sea ice that has melted. They hunt for bearded seals and other types of seals (USDOI BLM and MMS 1998).

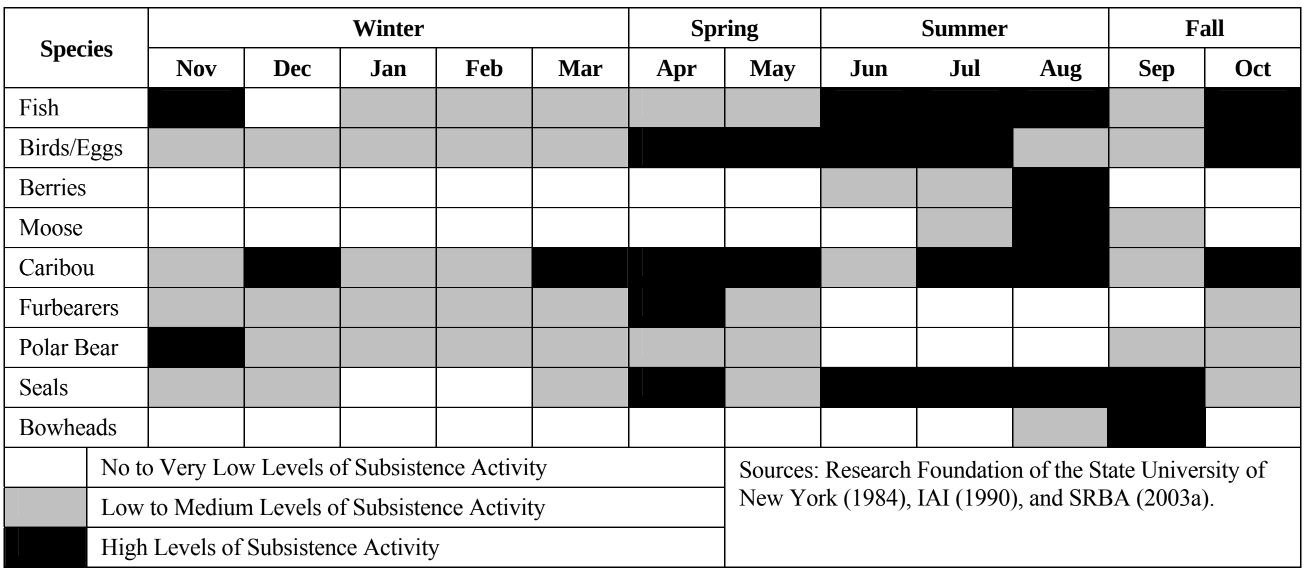


Figure 3-6. Annual Cycle of Subsistence Activities – Nuiqsut.

Nuiqsut hunters harvest several large land mammals, including caribou and moose. Caribou may be the most preferred mammal in Nuiqsut's diet, and during periods of high availability, it provides a source of fresh meat throughout the year. Harvest location data for caribou collected by the NSB (Brower and Hepa 1998, NSB 2003b) and ADFG (2001, 2003), and hunting area interviews (SRBA 2003b) conducted in Nuiqsut for the Alpine Satellite Development Project EIS, indicated that there are several primary harvest areas for caribou. North of Nuiqsut, these harvest locations include the Nuiqsut area, the Colville River Delta, the Nigliq Channel, and the Fish and Judy creeks area. To the south of Nuiqsut, the Colville River provides access to areas and sites such as Itkillikpaat, Ocean Point, the Itkillik River, Umiat, and the confluences of the Anaktuvuk and Chandler rivers. West of Nuiqsut are some of the most important remaining subsistence use areas for terrestrial mammals, including caribou, wolf, and wolverine. Nuiqsut hunters travel as far west as Barrow, and some reported traveling to within sight of Atqasuk, in pursuit of subsistence resources, particularly when they are less abundant near Nuiqsut. Travel to the east is undertaken by heading south of the Kuparuk and Meltwater projects by snowmachine, then looping back north to the vicinity of Franklin Bluffs and sometimes beyond. In open water months, travel east is by boat along the coast for caribou, seal, eider and sea ducks, and in fall to Cross Island for whaling. These areas are usually associated with TLUI sites, cabins, camps, and Native allotments with harvest locations for other species nearby. These harvest locations may be used in winter (October through May), summer (defined as the open water period, including June through

September), or both, and they may be accessed by foot, boat, all-terrain vehicle, and snowmachine. Nuiqsut hunters use the general vicinity of Teshekpuk Lake to harvest caribou, wolves, and wolverines, (Figures J-9, J-10) and several Nuiqsut families, along with relatives in Barrow and Atqasuk, share use rights to cabins, camps, and allotments in the area and consider it their homeland.

The most important species of waterfowl for Nuiqsut hunters are Canada and white-fronted geese and brant; eiders are also harvested. Ruth Nukapigak relates that "...when the white-fronted goose come, they do hunt them. When the thin ice near the mouth of the river breaks up, that is when they start duck hunting. We, the residents of Nuiqsut, go there to hunt for ducks when they arrive" (USDOI BLM and MMS 1998). The only upland bird hunted extensively is the ptarmigan (Brower and Hepa 1998, ADFG 2001). Recent data indicated that the bird harvest provides 5 percent of the total subsistence harvest (Brower and Hepa 1998). Waterfowl hunting occurs mostly in the spring, beginning in May, and continues throughout the summer. In the summer and early fall, such hunting usually occurs as an adjunct to other subsistence activities, such as checking fish nets.

Waterfowl harvested by the Iñupiat of Nuiqsut occupy two habitats in the greater Nuiqsut area. Ducks, geese, and brant molt and nest in the wet tundra to the north of Nuiqsut. Eiders nest on the sandy areas of the Colville River Delta and the barrier islands, molting after their arrival. Both groups of waterfowl raise their young in the area until fall, when they migrate south. Nuiqsut hunters harvest waterfowl during the migration in May and June using snowmachines and boats. The hunters harvest the migrating birds from snow blinds built to the south, near Sentinel Hill and Ocean Point or at Fish Creek. Once the river breaks up, hunters look for birds by boat, and start to look for eiders in the Colville River Delta and in Harrison Bay at the ice edge as summer approaches. Hunters end the waterfowl harvest when the birds are on their nests (SRBA 2003b).

In earlier times, Iñupiat resource users harvested flightless molting birds by cooperatively "herding" them into creeks, then dividing the harvest between the work group members. One resident remembered doing this as recently as the late 1940s at Oliktok Point. Nuiqsut people in the past gathered and stored eggs from waterfowl nests on the tundra. According to the 2003 interviews, eggs are no longer gathered, and certain species of waterfowl are not harvested for various reasons. Some residents indicated that they do not eat certain varieties of ducks (e.g. oldsquaws, northern pintails), while many chose to avoid harvesting black brant and spectacled eiders because they are species of concern. Nearly all interviewed resource users harvest geese in May, and most harvest some eiders when breakup allows boat travel on the river and in Harrison Bay (SRBA 2003b).

Fish provide the most edible pounds, per capita, of any subsistence resource harvested by Nuiqsut. While variable by season and from year to year, fish provide a relatively stable, predictable, and substantive contribution to subsistence resource harvests. The subsistence harvesting of fish is not subject to seasonal limitations under federal fisheries management, and no permit is required for rural residents, a situation that adds to their importance in the community's subsistence round. Nuiqsut has the largest documented subsistence fish harvest on the Beaufort Sea coast (Moulton et al. 1986a, Moulton 1997). On occasion, fish may provide the only source of fresh, easily accessed subsistence foods.

Nuiqsut's location on the Nigliq Channel of the Colville River, with large resident fish populations, reflects the importance of fish to subsistence users. The river supports 20 species of fish, approximately half of which are taken by Nuiqsut residents (George and Nageak 1986). Local residents generally harvest fish during the summer and fall. The summer, open-water harvest lasts from breakup to freezeup (early June to mid-September). The summer harvest covers a wide area, is longer than the fall/winter harvest in duration, and a greater number of species are caught. Broad whitefish, the primary species harvested during the summer, is the only anadromous species harvested in July. Thomas Napageak related that "in the summer when it is time to fish for large, round-nosed whitefish, the place called *Tirragruag* gets filled with them, as well as the entrance to *Itkillik*. Nigliq River gets filled with nets all the way to the point where it begins. We do not go to *Kuukpiluk* in the summer months. Then we enter Fish Creek... another place where they fish for whitefish is *Nuiqsagruaq*" (USDOI BLM and MMS 1998).

In July, lake trout, northern pike, broad whitefish, and humpback whitefish are harvested south of Nuiqsut. Traditionally, coastal areas were fished in June and July when rotting ice created enough open water for seining. Nuiqsut elder Sarah Kunaknana, interviewed in 1979, said: "...in the little bays along the coast we start seining for fish (*iqalukpik*). After just seining one or two times, there would be so many fish we would have a hard time putting them all away" (Shapiro et al. 1979). Salmon species reportedly have been caught in August, but not in large numbers. Pink and chum salmon are the species most commonly caught (George and Nageak 1986). Arctic char is found in the main channel of the Colville River, but is not abundantly caught (George and Kovalsky 1986, George and Nageak 1986, ADFG 2001).

The fall/winter under-ice fish harvest begins after freezeup, when the ice is safe for snowmachine travel. Local families fish for approximately 1 month after freezeup, until the river ice is too thick to allow the setting of nets through holes in the ice. The *Kuukpigruaq* Channel is the most important fall fishing area in the Colville River region, and the primary species harvested are Arctic and least cisco.

Nuiqsut resource users have a long history of subsistence fishing in the Colville River and its tributaries from the Colville River Delta to the confluence with the Ninuluk Creek, in the Nigliq Channel and nearby Fish and Judy creeks, and in the innumerable lakes in the region. Nuiqsut fishermen also use coastal areas east to the Kuparuk River and fish around several barrier islands, including Thetis and Cross islands. Many families set nets near Nuiqsut in the Nigliq Channel when time, transportation needs, or funds do not permit longer trips from town, particularly during the school and work year. Cooperative arrangements are made between resource users wherein resources (such as time, equipment, gas, and labor) are pooled in exchange for shares of the harvest. Resource users often fish in conjunction with other subsistence activities, such as caribou and moose hunting and berry picking, especially in harvest areas with camps and cabins. Certain species of fish are only seasonally available and must be harvested when present in the area. Nuiqsut fishers freeze or dry these fish for later use and barter. Other fish species are available year-round and provide fresh food as well as a welcome change in the diet during the winter and spring (SRBA 2003b).

3.4.2.5 Subsistence User Avoidance of Developed Areas

Following the reestablishment of Nuiqsut in the Colville River Delta in 1973, community residents re-familiarized themselves with the subsistence resources of the area based on the knowledge of elders who had remained in the area or continued to use the area while living in other communities. Their subsistence harvest and use areas are documented in *Nuiqsut Paisaŋich* in a series of maps (Brown 1979), by the NSB as part of its program of traditional land use documents (Hoffman et al. 1988), and by Pedersen (1979 and In Prep). In 1973, oil development was some distance from the community, but its impacts were felt by residents who had ties to the developed area and by residents who wished to use subsistence areas on the east side of the developed area (Brown 1979). These issues and concerns were documented in the early 1980s by researchers working under contract to MMS for the Social and Economic Studies Program (Institute for Social and Economic Research [ISER] 1983). The ISER (1983) report documented the high potential Iñupiat subsistence users have noted for conflicts between industrial and Iñupiat land uses and subsistence access. The report also outlined the conflicts and concerns between Iñupiat subsistence uses and industry (ISER 1983). No other community in Alaska is as close as Nuiqsut to intensive oil exploration, development, and production. This proximity is reflected in residents' increased concerns about reduced subsistence access through increased regulations, competition with outsiders, and the imposition of physically obstructive facilities in traditional use areas (ISER 1983).

Through the 1980s, the industrial developed area expanded overland west from Prudhoe Bay, and the possibility of nearshore and offshore development near Nuiqsut was impending (IAI 1990a). By 1985, development encompassed subsistence and traditional use areas from Oliktok Point south along the Kuparuk River (Pedersen et al. 2000). The harvest of marine resources at specific locations was complicated or prevented by onshore development at traditional camps (e.g., Oliktok Point, Niakuk) and by offshore activity (e.g., drilling, seismic testing, and sealift; Pedersen et al. 2000).

By 1990, Galginaitis wrote in MMMS Social and Economic Studies Special Report 8 that "Perhaps the most obvious effect of oil development in the Nuiqsut area has been that it has effectively removed certain areas from the Nuiqsut subsistence land use area" (IAI 1990a). Subsistence users' reasons for avoiding or not avoiding areas in response to oil development in the late 1980s were similar to those noted in the 1983 ISER study and included regulatory constraints, cultural prohibitions from using developed areas, lack of cultural privacy, notice or belief that a resource is contaminated, and physical obstacles and barriers such as low pipelines and steep gravel road side-slopes (ISER 1983, IAI 1990a).

Nuiqsut subsistence use areas retreated from the east as development moved westward from Prudhoe Bay to Oliktok Point, particularly in the area of the Kuparuk River Unit field. Onshore development displaced subsistence uses east of the Colville River for the majority of Nuiqsut users, and the few who continued to use the area did so primarily for political purposes and did not take many caribou there (IAI 1990b). By 1990, the concern in the community of Nuiqsut was that development would continue to encroach on their shrinking subsistence and traditional use areas on the Itkillik and Colville rivers and the Colville Delta (IAI 1990b). At that time, some hunters noted that further development in these subsistence use areas would impose a severe hardship on the community of Nuiqsut (IAI 1990b).

In 1993, onshore subsistence harvests and uses east of the Colville River and north of Nuiqsut declined to near zero, and development activity was encroaching on valued traditional use areas (Pedersen et al. 2000). Whaling at Cross Island, the use of onshore camps, and storage of the bowhead harvest at Oliktok Point became deeply entwined with oil company personnel and oversight, as companies sought to minimize the time spent by Iñupiat hunters in the developed areas and to avoid attracting polar bears to Oliktok Point by shipping whale meat and *maktaq* by air to Nuiqsut. This assistance provided some advantages to subsistence users because it was convenient and saved them time; however, it also reduced the autonomy of the hunters and subjected them to scrutiny and regulation throughout the whaling process, which result in a lack of cultural privacy (Pedersen et al. 2000).

Nuiqsut caribou harvests within the developed area in 1993 were at or near zero. Four percent were within 5 miles of developed areas, 17 percent were harvested from 6 to 15 miles, and 79 percent were harvested more than 16 miles from development. The 1994 caribou harvest data were similar in terms of the percent of caribou harvested in relation to harvest proximity to development. Key informants noted in a 1998 Nuiqsut group session that they no longer used the developed area northeast of Nuiqsut as intensively as they had in the past because of difficulties in accessing the area, lack of privacy, loss of cultural landmarks, uncertainty regarding regulations, and oil field security enforcement (Pedersen et al. 2000).

For the study years reported in Pedersen et al. 2000 (i.e., 1993 and 1994), harvest locations and amounts for caribou are consistent with the published and unpublished harvest location data from the NSB Division of Wildlife Management for 1994-95, 2000, and 2001 (Brower and Hepa 1998; NSB Department of Wildlife Management 2003b). Both sets of data support the finding that Iñupiat subsistence users harvest most of their caribou in locations that are distant from developed areas east of the Colville River. This shift applies to most other subsistence resources, as well.

Pedersen and Taalak (2001) conducted a survey of Nuiqsut households during June 1999 through May 2000. Caribou were the most widely used terrestrial big game resource in Nuiqsut, with an average of four caribou per household when averaged for all community households. According to their report, 75 percent of the 371 caribou harvested by Nuiqsut hunters from June 1999 through May 2002 with known harvest locations were harvested west of Nuiqsut, 11 percent were harvested in the immediate vicinity of the community, and only 14 percent were harvested to the east. Seventy-eight percent of all known caribou harvests occurred away (6 to >16 miles) from oil production facilities in 1999-2000. Twenty-two percent were reported harvested in peripheral areas (0 to 5 miles) to development, and there were no reports of harvests during this time period inside the industrial developed area. In general, these findings are consistent with the earlier conclusions for the 1993 and 1994 caribou harvests (Pedersen et al. 2000). However, the 1999-2000 caribou harvests classified as distant (> 16 miles) from oil development dropped to 51 percent, compared to 79 percent in 1993 and 77 percent in 1994. This reduction is the result of oil development (Alpine field) moving west into the Colville Delta, an area of focused Nuiqsut caribou harvests, especially during June through September.

Development in this area is too recent and there are insufficient data available to conclude whether harvesters will increase their distance from development in response to this relatively new facility. Furthermore, in 1999-2000, the Alpine field footprint was relatively small compared to larger development east of the Colville River, and ConocoPhillips Alaska, Inc., has made efforts to work with Nuiqsut to accommodate hunters. Systematic, time series monitoring of subsistence harvests and locations to document any changes to subsistence harvest patterns is being undertaken in Nuiqsut, Barrow, and Atqasuk by the Alaska Department of Fish and Game and the Iñupiat Community of the Arctic Slope (Pedersen 2004).

Based on data from Pedersen et al. (2000) and Pedersen and Taalak (2001), as a consequence of oil development, Nuiqsut caribou harvesters tend to avoid development, with approximately 78 percent of the 1993 and 1994 caribou harvests occurring greater than 16 miles from the development east of the Colville River. In addition, 51 percent of the 1999-2000 harvests occurred greater than 16 miles from the Alpine field development, while 27 percent occurred 6 to 15 miles from the Alpine field development.

Further development anticipated in Pedersen et al. (2000) has come to pass with the development of Alpine, Meltwater, Tarn, Fiord, and other oil fields in the vicinity of Nuiqsut. This ongoing development has contributed to a feeling of being “boxed in” for Nuiqsut subsistence users (Pedersen et al. 2000). The Committee on the Environmental Effects of Oil and Gas Activities on Alaska’s North Slope recently concluded in a NRC (2003) report that:

> On-land subsistence activities have been affected by the reduction in the harvest area in and around the oil fields. The reductions are greatest in the Prudhoe Bay field, which has been closed to hunting, and in the Kuparuk field, where the high density of roads, drill pads, and pipelines inhibits travel by snowmachine. The reduction in area used for subsistence is most significant for Nuiqsut, the village closest to the oil-field complex. Even where access is possible, hunters are often reluctant to enter oil fields for personal, aesthetic, or safety reasons. There is thus a net reduction in the available area, and this reduction continues as the oil fields spread (NRC 2003).

3.4.3 Sociocultural Systems

The topic of sociocultural systems encompasses the cultural values and social organization of the society. This section provides a profile of the sociocultural systems that characterize Barrow, Atqasuk, and Nuiqsut. All of these communities are within the NSB. The ethnic, sociocultural, and socioeconomic makeup of the communities on the North Slope is primarily Iñupiaq (Iñupiat).

Sociocultural systems of the North Alaskan Iñupiat are described and discussed in detail in the *Liberty Development and Production Plan Final EIS* (USDOI MMS 2002), the *Beaufort Sea Sale 170 Final EIS* (USDOI MMS 1998), the *Beaufort Sea Oil and Gas Development Project/Northstar Final EIS* (USACE 1998), and the *Beaufort Sea Sale 144 Final EIS* (USDOI MMS 1996a). Sociocultural systems of the North Alaskan Iñupiat are described and discussed in detail in the *Beaufort Sea Sale 97 Final EIS* (USDOI MMS 1987a), the *Chukchi Sea Sale 109 Final EIS* (USDOI MMS 1987b), the *Beaufort Sea Sale 124 Final EIS* (USDOI MMS 1990d), and the *Beaufort Sea Sale 144 Final EIS* (USDOI MMS 1996a).

The following description is augmented by information from current studies including: USDOI BLM National Petroleum Reserve – Alaska 105(c) studies and other pertinent documents (USDOI BLM 1978a, b, c; 1979b, c, d; 1981; 1982a, b, c; 1983a, b, c; 1990; 1991; Schneider et al. 1980; Hoffman et al. 1988; SRBA et al. 1993; Alaska Natives Commission 1994; Human Resources Area Files 1994; Fall and Utermohle 1995; ADFG 1996, 2002; and USDOI MMS 1996b, c).

3.4.3.1 Cultural Values

For centuries, survival in the Arctic has centered on the pursuit of subsistence foods and materials and the knowledge needed to find, harvest, process, store, and distribute the harvest. The development of Iñupiat culture depended on passing on traditional knowledge and beliefs about subsistence resources. This knowledge included observations of game behavior, how to use those observations to successfully locate and harvest game, and how hunters and their families should behave to ensure successful harvests in the future. Other skills and knowledge handed down through the generations included a suite of tools, techniques, and strategies necessary to survive and even thrive in the harsh Arctic environment (Spencer 1976). For the Iñupiat, subsistence and culture continue to be inextricably intertwined. The process of obtaining, refining, and passing on subsistence skill is inextricably linked to the Iñupiat culture, which is based on interdependent family groups, and a tradition of sharing harvested resources.

Traditionally, Iñupiat cultural values focused on their close relationship with natural resources, specifically game animals and the supernatural, which was believed to control natural phenomena, with specific beliefs in animal souls and beings controlling the movements of animals. Other cultural values include conflict avoidance, an emphasis on the community, its needs, and its support of other individuals. The Iñupiat respect people who are generous, cooperative, hospitable, humorous, patient, modest, and industrious (Lantis 1959; Milan 1964; Chance 1966, 1990). Although there have been substantial social, economic, and technological changes in Iñupiat lifestyle, subsistence continues to be the central organizing value of Iñupiat sociocultural systems. The Iñupiat remain socially, economically, and ideologically loyal to their subsistence heritage. Indeed, "most Iñupiat still consider themselves primarily hunters and fishermen" (Nelson 1969). North Slope residents voice this refrain repeatedly (Kruse et al. 1983; ACI et al. 1984; IAI 1990a, b; USDOI MMS 1994). Bernice Pasula stated at the *Beaufort Sea Sale 124 EIS* scoping hearings in Nuiqsut that "I am a whaler, and I am proud to be a whaler, and my kids will be whalers too for as long as it'll go on, and maybe someday I'll have my own crew, and that's my dream" (USDOI MMS 1990a).

Task groups are still organized to hunt, gather, and process subsistence foods. Cooperation in hunting and fishing activities also remains an integral part of Iñupiat life, and a major component of significant kin ties is the identity of those with whom one cooperates (Heinrich 1963). Large amounts of subsistence foods are shared within and between the communities, and the people one gives to and receives from are major components of what comprises significant kin ties (Heinrich 1963; ACI et al. 1984). As discussed in the 2004 *Alpine Satellite Development Plan Final EIS* (USDOI BLM 2004c), the sharing of subsistence foods is essential to the maintenance of family ties, kinship networks, and community well-being. Disruption of subsistence harvest patterns could alter these cultural values and affect community social structure. For the system of sharing to operate properly, some households must consistently produce a surplus of subsistence goods. For this reason, the supply of subsistence foods in the sharing network is more sensitive to harvest disruptions than the actual harvest and consumption of these foods by the primary producer.

The cultural value placed on kinship and family relationships is apparent in the sharing, cooperation, and cooperative subsistence activities occurring in Iñupiat society. Cultural values are also apparent in the patterns of residence, reciprocal activities, social interaction, adoption, political affiliations, employment, sports activities, and membership in voluntary organizations (e.g., Mother's Club, Search and Rescue; ACI et al. 1984). Barrow resident Beverly Hugo, testifying at public hearings for the MMS' *Beaufort Sea Sale 124 EIS*, summed up Iñupiat cultural values this way:

> ...these are values that are real important to us, to me; this is what makes me who I am... the knowledge of the language, our Iñupiat language, is a real high one; sharing with others, respect for others... and cooperation; and respect for elders; love for children; hard work; knowledge of our family tree; avoiding conflict; respect for nature; spirituality; humor; our family roles. Hunter success is a big one, and domestic skills, responsibility to our tribe, humility... these are some of the values... that we have... that make us who we are, and these values have coexisted for thousands of years, and they are good values... (USDOI MMS 1990b).

Bowhead whale hunting remains the center of Iñupiat spiritual and emotional life; it embodies the values of sharing, association, leadership, kinship, Arctic survival, and hunting prowess (Bockstoce et al. 1979; ACI et al. 1984). The importance of the whale hunt is more than emotional and spiritual. The organization of the crews does much to delineate important social and kin ties within communities and define community leadership patterns. The structured sharing of the whale harvest helps determine social relations within and between communities (Worl 1979, ACI and SRBA 1984, IAI 1990a, b). Structured sharing also holds true for caribou, fish, and other subsistence pursuits. Only fur hunting is governed by a good-natured competitiveness among hunters (SRBA 2003). In Iñupiat communities, the giving of subsistence foods does more than feed people, it bonds giver and receiver, joining them to a living tradition and reinforces a feeling of community.

Today, this close relationship between the spirit of a people, their social organization and the cultural value of subsistence hunting may be unparalleled when compared with other areas in America where energy development is taking place. The Iñupiat's continuing strong dependence on subsistence foods, particularly marine mammals and caribou, creates a unique set of potential effects from onshore and offshore oil exploration and development on the social and cultural system. Barrow resident Daniel Leavitt articulated these concerns during a 1990 public hearing for Beaufort *Sea Sale 124 EIS*:

> ...as I have lived in my Iñupiat way of livelihood, that's the only... thing that drives me on is to get something for my family to fill up their stomachs from what I catch (USDOI MMS 1990c).

Integrity of Place

In traditional times, Iñupiat extended family groups named themselves for the areas they used, which the Iñupiat in turn subdivided into people of the land (Nunamiut) and people of the coast (Taremiut; Spencer 1976). Some of the people who resettled Nuiqsut, for example, considered themselves Kuukpikmuit, people of the Colville River Delta. One strategy Iñupiat used to maintain their connection to their homelands before the resettlement period was to use summer and winter school vacations to go from Barrow out to their camps. These regional groups reestablished NSB communities, many depopulated by the 1960s, in order to ease access to places that were important subsistence and meeting places. The availability and use of modern transportation technology allowed continuous use when it was necessary to reside in Barrow for education, health care, and/or employment (Brown 1979).

Many people continue to use or desire to return to camps and harvest locations used in traditional times. Iñupiat consider traveling "out on the land" to be the natural and preferred state of affairs, and many feel even a brief trip can be therapeutic and stress relieving (IAI 1990a, b). Some residents preserved their camps by applying for allotments before the passage of the ANCSA, while others continue to use the land much as they had before Congress enacted the ANCSA and ANILCA to address land ownership issues in Alaska. Maintaining these ties to traditionally used sites, many listed in the NSB TLUI, is a priority for residents of Iñupiat communities (Brown 1979).

3.4.3.2 Social Organization

The social organization of Iñupiat communities is strongly based on kinship. Kinship forms "the axis on which the whole social world turn(s)" (Burch 1975a). Historically, households were composed of large extended families, and communities were kinship units. Today, there is a trend away from the extended-family household because of increased mobility, availability of housing, and changes in traditional kinship patterns. However, kinship ties in Iñupiat society continue to be important and remain a central focus of social organization.

The social organization of North Slope Iñupiat encompasses not only households and families but also wider networks of kinsfolk and friends. These types of networks are related through overlapping memberships, and are embedded in those groups responsible for hunting, distributing, and consuming subsistence resources (Burch 1970). An Iñupiat household on the North Slope may contain a single individual or group of individuals who are related by marriage or ancestry. The interdependencies among Iñupiat households differ markedly from those found in the United States as a whole.

In the larger non-Iñupiat society, the demands of wage work emphasize a mobile and prompt workforce. While modern transportation and communication technologies allow for contact between parents, children, brothers, sisters, and other extended-family members, more often than not, independent nuclear households (father, mother, and children) or conjugal pairs (childless couples) form independent "production" units that do not depend on extended-family members for the day-to-day support of food, labor, or income. In contrast to the non-Native culture, in the Iñupiat culture individual family groups depend on the extended family for support and provision of day-to-day needs.

Associated with these differences, the Iñupiat hold unique norms and expectations about sharing. Households are not necessarily viewed as independent economic units, and giving, especially by successful hunters, is regarded as an end in itself, although community status and esteem accrue to the generous. The sharing and exchanging of subsistence resources strengthen kinship ties (Nelson 1969; Burch 1971; Worl 1979; ACI et al. 1984; Luton 1985; Chance 1990).

The following describes the communities that may be affected by development in the Planning Area. These community-specific descriptions discuss factors relevant to the sociocultural analysis of the community in relation to industrial activities, population, and current socioeconomic conditions. Following these descriptions, social organization, cultural values, and other issues of all the communities are discussed.

Atqasuk

Atqasuk is a small, predominantly Iñupiat community, located inland from the Arctic Ocean on the Meade River about 60 miles south of Barrow. In 2000, there were 228 residents, 94.3 percent of whom were Iñupiat (USDOC Bureau of the Census 1991, 2000). The community was established in the mid-1970s under the ANCSA by Barrow residents who had traditional ties to the area. People lived in tents until NSB-sponsored housing arrived in 1977. Atqasuk is an inland village and caribou and fish are the primary subsistence resources. Social ties between Barrow and Atqasuk remain strong, and men from Atqasuk go to Barrow to join bowhead whaling crews.

To a large degree, Atqasuk has avoided the rapid social and economic changes experienced by Barrow and Nuiqsut brought on by oil development activities, but future change could accelerate as a result of oil exploration and development in the National Petroleum Reserve – Alaska. Possible new pipeline routes could cross Atqasuk's terrestrial subsistence-harvest areas, as most of its traditional subsistence-use area is within the Northwest National Petroleum Reserve – Alaska. Atqasuk is located to the west of the Planning Area, and the eastern edge of its subsistence-use area approaches the western boundary of the Planning Area.

Barrow

On the North Slope, Barrow is the largest community and the regional center. Barrow's entire terrestrial subsistence-harvest area is within the boundary of the National Petroleum Reserve – Alaska, and the Planning Area is considered Barrow subsistence territory. Barrow already has experienced dramatic population changes because of increased revenues from onshore oil development and production in Prudhoe Bay and other smaller oil fields; these revenues have stimulated the NSB Capital Improvement Projects. Barrow is the largest community on the North Slope and its regional center. Barrow's population in 2003 was 4,417 (Alaska Department of Labor and Workforce Development [ADOLWD] 2004).

Nuiqsut

Nuiqsut, one of three abandoned Iñupiat villages in the North Slope region identified in the ANCSA, was resettled in 1973 by 27 families from Barrow. The population was 354 (92.7 percent Iñupiat) in 1990 and 433 (89.1 percent Iñupiat) in 2000 (USDOC Bureau of the Census 1991, 2000). Between 1990 and 2000, the population of Nuiqsut grew at a rate of 2.2 percent per year, which was slower than the rate of growth during the previous decade, and also slower than the growth of Barrow. However, Nuiqsut grew faster than Atqasuk during this period. Today, Nuiqsut is experiencing rapid social and economic change, with a new hotel, an influx of non-Iñupiat oil workers from the Alpine field adjacent to the community, and potential development of oil in the National Petroleum Reserve – Alaska. Much of Nuiqsut's subsistence use occurs within the proposed Planning Area, including many of its subsistence-harvest areas for caribou, fish, and birds. The estimated population for 2003 is 416 (ADOLWD 2004).

3.4.3.3 Characteristics of the Population

The North Slope includes two relatively distinct populations: local residents who are predominately indigenous Iñupiat natives, and the oil and gas industry workforces, who rotate on a regular schedule and are temporary worker/residents in the region. As temporary residents, the oil and gas industry workers have minimal participation in the local economy, and their needs for all services are provided by industry. On the other hand, full-time residents of the region form the primary social structure and the local economy.

The North Slope has a fairly homogeneous population of Iñupiat—about 72 percent in 1990. This is an approximation, as the 1990 Census did not distinguish between Iñupiat and other Alaskan Natives and American Indians, although there were only 110 individuals (1.8 percent of the total NSB population) in the NSB that fell into these latter two classifications. The Census did distinguish between Eskimo, Aleut, and Indian, although Iñupiat, Yup'ik, Cup'ik, and Siberian Yup'ik were grouped together as "Eskimos;" "Indians" included the Haida, Eyak, and Tsimsian Athabascan tribes. The percentage in 1990 ranged from 92.7 percent Iñupiat in Nuiqsut to 61.8 percent Iñupiat in Barrow (USDOC Bureau of the Census 1991). In 1990, the populations of the communities near the Planning Area were 139 in Point Lay, 492 in Wainwright, 3,469 in Barrow, 216 in Atqasuk, and 354 in Nuiqsut. In 2000, population counts were 247 for Point Lay, 546 for Wainwright, 228 for Atqasuk, 4,581 for Barrow, and 433 for Nuiqsut (USDOC Bureau of the Census 2000). The percentages in 2000 ranged from 89.1 percent Iñupiat in Nuiqsut to 64.0 percent Iñupiat in Barrow. In 2000, 5,450 (73.8 percent) NSB residents reported they were all or part Alaska Native or American Indian. Although the Census did not differentiate between Eskimo, Aleut, and Indian, it did ask for the individual's "Alaska Native or American Indian tribe(s)." Based on tribal data, at least 4,594 of the 7,385 NSB residents were Eskimo.

North Slope society responded to early contacts with outsiders by successfully changing and adjusting to new demands and opportunities (Burch 1975a; Worl 1978; NSB Contract Staff 1979). Since the 1960s, the North Slope has witnessed a period of intense change, with the pace of change quickened by the area's oil developments (Lowenstein 1981). In the Prudhoe Bay/Kuparuk River industrial complex, oil-related work camps have altered the seascape and landscape, making some areas off limits to traditional pursuits such as hunting. Large NSB Capital Improvement Projects have dramatically changed the physical appearance of NSB communities.

Social services have increased dramatically from 1970 to the present, with increased NSB budgets and grants acquired by or through the Arctic Slope Native Association and other nonprofit organizations, and village and regional tribal governments. In 1970 and 1977, residents of North Slope villages were asked about their state of well being in a survey conducted by the University of Alaska-Anchorage (UAA) Institute of Social and Economic Research (Kruse et al. 1983). The survey noted significant increases in complaints about alcohol and drug use in all villages between 1970 and 1977. Health and social-services programs have attempted to meet the needs of alcohol and drug-related problems with treatment programs and shelters for wives and families of abusive spouses and with greater emphasis on recreational programs and services, yet a lack of adequate funding for individual NSB city governments has hampered the development of these programs. In addition, declining revenues from the State of Alaska have seriously impaired the overall function of NSB city governments. Partnering together, tribal governments, city governments, and the NSB government may be able to provide programs, services, and benefits to residents. For several years, all communities in the NSB have banned the sale of alcohol, although alcohol possession is not banned in Barrow, and many communities are continually under pressure to bring the issue up for a local referendum vote (NSB 1998).

The introduction of modern technology has tied the Iñupiat subsistence economy to a cash economy (Kruse et al. 1982 *in* IAI 1990b). Nevertheless, oil-supported revenues help support a lifestyle that still is distinctly Inupiaq; indeed, outside pressures and opportunities have sparked what may be viewed as a cultural revival (Lantis 1973). What exists in the communities of the North Slope is a dual economic system "in which a modern cash economy and traditional subsistence are interwoven and interdependent," and through which the culture adapts and perpetuates itself (USDOI BLM 1979a, NSB 1998). People continue to hunt and fish, but aluminum boats, outboards, and all-terrain vehicles now help blend these pursuits with wage work. Iñupiat whaling remains a proud tradition that involves ceremonies, dancing, singing, visiting, cooperation between communities, and the sharing of foods. The possible effects of the proposed action on subsistence have been and will continue to be a major issue for residents in the North Slope communities.

The baseline of the present sociocultural system includes change and strain. The very livelihood and culture of North Slope residents have come under increasing scrutiny, regulation, and incremental alteration. Increased stresses on social well being and on cultural integrity and cohesion have come at a time of relative economic well being. The expected challenges on the culture by the decline in Capital Improvement Projects funding from the state have not been as significant as once expected. The buffer effect has come mostly through the dramatic growth of the NSB's own permanent fund, the NSB taking on more of the burden of its own capital improvements, and its emergence as the largest employer of local residents. However, NSB revenues from oil development at Prudhoe Bay are on the decline, and funding challenges (and subsequent challenges to the culture) continue as the state legislature alters accepted formulas for NSB bonding and funding for rural school districts.

North Slope residents exhibit an increasing commitment to area-wide political representation, local government (the revitalization of the Indian Reorganization Act [IRA] tribal governments), and the cultural preservation of such institutions as whaling crews and dancing organizations, as well as the revival of traditional seasonal celebrations. The NSB's Commission on Iñupiat History, Language, and Culture is an important body for preserving Iñupiat heritage, from conducting elders conferences and other cultural activities to preserving oral histories and actively pursuing the repatriation of cultural artifacts and remains under the Native American Graves Protection and Repatriation Act (Kruse et al. 1983; ACI et al. 1984; USDOI MMS 1994, 1995a, 1996a, 1997; USDOI BLM 1997; NSB 1998).

3.4.3.4 Institutional Organization of the Communities

The NSB provides most government services for the communities that might be affected by activity in the Planning Area. These services include public safety, public utilities, fire protection, and some public-health services. Future fiscal and institutional growth is expected to slow because of economic constraints on direct Iñupiat participation in oil-industry employment and growing constraints on the statewide budget, although NSB revenues have remained healthy and its own permanent fund account continues to grow as does its role as primary employer in the region (Kruse et al. 1983; Harcharek 1992, 1995). The ASRC, formed under ANCSA, runs several subsidiary corporations. Most of the communities also have a village corporation, a Traditional Village or IRA Village Council, and a city government. The IRAs and village governments have not provided much in the way of services, but village corporations have made service contributions.

3.4.4 Environmental Justice

The Iñupiat, a recognized Alaska Native minority, are the predominant residents of the NSB. The Iñupiat rely heavily on subsistence foods. Oil and gas exploration and development could affect the subsistence resources and harvest practices they depend upon.

Environmental justice is an initiative that culminated with President Clinton's February 11, 1994, EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," and an accompanying Presidential memorandum. The EO requires that each federal agency consider environmental justice to be part of its mission. Its intent is to promote fair treatment of people of all races, so no person or group of people bears a disproportionate share of the negative environmental effects from the country's domestic and foreign programs. While the EO focuses on minority and low-income populations, the USEPA defines environmental justice as the "equal treatment of all individuals, groups or communities regardless of race, ethnicity, or economic status from environmental hazards" (Envirosense 1997, U.S. Department of Energy 1997). Specific to the EIS process, the EO requires that proposed projects be evaluated for "disproportionately high adverse human health and environmental effects on minority populations and low income populations."

Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," requires the BLM to consult with Iñupiat tribal governments of the North Slope on federal matters that significantly or uniquely affect their communities. The USEPA's Environmental Justice guidance of July 1999 stresses the importance of government-to-government consultation. As one way to foster tribal participation and mitigate exploration and development impacts in the Planning Area, the BLM created the Subsistence Advisory Panel in 1998. Representatives from the communities of Anaktuvuk Pass, Atqasuk, Barrow, Nuiqsut, and Wainwright, a representative from the NSB, and BLM decision-makers, compose the Subsistence Advisory Panel. Since its inception, the Subsistence Advisory Panel has met numerous times in NSB communities, resulting in an ongoing dialogue that will guide the BLM in making decisions on future exploration and development activities in the National Petroleum Reserve – Alaska.

Scoping meetings were held during development of the Amended IAP/EIS. Iñupiat translators were provided at these meetings to facilitate participation of non-English speakers. Environmental justice considerations for this Amended IAP/EIS included: 1) initial scoping, 2) local radio broadcasts and notices in the North Slope newspaper, 3) follow-up meetings that included discussions specific to environmental justice concerns, 4) public hearings on the Draft Amended IAP/EIS, and 5) ANILCA 810 hearings. The scoping meetings were held during October and November, 2003, in the NSB communities of Anaktuvuk Pass, Atqasuk, Barrow, and Nuiqsut. During this scoping process, the BLM received feedback on specific environmental justice concerns of the Iñupiat residents. In addition, the BLM held a meeting in Anchorage early December 2003, with residents of Nuiqsut to discuss their concerns. The BLM met again with the residents of Barrow and Nuiqsut in mid-January 2004, to further discuss their concerns and project alternatives. Public hearings were held in the NSB communities of Anaktuvuk Pass, Atqasuk, Barrow, Bethel, and Nuiqsut during August 2004. During November and December 2004, ANILCA 810 and subsistence hearings were also held in the same communities.

Major concerns expressed at these meetings included:

- Protecting Native Allotments, hunting and fishing camps, and cultural sites
- Identifying and protecting important subsistence areas
- Protecting caribou migration routes
- Restricting access to subsistence areas and resources
- Providing river setbacks or buffers to protect historic fishing sites
- Studying and maintaining the health of fish and wildlife
- Mitigating seismic disturbance of caribou, fish, and whales
- Making better use of Traditional Knowledge
- Providing natural gas to local communities
- Providing more local hire
- Involving local people in scientific studies of resources
- Including local people in the planning process
- Improving oversight and enforcement of mitigation measures
- Cleaning up contaminated sites
- Minimizing disturbance from staging areas, roads, docking facilities, and pipeline access
- Clarifying the BLM's government-to-government policy

A more detailed discussion of Alaska Native concerns is provided in the *Public Scoping Summary Report for the Amendment to the Northeast National Petroleum Reserve – Alaska IAP/EIS* (ENSR 2004).

3.4.5 Land Uses and Coastal Management

3.4.5.1 Land Ownership and Uses

Land Ownership

The Planning Area boundary extends to the northern boundary of the National Petroleum Reserve – Alaska, generally following the shoreline but extending offshore to encompass certain bays and lagoons. The boundary follows the eastern boundary of the National Petroleum Reserve – Alaska from the coast up the Colville River to a point about 25 miles southwest of Umiat. From there it jogs north 27 miles and then west 54 miles to the Ikpikpuk River, which forms the western boundary of the Planning Area.

The majority of land within the Planning Area is under federal jurisdiction, with the remaining lands limited primarily to Native entities. The majority of these are located around the village of Nuiqsut (Map 1-5). The State of Alaska also owns a small portion of the Planning Area.

Federal Jurisdiction

Executive Order 3797, signed by President Warren G. Harding on February 27, 1923, reserved 23.7 million acres and established the Naval Petroleum Reserve Number 4 (PET-4). This area was reserved for oil and gas development for Naval defense purposes. The NPRPA of 1976 (PL 94-258) transferred jurisdiction of PET-4 from the Navy to the Secretary of the Interior and renamed it the National Petroleum Reserve – Alaska. The Planning Area encompasses approximately 4.6 million acres, of which 4,511,753 acres are under federal jurisdiction.

Ownership of the land in the bays and lagoons that are within the National Petroleum Reserve – Alaska boundary, but tidally influenced, were disputed between the state and federal governments. The U.S. Supreme Court in the United States v. State of Alaska (Orig. 84), commonly known as the "Dinkum Sands" case, ruled in June of 1997 that these lands are federally owned because the land was retained by the U.S. Congress at statehood (1959). These offshore lands within the Planning Area could be made available to oil and gas leasing, along with onshore federal lands. Lands beyond this northern boundary, extending from mean low tide out for 3 miles, are owned by the State of Alaska under the Federal Submerged Lands Act.

Native Allotments

The Native Allotment Act of 1906, as amended, allowed an Alaskan Indian and/or Eskimo to receive up to 160 acres of vacant and unappropriated land. Applicants had to show use and occupancy of lands selected.

The majority of the Native allotments within the National Petroleum Reserve – Alaska were closed to selection prior to the passage of the ANILCA. This was a result of applicants being informed that if they relinquished their claims, the village corporations would receive ANCSA conveyances sooner, and then the corporations would reimburse the applicants for the lands relinquished. Another factor was the belief that the National Petroleum Reserve – Alaska lands were not available for selection under the Native Allotment Act of 1906.

With the passage of the ANILCA (Section 905), allotments within the National Petroleum Reserve – Alaska were reinstated with the exception of the allotments on lands conveyed to the village corporations of Atqasuk, Barrow, or Wainwright. Section 12 of the Technical Correction Act of 1992 amended Section 905 of the ANILCA to allow the allotments on lands conveyed to the corporations within the National Petroleum Reserve – Alaska to be reconveyed if certain conditions were met. All three villages will reconvey the Native allotments to the U.S. for certification of the Native allotment to the applicant.

Certificates of Allotments issued on lands valuable for oil and gas contain a reservation of those minerals to the U.S. It is presumed that all certificates for allotments in the Planning Area will contain this reservation. There are approximately 34 allotments comprising approximately 4,380 acres within the Planning Area. All 34 have been surveyed and have been, or are being, certificated.

Village Corporation Lands

The ANCSA allowed the four village corporations of Atqasuk, Barrow, Nuiqsut, and Wainwright to select surface lands under Sections 12(a) and 12(b) (Map 3-43). The NPRPA reiterated the availability of lands for selection and conveyance by village corporations under the ANCSA. Section 12 of the Technical Corrections Act of 1992 allowed the villages to reconvey lands under a valid Native allotment application in exchange for an equal number of acres of additional selections. For the village of Nuiqsut, the total 12(a) and (b) entitlement is 77,014 acres within the Planning

Area. Currently, 28,970 acres have been patented and 29,360 acres have been conveyed on an interim status, leaving 18,684 acres that still need to be selected to complete Nuiqsut's entitlement.

Regional Corporation Lands

The ASRC owns 5,400 acres of surface land in the Planning Area at Cape Halkett, which was exchanged for ASRC's Kurupa Lake lands (5,332 acres) on December 9, 1981. The ASRC also owns limited subsurface rights within the Planning Area.

The ANCSA did not allow the ASRC to select the subsurface estate within the National Petroleum Reserve – Alaska. However, Section 12(a)(l) did allow the ASRC to select the subsurface estate from lands outside the National Petroleum Reserve – Alaska withdrawal in acreage equal to its entitlement. Public Land Order 5183, dated March 9, 1972, clarified this process while it withdrew National Petroleum Reserve – Alaska lands from subsurface selection by the regional corporation. The NPRPA (1976) reiterated the arrangement in 1976, recognizing the village corporations' selections of surface estate as provided by ANCSA without providing for other land claims.

It was not until 5 years later that selections by regional corporations were allowed in the National Petroleum Reserve – Alaska. The Appropriations Act of 1981 (PL 96-514) authorized the Secretary of the Interior to lease lands within the National Petroleum Reserve – Alaska for oil and gas exploration and development. The passage of this Act allowed the implementation of Section 1431(o) of the ANILCA by providing specific legislative authority to exchange National Petroleum Reserve – Alaska lands contingent upon legislative direction to open the National Petroleum Reserve – Alaska to commercial development. This specific provision allowed the ASRC to select the subsurface of village-selected lands if lands within 75 miles of the village lands were made available for commercial development. The ASRC selected the subsurface estate under all lands selected by Nuiqsut and under a portion of the lands conveyed to Wainwright. At Nuiqsut, the ASRC will receive the subsurface rights once the entitlement is completed.

State of Alaska

The state owns 1,450 acres at the Umiat Airport, which were obtained by a Quit Claim Deed on June 1, 1966 (U.S. Survey 9571). Lands beyond the northern boundary of the Planning Area, extending from mean low tide out for 3 miles, are owned by the State of Alaska under the Federal Submerged Lands Act. The ADNR makes decisions on the use of these state lands, including decisions on oil and gas leasing.

3.4.5.2 Land Uses

Authorized Use

Poor soil conditions in the Planning Area limit the ability of the BLM to entertain most land use proposals for summer operations. Permafrost underlays the entire National Petroleum Reserve – Alaska, and floodplains and wetlands cover the majority of the area, reducing even further BLM's ability to allow surface activity. Some winter activities are allowed with specific restrictions on a case-by-case basis.

Current management policy for the Planning Area allows only those activities that, with stipulations, would have a negligible impact on the environment. Because of the fragile nature of thawed tundra during the summer, permit sites are restricted to durable areas such as gravel bars, beaches, or existing gravel pads. During the winter, when the freeze has stabilized the mineral soils and the snow protects the vegetation, it is possible to traverse the tundra with Rolligon-type vehicles (low-impact vehicles operating on the tundra with minimal disturbance).

The activities listed below represent a sampling of long-term and short-term land use currently authorized or pending authorization within the Planning Area:

- Annual overland resupply moves between the various North Slope villages using track- or Rolligon-equipped vehicles.
- Active (Lonely) and inactive (Kogru) DEW-Line installation locations.
- Minimum Impact Permits (3-year duration) authorized under FLPMA include, but are not limited to, a Wildlife Observation Station at Teshekpuk Lake issued to the NSB, a paleontological dig (dinosaur bones) in the Colville River drainage at Ocean Point, and a proposed staging/storage area for the Western Geophysical Company at Inigok airstrip.
- A 15.5-acre lease to Cook Inlet Region, Inc., a Native regional corporation, for the USGS/Husky logistics camp and staging area near the Lonely DEW-Line installation. Cook Inlet Region, Inc., took possession of the buildings through a General Services Administration agreement.
- Numerous Special Recreation Permits within the Planning Area that authorize commercial sport hunting operations for up to a 5-year duration.
- Annual winter geophysical activities (seismic) by geophysical research companies throughout the Planning Area.
- Authorization for continued research on revegetation at well sites, climatic studies, etc.
- Various communication/navigation-related authorizations to federal agencies for Vortec sites, radar beacon sites, communication towers, etc.

There currently are approximately 20 authorizations for these types of activities within the Planning Area. Most of these are the type that allows use for 3 to 5 years, with none exceeding 20 years.

Access

There are no existing roads that link the Planning Area with any other villages within the National Petroleum Reserve – Alaska. The BLM, however, has linked the villages of Barrow, Atqasuk, Wainwright, and the Kogru River, northwest of Nuiqsut, with marked trails (marking is ongoing) that are usable only during the winter. These winter trails follow, but are not part of, existing ANCSA Section 17(b) easements, which connect existing road networks within the various villages with state, public, or private roads outside the National Petroleum Reserve – Alaska. The trails do not cross Native Allotments. There are no ANCSA 17(b) easements within the Nuiqsut village lands.

Structures

There are a number of structures, primarily cabins, on federal public lands without BLM authorization. An inventory to establish the location and ownership of these structures, as well as completion of survey and conveyance of Native allotments, must be completed before accurate numbers can be determined.

3.4.5.3 Coastal Zone Management

The Coastal Zone Management Act (CZMA) (16 USC 1451-1464, Chapter 33), enacted in 1972 and last amended in 1996, and the Alaska Coastal Management Act (ACMA; AS [Alaska Statutes] 46.39 and 46.40), enacted in 1977 and last amended in 2003, guide development and land use in coastal areas to provide a balance between the use of coastal areas and the protection of valuable coastal resources.

Alaska Coastal Management Program

In 1979, the Alaska Coastal Management Program (ACMP) was approved pursuant to the CZMA. The ACMP includes statewide standards and coastal district enforceable policies addressing development and use of natural resources within the coastal zone. Pursuant to the 2003 ACMA revisions, amendments to the ACMP have been submitted to the Office of Ocean and Coastal Resource Management (OCRM) in the National Oceanic and Atmospheric Administration (NOAA). Approval of the amendments is pending. The coastal zone and coastal district boundaries are mapped in *Coastal Zone Boundaries of Alaska*, an atlas produced by the Alaska Division of Governmental Coordination (ADGC; 1988). Maps of the coastal zone boundaries can also be seen on the internet at: www.alaskacoast.state.ak.us/GIS/boundary.htm. Portions of the Planning Area are included on Harrison Bay, Ikpikpuk River, Teshekpuk, and Umiat maps. Activities either occurring within the coastal zone or that may reasonably be expected to affect coastal resources and uses must be conducted in a manner consistent with the ACMP.

The CZMA excludes federal lands from coastal zone jurisdiction, however, the exclusion of federal lands does not remove federal agencies from the obligation of complying with the consistency provisions of Section 307 of the CZMA when federal actions or federally permitted activities on these excluded lands have spillover impacts that affect any land or water use or natural resource of the coastal zone within the jurisdiction of a state's management program (15 CFR § 923.33; 16 USC 1456; 11AAC 110.400). Federal activities, such as an oil and gas lease sale, having reasonably foreseeable effects on any coastal use or resource must be consistent to the maximum extent practicable with the standards of the ACMP and the enforceable policies of the NSB's Coastal Management Program. A consistency determination prepared by the BLM initiates the state's review for oil and gas lease sales.

Federally permitted activities in the coastal area of National Petroleum Reserve – Alaska must undergo an ACMP review if they require a listed federal authorization (15 CFR § 930.53[a][(1]; 11 AAC § 110.400). Federally permitted activities outside the coastal area that have reasonably foreseeable effects to coastal resources or uses must also undergo a state consistency review. Applicants for these federally permitted activities must certify that their activities are consistent with the ACMP. The state consistency review for federally permitted activities begins when the state receives a consistency certification and necessary data and information from the party submitting the application to the federal agency. Federally permitted activities subject to ACMP review will not be authorized if they are not consistent with the statewide standards of the ACMP and the coastal district enforceable policies.

The standard of review for federal activities, such as oil and gas lease sales, is that a project must be consistent with the ACMP "to the maximum extent practicable." The consistent "to the maximum extent practicable" standard does not apply to federally permitted activities. The standard of review for applicable federally permitted activities requires that these activities must be consistent with the ACMP standards and enforceable policies.

Thirty-three coastal districts have developed coastal management programs with enforceable policies that became part of the ACMP. District plans developed and approved under the previous ACMP are currently in effect, but will be updated by mid-2005 to comply with the revised ACMP. Amendments to the district programs must be approved by the ADNR commissioner and by the Secretary of Commerce through the NOAA OCRM. The statewide standards that may be relevant to potential activities in the Planning Area addressed in this Amended IAP/EIS are summarized below.

Resources and Habitats

Thirteen coastal habitat areas were identified as being subject to the ACMP habitats standards, including offshore areas; estuaries; wetland; tideflats; rocky islands and sea cliffs; barrier islands and lagoons; exposed high-energy coasts; rivers, streams, and lakes (including associated floodplains and riparian management areas); and important habitat. Each habitat has a policy specific to maintaining or enhancing the attributes that contribute to its capacity to support living resources (11 ACC 112.300).

Air, land, and water quality are included as the second of three policy areas under Resources and Habitats. The ACMP defers to the mandates and expertise of the ADEC for these resources. The standards incorporate by reference all the statutes, regulations, and procedures of the ADEC that pertain to protecting air, land, and water quality (11 AAC 112.310). Concerns for air and water quality are cited frequently during state reviews for consistency.

The third policy area encompasses historic, prehistoric, and archeological resources. For these resources, the ACMP indicates the ADNR will designate "areas of the coastal zone that are important to the study, understanding, or illustration of national, state, or local history or prehistory, including natural processes" (11 ACC 112.320).

Uses and Activities

Nine topics are addressed under this heading: 1) coastal development, 2) natural hazard areas, 3) coastal access, 4) energy facilities, 5) utility routes and facilities, 6) timber harvest and processing, 7) sand and gravel extraction, 8) subsistence, and 9) transportation routes and facilities. All of these uses and activities, except timber harvest and processing, may be relevant to potential activities within the National Petroleum Reserve – Alaska.

Implementation of the revised ACMP requires that adverse impacts to coastal zone resources be avoided where practicable and minimized where avoidance is not practicable. Where neither avoidance nor minimization is practicable, compensatory mitigation of adverse impacts should be implemented "to the extent appropriate and practicable" (11 AAC 112.900).

Both the federal CZMA and the ACMP require that uses of state and federal concern be addressed (CZMA Section 30312(C), AS 46.40.060, and AS 46.40.070). The ACMA further stipulates that local districts may not arbitrarily or unreasonably restrict or exclude such uses in their coastal management programs. Among the uses of state concern are the siting of major energy facilities and of transportation and utility routes and facilities.

North Slope Borough Coastal Management Program

The NSB adopted the NSB Coastal Management Program (CMP) in 1984. Following several revisions, the NSB CMP was approved by the Alaska Coastal Policy Council in April 1985 and by the NOAA Office of Ocean and Coastal Resource Management in May 1988. Amendments pursuant to the revised ACMP have not been developed as of this writing. The coastal management boundary adopted for the NSB CMP varies slightly from the interim boundary of the ACMP. In the mid-Beaufort sector, the boundary was extended inland on several waterways to include anadromous fish spawning and overwintering habitats. The NSB CMP is applicable inland to approximately 25 miles and along the full length of all major river corridors. Maps are viewable on the internet as noted above.

The NSB CMP was developed to balance exploration, development, and extraction of nonliving natural resources and maintenance of and access to the living resources upon which the Iñupiat traditional cultural values and way of life are based. Cultural and historic patterns of subsistence use of the natural resources in the National Petroleum Reserve – Alaska have been and continue to be of the highest priority to the NSB. The NSB's CMP has been implemented with the primary goal of protecting the subsistence lifestyle of the NSB's largely Iñupiat population while encouraging and managing economic development. Major land uses on the North Slope are divided between traditional subsistence uses and hydrocarbon-development operations. The NSB CMP contains four categories of enforceable policies: 1) standards for development, 2) required features for applicable development, 3) best-efforts policies that include both allowable developments and required features, and 4) minimization-of-negative-impacts policies.

Standards for development prohibit causing severe harm to subsistence resources or activities and disturbance of cultural and historic sites. Required features address reasonable use of vehicles, vessels, and aircraft; engineering criteria for structures; drilling plans; oil spill control and cleanup plans; pipelines; causeways; residential development associated with resource development; and air quality, water quality, and solid-waste disposal.

Best-efforts policies allow for exceptions if: 1) there is "a significant public need for the proposed use and activity," and 2) developers have "rigorously explored and objectively evaluated all feasible and prudent alternatives" and briefly documented why the alternatives have been eliminated from consideration. If an exception to a best-efforts policy is granted, the developer must take "all feasible and prudent steps to avoid the adverse impacts the policy was intended to prevent."

Policies in this category address developments that significantly could decrease productivity of subsistence resources or ecosystems or restrict access of subsistence users to a resource. They also place restrictions on various modes of transportation, mining of beaches, or construction in certain floodplains and geologic-hazard areas.

Developments and activities regulated under these policies include coastal mining, support facilities, gravel extraction in floodplains, new subdivisions, and transportation facilities. Siting policies include the state habitat policies and noninterference with important cultural sites or essential routes for transportation to subsistence resources.

All applicable developments must minimize "negative impacts." Regulated developments include recreational uses, transportation and utility facilities, and seismic exploration. Protected features include permafrost, subsistence activities, important habitat, migrating fish, and wildlife. Geologic hazards must be considered in site selection, design, and construction.

The NSB has adopted administrative procedures for implementing these policies based on the permit process established under Title 19 of the NSB's Land Management Regulations (LMRs) and the consistency-review process of Title 46 of the Alaska Statutes. The following is a brief discussion of the NSB's local land use plans that exist in the region.

North Slope Borough Land Management

The NSB Comprehensive Plan and LMRs were adopted in December 1982. The LMRs were revised in April 1990. The revisions simplified the regulatory process but did not alter the basic premise of the comprehensive plan—to preserve and protect the land and water habitat essential to subsistence living and the Iñupiat character of life.

A draft Comprehensive Plan revision, prepared in 1993, was approved by each of the eight community councils, but it was never approved and adopted by the NSB Assembly. The NSB is now in the process of initiating a new Comprehensive Plan that is expected to be completed in 2005.

The current LMRs have five zoning districts: Village, Barrow, Conservation, Resource Development, and Transportation Corridor. All areas within the NSB are in the Conservation District unless specifically designated as within the limited boundaries of the villages or Barrow, as a unitized oil field within the Resource Development District, or along the TAPS corridor (the Transportation Corridor).

Uses are categorized in the LMRs as: 1) uses that can be administratively approved without public review, 2) uses that require a development permit and must have public review before they can be administratively approved, or 3) uses that are considered conditional development that must be approved by the Planning Commission.

Policy revisions in the LMRs incorporated the policies of the NSB CMP and supplemented these with additional policy categories: Village Policies, Economic Development Policies, Offshore Development Policies, and Transportation Corridor Policies. Offshore policies are specifically limited to development and uses in the portion of the Beaufort Sea that is within the NSB boundary. All the policies address oil and gas leasing activities, onshore and offshore. The enforceable policies of the NSB CMP have been incorporated within the zoning ordinance in Section 19.70.050.

It is BLM's policy to consider local zoning to the extent practical in any decision regarding the use of federal lands. Local land use plans in the National Petroleum Reserve – Alaska are acknowledged, but they do not necessarily control activities on federal lands.

3.4.6 Recreational and Wilderness Resources

3.4.6.1 Recreation Resources

The BLM describes recreation resources in terms of the Recreation Opportunity Spectrum (ROS). The ROS classes are: Primitive; Semi-Primitive Nonmotorized; Semi-Primitive Motorized; Roaded Natural; Roaded Modified; Rural; and Modern Urban.

All lands are placed in a particular ROS class based on the setting, activities available, and the type of experience afforded. Once classified, lands are managed for recreation according to their ROS class. Most of the lands in the Planning Area fall within the Semi-Primitive Motorized management class. The remainder, corresponding to private lands within the Planning Area, falls within the Roaded Modified class.

Setting

The Planning Area is a vast Arctic region with outstanding recreation opportunities. Portions of the area are well suited for outdoor recreational activities such as backpacking, float boating, camping, fishing, hunting, and winter sports. Hunting and fishing activities of area residents are not extensively addressed here because those activities are too deeply ingrained in the subsistence lifestyle to be considered recreational.

With its small resident population, costly access, lack of facilities, and few visitors, the area currently is underused and could support additional recreation in the future. Despite its immense size (4.6 million acres), recreational use of the Planning Area probably represents about 1 percent of total statewide recreation.

Because of the lack of roads to (and within) the Planning Area, summer access is almost exclusively by charter aircraft. Aircraft are available for charter at various locations, including Umiat on the Colville River. Guide services are an additional cost and vary with the type of guided activity.

Among the more attractive opportunities afforded by the Planning Area are those associated with the pristine quality of the region, such as backpacking, float boating, and wildlife viewing. The untouched environment, combined with the remoteness of the area, offer a wilderness experience comparable to any other available in the U.S. Even in Alaska, there are few areas such as the National Petroleum Reserve – Alaska where a person can be 100 miles or more from the closest village or site of human activity. The area's principal outdoor recreational activities are described in the following sections.

Activities

Backpacking and Hiking

Very little backpacking (overnight trip) or hiking (day trip) unrelated to subsistence activities presently takes place within the Planning Area. It is likely that fewer than five recreational backpacking parties (four persons per party) enter the area each year, and most of this use probably is limited to areas near Umiat. Backpacking and hiking also occur in the major river valleys in conjunction with float-boating activities. The backpacking/hiking season is rather short, generally from late June to early September. There are no developed hiking trails. Access for backpacking is provided by aircraft using the larger lakes and gravel bars as landing sites.

Boating

Very little recreational use (i.e., not related to subsistence) is made of the rivers and lakes in the Planning Area. Fewer than 15 multi-day recreational float trips (four persons per trip) are estimated to occur within the Planning Area each year. Most of the boating is done with rubber rafts or folding kayaks to facilitate access by aircraft, which land on gravel bars or beaches, large pools on the rivers, or on lakes. Generally, the opportunities for float boating on rivers in the Planning Area are not outstanding in comparison to similar opportunities offered elsewhere in Alaska. For example, none of the rivers in the area offer whitewater boating because most of the rivers have an insufficient flow of water during much of the summer. Some of the better boating rivers in the area are the Colville and the Ikpikpuk rivers. Recreational boating and sailing are not practical on the many lakes and ponds in the Planning Area due to the shallowness of most lakes.

Sightseeing

According to Alaska's Outdoor Recreation Plan, sightseeing is one of the most popular recreational activities of Alaska's residents and the most popular recreational activity of visitors to Alaska (ADNR 1976). Although very little sightseeing occurs in the Planning Area, the opportunity to view wildlife in its natural habitat is perhaps the most exciting recreational opportunity in the region. Millions of waterfowl and other birds seasonally migrate to and through the area. Grizzly bear, Arctic fox, wolf, wolverine, caribou, moose, various raptors, and other animals inhabit the area. Some species tend to gather in the river valleys at certain times of the year, while other animals are found in large numbers near the coast (USDOI BLM 1978d). Following are descriptions of several notable wildlife viewing areas in the Planning Area.

- The area along the ACP of the National Petroleum Reserve – Alaska, including Teshekpuk Lake, contains the highest concentration of geese, swans, ducks, gulls, terns, jaegers, and loons in the National Petroleum Reserve – Alaska. Snowy owls may also be observed along the coast during the summer months.
- The area located approximately north of 70° North latitude, south of Teshekpuk Lake and between the Colville and Ikpikpuk rivers, has moderate to high concentrations of waterfowl, jaegers, terns, and loons during the summer.
- The area along the Colville River from just south of Nuiqsut to the Planning Area boundary is a moderate concentration area for moose during the winter and caribou during the summer.
- The area along the middle and lower segments of the Colville River provides habitat for a subspecies of peregrine falcon and other raptors during the summer. North of Umiat, the chance for viewing ptarmigan along the river increases. The area also provides an opportunity for observing grizzly bears from June through September.
- The area located on the upper Ikpikpuk River affords opportunities to observe moose during the summer. Grizzly bears and ptarmigan also may be seen here from June through September.

The prime viewing conditions are related to the open, treeless nature of the Arctic tundra, the tendency of some animals to concentrate in the riverine areas, the long hours of daylight during the summer, and lack of extensive contact between wildlife and humans.

Guided or packaged sightseeing tours offered by various companies may account for a significant increase in the total number of visitors to the region in the future. However, most of this use would be limited to villages and village corporation lands and would not affect the public lands. At present, this activity is almost exclusively focused on Barrow (outside the Planning Area).

Sport Hunting

Big-game animals are the primary targets of most sport hunting in the Planning Area. Few trophy animals are found, however, and game populations are abundant only in scattered locations within the Planning Area. Caribou of the TLH are the most numerous big-game animal in the Planning Area. Subsistence hunting by North Slope residents accounts for most of the caribou harvest within this herd. Most moose are taken within the Colville River drainage, particularly near Umiat. Moose populations on the North Slope, and especially on the Colville River, have declined significantly in recent years, and moose hunting in the area has been severely curtailed by the ADFG. Grizzly bears are the only bears hunted in the Planning Area; black bears do not inhabit the area. Grizzlies are hunted during the fall and spring, primarily in the foothills and protected river valleys of the southern portion of the Planning Area.

Sport Fishing

Sport fishing on the Arctic Slope is largely an incidental activity conducted opportunistically by persons in the area primarily for other purposes, such as big-game hunting, float boating, construction, or government projects.

Winter Activities

Very little winter recreation is known to occur in the Planning Area beyond the immediate area of Nuiqsut. Although extensive travel is usually linked to subsistence hunting and fishing and to visiting other villages, some travel is recreational. The gentle terrain and wind-packed snow throughout much of the Planning Area create favorable conditions for snowmachining, dogsledding, and cross-country skiing. The best skiing is found in the river and creek drainages, where snow is deeper and the hard-pack surface more level than elsewhere.

Tourism

Tourism could account for the greatest increase in the number of visits to the region in the future. Currently, few visitors leave the immediate vicinity of the villages or Native corporation lands.

Off-Highway Vehicles

The BLM is required by EO 11644 (as amended by EO 11989) and 43 CFR § 8340 to designate all public lands as "open," "limited," or "closed" to off-road vehicle (ORV) use. In Presidential EOs and BLM regulations, the term "off-road vehicle" or "ORV" has a legally established definition. For this discussion however, the term "off-highway vehicle" or "OHV" will be used. This is a designation treated by the public, industry, and land management agencies as interchangeable with the term "ORV" to describe the broad use of motorized vehicles in the Planning Area.

Recreational (nonsubsistence) use of OHVs is considered very low in the Planning Area. The area has vast stretches of wet, boggy terrain covered with tussocks, making OHV use difficult during the summer months. While some summer OHV use does occur adjacent to village lands and subsistence camps, access to the Planning Area is primarily via aircraft or motorboat along waterways.

Winter use of snowmachines is more common, although mostly associated with subsistence activities. Inter-village winter travel occurs along several travel routes that can migrate with changing snow and ice conditions, making a trail route difficult to establish and winter travel dangerous for the average recreational user. There is a potential for development of guided tour operations between villages, although this activity would need to be authorized through a Special Recreation Permit under 43 CFR § 2930 regulations and would include use stipulations.

Recreational Experience

For the most part, the recreational experience provided by the Planning Area is primitive. Virtually the entire area is characterized by an unmodified natural environment with a very low concentration of users and very little evidence of human use. The opportunity for isolation from the sights and sounds of other humans and to feel a part of the natural environment is high. Activities are not dependent on BLM facility development. The primitive experience may be tempered, however, because use of snowmachines and motorized boats is permitted.

Existing Recreation Developments

No BLM-maintained or authorized recreational developments or structures exist on public lands within the Planning Area. There is no developed road system into or through the area. Recreational access is almost entirely by aircraft. Typically, natural features such as lakes, rivers, gravel bars, and ridges serve as airstrips. Umiat, located on state land on the southeastern boundary of the Planning Area, has a state-maintained airstrip; fuel and limited lodging (a five-bed motel) are available. The village of Nuiqsut has a maintained landing strip that can be used by the public, although use by nonresident recreationalists is not encouraged. Emergency landings are possible at various DEW-Line sites located along the coast.

3.4.6.2 Wilderness

For an area to be considered for Wilderness designation it must be roadless and possess the characteristics required by Section 2(c) of the Wilderness Act of 1964. These characteristics are:

- Naturalness—lands that are natural and primarily affected by the forces of nature;
- Roadless and having at least 5,000 acres of contiguous public lands; and

- Outstanding opportunities for solitude or a primitive and unconfined types of recreation.

In addition, areas may contain "supplemental values," consisting of ecological, geological, or other features of scientific, educational, scenic, or historical importance, as discussed in the *BLM Wilderness Inventory and Study Procedures Handbook H-6310-1* (USDOI BLM 2001).

The Planning Area was evaluated for the above characteristics during the Section 105(c) studies in 1978. Practically all of National Petroleum Reserve – Alaska remains in a state of de facto wilderness as it was during that study. Residents of the area do occupy seasonal dwellings or fish camps, which if not entirely compatible with naturalness and solitude are, nonetheless, allowed in designated wilderness areas in Alaska. While the local population travels extensively by motorized vehicle (primarily snowmachines) over parts of the Planning Area, particularly near communities, there are no roads outside the communities. In spite of the National Petroleum Reserve – Alaska having been subjected intermittently to oil and gas exploration since the 1920s, the overall character of the Planning Area (excluding private lands) is that of a natural, undisturbed area, with very few obvious signs of modern human influence or presence. A visitor to the area or an inhabitant of one of the few settlements in or near the National Petroleum Reserve – Alaska can easily find opportunities for solitude (USDOI BLM 1978d).

During an inventory conducted in 2001, the BLM identified wilderness units within the Planning Area. These units were identified using hydrologic borders. This inventory identified the entire Planning Area as possessing wilderness characteristics. Each study unit was assigned a name and letter designation. Although most of the Planning Area meets the criteria for Wilderness designation, there are distinct differences in the characteristics, attributes, and uses within the Planning Area.

Characteristics of Wilderness

Naturalness

Because of the sheer size of the Planning Area, most of the lands have probably never had human intrusion. A portion of the eastern section of the Planning Area, however, especially those lands near Nuiqsut, is used and has been used for many years by the people who live in the community. Use consists of subsistence hunting with OHVs, motorboats, etc. Trails have been established from village to village and from villages to camps along river corridors. Many trails have no specific direction and were made in pursuit of subsistence resources. Use of OHVs and other means of access are allowed in Wilderness Areas (see ANILCA, Section 1110) for traditional and subsistence purposes.

Village to village utility proposals, such as power lines, natural gas lines, and other facilities oriented to village and/or city living, are being looked at for future accommodations. Cabins, generally used as seasonal dwellings for subsistence fishing camps, are scattered along the rivers and some lakes. Native Allotments either are, or will become, private lands. These allotments tend to be located primarily near Nuiqsut and along rivers.

Other facilities in place throughout the Planning Area (camps, airstrips, wellheads, etc.) remain from past oil and gas exploration. Most of these facilities are in various stages of reclamation. Some of the old methods of seismic surveys and transportation of personnel and equipment did leave lasting impacts on the soils and vegetation of the area. Scars of this past activity are still noticeable in some parts of the Planning Area today.

Roadless

Most of the Planning Area is roadless as defined by the *BLM Wilderness Inventory and Study Procedures Handbook* (USDOI BLM 2001): "The word 'roadless' refers to the absence of roads which have been improved and maintained by mechanical means to insure relatively regular and continuous use. A way maintained solely by the passage of vehicles does not constitute a road." In addition, with over 4.6 million acres of public lands, meeting the size requirements of at least 5,000 acres is obviously not a factor in considering whether the Planning Area meets the roadless and sufficient size criteria.

Outstanding Opportunities for Primitive and Unconfined Recreation

Outstanding opportunities for a primitive and unconfined recreation experience do exist in the Planning Area. These opportunities are largely attributed to the extreme remoteness of the area. Even in Alaska, there are a limited number of locations where an individual can be more than 100 miles in any direction from the nearest population center. This isolation provides exceptional opportunities for wilderness experiences.

Supplemental Values

In addition to the mandatory characteristics of naturalness, size, solitude, and/or primitive and unconfined recreation, an area may also contain supplemental values. The Planning Area contains several wilderness supplemental values. Principal among these is the varied wildlife in the area and the associated opportunities for scientific study.

Wildlife

Wildlife is an important characteristic that affects the quality of the wilderness experience in three ways. First, it enhances the experience by its very presence, particularly those species that commonly cause people to visualize wild country. In the Arctic, these species may include grizzly bear, polar bear, wolf, wolverine, caribou, moose, loons, gyrfalcon, peregrine falcon, golden eagle, and ptarmigan. Wildlife-viewing opportunities in the Planning Area are very good because some forms of wildlife are locally abundant and easily viewed at comfortable distances across relatively flat, treeless terrain. Wilderness-associated species are those often associated in the public's mind with (although not always biologically dependent on) a wilderness-like environment. Second, because of their intolerance of humans or their need for large areas of untrammeled land, some species can survive best in wilderness settings. Third, wilderness may provide habitat for rare and endangered species, which visitors would otherwise never have an opportunity to view. These species may not inherently need a wilderness habitat, but because they are close to extinction, wilderness is a sanctuary.

Environment and Challenge

To many people, wilderness evokes images of an area where one can experience solitude or serenity and that requires self-reliance. Recreational users of wilderness also expect outstanding opportunities for unusual adventure, excitement, and challenge. Nearly all of the National Petroleum Reserve – Alaska offers a wilderness environment in which visitors can experience feelings of solitude, adventure, and serenity. The bleakness of the far north also contributes to the impression of solitude.

Opportunities for Scientific Study

The presence of features for scientific, educational, scenic, or historical value is an important consideration in identifying areas for possible designation as Wilderness. The opportunity for nature study or informal outdoor education as well as formal scientific study is an important attribute of wilderness, if study can be done in a manner compatible with the essence of wilderness. Research opportunities in the Planning Area have been and are still excellent.

3.4.6.3 Wild and Scenic Rivers

A review of the previous planning efforts and Wild and Scenic Rivers (WSR) inventories and studies revealed that the Planning Area has been reviewed for WSR values at least two times previously.

The first study was completed in July 1972 by the Bureau of Outdoor Recreation. In a report entitled *Alaska Task Force Report on Potential Wild and Scenic Rivers as Part of the Native Claims Settlement Act*, two rivers within the study area, the Colville and Ikpikpuk rivers, were identified for further review.

The second WSR inventory was conducted as a result of a provision contained within Section 105(c) of the NPRPA. In compliance with this Act, the Colville and Ikpikpuk rivers again were inventoried and studied for WSR designation. No rivers in the Planning Area currently are included in the National WSR System.

Eligibility Review

Colville River

The Section 105(c) report (December 1978) states:

> The Colville River from its headwaters to Umiat meets the criteria established by the Wild and Scenic Rivers Act (WSRA) for inclusion into the National WSR system as a "wild river area." Outstanding values associated with the Rivers Area are wildlife, geologic, recreational, and archeological.

Under provisions of the WSRA, as amended in 1984, Congress had a timeframe of 3 years after submission of the study to address designation of the Colville River as a WSR. Congress did not take any action, and the river corridors returned to their former status. The ANILCA directed the Secretary of the Interior to study several rivers in Alaska, but in the case of the Colville River, it said that the 105(c) study is sufficient for Congressional purposes. The effect of this directive was that the Colville River was placed in a protective management status. Protective management limits projects that would adversely affect the free-flowing nature of the rivers and provides for the enhancement of the "outstandingly remarkable values" that made the river eligible for WSR status. Interim protection of the WSR values was afforded the Colville River until September 1984.

Factors considered in the Colville River suitability determination included but were not limited to the following:

- Characteristics that make the area a worthy addition to the National WSR System;
- Status of land ownership, use in the area, amount of private lands, and associated incompatible uses;
- Reasonably foreseeable potential uses that would be enhanced, foreclosed, or curtailed;
- Federal, public, state, tribal, local, or other interests in designation or non-designation, including the cost thereof that may be shared;
- Estimated costs of acquiring lands or interest in lands; and
- The ability of the BLM to manage and/or protect the river as a WSR.

Field studies were conducted in 1997 to update the eligibility findings from the Section 105(c) report. These studies were discussed on pages III-C-49 to III-C-54, and in appendices G and H in the 1998 Northeast IAP/EIS (USDOI BLM and MMS 1998). These studies showed that there had been little change in the Colville River between its headwaters and Umiat and that the 1978 report accurately characterized the Colville River as a "wilderness river." The river reach between Umiat and Nuiqsut was also found to be eligible for designation as a WSR because of the outstanding wildlife and paleontological values of this portion of the river.

Unquestionably, the Colville River has many characteristics that would make it a worthy addition to the WSR system. However, critical factors in evaluating the Colville River's suitability as a component of the WSR system are land ownership and the BLM's ability to manage and/or protect the river as a WSR. The relevant segments of the Colville River corridor being studied at this time are not solely under BLM jurisdiction. The riverbed, the corresponding body of water, and the right (east) bank of the river are owned and managed by the State of Alaska and the ASRC. Only the left bank is managed by the BLM. To protect and manage the river as a WSR would require the State of Alaska and ASRC to support the suitability determination and to make a commitment to assist in protecting the identified river values. While both the State of Alaska and ASRC recognize the significance of the Colville River and the importance of protecting identified resources, both clearly reject the notion that inclusion of the Colville River in the WSR system is the way to accomplish this goal (USDOI BLM and MMS 1998). Further, the ASRC is “strongly opposed” to any designation that, in their experience, limits the traditional use of the area by the Iñupiat people. The NSB has also stated that it does not support the designation of the Colville River as a WSR. Without the support and assistance of local interests and other land owners/managers, the Colville River is unmanageable and, therefore, unsuitable as a component of the WSR system.

Ikpikpuk River

The conclusion in the 1978 Section 105(c) report indicated:

> Because of the limited boating season, low water level, very limited and expensive access, repetitive scenery and low overall recreation potential, the Ikpikpuk River is not considered to be an outstanding candidate for the WSR System.

Field investigations completed in 1997 indicated that there has been little change in the Ikpikpuk River. For most of its length, the river still is characterized as a “wilderness river” with little evidence of human presence, but no resource values (i.e., wildlife, fisheries, geologic, scenic, historic, cultural, or other similar values) were found to be outstandingly remarkable. The most significant resource values noted were paleontological. Studies indicate that where the Ikpikpuk River erodes the Cenozoic formation, significant Pleistocene mammoth and other mammalian remains are exposed. While these resources are important as they relate to the archaeological investigations at the Mesa site and the North Slope, they are not as significant as the paleontological values found on the Colville River and thus not considered outstandingly remarkable in a regional context as required by the WSRA.

No new information has been gathered that would change the original 1978 determination that the Ikpikpuk River does not contain outstanding WSR values and, therefore, it was found not eligible.

Other Rivers

Sixteen additional rivers and creeks not addressed in the 105(c) report were screened, using the eligibility criteria of free flowing and containing at least one “outstandingly remarkable value.” None of these rivers were found eligible for further consideration.

3.4.7 Visual

Visual resources are described in the context of the Visual Resource Management (VRM) system. The VRM is the system used by the BLM to inventory and manage visual resources. It provides an analytical method to analyze potential visual impacts and to apply visual design techniques to ensure that surface-disturbing activities are harmonious with their surroundings. The Planning Area boundary encompasses non-federal lands, including State of Alaska lands and Kuukpik Corporation lands. Neither of the applicable non-federal entities has a system or methodology to assess the impacts of projects to the visual resources of the landscape. While the BLM cannot apply stipulations to non-federal lands, the VRM system is applied to the entire Planning Area. Implementing VRM involves two steps: conducting an inventory and providing an impact assessment. During the inventory stage, data are collected to identify the visual resources of an area in order to designate visual resource inventory classes.

An in-depth inventory of visual resources within the Planning Area was conducted as part of the National Petroleum Reserve – Alaska 105(c) studies completed in 1979. The 1998 Northeast IAP/EIS VRM study was based entirely on the National Petroleum Reserve – Alaska 105(c) report. The 2003 Alpine Satellite Development Plan study established updated VRM information for the Alpine field portion of the Planning Area.

3.4.7.1 Scenic Quality

The scenic-quality evaluation describes the characteristic landscape and determines scenic-quality ratings for the visual resources of the Planning Area. Visual resources are defined as the land, water, vegetation, animals, and structures that are visible on the land. The evaluation is intended to represent the overall impression a viewer has of the visual resources, rather than the view from any one location, including an aerial view, or during any one season of the year.

The scenic quality data component of VRM classes were collected as part of the 1979 105(c) report and the 2004 *Alpine Satellite Development Plan Final EIS*. The Planning Area was used as the frame of reference for rating scenic quality (USDOI BLM 2004c; Section 3.4.8).

The Planning Area was divided into 16 scenic-quality rating units (SQRUs) using the basic elements of landform, vegetation, water, color, distinctiveness, and cultural modification. Landform is characterized by vertical relief and spatial composition. Vegetation is represented by species, variety, and extent. Water is characterized by its shape, pattern, and color. Color is defined by its relative scales of hue (classifications of red, yellow, green, blue, or combinations) and value (lightness and darkness), and intensity (degree or strength). Distinctiveness is a measure of uniqueness within a region. Cultural modifications are defined as any human-caused change in the landform, waterform, or vegetation, or the addition of a structure that creates a visual contrast in the basic elements (form, line, color, texture) of the natural landscape.

Each SQRU was evaluated to determine its scenic quality. The Planning Area has seven SQRU units: the Beaufort Sea Coast, Dry Plains, Eastern Ridges, Large Water Bodies, Lower Colville River, Middle Colville River, and the remaining Wet Plains. Each SQRU was rated-on a scale of A through C as to the quality of its visual aesthetics:

- Class A SQRU has a great deal of visual variety, contrast, and harmony.
- Class B SQRU has a moderate amount of visual variety, contrast, and harmony.
- Class C SQRU has little visual variety, contrast, and harmony.

The following summarizes the landscape character and scenic quality of each SQRU.

The Beaufort Sea Coast SQRU, Class Rating C: The Beaufort Sea Coast SQRU consists of a 1-mile wide band along the Beaufort Sea coastline. It is characterized by broad horizons, large skies, limited topographic relief, and pack ice. The scenic variety of vegetation is limited, with little contrast in the vegetation. Notable contrast occurs between vegetated and nonvegetated areas. Strong forms and lines establish the edge between land and water. The water is the dominant element in the landscape. Changes in color are subtle with some contrast between the green of the vegetation and brown soil and blue to gray water surfaces. Polygonal ground forms create contrast in color tones of the vegetation.

Dry Plains, SQRU, Class Rating C: The Dry Plains SQRU is a flat, continuous plain with little visible topographic relief except for widely scattered drainage demarcations, pingos, and polygons. Its vegetation consists of low growing tussock tundra species. Water bodies are few and subtle. Color contrast is subtle within the more homogeneous vegetation. Because the Dry Plains are almost flat, there is little contrast between the blues of the water and the greens of the vegetation, unless you are in the immediate vicinity of the water.

Eastern Ridges, SQRU, Class Rating C: The Eastern Ridges SQRU is predominantly in the southern region of the Planning Area extending west from the Colville River. The unit is distinguished by low east-west ridges, which are 4 to 6 miles wide. The ridges are dissected by meandering streams, leaving a series of buttes, mesas, and steep-walled faces near the Colville River. This SQRU has a marked variation in topographic relief and has a wide variety of plant species. Vegetation consists of tundra species and taller willow and alder along streams and rivers creating interesting patterns in color and texture with barren soils and stream beds. Small streams and rivers are a dominant element in the landscape.

Large Water Bodies, SQRU, Class Rating C: This SQRU encompasses Teshekpuk Lake. It is characterized by distant views, broad horizons, large skies, and limited topographic relief. Plant species are generally of the tussock tundra community and slightly taller than similar species in surrounding units. The unit is similar to Remaining Wet

Plains (see below). One outstanding feature is the large water bodies where large expanses of water are visually dominate. Teshekpuk Lake is one of the largest lakes in the state.

Middle Colville River, SQRU, Class Rating A: The Middle Colville River SQRU, from the southeastern corner of the Planning Area to Umiat, is characterized by deep pools, fast riffles, long gravel bars, riparian vegetation, varied and abundant wildlife species, and prominent geologic features. This section of the river is contained by high, steep, rugged bluffs, and creates some of the finest scenery in the National Petroleum Reserve – Alaska. Other geologic features include coal seams, faults, and continuous folds (large anticlines and synclines). This unit exhibits greater visual difference in vegetation and has more variety in form, texture, and color than any of the other units. Stands of tall shrubs contrast sharply with the short vegetation communities above the riverbanks in both color and texture. Water must be considered a dominant influence in the scenery.

Lower Colville River SQRU, Class Rating B: The Lower Colville River SQRU consists of the riparian area of the Colville River from Umiat downstream to the mouth at the Beaufort Sea. This section of the river is characterized by 400-foot bluffs on the west bank near Umiat that gradually decrease to 10 to 20 feet at Nuiqsut, as well as twisted river channels and irregular oxbow lakes that add pattern and line to the landscape. The east bank of the river is characterized by willows and smaller brush species, while vegetation is lower near the mouth of the river creating diversity in form, texture, and color. Flat water comprises the lower Colville River. Sandbars provide the opportunity to view the mountains to the south.

Remaining Wet Plains, Class Rating C: This SQRU occupies approximately 75 percent of the Planning Area. The presence of thousands of lakes distinguishes the Wet Plains from other rating units. Water is the dominant visual element and presents in ice-wedge polygon patterns and numerous elliptical and elongated lakes. The most distinguishing features of the Wet Plains are its vastness and flatness. The landform is described as a flat continuous plain, displaying little relief other than those small differences along stream corridors and pingos. Variation in elevation is approximately 7 feet. The casual observer sees little contrast in the vegetation because the tussock-forming species that compose the tundra are short and matted. Notable contrast occurs between vegetated and non-vegetated areas along rivers and streams in the gravel bars and bluffs. The composition of vegetation produces little variation in form, texture, and pattern. Colors provide contrast between the greens and browns of vegetation and barren soils and the blues and grays of the water bodies.

3.4.7.2 Visual Sensitivity

Visual sensitivity is a key component in identifying VRM classes. In the 1979 105(c) report, visual sensitivity used two factors: the amount of use an area receives and viewers' expressed attitudes toward what they see. The report mapped areas of visual concern, delineating them as high, moderate, or low concerns for changes in scenic quality and for prevention of visible change in the landscape. Additional data used to determine sensitivity were obtained from meeting notes from Subsistence Advisory Panel meetings, written comments on the 1998 Northeast IAP/EIS, and from conversations with agency staff knowledgeable about uses within the Planning Area. Areas identified as sensitive include known travel routes, areas of human habitation, areas of traditional use, and Native allotments. Numerous areas are noted to have potentially high visual sensitivity.

3.4.7.3 Distance Zones

Distance zones are the third major component, along with scenic quality and visual sensitivity, in determining visual resource inventory classes. They are also important in assessing visual impacts. Distance from an object affects how clearly elements of a landscape are perceived, with visible details of a particular object decreasing with increasing distance. Distance zones are one basis for determining the visual sensitivity of Planning Areas. The VRM system recognizes three distance zones: Foreground-Middleground, Background, and Seldom-Seen.

Each distance zone is defined as follows:

- **Foreground-Middleground Zone**. This is the area that can be seen from each travel route for a distance of up to 5 miles where management activities might be viewed in detail.
- **Background Zone.** This is the remaining area that can be seen from each travel route to approximately 15 miles. It does not include areas in the background that are so far distant that the only thing discernible is the form or outline.
- **Seldom-Seen Zone**. These are areas that are not visible within the Foreground-Middleground and Background zones and areas beyond the Background Zone.

3.4.7.4 Cultural Modifications

The Planning Area is still primarily a natural landscape where man has not substantially changed the scenic quality. However some areas have been modified by the activities of man. Buildings are the most likely to be seen and have the most modification from the natural landscape. The main areas where buildings exist are Nuiqsut, Umiat, Camp Lonely, and Lonely DEW-Line site.

Nuiqsut is located along the eastern boundary of the Planning Area. The community has a population of about 433 living in mostly single family houses covering about 9 square miles. Other landscape modifications include the landfill and associated road, and a road to the Colville River. The community introduces straight vertical and horizontal lines in a predominately horizontal landscape. Color differences between the natural greens and the many shades of the community's buildings, and the browns of the roads and landfill are evident. The structures introduce distinct rectangular form into a natural landscape with indistinct, irregular, and complex landforms.

Umiat, Camp Lonely, and Lonely DEW-Line site are smaller in size but have many of the same resulting modifications to the natural landscape as Nuiqsut.

Other buildings found throughout the Planning Area are cabins and camp structures associated with subsistence activities. These structures are usually isolated single story small plywood cabins that produce some contrast with the surrounding landforms but on a very local scale along rivers and creeks. The exception is along the Miguakiak River and Teshekpuk Lake where structures are more clustered or present as "strip development."

Airstrips are located at five places within the Planning Area. While the profile of an airstrip is low, landform changes are introduced by brown colors in predominantly green vegetation and more regular lines than the surrounding irregular vegetation.

Capped wells (called Christmas trees) dot the landscape. However, given the small footprint and most being less than 6 feet tall, these modifications are very hard to see unless you are within a couple hundred feet of them.

There are no permanent roads outside the communities, and very few trails exist very far from any community. Summer travel is primarily by watercraft along rivers and the coastal areas. Some areas around Nuiqsut receive travel by ATV, however, these trails are hard to see from more than about 25 feet away. Ice roads are used during the winter months and leave changes in vegetation colors during the summer, but again, this contrast is very hard to see from more than a few feet away.

While these areas introduce modifications to the landform, they also provide places of use and special interest or key observation area from which to evaluate the sensitivity levels.

3.4.7.5 Visual Resource Inventory Classes

Based on the combination of the scenic quality, sensitivity levels, and distance zones, interim VRM classes have been identified for portions of the Planning Area. The VRM recognizes the following classes and corresponding objectives:

- **Class I Objective:** To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention.
- **Class II Objective:** To retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer.
- **Class III Objective:** To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract the attention but should not dominate the view of the casual observer.
- **Class IV Objective:** To provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high and may dominate the view and be the major focus of viewer attention.

3.4.7.6 Visual Resource Management Within the Planning Area On Adjacent Lands

Alpine Satellite Development Plan EIS

Visual Resource Management classes were not established in the 1998 Northeast IAP/EIS. It is BLM policy that interim Visual Resource Management classes are established when a project is proposed for which no VRM objectives have been approved. Using scenic quality, sensitivity, and distance zones as well as other management factors, the Alpine field area would be assigned three VRM classes. The Colville River, from the southern project boundary to Harrison Bay, including the Delta area, would be VRM Class II. Fish Creek, Judy Creek, and the Tingmiaksiqvik River would be VRM Class III. The rest of the project area would be VRM Class IV. With completion of the Alpine Satellite Development Plan EIS process, this area within the Planning Area will have visual resource management classes assigned that will then guide resource allocation decisions.

Northeast National Petroleum Reserve – Alaska EIS Record of Decision (October 1998)

The 1998 Northeast IAP/EIS ROD assigned VRM classes to the Colville River. The Colville River Special Area will be managed for VRM Class I upstream of Umiat and VRM Class II below Umiat, with exceptions allowed for subsistence structures and essential pipeline crossings.

Northwest National Petroleum Reserve – Alaska IAP/EIS Record of Decision (January 2004)

The Northwest IAP/EIS ROD assigned VRM classes as follows: The lands along the Colville River area are designated VRM Class I. Identified estuarine areas and lands along the 21 rivers eligible for designation as WSRs are designated VRM Class II. All lands within 3 miles of the banks of all identified water bodies are designated VRM Class III. The remainder of the Northwest National Petroleum Reserve – Alaska is designated VRM Class IV.

3.4.8 Transportation

Transportation systems developed for the Prudhoe Bay/KRU complex would be the expected source of transportation support for development activities in the Planning Area. The Planning Area lies near the western extremity of the Prudhoe Bay/KRU complex. The Prudhoe Bay/Kuparuk wells are mature producers supported by an extensive network of access roads and crude-oil-gathering lines. This network is constantly expanding as new and satellite crude oil production sites are identified. The Alpine field has brought the expanding North Slope infrastructure to the edge of the National Petroleum Reserve – Alaska. Pertinent land routes (Dalton Highway, North Slope oil roads, associated trails, and ROWs), airports and airstrips, and cargo-docking facilities are discussed in this section.

Within the National Petroleum Reserve – Alaska, there are few roads, identified ROWs, or airstrips, and no developed marine facilities exist along the Planning Area coastline. Any future oil and gas industry expansion into National

Petroleum Reserve – Alaska would extend from existing North Slope infrastructure. The Dalton Highway and the Deadhorse Airport would be the primary access routes most of the year for development of Planning Area. Consequently, this section concentrates on the existing Prudhoe Bay/Kuparuk facilities east of the Planning Area and those limited facilities within the Planning Area.

3.4.8.1 Road Systems

The Dalton Highway (also known as the Haul Road) is a north-south, 415 miles long, all-weather gravel road connecting Livengood with the Deadhorse airstrip at Prudhoe Bay. The Dalton Highway is the sole overland route connecting Prudhoe Bay to central and southern Alaska's other major highway systems. The Dalton Highway is 28 feet wide with an average of 3 to 6 feet of gravel surfacing. Historically, only the portion of the highway from Livengood to the Yukon River Bridge, and later Disaster Creek, was open to the public. In 1995, however, the highway was opened to public access as far as the security gates at Deadhorse. Beyond the security gate, the oil field roads are privately owned and maintained.

The majority of the vehicles traveling the Dalton Highway are commercial freight vehicles associated with oil field activities, although privately owned vehicles and commercial tour operators also use the Dalton Highway. Summer (June-August) traffic levels for the Dalton Highway are substantially higher than traffic levels for the rest of the year. During the summer of 2000, each month's average daily traffic count at milepost 134 (the Yukon River Bridge) was approximately 450 vehicles, however, the annual average daily traffic (AADT) count at the same checkpoint was 245. Farther north, at the Atigun River count station, AADT levels dropped to 230 vehicle trips (Alaska Department of Transportation and Public Facilities [ADOTPF] 2003).

Traffic levels on the Dalton Highway have trended higher over recent years. At the Yukon River Bridge, the AADT was approximately 200 in 1996, 245 in 2000, and 254 in 2002 (ADOTPF 1996, 2001; Fantazzi 2004). Annual Dalton Highway truck traffic (loaded and unloaded combined) in 1996 was 45,236 trucks, accounting for an average of about 125 per day, or over 60 percent of total traffic. While truck traffic increased by over 35 percent between 1990 and 1996, it had fallen back to approximately 82 truck trips per day by 2000 (ADOTPF 2001). Average daily truck traffic accounted for only 34 percent of total traffic in 2000, even as total traffic was increasing, indicating that non-commercial traffic has been growing in recent years.

The main road within the Prudhoe Bay/KRU complex is the Spine Road. This road crosses through both the Western and Eastern Operating areas, providing access from Deadhorse west to the KRU Base Camp and east to the Endicott oil field. Milne Point, the Oliktok field, and other satellite fields and facilities within the Operating areas are connected to the Spine Road. Since 1998, approximately 31 miles of new gravel roads have been constructed in oil and gas fields on the North Slope. This includes 4 miles of new roads in the Eastern Operating Area and 27 miles in the Western Operating Area. In the Western Operating Area, 25 miles were associated with the KRU fields, and 2 miles were for the CD-2 Access Road for the Alpine field. In 2001, there were approximately 400 miles of gravel roads associated with oil and gas fields on the North Slope.

The newly discovered Alpine Satellite Development Project field in the Colville River Delta will be connected by an ice road to the Spine Road rather than by the typical gravel road. Exploratory drilling of the Alpine Satellite Development Project prospect also was assisted by ice-road connections to the Prudhoe/KRU complex, with no gravel roads emplaced. The gravel roads typically are 35 feet wide and elevated approximately 5 feet above the ground. If approved by the BLM, a permanent gravel road would extend from the Alpine field pad CD-2 to pads CD-6 and CD-7, both located within the Planning Area. The road would have a 32-foot-wide driving surface to accommodate two-lane traffic and wide-load moves and would extend about 22 miles into the Planning Area. Gravel roads would be constructed with a minimum side slope of 2-feet horizontal to 1-foot vertical (2H:1V). The minimum depth of gravel roads would be 4 feet. This depth maintains the permafrost condition by insulating the tundra and offsetting the loss of insulating effect caused by compression of the vegetated tundra below the gravel.

Within Prudhoe Bay's Eastern and Western Operating areas, there are approximately 200 miles of interconnected gravel roads (Map 3-44). There are approximately 94 miles of other interconnected roads within the Kuparuk River

Unit. There are also 8 miles of causeways providing access to facilities and drilling sites, including the 5-mile long causeway to the Satellite Production and Main Production Islands at the Endicott field. Traffic data are not available for the roads within the Prudhoe Bay/KRU operating area.

Nuiqsut and other North Slope villages have gravel roads providing access to the airstrip, housing, and community facilities. During winter months, the roads are covered with ice and transportation is by cars, trucks, snowmachines, and other all-terrain vehicles. During the summer, cars, trucks, and all-terrain vehicles use these roads. Data are not available for traffic volumes on Nuiqsut's road system.

West of the Colville River, outside the villages, surface transportation routes for petroleum exploration take the form of ice roads or Rolligon trails. The winter transport routes vary, using nearby lakes as water sources for ice-road construction. Residents of Nuiqsut also utilize these ice roads.

Proposed Colville River Road from the Kuparuk River Unit to the National Petroleum Reserve – Alaska

The State of Alaska's Industrial Roads Program, also known as "Roads to Resources," began in March 2003 as part of the Northwest Alaska Transportation Plan, after transportation analyses showed that new North Slope oil field roads would accelerate development and provide significant revenue/employment opportunities.

As part of the Industrial Roads program, the ADOTPF is planning to construct an all-season gravel road to the National Petroleum Reserve – Alaska. The ADOTPF has been studying several routes. The primary candidate is an 18-mile route that would exit the Spine Road at the far western terminus (near the Tarn development) of the Kuparuk River Unit road system and proceed westward to a crossing of the Colville River 3 miles south of Nuiqsut (Map 3-44). The route would require the construction of a 3,300-foot bridge across the Colville River. The road would be 32 feet wide and built on a 5-foot-thick base of gravel. As reported in *Petroleum News*, the road would be capable of handling all ordinary industrial loads, including drilling rigs (Nelson 2003). The proposed route would likely to take 3 years to design/permit and 2 to 3 years to construct. The bridge project would likely follow completion of the road.

The proposed road is expected to stimulate oil and gas development on State lands and in the National Petroleum Reserve – Alaska, and provide cheaper transportation of materials and supplies to Nuiqsut. The road and bridge would enable oil and gas companies to develop staging areas to the west of the Colville River and access points beyond via ice roads. The ADOTPF has also indicated that it is in the initial planning stages for a mainline road from the proposed Colville River bridge into the National Petroleum Reserve (Nelson 2003), but a route has not yet been developed. The Bureau of Indian Affairs is proposing to build a gravel road from Nuiqsut to the proposed Colville River bridge.

Section 118(e) of the Transportation Enhancement Act – 21 (TEA-21) authorizes the expenditure of federal funds for resource development road construction projects without regard to the traditional "public funds equals public access" caveat. The TEA-21 allows industrial use designation of these roads that precludes or limits public access, even though state or federal funds are used. The ADOTPF is investigating the full implications of this statute on the North Slope roads development program currently underway. It is as yet unclear whether the Spine Road, or any other road into the National Petroleum Reserve – Alaska, would be open to public use.

3.4.8.2 Aviation Systems

There are two major airstrips in the Prudhoe Bay/KRU area, the state-owned and operated Deadhorse airport and the privately owned and operated KRU airstrip. The Deadhorse airport is served by a variety of aircraft and can accommodate Boeing 737 jet aircraft. The Deadhorse facility has an asphalt airstrip that is approximately 6,500 feet long by 150 feet wide. The airport has a small passenger terminal and hangars, storage warehouses, and equipment for freight handling. Annual passenger counts for scheduled flights (Alaska Airlines) into Deadhorse are estimated at 140,000 persons. Total annual oil and support company personnel passenger counts ranged between 205,000 and 220,000 persons from 1992 to 1996, transported by Aviation Shared Services (Ahern 1997). Aviation Shared Services transports only employees, contractors, and cargo. Commercial cargo service is also provided into Deadhorse and to satellite oil field strips. Annual tonnage shipped by air into the Prudhoe/KRU complex is difficult to estimate. A range of 250 to 500 tons is probable, as most cargo tonnage is transported on the ground via the Dalton Highway.

The KRU airstrip is owned and operated by Aviation Shared Services. The airstrip is approximately 6,500 feet long and 150 feet wide; it is primarily used by Aviation Shared Services, providing scheduled flights several times per week (Morrison 1997).

Barrow has a state-owned airport with an asphalt runway approximately 6,500 feet long and 150 feet wide. Barrow is the transportation hub for villages on the North Slope. Alaska Airlines provides regularly scheduled jet passenger flights into Barrow from Anchorage and Fairbanks, and other air carriers offer shuttle service from Barrow to various North Slope communities. The Barrow airstrip is accessible year-round with use constraints involving severe weather, an occasionally obstructed runway, and migratory waterfowl that may be present in the area during spring and fall. Available airport services include minor airframe and power plant repairs (USDOC NOAA 1997). Airport facilities include two large hangars, storage warehouses, and equipment for freight handling.

Nuiqsut is serviced by a 4,500-feet long gravel airstrip located adjacent to the village. The airport is equipped with a rotating beacon, approach lights, high-intensity runway lights, and visual-approach slope-indicator systems. The runway is not attended or monitored (USDOC NOAA 1997). The community is served by twice-daily flights carrying passengers, cargo, and mail. These commercial flights connect it with Barrow and Deadhorse. Chartered aircraft also use the airport on a regular basis.

In addition, there is a 5000-feet long gravel airstrip located at the Alpine field near pad CD-1.

3.4.8.3 Marine Transportation Systems

Marine transportation on the North Slope generally is freight oriented with the exception of relatively small, inboard and outboard engine watercraft used by villagers and less frequently for scientific research. Marine transportation provides an economical means of transporting heavy machinery and other cargo with a low value-to-weight ratio. Marine shipments to the North Slope are limited to a seasonal window between late July and early September, when the Arctic coast is ice-free. Port facilities on the North Slope range from shallow-draft docks with causeway-road connections, to facilities located at Prudhoe Bay, to beach-landing areas in North Slope communities. Because there is no deepwater port, cargo ships and oceangoing barges are typically offloaded to shallow-draft or medium-draft ships for lightering to shore. Occasionally, smaller craft also are used to transport cargo upriver.

There are three dockheads for unloading barges at Prudhoe Bay, one at East Dock and two at West Dock. A 1,100-foot-long causeway connects East Dock to a no longer used 100-foot-wide by 270-foot-long wharf constructed from grounded barges (USDOD et al. 1984). West Dock, a 13,100-foot-long by 40-foot-wide, solid-fill, gravel causeway, is located along the northwestern shore of Prudhoe Bay east of Point McIntyre. There are two unloading facilities off of the gravel causeway at West Dock. One facility is located 4,500 feet from shore and has a draft of 4 to 6 feet. The second facility is located about 8,000 feet from shore and has a draft of 8 to 10 feet. Water depths around the causeway average 8 to 10 feet.

There is another dock at Oliktok Point extending 750 feet from the original shoreline. At the dockface, the water depths reach 10 feet while at the bottom of the dock’s boat ramp water depths draw at least 5 feet. The Oliktok facility also doubles as a seawater-treatment plant (Rookus 1997).

Marine sealifts bring oil field supplies and equipment to the Prudhoe Bay/Deadhorse area as the expansion or construction of additional facilities is required. Arrival and offloading is affected by the sea ice. The ice-free window occurs generally from late July through early September.

There are no port facilities in Barrow. Supplies and cargo are brought into the area by barges and larger cargo ships and taken to shore by smaller vessels. Supplies are either offloaded directly onto the beach or are lifted off by crane.

The primary area used for offloading supplies is located north of the community. Nuiqsut is located roughly 18 miles upriver from the sea on a channel of the Colville River. Supplies and cargo are brought to the shoreline of the Beaufort Sea by barges and larger cargo ships and then taken upriver by smaller vessels.

3.4.8.4 Pipeline Systems

Future Planning Area oil production would be transported to the TAPS Pump Station No. 1 for transport to Valdez for shipment. There are several major trunk pipeline systems that carry crude oil to the TAPS—Prudhoe Bay East, Prudhoe Bay West, Milne Point, Endicott, Lisburne, Kuparuk, Badami, and Alpine field (Map 3-3). These systems total approximately 415 miles in length and are of various types of crude oil carriers. All of these pipelines are aboveground, elevated on vertical support members. There are numerous production pad feeder lines serving each of these TAPS gathering lines. Often pipelines are "bundled" with different crude and non-crude carriers occupying the same right-of-ways. Access roads run along each of the pipelines, except at Badami and Alpine field, to provide for operations, maintenance, and repair.

Crude oil produced from the Planning Area would be transported to the Kuparuk River Unit. A new pipeline would likely be constructed to carry oil from Planning Area production facilities to the Alpine field. From there, oil would be transported within an existing pipeline between the Alpine field and KRU, or within a new pipeline. Oil produced from the Alpine field is transported from the Alpine field to KRU through a 35-mile-long pipeline that is 14 inches in diameter. This pipeline from Alpine field CD-1 is currently carrying 100,000 barrels of oil a day to KRU and then on to TAPS Pump Station 1. The transport of oil from the Planning Area through this pipeline would depend upon the future production rates of the Alpine field and the capacity of the Alpine field sales oil line at the time oil was transported from the Planning Area. If there was insufficient capacity in the Alpine field sales oil line to carry oil from the Planning Area, a new pipeline would be constructed between the Alpine field and KRU to carry oil from the Planning Area. The pipeline would likely follow existing pipeline and road right-of-ways. From KRU, the oil would be transported to TAPS Pump Station No. 1 through the 22-mile-long Kuparuk pipeline. Oil flow capacity in the Kuparuk pipeline is 350,000 bbl per day, and the pipeline is currently transporting 325,000 bbl per day (USDOI BLM and MMS 2003). Production from the Alpine field, as well as additional discoveries in the National Petroleum Reserve – Alaska, could create a product flow in excess of the Kuparuk line's carrying capacity.

From Pump Station No. 1, the TAPS heads south for over 800 miles to an oil-transshipment terminal located at Valdez on Prince William Sound. The oil pipeline is 48 inches in diameter with a 30-foot-wide access road and work pad running adjacent to it. The TAPS throughput capacity is approximately 2.1 to 2.2 MMbbl per day; however, its daily throughput now averages 1.0 to 1.4 MMbbl. Declining throughput has reduced the number of pumping stations from an historic high of 11 to 6. The TAPS southern terminus is the Valdez Marine Terminal. The terminal has 18 crude-oil-storage tanks with a total capacity of 9.18 MMbbl.

3.4.8.5 National Petroleum Reserve – Alaska Facilities

Transportation facilities within the National Petroleum Reserve – Alaska are few. Apart from Nuiqsut, the only facilities that warrant special attention are those at Lonely, Umiat, and Inigok (Map 3-45). Lonely is the site of a remotely controlled DEW-Line station that also doubled as an oil field-support base for Husky Oil during the 1974 to 1982 National Petroleum Reserve – Alaska exploration period. At that time, the Lonely camp contained a well-maintained gravel runway that was 5,200 feet long by 150 feet wide, runway lighting, and beacons as well as navigational aids, fuel supplies, and warehousing. At the end of the Husky Oil exploration period, the Husky logistics facility at Lonely was surplused out for public bid. Currently, the airport is closed. The Lonely DEW-Line station does have a short pipeline for offshore oil deliveries from tanker barges and a gravel barge-landing site (Meares 1997).

The Umiat facility is a public airstrip operated by the State of Alaska. During summer months, the airstrip is maintained by Umiat Commercial Company, a private contractor; however, there is no winter maintenance. The airstrip is 5,400 feet long by 74 feet wide, has some navigational aids and runway lights, and can accommodate Hercules-class cargo aircraft. Privately-owned facilities are located next to the airstrip.

Inigok, the third major airstrip, is located at a former Husky Oil drilling site. The airstrip, estimated to be 7,000 feet long by 100 feet wide, was constructed during 1977. The Inigok facility is an insulated gravel airstrip. Approximately 1 foot below the gravel surface, the runway is underlain by polystyrene foamboard. Below the foamboard to a depth of 6 feet from the runway top is a layer of permanently frozen sand fill (Kachadoorian and Crory 1988). Due the nature of its construction, the Inigok strip remains useable some 18 years after its abandonment and is routinely used by the BLM during the summer.

3.4.8.6 Ice Roads

Historically, the Iñupiat navigate from Barrow to the Nuiqsut region along a cluster of coastal and landfast ice routes. Weather and ice conditions often dictate the route used. Along these routes, they travel to Teshekpuk Lake, the Colville River Delta, and Nuiqsut. Since 1983, ice bridges have been constructed across the Colville River. The first bridge was built to facilitate drilling on a lease held by the ASRC. The second bridge, built by the people of Nuiqsut in 1984, helped the village respond to a fuel crisis (Smith et al. 1985). Since then, villagers have annually constructed an ice road from Nuiqsut to Oliktok or the nearest oil-exploration ice road, whichever is closer. The road is created by blading the snow off the river's ice cover, once sufficient thickness has been reached. The road is used for the overland transport of fuel and other material; it also gives the residents access to the Dalton Highway. Beginning in the mid-1990s, ConocoPhillips has built the ice road from Nuiqsut to Kuparuk most years.

3.4.9 Economy

The NSB includes the entire northern coast of Alaska and encompasses almost 90,000 miles of territory (NSB 2003a), equal to 15 percent of the land area of Alaska. The passage of the ANCSA in 1971, formation of the NSB in 1972, and development of the oil field at Prudhoe Bay have all influenced the economy of the North Slope. The oil and gas industry is an important sector in the Alaskan and North Slope economies, providing substantial revenues to the State and the NSB. The NSB provides public services to all of its communities and is the primary employer of local Alaska Native residents. The substantial increase in provision of public services and employment opportunities has improved the quality of life for residents of the NSB in terms of infrastructure, medical care, and educational opportunities. This rapid improvement in economic well-being, beginning during the 1970s, was followed by a shift in demographics. Population on the North Slope more than doubled between 1970 and 2000, from a population of 3,075 to 7,385 (USDOC Bureau of the Census 2000). In July 2003, the population of the NSB was estimated to be 7,234, a decrease of 2 percent from 2000 (Alaska Department of Labor and Workforce Development [ADOLWD] 2003). Section 3.4.3.3 (Characteristics of the Population) provides additional information on the population and ethnic characteristics for the National Petroleum Reserve – Alaska.

After formation of the NSB, the influx of money for capital projects and employment opportunities in some of the smaller communities provided incentives to lure people back to their villages from larger population centers (Jorgenson 1990). Many of the Iñupiat who lived in Barrow returned to their home villages (Knapp and Nebesky 1983). The villages of Nuiqsut, Point Lay, and Atqasuk, which had been abandoned, were resettled in the 1970s. The return to small traditional villages reflected preferences of many Iñupiat for a more rural lifestyle, provided modern public services and facilities, and opportunities for employment were also available (Peat, Marwick, Mitchell & Company 1978). However, over half of the NSB's population continues to live in Barrow.

Another factor that contributed to the population increase, particularly in Barrow, was the in-migration of non-Iñupiat into the NSB. The percentage of non-Natives in the population of the NSB increased from 17 percent in 1970 to 27 percent in 1990, and was 26 percent in 2000 (USDOC Bureau of the Census 2000).

Beginning in the mid-1970s, employment opportunities in the oil and gas and construction sectors resulted in an influx of nonresident workers on the North Slope. While total earnings in the North Slope region increased significantly during this time, most of these dollars were earned by nonresidents and were not re-spent in the local regional economy. However, indirect effects from government expenditures and oil and gas development expanded the private support section (e.g., telecommunications, utilities, trade, finance, insurance and real estate). Economic activities in the region are still driven primarily by oil field activities, public expenditures, and the construction sector.

While household and per capita incomes have increased on the North Slope, these increases have been offset, to some extent, by the high cost of living in the region. Surveys indicate that subsistence resources continue to be of economic and cultural importance to residents, but the adoption of modern technology has raised the cost of participating in subsistence activities. While North Slope residents generally agree that the overall quality of life in their communities has improved, and the percent of families with income below the poverty level has declined over the years, residents continue to express concern about the social, cultural, and biological effects of rapid economic development in the region.

3.4.9.1 NSB Revenues and Expenditures

The NSB is a unique area in Alaska, in part because of wealth derived from oil reserves and the relative lack of private industry sectors outside of North Slope oil enclaves. Figure 3-7 shows major revenue sources for the NSB from 1985 through 2000. Property taxes are the primary source of revenue for the NSB, accounting for 77 percent of local revenues and 88 percent of all operating revenues in 2000 (ADCED 2003). Other revenue sources include enterprise revenue, state and federal education revenue, state safe communities revenue, and local revenues such as gaming and rental property revenues.

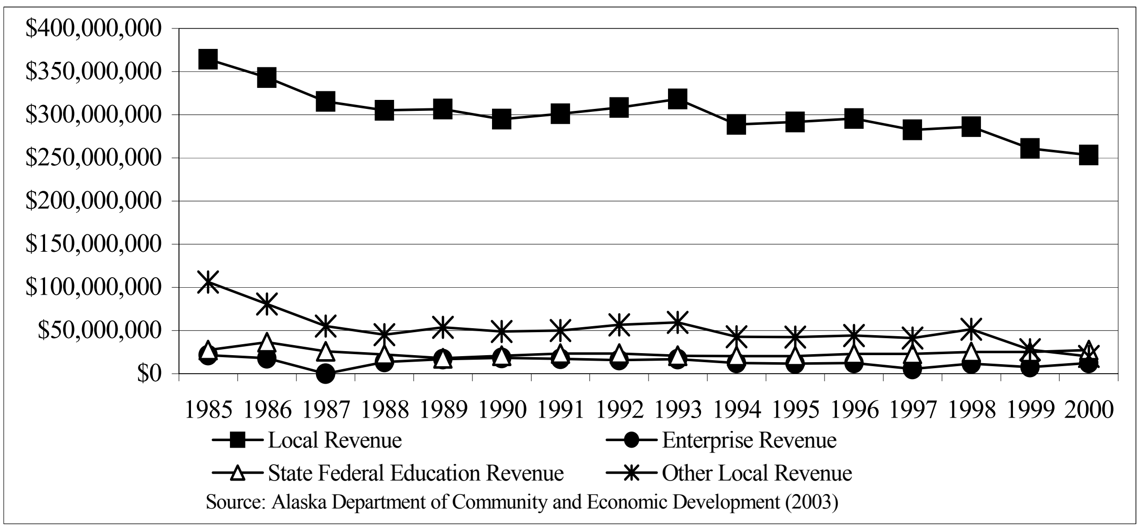


Figure 3-7. North Slope Borough Major Revenue Sources During 1985 to 2000.

Oil and gas property is exempt from local municipal taxation, but the state levies a 20-mill tax against this property. Each municipality with oil and gas property within its boundaries is reimbursed an amount equal to the taxes which would have been levied on the oil and gas property, up to the 20-mill limit (ADCED 2002). The 2002 property tax rate for the NSB was 18.5 mills (ADCED 2003). Since the 1980s, the NSB property tax base has consisted mainly of high-value property owned or leased by the oil industry in the Prudhoe Bay area. The oil industry infrastructure has been expanding to the west and now extends into the National Petroleum Reserve – Alaska. In 2001, just over 95 percent of property taxes received by the NSB came from BP Exploration (Alaska), Inc., Phillips Alaska (now ConocoPhillips), Alyeska Pipeline Services Company, Nabors Alaska Drilling, and Halliburton Company (NSB 2001). Table 3-13 shows property tax and oil and gas tax revenues for the NSB for 1990 through 2002.

A critical issue facing the NSB is the growing shortfall in revenues due to the decline in assessed value resulting from depreciation of petroleum-production related facilities. The real property assessed valuation for the NSB has declined from $11.5 billion in 1992 to $9.4 billion in 2001 (NSB 2001). As assessed values decline, tax revenues and bonding capacity also decline. The NSB expects total assessed value to continue to decline to about $5 billion by 2013 (Wright 2001).

Table 3-13. Property Tax and Oil and Gas Tax Revenues for the North Slope Borough during 1990-2002.

Year	Property ($)	Oil and Gas ($)	Total ($)
1990	2,984,359	216,134,219	219,118,578
1991	5,561,345	216,842,467	222,403,812
1992	3,552,225	223,813,149	227,365,374
1993	4,255,116	231,659,172	235,914,288
1994	2,008,578	222,765,775	224,774,353
1995	3,753,201	223,520,017	227,273,218
1996	3,533,180	224,756,637	228,289,817
1997	3,564,942	220,362,787	223,927,729
1998	4,484,168	207,190,459	211,674,627
1999	15,113,289	196,398,867	211,512,156
2000	16,416,808	195,095,348	211,512,156
2001	12,008,846	189,954,310	201,963,156
2002	6,239,417	193,019,738	199,259,155

Source: ADCED (2002).

According to Alaska Statute 29.45090(a), the NSB is limited in the taxes it can levy for the municipal operating budget, but not in what it can levy to pay for debt service. The NSB's primary means of receiving revenues from oil development is to borrow money for capital expenses and then levy taxes for debt service. Because of the tax structure, the NSB has had an obvious incentive to embed operating and maintenance type activities in capital projects (since debt for the former is limited, while debt for the latter is not). However, as the assessed value of oil and gas properties declines, bonding capacity is also expected to decline to the point that bond proceeds will not be sufficient to support capital commitments.

Future assessed values could be higher than current projections if a natural gas pipeline is built from the NSB to Lower 48 markets, or if development occurs in the National Petroleum Reserve – Alaska. However, it is difficult to imagine major increases in assessed values in the near future. The rate of decline in assessed values might be more moderate than currently expected, but there will almost certainly be a decline in tax revenues and bonding capacity in the near term.

3.4.9.2 North Slope Borough Employment

History of Employment in the North Slope Borough

Figure 3-8 shows total employment on the North Slope from 1965 to 2001, including oil-industry workers at Prudhoe Bay. Before incorporation of the NSB in 1972, information on employment was limited to Barrow. In 1968, the Barrow area was expanded to include communities such as Anaktuvuk Pass and Wainwright, which accounts for the sharp rise in total employment from 777 individuals in 1967 to 2,218 in 1968. Between 1975 and 1980, employment estimates describe a wider area: the North Slope Division. The employment estimates shown are for 1980 to the present for the NSB.

Total employment for all industries on the North Slope increased during the following periods:

- 1974 to 1976 - coinciding with construction of the TAPS and Dalton Highway.
- 1980 to 1983 - coinciding with an increase in NSB-related construction projects.
- 1999 to 2001 - moderate growth in the mining and service sectors coinciding with the construction of the Alpine field and North Star facilities.

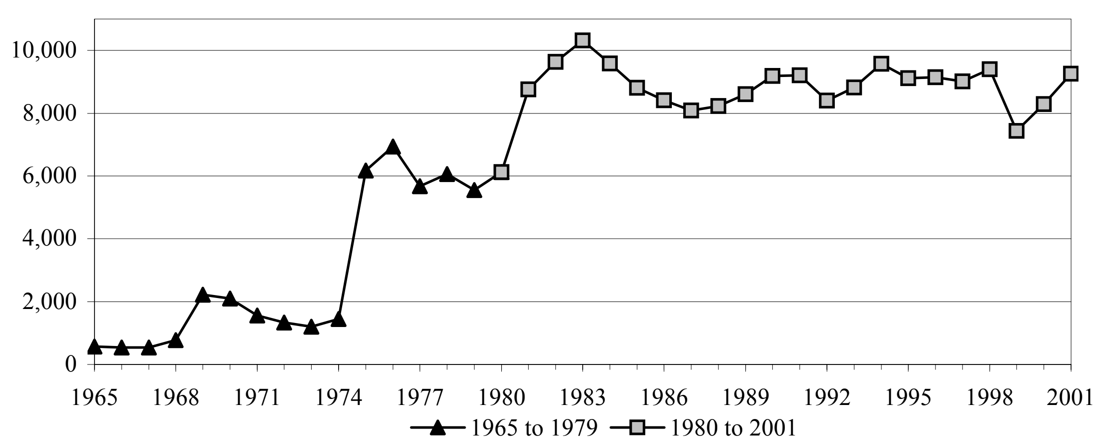
The sharpest declines in total employment occurred between 1983 and 1987 and between 1988 to 1989, as a result of declines in construction and mining sector jobs. Near-record employment losses occurred in 1999 when oil industry employment fell below the 8,000 level for the first time since 1983 because of the decline in oil prices from $19 a barrel in 1997 to $12.55 in 1998.

Employment rebounded by late 2000 and reached a 10-year high in 2001 because of the development of the Alpine and North Star oil fields. However, as work on these projects neared completion by late 2001, employment began to fall steeply, declining by 8 percent. By 2003, employment fell to levels as low as those seen in 1999 (Fried and Windisch-Cole 2003). Despite high oil prices over the past 4 years, employment has continued to exhibit a downward trend. Few new projects are underway or planned for the near future.

In 2002, non Alaska residents made up nearly 26 percent of all workers in the oil industry (Hadland 2004). Nonresidents were paid $239 million in 2001 and $234 million in 2002. The percent of total earnings paid to nonresident workers was 26 percent, nearly twice the statewide private sector average.

Oil industry employment has a very narrow definition, and as a result, many of the thousands of jobs that service the oil and gas industry are not classified as oil industry employment. These jobs, which include catering, security, construction contracting, transportation, engineering, and other support services, account for 27 percent of the more than 6,000 jobs at Prudhoe Bay. According to the University of Alaska-Anchorage, almost 25 percent of all jobs in the state can be attributed to petroleum.

As illustrated in Figure 3-8, in many years the number of workers in the NSB is higher than the total population of the region. The North Slope has the highest concentration of oil industry workers in the state, accounting for nearly half of the North Slope's wage and salary employment. However, very few oil workers reside in the North Slope. Among Alaska residents working on the North Slope, according to Census 2000, 1,541 were residents of Anchorage, 813 were residents of the Mat-Su Borough, and 755 were residents of the Kenai Peninsula.



Note: Employment figures in the first data series (1965 to 1979) pertain to the Barrow-North Slope Division, while the figures in the second data series (1980 to 2001) pertain to the NSB.
Source: Alaska Department of Labor and Workforce Development (2003).

Figure 3-8. Total Employment in the North Slope Region, 1965 to 2001.

While Alaska produces 17 percent of the nation's oil, it does so with only 2.6 percent of the industry's U.S. workforce. Larger fields do not necessarily need more workers than small fields. Economy of scale is one of the reasons for the state's relatively small workforce. Prudhoe Bay, the largest oil field in the nation, accounts for 45 percent of the North Slope's production. Kuparuk is the second largest field in Alaska, followed by the Alpine field near Nuiqsut. Because of their remoteness, many of Alaska's oil fields are considered marginal or noneconomic. These fields would be viable in a more populated, less remote environment.

Unemployment in the North Slope Borough

Tables 3-14 and 3-15 show employment characteristics for residents of the NSB, including the size of the average annual labor force, the number of individuals employed and unemployed, and the unemployment rate. In 1990, the unemployment rate was 3.5 percent and the lowest rate in the last 25 years. The unemployment rate more than tripled between 1990 and 2002, from an annual average of 3.5 percent in 1990 to an annual average of 11.9 percent in 2002. The largest increase in the unemployment rate, which was recorded between 1998 to 2000, can be attributed to layoffs in the petroleum industry and declines in NSB-related construction activities.

In simple terms, unemployment rates are calculated by dividing the number of people looking for work by the total number of available workers in the labor force. Unemployment rates in the double digits usually indicate a depressed or stagnant economy, while a rate under 4 percent is considered full employment. However, there are limitations in interpreting this information, because no differentiation can be made between full-time and part-time jobs. In addition, it does not account for individuals who are underemployed or the discouraged worker who is involuntarily unemployed but has given up actively seeking employment. Some Alaska economists do not think that the discouraged-worker hypothesis applies to the NSB. In a mixed cash-subsistence economy, people who do not have cash jobs for part of the year may not take one if offered (Berman 1997). According to a 1998 census conducted by the NSB, 13 percent of the NSB's resident labor force reported being underemployed, and 27 percent worked fewer than 40 weeks in 1998 (NSB 1999).

Table 3-14. Employed Persons 16 Years and Older, North Slope Borough and Communities, by Industry, during 2000.

Industry	NSB	Anaktuvuk Pass	Atqasuk	Barrow	Kaktovik	Nuiqsut	Pt. Hope	Pt. Lay	Wainwright
Agriculture, forestry, fishing and hunting, and mining	63	0	0	38	0	6	7	7	5
Construction	237	13	12	103	9	43	23	23	11
Manufacturing	12	0	0	9	0	0	0	0	3
Wholesale trade	8	0	0	3	0	0	0	4	1
Retail trade	190	3	2	123	13	13	17	5	14
Transportation, warehousing, and utilities	282	10	8	167	8	24	29	11	21
Information	43	2	0	38	0	2	0	0	1
Finance, insurance, real estate, and rental and leasing	74	0	5	62	4	0	0	0	2
Professional, scientific, management, administrative, and waste management services	98	2	0	85	6	0	1	3	1
Education, health, and social services	1,017	29	16	718	46	37	86	24	60
Arts, entertainment, recreation, accommodation, and food services	97	2	0	57	6	5	12	0	15
Other services (except public administration)	179	9	10	136	0	12	6	0	6
Public administration	690	30	13	447	25	34	56	19	64
TOTAL	2,990	100	66	1,986	117	176	237	96	204

Source: USDOC Bureau of the Census (2000).

Table 3-15. Annual Average Labor Force Statistics for North Slope Borough 1990 to 2002.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Labor Force	2,818	2,917	2,849	3,021	3,220	3,157	3,273	3,260	3,310	3,121	3,299	3,263	3,312
Employment	2,719	2,783	2,724	2,883	3,095	3,040	3,114	3,082	3,138	2,874	2,982	2,976	2,936
Unemployment	99	134	125	138	125	117	159	178	172	247	317	287	395
Rate (%)	3.5	4.6	4.4	4.6	3.9	3.7	4.9	5.5	5.2	7.9	9.6	8.8	11.9

Note: Effective with release of January 2003 data, labor force data for all areas have been revised back to January 2000. This revision is the result of incorporation of the 2000 Census population controls at the state level and changes in methodology. Therefore, data for years prior to 2000 are not comparable with data for 2000 and later years.
Source: Alaska Department of Labor and Workforce Development (2003).

Table 3-16 shows the number of individuals aged 16 years and older living in each of communities of the NSB, the percentage that worked in 1999, and the percentage that worked part of the year. The working population in 1999 ranges from a low of 69.3 percent in Anaktuvuk Pass to a high of 89.1 percent in Point Lay. Of note is that while most of these workers usually worked 35 or more hours per week, with the exception of those in Barrow, less than half of them worked 50 to 52 weeks a year. From 32.9 percent to 59.2 percent of those who worked in 1999 worked 39 or fewer weeks of the year.

The oil industry is relatively isolated and provides revenues for the NSB through taxes with some limited employment of North Slope residents. While the oil industry is considered an important sector that drives the cash economy in the North Slope, subsistence activities are also considered essential to the livelihood of North Slope residents.

A primary goal of the NSB has been to create employment opportunities for Alaska Native residents, and it has been successful in hiring large numbers of Alaska Natives for NSB construction projects and operations. As a result, the NSB government itself is viewed as the primary local industry. The NSB employs many permanent residents directly and finances construction projects under its Capital Improvement Program, which employs additional NSB residents. The NSB pay scales have been equal to, or better than, those in the oil and gas industry, while working conditions and the flexibility offered by the NSB are considered by Alaska Native employees to be superior to those in the oil and gas industry. In addition, NSB employment policies permit employees to take time off (particularly for subsistence hunting).

The North Slope Borough as Employer

Figure 3-9 compares employment in the NSB's government sector with employment in NSB's private sector for 1980, 1990, and 2000, according to U.S. Census data. In 1980, the government sector supported 51 percent of resident employment; by 1990 this share increased to about 65 percent, and by 2000 it accounted for about 62 percent of the jobs. In contrast, the share of private sector jobs decreased, from 47 percent in 1980 to about 36 percent in 2000.

North Slope Oil Industry Employment of North Slope Borough Alaska Native Residents

Very few Alaska Native residents of the North Slope have been employed in oil-production facilities and associated work in and near Prudhoe Bay since production started in the late 1970s. This historical information has relevance when assessing the potential economic effects of proposed oil and gas exploration and development on the North Slope Native population. A study contracted by MMS showed that 34 North Slope Natives interviewed comprised half of all North Slope Natives who worked at Prudhoe Bay in 1992, and that the North Slope Natives employed at Prudhoe Bay comprised less than 1 percent of the 6,000 North Slope oil-industry workers (USDOI MMS 1993). This pattern is confirmed by data from 1998, which found that 10 NSB Iñupiat residents were employed in the oil industry that year.

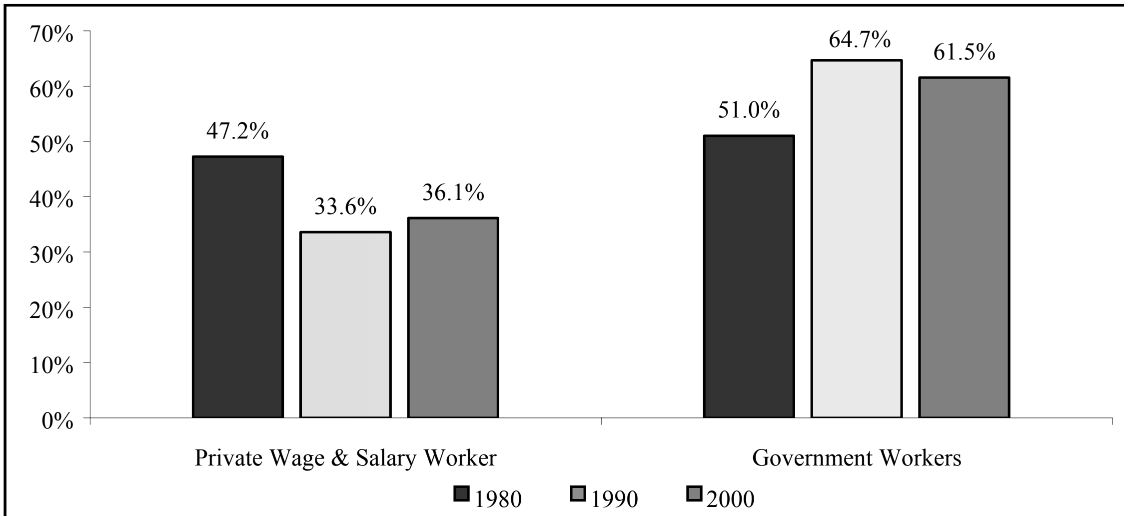
Census data from 2000 supports the continuation of this finding (USDOC Bureau of the Census 2000). Table 3-17 shows the percentage of workers aged 16 and older who worked in their place of residence. Almost 94 percent of workers living in Barrow worked in Barrow. One hundred percent of the workers living in Atqasuk worked in Atqasuk. Approximately 4 percent of workers in Nuiqsut, 7 percent of workers in Kaktovik, 13 percent in Wainwright, 13 percent in Point Hope, and 16 percent in Point Lay worked outside of their place of residence.

The NSB is concerned that the oil industry has not done enough to accommodate training of unskilled laborers, or to accommodate their cultural and economic needs to participate in subsistence-hunting activities. The NSB also is concerned that the oil industry recruits employees using methods common to western industry, and would like to see serious attempts by industry to hire NSB residents (Nageak 1998).

Table 3-16. Number of Weeks Worked, by Number of Hours Per Week.

Place	Anaktuvuk Pass	Atqasuk	Barrow	Kaktovik	Nuiqsut	Point Hope	Point Lay CDP	Wainwright
Population 16 years and over	205	121	3,069	190	264	493	138	385
Worked in 1999 (%)	69.3	70.2	80.0	81.1	78.0	69.8	89.1	74.5
Usually worked 35 or more hours per week (%)	95.1	91.8	88.0	88.3	86.9	89.5	85.4	89.9
50 to 52 weeks (%)	33.3	50.0	53.1	36.8	37.4	26.9	46.7	39.9
48 and 49 weeks (%)	0.0	2.6	5.2	1.5	2.8	2.3	5.7	3.9
40 to 47 weeks (%)	7.4	2.6	8.6	11.8	10.6	4.9	4.8	5.4
27 to 39 weeks (%)	13.3	7.7	10.1	25.0	13.4	26.6	17.1	16.3
14 to 26 weeks (%)	21.5	12.8	10.6	3.7	16.8	18.2	20.0	14.7
1 to 13 weeks (%)	24.4	24.4	12.2	21.3	19.0	21.1	5.7	19.8
Did not work in 1999 (%)	30.7	29.8	20.0	18.9	22.0	30.2	10.9	25.5

Source: USDOC Bureau of the Census (2000).



Source: USDOC Bureau of the Census (1981, 1991, 2000).

Figure 3-9. Share of Employment by Type of Worker, 1980, 1990, and 2000.

In response to this situation, BP Exploration – Alaska initiated the Itqanaiyagvik Program, a training partnership with ASRC, Illisagvik College, and the NSB School District with a purpose of creating career pathways into the oil industry for Alaska Natives. The program began in 1998 and enhances secondary and post-secondary programs through new curriculum, internships, and job-shadowing opportunities, and provides long-term education and training for professional and craft jobs.

Table 3-17. Place of Residence and Work.

Place	Anaktuvuk Pass	Atqasuk	Barrow	Kaktovik	Nuiqsut	Point Hope	Point Lay CDP	Wainwright
Workers 16 years and over	100	66	1,881	111	165	228	89	190
Living in a place (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Worked in place of residence (%)	78.0	100.0	93.8	92.8	96.4	87.3	84.3	87.4
Worked outside place of residence (%)	22.0	0.0	6.2	7.2	3.6	12.7	15.7	12.6
Source USDOC Bureau of the Census (2000).								

The Nuiqsut Public Hearing for the Northwest IAP/EIS in March 2003 provided additional insight to the oil-industry's employment of NSB-resident Alaska Natives. It was noted that ConocoPhillips has partnered with ASRC in offering training programs for North Slope residents interested in oil field maintenance and heavy equipment maintenance. Twenty North Slope residents spent the summer of 2002 working and training in these areas. ConocoPhillips has worked closely with Kuukpik Corporation, ASRC, and other companies to hire and train Alaska Natives. ConocoPhillips, in cooperation with Kuukpik Corporation, sponsors mentoring and training at the Alpine field for North Slope residents (Mr. Wheathall, Nuiqsut Public Hearing 2003). As a result of current development of the Alpine field, Nuiqsut has received a number of economic benefits and employment opportunities, including the following:

- Contracts totaling approximately $250 million were awarded to Kuukpik (the Nuiqsut Village Corporation) and its joint-venture businesses. ConocoPhillips Alaska, Inc., currently has contracts with several Kuukpik Corporation joint ventures, including Nanuq (construction); Kuukpik/Arctic Catering (catering); Kuukpik/Fairweather (seismic); Kuukpik/LCMF (surveying); Kuukpik/Carlisle (trucking), and Kuukpik/Purcell (security). The Doyon Corporation is contracted for drilling services, and CCI is contracted for oil spill response services.
- As of June 2003, four Nuiqsut residents were working full-time in the Alpine field operations group and six full-time in the construction group.
- Seasonal work opportunities have been made available to residents of Nuiqsut and other communities in the area. During the first 5 months of 2003, ConocoPhillips Alaska, Inc., reported employing approximately 100 local residents, predominantly Iñupiat.
- Ongoing jobs are held by Nuiqsut residents, including one monitor for the ConocoPhillips Alaska, Inc., air quality/meteorology monitoring station in Nuiqsut; two ice road monitors (during the winter ice road season), and two environmental studies assistants (typically subsistence representatives during the summer). "Stickpickers" are also employed during the summer to collect debris at the edge of production pads and along ice road routes.
- Increased economic activity within Nuiqsut related to ongoing Alpine field operations includes increased occupancy at the Kuukpik Hotel, an office space lease from the city of Nuiqsut for the ConocoPhillips Alaska, Inc., liaison, and storage of ice road equipment.

Bernice Kaigelak has lived in Nuiqsut since resettlement in 1973 and has experienced many changes since then. She feels that ConocoPhillips has broken its promises for jobs at the Alpine field, and thinks that 3 or 4 percent of the 500 residents of Nuiqsut work at the Alpine field (Bernice Kaigelak, Nuiqsut Public Hearing, 2003). Eli Nakapigak agreed with Ms. Kaigelak's comments. He added that 8 years ago, then Secretary of the Interior Bruce Babbitt and Alaska Governor Tony Knowles held a pubic hearing in Nuiqsut. They promised the village jobs as a result of allowing exploration and development in the Planning Area. At that time, Nuiqsut had 14 percent unemployment; today unemployment is nearly the same at 15 percent. Mr. Nakapigak wondered when promises to Nuiqsut will be kept (Eli Nakapigak, Nuiqsut Public Hearing 2003).

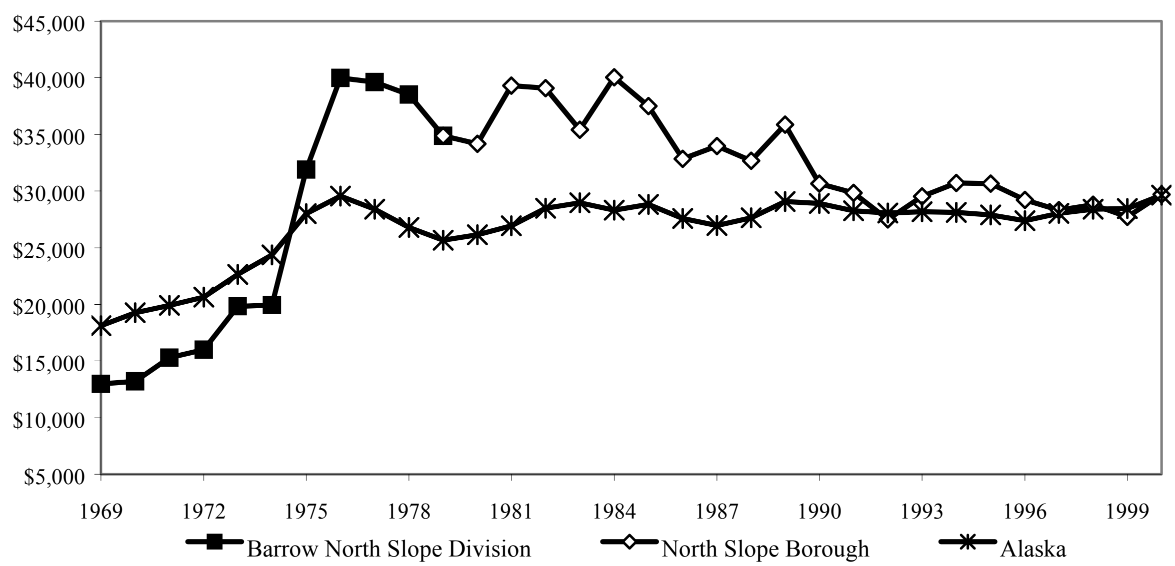
Personal Income

Personal income is the income received by people from all sources: private sector and government wages, salary disbursements, other labor income, farm and nonfarm self-employment income, rental income, personal dividend income, personal interest income, and transfer payments. Per capita personal income is the annual total personal income of the residents of an area divided by their resident population. Per capita personal income can be a measure of economic well being because the amount of goods and services that people can afford is often directly related to their personal income.

Figure 3-10 shows annual per capita personal income (in 2000 dollars) for residents of the North Slope, compared to that of Alaska residents as a whole, for 1969 through 2000. Starting in 1984, the real per capita income in the region began to decline, recovering slightly from 1988 to 1989, and then declining again in 1992. Despite this overall decline in per capita income, North Slope residents have generally enjoyed higher real personal per capita incomes than the statewide average. On the other hand, the statewide average real per capita income has been more stable than that of the North Slope. This is to be expected, as regional economies that are not highly diversified tend to be more sensitive to internal and external economic changes.

Figure 3-11 compares median household income for NSB communities for 1979, 1989, and 1999. In 1999, the North Slope median household income was approximately 150 percent of the median household income for the U.S. and 122 percent of the median household income of the State of Alaska. Figure 3-12 shows the NSB's per capita personal income as a percent of per capita personal income for the U.S. In the early 1980s, per capita income in the NSB was more than twice the per capita income of the U.S., although the gap has closed since then.

While per capita personal income and median household income are high, the cost of living in the region may be the highest in the nation. Any discussion of the "economic well-being" of residents of the North Slope should take into consideration that the high cost of living offsets the higher income levels earned. In 1994, the cost of living in Barrow was around 278 percent of the average cost of living in the Lower 48 states, and 214 percent of the Anchorage average (NSB 1995).



Note: Real income estimates are expressed in 2000 dollars.
Source: Bureau of Economic Analysis (2000).

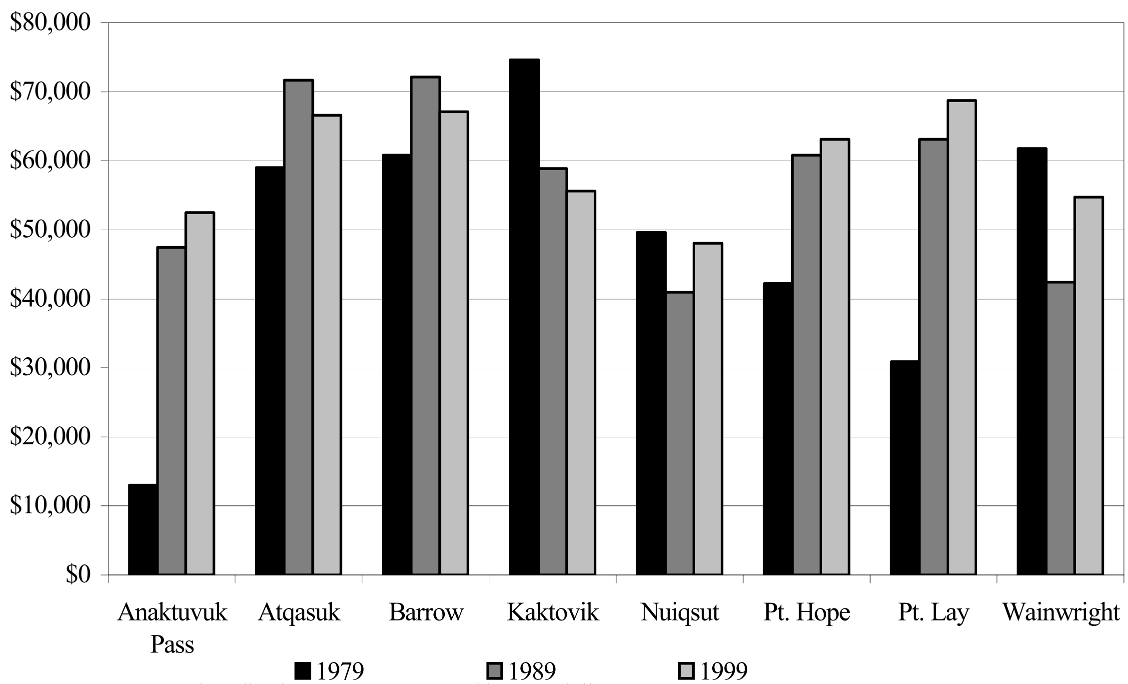
Figure 3-10. Per Capita Real Personal Income, Barrow-North Slope Division, North Slope Borough, and Alaska, 1969 to 2000.

Atqasuk

Households responding to a 1998-1999 NSB census survey reported that 17 households (52 percent) spent more than $2,000 on subsistence activities, while 11 households (33 percent) spent between $4,000 and $10,000 and 3 households (9 percent) reported spending more than $10,000 on these pursuits. Of households that responded to the survey, 23 households (70 percent) consumed half or more of their food from subsistence harvests, and 4 (12 percent) reported less than half, while 6 (18 percent) reported very little use of subsistence foods.

Barrow

Household expenditures on subsistence activities shown indicate that 414 households (84 percent) responding to the 1998-1999 NSB survey spent from $1 to $10,000 on subsistence activities during the previous calendar year. Of households responding, 76 households (16 percent) reported spending no money on subsistence activities, 87 households (18 percent) spent from $1 to $500 on subsistence activities, and 159 households (32 percent) spent between $1,001 and $6,000 per year on subsistence activities. Twenty-one percent of responding households reported spending more than $6,000 in the previous year on subsistence activities. For households responding to the subsistence foods consumption survey, 298 (56 percent) reported eating subsistence foods for half or more of their food intake, while 83 respondents (16 percent) reported "very little" and only 27 (5 percent) reported eating no subsistence foods. It is likely that some number of those not spending money for subsistence pursuits are receiving subsistence foods or participating indirectly in some fashion as part of family or group activities (NSB 1999).



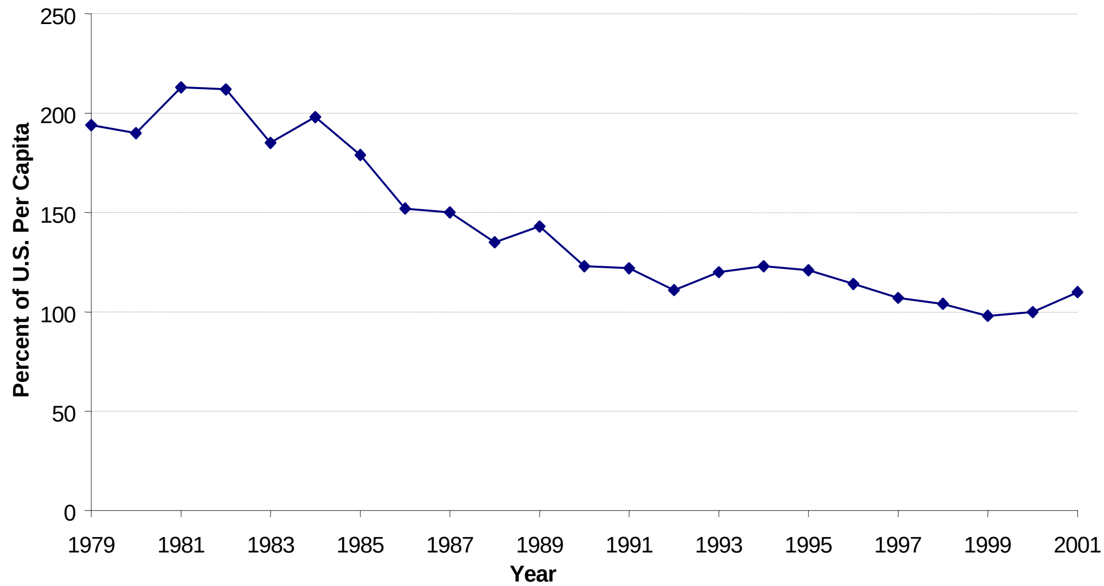
Note: Real median incomes are expressed in 2000 dollars.
Source: USDOC Bureau of the Census (2000).

Figure 3-11. Real Median Household Income in North Slope Borough Communities, 1979, 1989, and 1999.

Nuiqsut

Nuiqsut residents responding to a NSB 1998-1999 household census indicated that 17 households (27 percent of respondents) spent from $1 to $1,000 on subsistence activities, 24 households (38 percent of respondents) spent between $1,001 and $6,000 per year on subsistence activities, and 16 (25 percent of respondents) spent more than

$6,001. Eight Nuiqsut residents reported spending more than $10,000 on subsistence activities. Nuiqsut residents were also asked what amount of subsistence foods they ate daily; of the 44 respondents, 75 percent indicated that subsistence foods made up half or more of their daily food intake. Only 6 (14 percent) respondents indicated little or no use of subsistence foods.



Source: USDOC Bureau of Economic Analysis, Regional Economic Information System (2003).

Figure 3-12. Per Capita Personal Income of North Slope Borough as a Percent of U.S. Per Capita.

3.4.9.3 State Revenue

The state receives revenues from oil and gas activities in the National Petroleum Reserve – Alaska, but these revenues are treated differently than those from other state or federal lands. Federal law designating the National Petroleum Reserve – Alaska in 1980 established a requirement that 50 percent of lease sale revenues, royalties, and other revenues be paid to the State of Alaska (42 USC § 6508), and the other 50 percent be paid to the General Fund of the U.S. Treasury. The 50-percent distribution does not apply to severance, property, and conservation taxes that are levied by the state. The National Petroleum Reserve – Alaska monies paid to the state are to be used for: 1) planning, 2) construction, maintenance, and operation of essential public facilities, and 3) other necessary provision of public service by subdivisions of the state most severely impacted by development of oil and gas leased under the section (ADCED 2003). The state began receiving these monies in 1983.

The state generally receives income from oil and gas leases twice a year and makes these funds available as grants to eligible municipalities in the following state fiscal year. The state places these revenues in the National Petroleum Reserve – Alaska Special Revenue Fund (AS 37.05.530). The ADEC administers the fund and grants under the National Petroleum Reserve – Alaska Impact Mitigation Program (19 AAC § 50). Funds not issued as grants by the end of each fiscal year are distributed in the following manner: 50 percent to the Permanent Fund, 0.5 percent to the Public School Fund, and 49.5 percent to the General Fund.

Municipalities may apply for grants each year for planning, construction, and maintenance of essential public facilities or for provision of other necessary public services, by demonstrating present or future impact from oil and gas exploration, production, or transportation and by meeting certain eligibility requirements (19 AAC § 50.050).

From 1987 to 1999, nearly $10 million was disbursed by the State of Alaska to fund the National Petroleum Reserve – Alaska Impact Mitigation Program. For FY 2000 through 2004, an additional $56,381,412 was awarded to North

Slope communities under the program; another $3 million is expected to be awarded in FY 2005 (ADCED 2004). In the past 3 years, these funds were used to pay administrative salaries; build and maintain facilities in North Slope communities; upgrade equipment; conduct fish, waterfowl, gull, fox, and caribou surveys; monitor subsistence harvest; assess the impacts to fish from hydrocarbons; and provide health care training and education.

Table 3-18 shows National Petroleum Reserve – Alaska grant projects funded in Nuiqsut from 1993 through 2004, totaling more than $14 million. Grant monies are used for a wide variety of projects ranging from city operations and maintenance, funding of a NSB police officer, and the NSB Nuiqsut Natural Gas Upstream Conditioner project. Capital projects for other communities in the NSB can be found on the Department of Community and Economic Development Rural Alaska Project Identification and Delivery System Database at http://www.dced.state.ak.us/cbd/commdb/CF RAPIDS.htm.

In Barrow, $42 million of National Petroleum Reserve – Alaska grant money has funded 58 projects during this period. Atqasuk has received approximately $1.2 million in funding for eight projects from 1993 through 2004. The state also receives monies for oil and gas activities from the BLM and MMS. Between FYs 1948 and 2002, the BLM and MMS distributed almost $426.8 million to Alaska from federal onshore leases.

When the federal government offers tracts of land for lease in the National Petroleum Reserve – Alaska, the BLM provides public notice that funding may become available for National Petroleum Reserve – Alaska Impact Mitigation grants, and requests communities to submit project proposals through grant applications. The 1999 Lease Sale in the Planning Area produced $38.6 million in bonus bids and approximately $1.7 million annually in rentals due to the state. The federal government has transferred all but $3 million of these funds to the state. The $3 million is in escrow pending Kuukpik Village Corporation land selections in the Planning Area. The federal government estimates future annual rentals due to the state from the 1999 Northeast National Petroleum Reserve – Alaska Lease Sale to be $2 million.

In 2002, the BLM awarded leases on approximately 60 tracts in the National Petroleum Reserve – Alaska totaling 579,269 acres. The BLM estimates the initial lease fees to be $63.8 million. The lease sale produced $31.9 million in bonus bids due to the state.

From 1986 through 2002, the federal government distributed just over $520 million to the State of Alaska under Section 8(g) of the Outer Continental Shelf Lands Acts (OCSLA), as amended (Table 3-19). Section 8(g) of the OCSLA Amendments of 1978 provided that the states were to receive a "fair and equitable" division of revenues generated from the leasing of lands within 3 miles of the seaward boundary of a coastal state containing one or more oil and gas pools or fields underlying both the OCS and lands subject to the jurisdiction of the state. However, the states and the federal government could not reach agreement on the meaning of the term "fair and equitable," so these revenues were placed in an escrow fund beginning in August 1979. Beginning in December 1979, revenues from the Beaufort Sea in Alaska were placed into a second escrow fund under Section 7 of the OCSLA Amendments of 1978.

The dispute over the meaning of "fair and equitable" was resolved by Congress with passage of the OCSLA Amendments of 1985, PL 99-272. The law provided for disbursement of escrow funding during FYs 1986-1987, a series of settlement payments disbursed to the states over a 15 year period from FY 1987 to FY 2001, and recurring annual disbursements of 27 percent of royalty, rent, and bonus revenues received within each affected state's 8(g) areas. The distribution of $322.9 million in Section 7 Beaufort Sea escrow funds was authorized to Alaska in FY 1988. Table 3-20 shows a breakdown of the revenues from royalties, rents, bonuses, Section 7 escrow, Section 7 rents, Section 8(g) escrow, and settlement payments for FYs 1994 through 2002. Settlement payments were completed in 2001.

Between 1968 and 2001, the federal government disbursed the following revenues through special purpose accounts: $29.2 million of OCS revenues through the Federal Land and Water Conservation Fund Grants, $66.9 million in Land and Water Federal Acquisitions, and $9.7 million for the Historic Preservation Fund to the state (http://www.mrm.mms.gov/Stats/pdfdocs/SMS_Alaska_01.pdf).

Table 3-18. Capital Projects in Nuiqsut Funded by National Petroleum Reserve – Alaska Grants, 1993-2004.

Fiscal Year	Project Description	Project Stage	Agency Cost ($)	Type	Contractor
2004	North Slope Borough-Nuiqsut Natural Gas Upstream Conditioner	Contract	2,000,000		North Slope Borough
2003	North Slope Borough-Nuiqsut Natural Gas Project	Contract	450,000		North Slope Borough
2002	Cultural Center Operations and Maintenance	Preliminary	288,000	Force Accounting	City of Nuiqsut
2002	City Operations and Maintenance	Contract	200,000	Force Accounting	City of Nuiqsut
2002	Teen Center Operation and Maintenance	Preliminary	121,310	Force Accounting	City of Nuiqsut
2002	Emergency Hunting Shelters	Preliminary	60,000	Direct Grant	City of Nuiqsut
2002	Wooden Deck Ball Court	Preliminary	30,000	Direct Grant	City of Nuiqsut
2000	North Slope Borough - Natural Gas Piping Distribution	Contract	3,800,000	Direct Grant	North Slope Borough
2000	North Slope Borough - Natural Gas Conversion	Construction	2,200,000	Direct Grant	North Slope Borough
2000	North Slope Borough - Above Ground Service Connection	Completed	2,100,000	Contract	SKW Eskimos, Inc.
2000	Cultural Center Construction	Construction	939,800	Contract	City of Nuiqsut
2000	Retractable Boat Ramp-Design/Construct	Design	765,000	Contract	City of Nuiqsut
2000	Day Care Construction/Operation and Maintenance	Construction	495,400	Force Account	City of Nuiqsut
2000	City Hall Expansion/Kisik Center Renovation	Construction	340,000	Contract	City of Nuiqsut
2000	Local Government Operations	Completed	200,000	Direct Grant	
2000	Graveyard Fencing	Construction	156,000	Force Account	City of Nuiqsut
2000	North Slope Borough – Police Officer for 3 years	Completed	100,000	Direct Grant	
1995	Local Government Operations	Completed	3,320	Direct Grant	
1994	Local Government Operations	Completed	4,167	Direct Grant	
1993	Local Government Assistance	Completed	90,000	Direct Grant	
	Total		14,342,997		

Source: Rural Alaska Project Identification and Delivery System Database, ADCED (2003).

Table 3-19. Distribution of Federal Offshore Revenues to Alaska during Fiscal Years 1986-2002.

Type of Revenue	Disbursement ($)
Production Royalties	166,957
Rents	4,966,588
Bonuses	3,359,838
Section 7 Escrow	322,900,000
Section 7 Rents	3,690,074
Section 8(g) Escrow	51,000,000
Settlement Payments	134,000,000
Total	520,083,457

Source: USDOI MMS (2004).

Table 3-20. Distribution of Offshore Revenues to Alaska during Fiscal Years 1994-2002.

Disbursements($)	1994	1995	1996	1997	1998	1999	2000	2001	2002
Production Royalties	8,810	8,882	101,266	8,683	8,683	8,683	-	4,584	8,683
Rents	120,967	49,058	40,235	137,726	114,893	203,781	212,464	208,959	1,059,408
Bonuses				574,255	3,138	1,092,168			
Section 7 Escrow									
Section 7 Rents	8,348	6,553	6,553	3,210,286	33,472	10,215	56,801		
Settlement Payments	9,380,000	9,380,000	9,380,000	13,400,000	13,400,000	13,400,000	13,400,000	13,400,000	
Total	9,518,125	9,444,493	9,528,054	17,330,950	13,560,186	14,714,847	13,669,265	13,613,543	1,068,091

Source: USDOI MMS (2004).

The U.S. Congress authorized the Coastal Impact Assistance Program (CIAP) in fiscal year 2001 by amending § 31 of the OCSLA. The purpose of the CIAP is to assist states and local communities in mitigating the impacts of OCS oil and gas development and productions. Alaska was appropriated $12,208,723 in funds. The Alaska Division of Governmental Coordination (ADGC) managed the program at the state level. The ADGC received $7,935,670, the NSB received $1,939,680, and the remaining 17 coastal boroughs and coastal resource service areas received $10,000 to $600,000 each. The ADGC used nearly $3 million for a Competitive Grants Program. The NSB used its CIAP funds to conduct projects managed by its Department of Wildlife Management.

3.4.9.4 Federal Revenues

The 1999 Lease Sale in the Planning Area resulted in $38.6 million in first year bonus bids and $1.7 million in first year rentals for the federal government. The federal government estimates future annual rentals due to the federal government from the 1999 Northeast National Petroleum Reserve – Alaska lease sale to be $2 million. The 2002 Lease Sale in the Planning Area resulted in $31.9 million in first-year bonus bids for the federal government.

Beaufort Sea Sale 186 was held on September 24, 2003. Bids totaling $10,175,949 were submitted on 34 tracts covering approximately 181,000 acres offshore of Alaska's Arctic coast. High bids totaled $8,903,535.

Federal offshore collections for Alaska amounted to more than $6.6 billion for calendar years 1976 to 2000. Total federal OCS revenues for the Beaufort Sea amounted to $1.1 million in 1995, $16.2 million in 1996, $1.3 million in 1997, $7.4 million in 1998, $1.4 million in 1999, $1.3 million in 2000, and $1.1 million in 2001.

Federal income tax collected from workers on the Alaska OCS is estimated to have been $1.1 million for drilling and related activity on Warthog and Liberty islands in 1997. The federal government collected no income tax from workers on the Alaska OCS in 1995, 1996, or 1998-2000 because there was no work on the Alaska OCS during those years.