U.S. Department of the Interior
Bureau of Land Management

BLM

September 2006

Bay

Draft Resource Management Plan and Environmental Impact Statement

Volume 2: Chapters 4-5, Appendices, References, Acronyms and Glossary

Anchorage Field Office, Alaska

The Bureau of Land Management Today

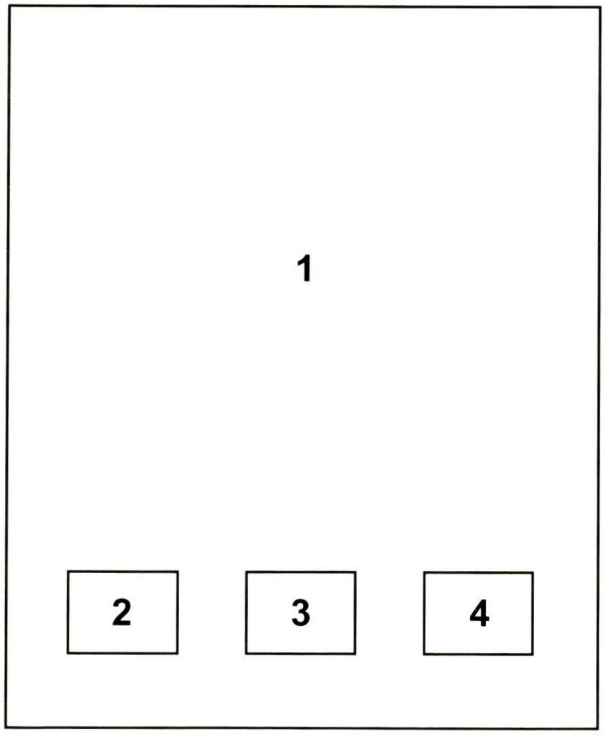
Our Vision

To enhance the quality of life for all citizens through the balanced stewardship of America's public lands and resources.

Our Mission

To sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/AK/PL-06/022+1610+040



BLM Cover Photos:

1. Goodnews River Middle Fork, Alaska.
2. Berry picking, Port Heiden, Alaska.
   Photo by Chris Arend © Bristol Bay Native Corporation
3. Clamming in Port Heiden, Alaska.
   Photo by Chris Arend © Bristol Bay Native Corporation
4. Fish camp at Graveyard Point, Alaska.
   Photo by Chris Arend © Bristol Bay Native Corporation

U.S. Department of the Interior

Bureau of Land Management

DRAFT
Bay Resource Management Plan and Environmental Impact Statement

Volume II

Chapter IV: Environmental Consequences
Chapter V: Consultation and Coordination
Appendices
References
Acronyms
Glossary

Prepared by the
Anchorage Field Office

Alaska

September 2006

Table of Contents

Chapter IV: Environmental Consequences

Chapter V: Consultation and Coordination

Appendices

References

Acronyms

Glossary

List of Tables

List of Figures

Maps

Chapter IV: Environmental Consequences

Chapter IV: Environmental Consequences

A. Introduction

This chapter describes the predicted consequences, or potential effects, on the physical, biological, and human environment from implementing the Alternatives described in Chapter 2. The analysis of impacts associated with the Alternatives is required by BLM planning regulations and by the Council on Environmental Quality (CEQ) regulations at 40 CFR 1500-1508 implementing the National Environmental Policy Act (NEPA). The analysis presents best estimates of impacts. As required by NEPA, direct, indirect, and cumulative effects are addressed. The chapter first provides a summary of the methods and approach used in the effects assessment, describes the type of effects analyzed, and summarizes the assumptions used during the analysis.

Effects are defined as modifications to the environment as it presently exists that are brought about by external actions or events. These effects may be beneficial or adverse, and my result from the action directly or indirectly. Effect levels are determined by their magnitude (measure of change), extent (size of change), duration (length of time; e.g. temporary, short-tem or long-term), and likelihood of change. The characteristics of an effect level vary according to resource category; however, in general an effect that persists more than a few years would be considered long-term. Effects that would allow the resource to revert back to its predisturbance condition within a few years of the activity would be considered short-term. The magnitude or extent of an effect is dependent upon the current condition of the resource.

Chapter IV is organized into the following main sections:

- Introduction
- Assumptions and Methods
- Direct and Indirect Effects
- Cumulative Effects
- Irreversible and Irretrievable Commitment of Resources
- Unavoidable Adverse Impacts

B. Assumptions and Methods

The type and level of effects that could result from implementing the Alternatives have been identified using the information presented in Chapter III, which provides the current condition of the environment. Activities that may occur in the reasonably foreseeable future within the Bay planning area were also considered as part of the analysis. This effects analysis presents the best estimates of direct, indirect, and cumulative effects, and analysis and conclusions are based on interdisciplinary team knowledge of the resources in the planning area, on information provided by BLM and other agency experts, on relevant literature, and on professional judgment. At this time, no specific development projects have been proposed. It is the task of this EIS to describe the potential effects from a proposed Alternative, which exact kinds and locations of future projects are unknown. While the analysis of this chapter provides quantitative data wherever possible, qualitative analysis is also provided.

1. Analytical Assumptions

Assumptions and estimates were made to facilitate the analysis of the project effects. These assumptions set guidelines and provide reasonably foreseeable projected levels of development that would occur within the planning area over the next 20 years. These assumptions should not be interpreted as constraining or redefining the management objectives and actions proposed for each Alternative and described in Chapter II. If no assumptions were made for a resource, the heading is not included in the following sections.

- Sufficient funding and personnel would be available for implementation of the final decision.
- Implementation of actions from any of the Resource Management Plan/Environmental Impact Statement Alternatives would be in compliance with all valid existing rights, Federal regulations, bureau policies, and other requirements.
- The discussion of effects is based on the best available data. Knowledge of the planning area and professional judgment, based on observation and analysis of conditions and responses in similar areas, are used to infer environmental effects where data are limited.
- Acreage figures and other numbers used in the analysis are approximate projections for comparison and analytic purposes only. Readers should not infer that they reflect exact measurements or precise calculations.
- State and Native entitlements are being fulfilled rapidly, and will be met sometime within the next five to ten years. This will reduce the acreage of current BLM-managed lands within the Bay planning area.
- State-selected and Native-selected lands are segregated from mineral entry. These lands will become available for mineral entry or leasing only when they either are conveyed out of Federal ownership or are maintained in long-term BLM management upon rejection of land selection.
- Although it is currently not possible to identify BLM-selected lands that may remain in BLM jurisdiction over time, any isolated parcels that do may be considered, along with parcels identified in the Alternatives, for future exchange in order to consolidate existing discontiguous blocks of BLM unencumbered lands.

2. Resource Assumptions

a) Air Quality, Soil, and Water Resources

(1) Air Quality

- The air in the Bay planning area currently is judged to be pristine. Increasing uses of the area for recreation or development may cause deterioration in the current air quality, especially during seasons of high visitation.
- The most likely causes of deterioration in air quality in the Bay planning area are smoke and gases from wildland fire, dust from travel on unpaved roads, and dust and exhaust from new construction or development, including mining activities.

(2) Soils

- The majority of the soils present on BLM unencumbered lands in the Bay planning area are inceptisols; histosols make up another small percentage. There is very little soil formation with either type, and they may present challenges with respect to their susceptibility to erosion and the difficulty with which they can be reclaimed.

- Permafrost is found intermittently throughout the Bay planning area. The current regional environmental warming trend is bringing major changes in soil moisture, organic matter, changes in vegetation patterns, and weathering patterns. Changes will affect carbon and nitrogen cycles and gaseous emissions. Additionally, frost heave and slumping may affect soils.

(3) Water Resources

- Demand for clean water will increase should recreation use, population, commercial development, or infrastructure development increase. Water quality requirements would be achieved through the use of the Required Operating Procedures (ROPs).

b) Vegetation

- Demand for healthy fish and wildlife habitat, particularly riparian and wet and dry tundra habitats, will continue and may increase. Demand for subsistence uses associated with the various vegetation types present in the Bay planning area will also continue or may increase. In addition to rich habitat for fish and wildlife, current human uses of vegetation include gathering personal firewood and logs for home use and light construction, and subsistence gathering of berries and a variety of plants for food and crafts.
- Natural and human-caused fire events are expected to increase should the current drying trend and bark beetle infestation continue. In the past this region had few fires due to the well-watered nature of the area and the marine influence. Fire suppression efforts will continue in areas near villages and where wildland fire would produce undesirable resource effects.
- There is one plant on the Special Status Species list present in the Bay planning area. Increased visitor use or development activities may add to the necessity for additional protective measures where the plant occurs.

c) Wetland-Riparian

- The desired condition of wetland and riparian communities is proper functioning condition. Pressure on some riparian and wetland areas will increase should recreation, population, development projects, or infrastructure development increase. This will result in localized effects to riparian vegetation, but not at levels that threaten proper functioning condition except in localized areas that will need to be addressed on a case-by-case basis as they develop and are identified. Placer mining may threaten the properly functional condition of localized riparian and wetland communities.

d) Invasive Plant Management

- The Bay planning area vegetation is predominantly pristine and free from invasive non-native plants. Inventory efforts will continue to identify specific occurrences of legally-designated noxious weeds and invasive plants. Increases in invasive species will reduce habitat quality and quantity.

e) Wildlife, Fisheries and Aquatic Habitats

(1) Wildlife

- While a relationship exists between the quantity and quality of habitat and the potential size and distribution of wildlife populations, not all available habitats are occupied by wildlife. Populations of migratory species are affected by the availability and quality of wintering habitats outside the state or the planning area. BLM lands in the planning area provide seasonal and year round habitats that are required to maintain abundance, productivity and distribution.

- Management actions intending to benefit a specific habitat for a priority species of fish or wildlife may have beneficial or adverse affects to some other species of fish and wildlife occurring in that same habitat.
- Demand for a sufficient amount of quality wildlife habitat to sustain viable populations of wildlife and its human uses, particularly game species, will likely increase over the life of the plan. Additionally, animal populations can be expected to fluctuate in natural cycles over the course of the planning period. Quality wildlife habitat to maintain viable populations and human uses up to the carrying capacity of populations will be needed.

(2) Fisheries and Aquatic Habitats

- The demand for fisheries resources from increased subsistence, commercial, and recreational fishing will increase during the life of the plan, resulting in increased pressure on fish populations in the planning area.
- The international and national trends toward the protection and management of wild stocks would increase demands for production capability information in selected streams.
- Potential impacts to aquatic habitat quality will increase during the life of the plan should increased recreation, project development, and infrastructure development take place.
- The BLM will continue to manage fish habitat to protect important spawning, rearing, overwintering, and migratory habitat for resident and anadromous fish species.
- The BLM will cooperate with the Alaska Department of Fish and Game to manage, to protect, and to maintain the genetic integrity of Alaska's wildstock populations of resident and anadromous fish.

f) Special Status Plant and Animal Species

- Continuing current monitoring programs and adding new wildlife inventories and monitoring may identify additional Special Status Species on lands administered by BLM, or may document the expansion of known ranges of species currently on the BLM Alaska Special Status Species list.
- Nationally, the legal requirement for protection of species listed under the Endangered Species Act (ESA), as well as for species not yet listed, but of concern, will likely increase.
- There are two endangered species, one threatened species, one candidate species, and numerous sensitive wildlife species present in the Bay planning area. Demand for protection of these species may increase as inventory indicates critical habitat and recovery plans are developed and implemented. Increased visitor use or development activities may add to the demand for greater protective measures in areas where special status species occur.
- One plant on the BLM Special Status Species list has been documented on BLM-administered lands in the planning area. Increased visitor use or development activities in the plant's habitat could occur within the life of the plan.

g) Wildland Fires and Fuels Management

- Fire is an essential renewing force in interior forest (taiga) ecosystems, as the fire releases nitrogen and other essential nutrients from woody vegetation back into the soil, allowing for new plant growth.
- Depending on the characteristics of the fire, a burn can alter the vegetation composition of forest communities from late successional species such as spruce, to early successional or pioneer species, such as alder and fireweed (nitrate-fixing plants) (USFS 2002). A well-managed fire implementation plan is beneficial to the interior forest (taiga).
- Fire is not a usual or consistent change agent in the coastal temperate forest. However, with increasing temperature and drying, the fire regime in the Bay planning area may change. Wildland fire frequency may increase over the planning period due to this trend, and with the possibility of increased recreation, population, project development and infrastructure development.

h) Cultural Resources

- Undertakings on BLM managed lands have the potential to damage cultural resources. Cultural resources will be considered before any undertakings on these lands are authorized (Section 106 of the National Historic Preservation Act) and damage will be avoided or mitigated before the undertaking is begun.
- All cultural resources will be treated as potentially eligible to the National Register of Historic Places until determined otherwise.
- Inventory efforts to identify cultural resources on BLM managed lands will continue and they will be evaluated for eligibility to the National Register of Historic Places.
- Resource use of cultural resources includes scientific research, interpretation, preservation for future research, and traditional cultural uses. This demand will increase in the future.

i) Paleontological Resources

- Undertakings on BLM managed lands have the potential to damage paleontological resources. Significant paleontological resources will be avoided or otherwise mitigated whenever possible.
- Authorized resource use of fossils includes scientific research, interpretation and educational outreach and limited collection of non-vertebrate fossils by the general public.

j) Visual Resources

- Scenic resources will remain in demand from local residents who want to maintain scenic quality, local businesses that depend on tourism, and an increasing level of recreational users within the Bay planning area over the life of the plan. Increasing tourism will increase the value of scenic views, undeveloped landscapes and open spaces.
- Wilderness characteristics of naturalness, solitude, and primitive and unconfined recreation are expected to remain in demand from local residents and those visitors who want to experience the primitive and unspoiled nature of the local landscape. Businesses that depend on natural landscapes for their excursions, such as ecotourism, guided hunting, and guided sport fishing, will favor an area that possesses wilderness characteristics. Recreationists who depend on a backcountry experience for their activities will also seek lands that have wilderness characteristics (BLM 2005).

3. Resource Uses Assumptions

a) Forest Products

There are few opportunities to utilize forest products for anything other than personal use, due to the fact that there are few forests on BLM lands in the Bay planning area, and the trees are not considered to be of commercial value. While forests are reportedly expanding due to the warming, drying climate trend, the bark beetle infestation and other insect invasions are also spreading. The current situation for forestry is not expected to change during the life of the plan.

b) Livestock Grazing

- No livestock grazing currently occurs under permit, nor has any interest been expressed in requesting livestock grazing authorization. The only anticipated grazing uses might be incidental use associated with recreational and commercial use of pack animals for hunting, fishing, and other back country recreation. Authorizations for grazing by pack animals will be examined on a case-by-case basis.

- No requests for reindeer grazing permits are anticipated. There are no current reindeer grazing authorizations within the Bay planning area.

c) Minerals

(1) Leasable Minerals

- No leasable mineral development with the exception of natural gas would occur within the life of the plan on BLM administered lands.
- Oil and gas exploration would occur as described in the Reasonably Foreseeable Development (RFD) Scenario. The RFD predicts activity based on geologic potential as well as past exploration, accessibility, and lack of existing infrastructure. The following is reasonably foreseeable to occur within the planning area:
    - One seismic survey would occur every five years covering 63 linear miles with a total of 250 miles collected over the next 20 years. Short term disturbance would average one acre per mile; however, long term disturbance will be minimal. The seismic surveys would begin by collecting 2-D seismic lines through the use of shot-hole or Vibroseis. The crew size for this operation would be 20-50 (35-65 for 3-D seismic), and the job would be completed in 2-4 weeks. Support equipment would be barged either to Dillingham, Naknek, or Pederson Point. A central "base" would not be established, as individual staging areas (164' x 164' or 650' x 650') would be used. The entire operation would be accomplished during the winter months if conditions were favorable. The acquisition of 3-D seismic data is a key step in the exploration process. It is used to identify and map the prospects of interest. Successful and accurate interpretation results in more efficient drilling with fewer dry holes, better drill pad positioning and higher petroleum recoveries. For the purposes of analysis, it is assumed that the drilling of holes (shot holes) by off-road, track-mounted drills and the detonation of explosives (shots) placed in the shot holes would account for approximately 46% of the source points total. Heli-portable drill rigs would access approximately 44 % of the source points on steeper terrain (slopes in excess of 20%). The vibroseis-mounted vehicles would access about 10% of the source points on off-road, less steep trails (less than or equal to 15% slopes). It is assumed that significant portions of the contract area are inaccessible for locating source and receiver points due to the steep topography.
    - Two exploratory gas wells would be drilled during the first five years of the plan. If possible, the operator will use nearby existing facilities for housing and feeding its crew. If the facilities are not available, a temporary camp of trailers may be placed on the pad. One of the two wells would have an appreciable gas show resulting in drilling one field delineation well. The delineation/confirmation well is likely to be required before a commitment is made to develop the project and a contract is signed with the local utility company. It is assumed that the discovery field will comprise 1,280 acres and will produce from two wells located on two drill sites, one mile apart. Typically, after analyses of the data and subsequent geotechnical description of the reservoir, exploration wells are not used for production purposes. Under this scenario, however, both the exploration well and delineation well are used for production of natural gas since pipeline construction costs and additional well drilling costs render the project sub economic.
    - Given a 15-year plan life, it is assumed that a total of 6 exploration wells would be drilled. Low ground pressure vehicles in conjunction with helicopters would transport equipment and crews to the drill sites.
    - One gravel staging area (6 acres) would be developed to receive and store equipment for the winter exploration program.
    - One gas field likely would be developed in the Koggiling Creek block (this block was picked due to its proximity to the Dillingham market). It is assumed the field would contain 18 bcf of gas reserves. Production from this field would come from the discovery well and delineation well, spaced one mile apart. The drilling of each well would disturb 6 acres. There would be up to 6 gas exploration wells plus one additional gas delineation well.

  - The gravel pads would be joined by a 35-foot wide, 5-foot thick gravel road (40,000 cubic yards per mile). The road would link the drilling pads only and one section would also serve as an airstrip. Gravel required for construction would likely be mined during winter months to reduce impacts. The source would likely come to the closest feasible gravel source to the gas field, using one or two separate gravel deposits (10-20 acres in size).
  - A typical life of a producing gas well is 10 to 12 years. Therefore, one or both gas production wells may be plugged after the planning period. Field abandonment may take from 2 - 5 years after production ends.
  - Natural reservoir pressure would be adequate to push the gas through the 3-inch transmission pipeline 40 miles to the Dillingham market. No compression facility would be needed. The pipeline would be constructed during the winter months to reduce impacts, dependent upon the presence of sufficient snow cover and sufficiently cold temperatures to freeze the ground.
  - One of the production wells would serve as an in-field underground injection well (annular injection) to dispose of drilling waste, wastewater, spent fluids, chemicals and the produced water. The ability to dispose of fluid downhole is dependent on the existence of suitable subsurface formations, the formation fluid content, proximity to any hydrocarbon bearing zones and the availability of an annulus between the casing strings set in the well.
  - When there is insufficient snow cover for oil and gas related operations, low ground pressure vehicles will be used in conjunction with air support.
- This level of development is assumed for the purposes of impact analysis in the EIS. Actual exploration, development, and production may vary considerably based on exploration results, price of oil and gas, and marketability. Additionally, to market the gas in Dillingham, the current diesel plant would need to be converted to gas. For this to be economical, funding would need to come from energy subsidies derived from the State of Alaska or the Federal Government.
- An ongoing joint State/Federal program to determine the feasibility of developing coal bed natural gas (CBNG) for the benefit of rural communities does not plan to explore the Bristol Bay area at this time. If CBNG were available close to a rural community the development would occur on non-BLM administered lands. BLM lands in the planning area are not in proximity to the two largest communities, Dillingham, Naknek and King Salmon. Transportation costs associated with building a gas pipeline would render CBNG development uneconomic.

2) Locatable Minerals

- Chapter III summarizes the activity levels in the planning area based on surface disturbance tabulated from mining plans and notices of mining operations submitted through the Annual Placer Mining Application and Permit process for both placer and hard rock operations. The RFD for locatable minerals (BLM 2006) summarizes the historic data characterizing mineral occurrences by commodity and genetic ore deposit modeling, as well as differentiating between placer and lode mining methods. Based on this information, a placer mine scenario was developed around a medium-scale (250 cubic yards per day) placer mine as the most likely mining activity to occur in the planning area in the reasonable future. The typical placer mine would result in a maximum of 1-5 acres of surface disturbance at any given point in time. Two similar lode mining scenarios have been dropped from further consideration as it was determined that due to the length of time needed to bring a lode deposit to production and the undeveloped nature of the potential lode deposits, there would be no lode mining development, particularly on BLM unencumbered lands, during the life of the plan.

  - Placer Mining - Placer mining for gold and platinum is the most common type of mining that occurs in the planning area. Placer platinum is the most likely development target while placer gold is the most likely target for exploration and development. Mineral resource development in the planning area is occurring primarily on State, Native, and private lands. This can be attributed to the patenting of large numbers of Federal mining claims staked during the gold rush era and to the State and Native corporations targeting mineral resources for selection under the Alaska Native Claims Settlement Act (ANCSA).

- Additional exploration should prove that development of placer properties in the Bonanza Creek, Goodnews Bay/Snow Gulch, Iliamna/Fog, Kijik Lake, Platinum, and Shotgun Hills areas in the planning area is feasible. These deposits would probably be developed either as small surface open-cut sluice box operation or as a bucket-line dredge operation (Goodnews Bay Platinum Mine).

- Anticipated placer mining activity in the Bay planning area is expected to occur in the Snow Gulch part of the Goodnews Bay/Snow Gulch area on BLM unencumbered lands. There is expected to be 1 to 3 small scale placer operations employing 3 to 5 people at each location. Most likely activity would occur on Barnum Creek, Domingo Creek, Faro Creek, or on Jacksmith Creek. Table 4.1 provides information on anticipated new placer mines under each Alternative.

Table 4.1. Anticipated New Placer Mines

	Alternative A	Alternative B	Alternative C	Alternative D
Anticipated placer mines on BLM-Managed Lands	0	1-3	0	1-3

- Hard Rock Exploration and Development - Historic producers of hard rock for mercury operated on a small scale in the early part of the twentieth century. Today, development projects involve gold and copper from developing new and old prospects. Most of these are located on State and Native lands in the Iliamna/Kvichak area. Hard rock exploration is up in the region, generated by the increasing price of gold and increased interest in mineral occurrences on State and Native lands.

- Elsewhere around the State, exploration has focused on deposits of rare metals (nickel and platinum group metals [PGM]) has occurred in the Broxson Gulch area north of the Denali Highway, East Central Alaska Range. Exploration results in this area indicate that there is the potential for a significant discovery of these metals. This interest, coupled with the rising price of platinum, has sparked recent exploration efforts in the Goodnews Bay along the Salmon River where platinum has historically been mined by placer methods.

- Additional exploration should prove that development of lode properties in the Bonanza Creek, Goodnews Bay/Snow Gulch, Iliamna/Fog, Iliamna/Kvichak, Kasna Creek, Kemuk Mountain, Kijik Lake, Pebble Copper, Platinum, Shotgun Hills, and Sleitat Mountain areas in the planning area is feasible. These deposits would probably be developed either as open pit or as cut and fill underground mines. Surface disturbance will vary depending on the mine design, construction of roads, power line corridors, selection of tailing disposal method, and other factors. An order of magnitude estimate would be in the range of 1,300-3,400 acres. Road building, airstrips, and associated material sites account for the largest surface disturbance followed by mine, mill, tailings disposal site, and camp facilities. While most of these disturbances would occur on State or Native lands, some road construction or power lines could cross BLM-managed land.

- Currently in the pre-production phase of exploration and development is the Pebble Copper property on State lands near Lake Iliamna. This plan is a hard rock, combination open pit and underground mine with a mill that combines free milling processes with floatation and vat chemical leach circuits to recover gold and copper. This mill could include ore from locations situated close by, the Pebble South and the Big Chunk (BC) properties, to name a few. More than 100 employees would contribute to the Iliamna area economy and the mine mill complex could draw power from the Homer utilities grid.

- Table 4.2 provides information about anticipated new locatable lode exploration projects under each Alternative. Anticipated locatable lode exploration activity in the Bay planning area is expected to occur in the Snow Gulch part of the Goodnews Bay/Snow Gulch and Iliamna/Kvichak areas on BLM-managed lands. There is expected to be 1 to 2 small scale open pit operations employing up to 275 people at each location. Most likely open pit operations would occur activity would occur in the Faro Creek area on Figure Four and Island mountains. There is expected to be 1 to 2 small scale underground operations employing up to 300 people at each location. Most likely underground operations would occur activity would occur in the Iliamna/Kvichak area in the vicinity of the Nushagak River and Klutuk Creek.

Table 4.2 Anticipated New Locatable Lode Exploration Projects

	Alternative A	Alternative B	Alternative C	Alternative D
Anticipated locatable lode mines on BLM-managed lands	1	2-4	0	2-4

(3) Salable Minerals (Mineral Materials)

- Salable materials and industrial minerals including sand & gravel, building stone, pumice, clay, and limestone are common throughout the Bay planning area.

- Active rock quarries are located on Native land near Dillingham, Platinum, and Goodnews Bay. Numerous sand and gravel pits exist near Dillingham and King Salmon, mostly located on certified Native Allotments. Most communities in the planning area have a small gravel pit for local use.

- No active mineral material contracts, community pits, or free-use permits issued by BLM exist within the Bay planning area. Most of the sites in the planning area are roadside material sites owned by villages or the State, or certified Native Allotments.

- Mineral material sales would occur under Alternatives B and D in association with oil and gas development. These impacts are discussed under leasable minerals.

- Future sand and gravel needs for the Bay planning area will be well supplied by the existing sources on private land.

- Expected future needs will be project driven, related to the development of mines, oil and gas exploration and production, roads, airstrips/airports, village improvements, and other infrastructure needs.

d) Recreation

- Because much of the BLM-managed land within the Bay planning area generally consists of isolated parcels that are not accessible by road, increases, if any, will be focused on sport hunting and fishing, recreation OHV use (including snow machines), hiking, canoeing, and rafting.

- Currently, BLM manages six BLM Special Recreation Permits (SRPs) within the planning area, with the majority operating on State and Native selected lands. Commercial recreation applications are predicted to increase from the current six, to as many as ten applications in the next five years. These are strictly for large game guide hunting operations in the Iliamna Lake area in the eastern Bay planning area region.

- There is economic benefit to communities and businesses for providing opportunities to accommodate the public seeking professional guide services.

- An activity plan is proposed to further assess potential impacts, conflicts, and use levels for SRPs and air transporters, to be completed within five (5) years from plan approval.

- Public health and safety issues for visitors will receive priority consideration in the management of public lands. Demand for safe visits will increase with increasing numbers of public land users.

e) Travel Management

- The use of Off-Highway Vehicles (OHVs) for hunting and subsistence will remain stable or increase slightly. Primary factors for increases in use are the greater public interest in unconfined, outdoor recreational opportunities, and rising disposable income for use on recreational pursuits.

- Changes in OHV design and technology will continue, enabling OHV users to range into areas that were once thought of as inaccessible due to terrain and water or soil features.

- Future demand for roads to support mineral exploration and development or other resource developments on or across from BLM-managed lands may increase in proximity to villages and communities. Current demand for road development is limited due to the nature and location of the lands within Bay planning area.

- It is generally accepted practice that OHV designation starts at the "limited" classification. Use of designated or existing trails would be allowed for subsistence harvests by qualified subsistence users.

- No transportation or utility corridors have been identified as a result of this planning effort. The BLM recognizes that they may be proposed during the life of the plan and will consider them at that time.

- From public scoping input, there is community support to manage off-highway vehicle recreation while providing existing and reasonable access to still occur.

- At this time, there is little known concerning the specific OHV patterns or locations by either local users accessing traditional use areas or by commercial providers. A comprehensive trails and travel management plan is proposed for completion within five years of approval of the Bay plan.

- The use of OHVs for recreational purposes and subsistence hunting within the Bay planning area is centered around existing villages and communities such as Dillingham, Goodnews Bay, and King Salmon.

- The need for access to public lands may increase slightly as Native corporation entitlements are met and if restrictions on use of those private lands are implemented by the Native corporations. The public easements reserved through Section 17(b) of ANCSA will become more important during the life of the plan. The need to identify and maintain these easements on the ground will increase.

- For the purposes of this document, OHVs include snowmachines. However, most impacts described in this analysis result from OHVs used during snow-free months. Where impacts are specific to snowmachines, they are described as such.

f) Renewable Energy

- As the cost of fossil fuels rises, Federal, State, and local governments, private concerns and individuals in the Bay planning area will be seeking alternative sources of renewable energy. However, BLM unencumbered lands are not located in proximity to the villages, and the probability of receiving applications to permit or lease commercial construction of facilities on BLM lands is low.

g) Lands and Realty Actions

- Disposal or Land Exchange - Land conveyance to the State and Native corporations will be completed within the life of the plan. BLM would consider land exchanges to resolve issues of split estate of ownership of surface and subsurface resources. Land exchanges would not be pursued until State and Native entitlements are resolved on parcels being considered. Isolated parcels of land in the Iliamna East and Iliamna West Blocks and two sections east of Aleknagik would be identified in this RMP/EIS for potential exchange. Additional isolated parcels that revert back to BLM after all land conveyance is completed might also be considered for future exchange. Land exchange identified under Section 206 of the Federal Land Policy and Management Act (FLPMA)(1976) would be the preferred method of land ownership adjustment, and would be used to consolidate the larger, discontiguous tracts of BLM unencumbered lands. Any proposed disposals of land through sales would be considered on a case-by-case basis.

- Land Ownership Adjustment - State and Native corporation land entitlements will be met within the life of the plan. BLM may retain management of approximately 20% of lands currently selected by the State and Native corporations. Once land status is resolved, there would be a demand, both internally and externally, for land ownership adjustments to improve the manageability of Federal and non-Federal lands.

- Withdrawals (ANCSA 17(d)(1)) - ANCSA 17(d)(1) withdrawals are Public Land Orders implementing this provision of ANCSA. The review of these withdrawals within the planning area is addressed in this RMP/EIS. The revocation of ANCSA 17(d)(1) withdrawals would remove the restriction created in ANCSA, which closed the lands to all forms of appropriation under the public land laws, including mining (except in some locations for metalliferous minerals) and the mineral leasing laws. Recommendations for removing the ANCSA 17(d)(1) withdrawals would be implemented as described in each Alternative. Should new withdrawals of another type be proposed to take their place, existing withdrawals in these areas will be retained until the new withdrawal is in place.

- Withdrawals Other Than ANCSA 17(d)(1)(FLPMA Section 204) - Other withdrawals identified in the Bay Planning area are for administrative sites, power sites, and military purposes. Two water power withdrawals, seven military withdrawals, and nine administrative site withdrawals, comprise approximately 38,500 acres within the planning area. Creating, modifying, renewing or revoking withdrawals for other Federal agencies is forecast to continue to be an important function of the BLM. As populations grow throughout the region, pressures placed on resources will continue to escalate, which may impact the number of requests from Federal agencies for withdrawals and demands for withdrawal review may increase from the state and local governments. As part of the land planning process the BLM will review existing withdrawals.

- Land Use Authorizations and Rights-of-Way - As the State and Native Corporation land entitlements are met there will be a limited demand for land use authorizations under 43 CFR §2920 and 43 CFR §2800 within the Bay planning area. Only those remaining BLM unencumbered lands will require a land use authorization for permit activities involving rights-of-way, R&PP lease, and other actions within this category. These actions will fluctuate with the degree of economic growth and infrastructure occurring within and adjacent to the planning area.

In accordance with 43 CFR§2880, BLM shall place stipulations on these Rights of Way requiring:

- Restoration, revegetation, and curtailment of erosion.
- Compliance with air and water quality standards.
- Control or prevention of damage to the environment, to public or private property, and hazards to public health and safety.
- Protection of the subsistence interests of those living along the right of way.

- Wind Energy Development - Future actions may demand processing energy-related rights-of-way applications to ensure that public lands are used to promote energy production. The request for future rights-of-way related to energy development may consist of such rights-of-way for petroleum pipelines, electric power lines, energy development and distribution facilities, roads, water facilities, and communication sites needed for energy development.

- ANCSA 17(b) Easements - BLM would continue to manage ANCSA Section 17(b) easements that have been reserved in patents or interim conveyances to ANCSA corporations.

- 17(b) easement management will be transferred to the National Park Service or the U.S. Fish and Wildlife Service for those easements that access lands administered by these agencies or are wholly within the boundaries of the park, preserve, Wild and Scenic River corridor, or refuge.

- BLM will continue to mark and verify 17(b) easement locations as staffing and budgets allow.

- BLM reserves easements to ensure access to Federal, State, and municipal corporation lands as ANCSA conveyances occur. BLM would continue to identify, sign, map, monitor use, and realign 17(b) easements, with priority based on:

  - Easements accessing lands that are permanently managed by BLM or are important to BLM programs.
  - Easements receiving high public use.
  - Easements required to implement an activity or implementation plan.
  - Easements where land owners support the activity allowed by the easement. (Often support of the landowner is key to resolving signing issues, realignment, mitigating damage, and addressing other issues).
  - Easements where signing or education would mitigate environmental damage to the land where the easement is located or to BLM-managed lands.

- Access - BLM will continue to manage 17(b) easements that access public lands across Native lands. An effort will be made to transfer 17(b) easements that other Federal agencies and consider agreements to transfer management to State and local entities on a case-by-case basis.

- There is no expected decrease in access needs currently provided by 17(b) easements. Road and utility easements associated with specific proposed activities will be considered on a case-by-case basis. BLM is able to transfer jurisdiction of a 17(b) easement to the State of Alaska or to a political subdivision if they agree to it.

4. Special Designation Assumptions

a) Areas of Critical Environmental Concern

Areas designated as Areas of Critical Environmental Concern (ACECs) will be managed to maintain the values for which they were designated.

b) Wild and Scenic Rivers

Recreational use of the river corridors being considered for proposed Wild and Scenic River (WSR) designation would increase. If the proposed corridors were designated, prescribed management would protect the Outstandingly Remarkable Value (ORV) for which the rivers were designated, requiring a mix of education and regulatory measures.

5. Social and Economic Assumptions

a) Public Safety

Public health and safety issues will receive priority consideration in the management of public lands. Demand for safe visits will increase with increasing numbers of public land users.

b) Social and Economic Conditions

While the population in some villages may decrease, overall the population in the Bay planning area is expected to increase during the life of this plan.

c) Tribal Treaty Rights

As a government agency, the BLM will maintain a special government-to-government relationship with Federally-recognized Indian Tribes. Residents of these areas utilize Native and village corporation lands as well as BLM-managed public lands for traditional subsistence activities, and will continue to do so. Through this planning process, the BLM has initiated consultation with different village entities. This consultation will continue throughout the planning period.

3. Subsistence Assumptions

BLM will continue to play a role in the management of subsistence resources on Federal public lands. Based on current trends, the demand for subsistence resources will stay the same or will increase during the life of the plan.

C. Direct and Indirect Effects to Resources

1. Introduction

Direct, indirect, and cumulative impacts are considered in effects analysis, consistent with direction provided in 40 CFR 1502.16.

- ***Direct effects*** are caused by an action or by implementation of an Alternative and occur at the same time and place as that action or implementation.
- ***Indirect effects*** also result from an action or implementation of an Alternative, but usually occur later in time or are removed in distance from the action or implementation, but are still reasonably foreseeable.
- ***Cumulative effects*** result from individually minor but collectively significant actions over time. A cumulative impact is an impact on the environment that results from the incremental impact of the

action when added to other past, present, and reasonably foreseeable future actions regardless of what agency, entity (Federal or non-Federal), or individual undertakes such other actions (40 Code of Federal Regulations 1508.7 and 1508.8).

Actions anticipated during the life of the plan on all lands in the planning area, including private, State, Native corporation, and Federal (FWS and NPS) lands, have been considered in the analysis to the extent reasonable and possible. Decisions about other actions occurring within the planning area could be made by many public and private entities, though the location, timing, and magnitude of these actions are not well known. Assumptions about actions outside of the BLM's jurisdiction that are considered in the cumulative effects analysis include:

- ANCSA and State land entitlements will be fulfilled within the life of this plan.
- The BLM will retain approximately 14% of the lands currently selected by the State or Native corporations, while approximately 86% will be conveyed.
- Land sales (settlement and remote settlement areas) will continue on State lands consistent with the Alaska Department of Natural Resources area plans.
- Mineral exploration and development will increase on State and Native lands.
- Mineral exploration and development will remain minimal in National Parks and Preserves within the planning area, and in the Wildlife Refuges.
- National Parks, Preserves, and Wild and Scenic Rivers within and adjacent to the planning area will continue to manage for remote, primitive recreation experiences. Access into parks will continue to be primarily by air and boat.
- National Wildlife Refuges within or adjacent to the planning area will continue to be managed for wildlife and compatible remote, primitive recreation experiences. Access into refuges will continue to be primarily by air and by boat.
- Road construction will increase on State and Native corporation lands in support of local communities, and mineral exploration and development.
- Use of communication sites will increase.

Irreversible or irretrievable commitment of resources and unavoidable adverse impacts are discussed after the Cumulative Impacts section.

- *Irreversible commitment of resources* result from actions in which resources are considered permanently changed.
- *Irretrievable commitment of resources* result from actions in which resources are considered permanently lost.
- *Unavoidable adverse impacts* are those that remain following the implementation of mitigation measures, and include impacts for which there is no mitigation.

Treatment of BLM Critical Elements

BLM's National Environmental Policy Act (NEPA) Handbook, as supplemented with BLM Instruction Memorandum No. 99-178, identifies 14 "Critical Elements of the Human Environment" that must be addressed during environmental analysis (BLM 1988; BLM 1999):

- Air Quality
- Areas of Critical Environmental Concern (ACECs)
- Cultural Resources
- Environmental Justice
- Floodplains
- Hazardous or Solid Wastes
- Invasive, Non-native Species
- Native American Religious Concerns
- Prime or Unique Farmlands
- Threatened or Endangered Species
- Water Quality

- Wetlands/Riparian Zones
- Wild and Scenic Rivers (WSRs)
- Wilderness

No Prime or Unique Farmlands, designated Wild and Scenic Rivers, designated ACECs, or designated Wilderness currently exist on BLM-managed lands within the Bay planning area (NRCS 2006). Impacts related to proposed designations or findings are described. The remaining elements are identified and addressed in the relevant sections of this chapter.

Availability of Data and Complete Information

The best available information relevant to the decisions to be made was used in development of the RMP. Considerable effort over a two-year period has been taken to acquire and convert resource data into digital format for use in the plan. Data have been acquired from BLM sources and from outside sources such as the State of Alaska, U.S. Fish and Wildlife Service, and National Park Service.

Some information was unavailable for use in developing this plan, usually because inventories have not been conducted or are not complete. Specific data that were unavailable include:

- Inventory and assessment of trails
- Detailed soils surveys
- Recreation use information for waterways
- Definitive Special Status Species and habitat occurrence (plant and animal); delineation of identification and conservation measures
- Riparian assessments
- Certain key wildlife seasonal and life function habitat occurrences; use/concentration areas identification and delineation
- Watershed assessments
- Cultural Resource inventories of uplands and smaller drainages

As a result of these deficiencies, impacts cannot be quantified given the proposed management of certain resources in these instances, impacts are projected in qualitative terms or in some cases are described as unknown. Inventory efforts identified in Chapter 2 will continue to update and refine the information used to implement this plan.

2. Resources with Effects Common to All Alternatives

a) Air Resources

Much of the Bay planning area is designated as unclassifiable, with regard to air resources (USEPA 2004a). Regardless of the selected Alternative, Air resources in the Bay planning area will be affected. Although there will be varying degrees of effects throughout the planning area, it is expected that Alternative B may result in a greater magnitude of impacts due to potential mineral development or OHV activity. Due to the scattered nature of BLM lands and the low potential for reasonably foreseeable mineral development, the impacts on air resources would be minimal under all Alternatives. Impacts from OHV activity will be localized and would be expected to dissipate quickly.

b) Climate, Physiography, and Geology

The proposed Alternatives would have little direct or indirect effect on climate in the Bay planning area. There is a moderate likelihood of development associated with locatable and salable minerals, and a low to moderate likelihood of development associated with leasable minerals on BLM-administered lands in the Bay planning area during the life of this plan. There is a small amount of OHV use on BLM lands in

the eastern part of the Bay planning area, but effects on the physiographic and geologic resources are expected to be negligible.

c) Floodplains

The land management actions proposed under any Alternative would have minimal effects to floodplains. Alternative B has the potential to impact more areas due to mineral development and OHV activity. Impacts on floodplains under Alternative B would be greater in magnitude than under any of the other Alternatives. However, the scattered nature of BLM lands and low potential for reasonably foreseeable mineral development indicate that effects on floodplains would be minimal under all Alternatives.

The potential impacts from exploration and mining for locatable (metalliferous minerals) in floodplains under any of the Alternatives could include the destruction of the structure and stability of the floodplain. Impacts under all Alternatives would be reduced with the implementation of Required Operating Procedures and mitigation measures developed during the NEPA analysis for specific action proposals.

d) Wildlife and Special Status Species

Some of the sensitive migratory bird species are subject to subsistence hunting by Alaska Natives. The recent changes in the Migratory Bird Treaty Act relative to subsistence taking of migratory birds refers to all migratory birds including waterfowl, shorebirds, and other species groups. These populations are monitored by the USFWS and spring and summer migratory bird harvests are managed under legislation implementing the Migratory Bird Treaty Act Amendments. BLM provides input as necessary to the USFWS regarding decisions on harvest regulations and therefore has no direct role in mortality rates of these species. BLM is involved indirectly in allowing access across its lands, but these transportation requests and historic trails serve a multitude of purposes in addition to access for hunting. Activities on BLM administered lands that require permits are reviewed for consistency with applicable wildlife conservation laws such as the Bald Eagle Protection Act, Migratory Bird Treaty Act, Marine Mammal Protection Act, and others during the permitting process.

Species of wildlife listed on the Alaska BLM sensitive species list are considered in proposals for uses of BLM lands to mitigate impacts to these species in order to avoid their potential listing under the Endangered Species Act.

Some Special Status Species are subject to subsistence hunts by Alaska Natives (e.g., Steller's eider, Steller sea lions), but the numbers killed each year are managed under the terms of the Marine Mammal Protection Act, and the Endangered Species Act (ESA), which provide exemptions for certain qualifying Alaska Native subsistence harvests. Because many marine species are susceptible to oil pollution in the water, any activities on BLM lands that had the potential for accidental release of oil or other harmful materials into the marine and coastal environments should receive careful scrutiny for prevention and mitigation measures during the permitting process under all Alternatives. These measures would protect T&E species from potential mortality as well as decreased reproductive rates. Other protective measures for T&E species and their habitats would also be considered under all Alternatives during the permitting process for other types of proposed activities on BLM lands such as mining and road building.

BLM is required by law and by its own policies to cooperate and coordinate with the USFWS and NMFS to develop and implement appropriate conservation measures for T&E species on BLM lands. This applies to all the Alternatives and all regions of the Bay planning area. The policy common to all Alternatives is to be consistent with the ESA during the planning and permitting processes.

Critical habitats for Steller sea lions and Steller's eiders have been established, and critical habitat for other listed species has been designated by the USFWS and NMFS. (No critical habitat has been established on BLM-administered lands in the Bay planning area.) Recovery plans have been established for Steller sea lions in conjunction with NMFS and Steller's eiders in conjunction with USFWS. BLM has not undertaken any specific monitoring or surveys for Special Status Species on its lands.

3. Direct and Indirect Effects to Air Quality, Soils, Vegetation, and Water Resources

a) Effects Common to all Alternatives

Proposed management of the following resources/resources uses/programs would have no anticipated impacts to vegetation management: Cultural Resources, Paleontological Resources, Visual Resources, Renewable Energy, Lands and Realty Actions, Social and Economic Conditions, and Subsistence.

(1) Effects to Soils from Environmental Change (Common to All)

One aspect of environmental studies is to anticipate how soils will change with regional environmental warming. Changes will affect carbon and nitrogen cycles and gaseous emissions, including the release of greenhouse gases (Birkeland 1999; Lal and others 1995) and the increased uptake of carbon dioxide and the production of oxygen. Major changes include (1) changes in soil moisture, with wetter ones experiencing greater leaching, and drier ones accumulating salts, (2) changes in organic matter, which will equilibrate at new levels as a function of changing climate-vegetation patterns, (3) greater weathering will release more nutrients, which could influence biomass production, the impact which will vary from place to place.

(2) Effects to Soils, Water, Vegetation and Air from Vegetation Management (Common to All)

Vegetation throughout the planning area would benefit from proper management of soils, water, and Special Status Species plant resources. Implementation of mitigation measures to protect terrestrial and wetlands vegetation on a project-specific basis would benefit not only vegetation but also soils, water, and air quality. It would limit disturbance and thermokarst subsidence to permafrost soils (some of which are present in the Bay planning area), would reduce soil erosion, limit blowing dust and airborne particulates, and control sediment runoff that impairs water quality, and would assist the recovery of terrestrial and aquatic habitat from permitted uses. Direct and indirect effects for Special Status Species plants will be discussed separately.

(3) Effects to Soils, Water, Vegetation and Air Quality from Fire and Fire Management (Common to All)

Fire is recognized as an essential ecological process and natural agent of change in ecosystems. At the same time, it has impacts to air quality, soil, and water resources as described in detail in the Land Use Plan Amendment for Wildland Fire and Fuels Management for Alaska (BLM 2004). Soils can be affected by fire in several ways. Fire can be beneficial in stimulating new vegetative growth, in helping maintain a mixture of vegetation types and age classes that provide soil stability, and in providing essential nutrients to the soil matrix. Implementation of various fire management options (Critical, Full, Modified, or Limited) in wildland fires and the level at which fire would be used to manipulate the vegetation would directly affect the diversity of the habitats present in the planning area and the successional stages of the plant communities throughout. Fire can also strip soils completely of vegetation and make them vulnerable to erosion if heavy rains occur before vegetative regrowth takes place. Species such as willow and alder sprout quickly after a fire and bring soil stabilization. If the fire is sufficiently hot, it can sterilize the earth, precluding regeneration of the plant species that were present before the fire, and allowing introduction of new species. Wildland fires have not occurred with great regularity in the planning area due to the marine influence on the region's climate and the well-watered nature of the wet tundra environment. Should the current warming and drying trend continue, the fire regime might change.

(4) Effects to Soils, Water, Air and Vegetation from Livestock Grazing (Common to All)

Grazing by domestic livestock (cattle, horses, sheep and goats), ranched wildlife, or reindeer can impact soil, water, air and vegetation resources. Grazing can degrade wetlands, stream, riparian, and tundra

vegetation by creating localized areas of trampled and over utilized natural vegetation including lichens, mosses, grasses, forbs, willow, and dwarf birch. It can denude areas of vegetation and cause conversion of naturally occurring plant communities to less productive or less desirable ones. It can create a proliferation of trails, impacting habitat by compacting soils under them, by reducing the viability of vegetative ground cover, and by making soils susceptible to wind and water erosion due to keeping the animals in one general area. Trampling at watering locations can cause destruction of the vegetation mat and silting of the water body. Although there is a history of reindeer herding in the Bay planning area, due to the fact that there currently are no herds of cattle, caribou, or other livestock in the Bay planning area, and no interest has been expressed in this activity, this type of impact is not likely to be a problem for the foreseeable future. Should grazing be permitted, assessment and application of proper use criteria, range suitability criteria and carrying capacity, annual monitoring of grazing allotments, consultation with herders, and use of allotment management plans encourage proper range management and help to prevent or mitigate adverse effects to soil, water, air and vegetation resources.

(5) Effects to Soils, Water, Vegetation and Air from Hazardous Materials Management (Common to All)

The BLM management actions under all Alternatives for hazardous or solid wastes may beneficially affect soil, water and air quality by ensuring adequate protections against soil, water and air becoming polluted by hazardous or solid wastes at current and future permitted sites, and conducting clean-up of soils and water that have become polluted, as those sites are discovered.

(6) Effects to Soils, Water, Vegetation, and Air from Forestry Management (Common to All)

There is no commercial use of timber and no associated road construction activity on BLM lands within the Bay planning area. No commercial use of timber is anticipated due to the lack of commercial-grade timber resources. A small amount of household use of timber takes place in the form of gathering firewood and house logs. Effects to soil, water, vegetation and air are expected to be minimal to nonexistent should the existing kinds and amounts of forest products be available and the current pattern of use continue into the future.

(7) Effects to Soils, Water, Vegetation and Air from Locatable Minerals (Common to All)

Some mining exploration and development could occur on some BLM unencumbered lands in the Bay planning area, and on existing Federal claims under any Alternative. Potential effects include disturbance and redistribution of gravel, overburden, and soil materials. Existing and future locatable mineral activities unfavorably impact wetlands, stream, riparian and tundra vegetation and habitats by stripping away the vegetative mat as part of mine site overburden, trampling or eliminating vegetation in the development of mine site infrastructure, and increase the potential for introduction and spread of exotic and invasive plant species. The structure of the soil profile and the stability of floodplains is destroyed on a temporary basis and can result in long-term, permanent changes. Removal of soil could also cause an increase in stream sedimentation and turbidity and a decrease in stream channel stability. Required Operating Procedures (ROPS) to protect soil include separating organic overburden from mined gravels for future reclamation, backfilling all mining pits with tailings as the mining progresses and spreading the remaining vegetation and overburden piles on the ground surface up to the stream channel. Current soil storage handling stipulations do not prevent damage to soil health and viability and this reduces the soil's capability to support revegetation.

(8) Effects to Soils, Water, Vegetation and Air from Mineral Materials (Common to All)

Few mineral materials requests for BLM unencumbered lands in the Bay planning area are anticipated due to the generally isolated and remote location of these lands and the activities that are anticipated during the life of the plan. Mineral materials would be needed to support oil and gas development if it occurred. Such exploration and development activities on BLM lands might only be economically feasible in the Koggiling Creek block. Mineral material acquisition and disposal can unfavorably impact vegetation by destroying vegetation growing on the site and by compacting and removing soils, hindering plant

regrowth. Mineral material excavation and disposal may degrade soil resources. Because soil development is slow in this region, some sites may recover to the original vegetative cover very slowly or not at all. Impacts would be reduced under all Alternatives with implementation of Required Operating Procedures. Additional mitigation measures, if necessary, could be developed during NEPA analysis of specific material site disposal actions.

(9) Effects to Soils, Water, Vegetation and Air from Recreation and Travel Management (Common to All)

Recreation use takes place throughout the Bay planning area. Most of it is focused on guided and unguided sport hunting and fishing, which tends to make use of different areas in different months and years, influenced by the movements and abundance of wildlife. Effects would include impacts to vegetation and soils from temporary campsites, development of social trails, and aircraft landings, that may result in erosion should the vegetative cover be destroyed, and/or compaction of soils. Repeated scrambling up and down river and stream banks can destroy riparian vegetation and create bank erosion.

Off-Highway Vehicles (OHVs) are mostly used in areas with proximity to villages. Under all Alternatives there would be some impacts to soils by OHV use, since no areas would be completely closed to OHV use. Impacts to wetlands would include the potential for loss of vegetative cover, soil erosion, soil compaction, thermokarst subsidence, water diversions, and ponding. Commercial and non-commercial recreation activities could cause effects to wetlands, stream, riparian and tundra vegetation. Temporary and repeated use of campsites and aircraft landings at remote sites are two common activities on BLM lands in the Bay planning area that may have direct effects to riparian and tundra vegetation. Impacts could include trampled and broken vegetation, compacted and disturbed soil, and an increased potential for wildland fires. There would be a slight possibility of localized soil and water contamination from hydrocarbons or from lead-acid batteries. Where trails cross streams, riparian soil and vegetation may be altered or destroyed, increasing soil loss and sedimentation into aquatic habitats and resulting in diminished water quality. Given the relatively low level of recreational use on the remote BLM-managed lands, these impacts would be minimal overall and degradation of air quality, soil and water resources should not increase in the foreseeable future.

(10) Effects to Soils, Water, Vegetation and Air from Lands and Realty Management (Common to All)

There are minor impacts to air quality, soil, and water resources from lands and realty actions under all Alternatives. An exception would be a right-of-way that authorized road construction.

Access (Rights-of-Way and Easements) - Construction of access roads, railroads, bridges, culverts, and gravel pads in easements may adversely affect soil in the region. Construction of roads has a major local impact, removing soils. Construction of bridges and culverts may create diversion of water and subsequent soil erosion at the site. Development of borrow pits for road construction can impact soils by removing them. Currently there are no proposals for developments. Should BLM receive proposals for road or gravel pad construction, impacts would be reduced under all Alternatives by implementing Required Operating Procedures. Additional mitigation measures could be developed during the NEPA analysis of specific realty actions.

Disposals and Acquisitions - Disposal of BLM lands results in removal of the land from the public domain to state entitlements, Native Settlements, private or state exchanges, mining patents, Recreation and Public Purposes (R&PP) sales, and Federal Land Policy and Management Act (FLPMA) sales. The relinquishment of BLM-managed lands removes them from the requirements of BLM policies that currently provide some degree of protective measures to soil resources. Should lands be acquired by BLM, they would then be subject to BLM protective policies. Should BLM lands be transferred to other Federal or State agencies, they would be managed under protective measures similar to those of BLM.

Withdrawals - Effects to soils on lands withdrawn under authority other than (d)(1) would be the same for all Alternatives. In the Bay planning area they include FERC sites and military sites, to name two.

Contamination by hazardous materials, compaction, erosion, and solifluction from changes in the condition of the permafrost could all occur.

b) Effects to Soils, Water, Vegetation and Air Quality for Alternative A

(1) Effects to Soils, Water, Vegetation, and Air from Vegetation Management (Alternative A)

Impacts to soil, water, vegetation and air resources from vegetation management would be the same as that discussed under Impacts Common to All Alternatives.

(2) Effects to Soils, Water, Air and Vegetation from Livestock Grazing (Alternative A)

Impacts to soil, water, and air resources from livestock grazing would be similar to those discussed under Impacts Common to All Alternatives. Under this Alternative, applications for grazing permits would be considered throughout the planning area but would likely not be approved for areas within occupied caribou habitat, due to the difficulty of managing reindeer within occupied caribou habitat.

(3) Effects to Soils, Water, and Air from Lands and Realty: ANCSA 17(d)(1) Withdrawals (Alternative A)

In Alternative A, existing ANCSA 17(d)(1) withdrawals would be retained. For those lands currently closed to mineral exploration and development, they would remain closed, and impacts to soils, air, and water from minerals exploration and development would be the same as they are today.

(4) Effects to Soils, Water, and Air from Leasable, Locatable, and Salable Minerals (Alternative A)

Leasable Minerals. Under Alternative A, BLM-managed lands would be closed to fluid mineral leasing; however, BLM has the authority to lease lands where oil and gas are being drained, and those areas subject to leasing under 43 CFR 3400.2 would be open to coal exploration and study.

Locatable Minerals and Salable Mineral Materials. Under Alternative A, 152,746 acres of BLM-administered lands within the planning area, acreage currently not withdrawn under ANCSA 17(d)(1), would be open to hard rock mineral exploration. Within the Bay planning area, approximately 3,999 acres would remain withdrawn from mineral entry due to withdrawals other than 17(d)(1). Development of salable minerals on BLM-managed lands is not expected to occur during the life of this plan. Hard rock mineral exploration and development activities could adversely affect soils, water and air quality including

- Loss of vegetative cover and subsequent erosion of soil, rutting, ponding
- Disturbances to and removal of soil from development of gravel roads, borrow pits, bridges, exploratory drilling work, erection of temporary campsites, seismic tests, construction of gravel pads, and use of heavy equipment for extraction.
- Compaction of soils from vehicles, heavy equipment, social trails
- Sedimentation of water bodies
- Wind-blown particulates
- Smoke and exhaust

(5) Effects to Soil, Water, Vegetation, and Air from Travel Management (Alternative A)

Under Alternative A, impacts from OHV use and travel management would be the same as today. They would be greater than in Alternatives C and D. The planning area would remain undesignated and cross-

country use of OHVs weighing 2,000 pounds or less Gross Vehicle Weight Rating (GVWR) would be allowed throughout. Sensitive habitat areas would not receive additional protection from OHV impacts.

c) Effects to Soils, Water, Vegetation and Air Quality for Alternative B

(1) Effects to Soil, Water, and Air from Vegetation Management (Alternative B)

Since Alternative B promotes exploration and development activities, impacts to soil resources from vegetation management would likely increase somewhat, due to a projected increase in surface-disturbing activities. In addition to the information that was provided in Impacts Common to All Alternatives, management of vegetative resources under Alternative B would implement Required Operating Procedures to preserve the protective vegetation cover on soil and permafrost, and to reduce erosion and sediment runoff that degrades water quality.

(2) Effects to Soil, Water, Air and Vegetation from Livestock Grazing (Alternative B)

Impacts to soil from livestock grazing under Alternative B would be the same as that for impacts Common to All Alternatives.

(3) Effects to Soil, Water, Air, and Vegetation from Leasable Minerals (Alternative B)

Under Alternative B, all unencumbered lands (1,176,269 acres) except for 3,999 acres withdrawn under Public Land Orders other than ANCSA 17(d)(1) and any selected lands whose selections are relinquished or revoked would be open for fluid mineral leasing. Based on the reasonably foreseeable development scenario, while there is a medium potential for the generation of oil and gas in the Alaska Peninsula and the Bristol Bay Nushagak Basin, and a low potential for the Goodnews Bay region, there is a low development potential for all areas. The Reasonably Foreseeable Development Scenario assumes exploration for gas in the Koggiling Block of BLM unencumbered lands in the Bristol Bay area. However, in the Bristol Bay Nushagak Basin no oil or gas exploration has taken place to date. The region is remote, and it lacks existing infrastructure to deliver the product to market.

Using the Reasonably Foreseeable Development Scenario for the Bay planning area, the Resource Assumptions for Leasable Minerals on pages 7 and 8 were formulated. Based on that Scenario, the following effects could occur.

Assuming use of modern Alaska oil construction and operations practices, there would be relatively few long-term impacts to soil resources. Modern operations have substantially decreased the footprint of drill pads, which now affect approximately two to four acres, from which the topsoil is removed and stockpiled. However, current soil storage handling stipulations do not prevent damage to soil health and viability and this reduces the soil's capability to support revegetation. 20 Alaska Administrative Code [AAC] 25.520 requires a maximum of four oil wells, or one gas well, for each 640 acres. An oil spill or natural gas blowout may adversely affect soil in the immediate areas by contamination; should compacted soil also be present, the amount of compacted soil could increase the affected area. Post-production oil and gas remediation measures include the removal of structures, including drill pads, redistribution of stockpiled topsoil over the disturbed area, and subsequent reseeding, recontouring, and drainage control. The full magnitude of production effects is dependent upon the location, depth, size, and soil composition of the project area.

Coal Bed Natural Gas - CBNG is methane gas that is extracted from coal beds. Exploration for CBNG usually requires four to five wells, each requiring a gravel pad of approximately one square acre. Drilling mud and cuttings are typically disposed of on-site. Upon completion of exploration, the drill rig, all debris and other waste material are removed from the site. Should this type of development occur, it is expected that an average of five to seven acres of soil resources would be affected per well. This includes construction and operation of the well site, support sites, access roads, temporary roads, pump stations, injection facilities, utility lines and pipelines. Requiring utilization of existing road systems (few of which

exist in the Bay planning area) and vehicles that do not cause significant damage to the vegetation cover or to soils would reduce some effects.

Seismic Exploration - Seismic surveys involve seasonal occupation and transport of seismic equipment and camps using sledge-drawn trailers at locations chosen for best transport, preferably at times when the snow cover accumulation is sufficient to insulate the tundra and after the ground, lakes, and rivers are frozen. In the Bay planning area during the past 20 years, snow accumulations in some years have been insufficient to drive snow machines across, and the timing of freeze-up has been uncertain with the regional warming trend.

Historically, the principal effect of seismic activities on soil and water resources has been diversions of shallow water tracks and ponding in places where track depression compresses the organic mat sufficiently to alter the thermal regime, melt surface ground ice, and alter the native vegetation (Emers and Jorgenson 1997). More recently, modern seismic lines, with newer low-ground pressure equipment have less impact on the tundra than older, outdated types, but impacts to the tundra are more likely to occur during the camp move (WesternGeco 2003). A 2D operation covers fewer line miles, but the camp moves virtually every day. While a 3D seismic operation covers more line miles, the camp moves less often (WesternGeco 2003). While extensive thermokarst erosion along recent winter seismic trails is seldom observed, impacts to vegetation and surficial compaction are still in evidence (Jorgenson et al. 2003). Adequate protection of the tundra requires a uniformly distributed snow pack with a hard surface crust. Often, less than ideal snow conditions exist in the Bay planning area. Varying levels of disturbance elsewhere have been documented even where the snow depth exceeded two feet (Felix et al. 1989).

Observations by the BLM and others(National Research Council) indicate that short-term transitory impacts, such as surficial compaction, diversions of shallow water tracks and limited ponding are estimated at about one percent of the proposed seismic lines per season, though newer, low ground pressure equipment could reduce this significantly. Since tundra vegetative mat has been shown to recover in 7 to 10 years where damage is not severe (Abele et al. 1984, Jorgenson et al. 2003), the long term impacts due to thermokarst erosion, such as permanent diversions of shallow water tracks and limited ponding, are estimated at only about one percent of the short-term impacts. These impacts are strongly influenced by snow depth and distribution and may only happen when seismic activities occur under less than ideal snow conditions (National Research Council 2003). Where disturbance does occur, it could take from several years to several decades for the effects to be ameliorated (Walker et al. 1987).

These types of impacts would be reduced by implementation of ROPs, including limiting most seismic exploration to those times during the winter when the ground is frozen and snow cover is adequate, or, those conditions lacking, utilization of Alternative means of travel and transport, such as helicopter.

Exploratory Drilling and Field Development- Exploratory drilling in Alaska typically occurs in the winter when snow pack and frozen ground help minimize impacts from surface disturbing activities. Surface disturbance directly impacts plant communities through vegetation removal and mechanical damage to plants. Indirect impacts of surface disturbance on vegetation include soil compaction, erosion, changes in hydrology, and encroachment by invasive plant species. These indirect impacts can limit recovery or rehabilitation of vegetative communities following disturbance. Construction of gravel pads and in-field roads, and overland travel by low-ground-pressure vehicles would temporarily impact various vegetation regimes by soil compaction, damage or destruction of tussocks, disturbance to tundra wetlands, and acceleration of stream bank or lake shore erosion.

Most allowable uses have the potential to affect soil resources to some degree. Surface-disturbing actions would result in removal of vegetative cover, loosening the surface soil, formation of compacted layers, reduced infiltration, changes in physical and biological properties, reduction in organic matter content, and increasing the potential for accelerated erosion by exposing soil particles to wind and water. There also would be a loss of soil productivity through disruption of natural soil horizons and removal of vegetated acreage for use by roads, well pads, and other facilities. Operating vehicles on moist soils, especially heavy equipment, is likely to cause compaction of the surface layer, decrease infiltration and aeration, and reduction of soil productivity by making it more difficult for plant roots to grow and obtain soil moisture and nutrients. Indirect impacts caused by disrupting soil stability, increased compaction, and

moisture and nutrients. Indirect impacts caused by disrupting soil stability, increasing compaction, and reducing productivity include (1) sedimentation of drainages and perennial water bodies primarily by wind or water erosion, (2) particulate matter affecting air quality through wind erosion, (3) reduced infiltration, (4) an increase in surface water runoff that could cause higher peak streamflows and possibly downstream flooding, and (5) changes in surface water quality caused by esposing soils or bedrock with undesirable chemical characteristics.

The extent of the impacts to water resources would depend on the location and the nature of the exploration area. Possible impacts include drainage disruption, sedimentation, water removal, gravel removal, and thermokarsting in areas where permafrost is present. An impact to riparian and wetland areas impacts the physical, chemical, and biological components of an ecosystem. Activities that contribute to the decline in abundance, distribution, or functionality of riparian and wetland communities are considered adverse impacts. Direct impacts to riparian and wetland communities result from disturbing vegetation or ground surfaces. Indirect impacts to riparian and wetland communities result from actions within a watershed that cause a change in riparian and wetland functionality (e.g., increased rates of sediment loading into streams or increased surface runoff to streams), a change in water chemistry, or spread of invasive nonnative species. Changes in water chemistry, for example, can affect riparian and wetland areas primarily through changes in plant species composition, which could impact use of the area by wildlife.

Inadequate design or placement of structures, culverts, or bridges can alter natural sediment transport and deposition, creating scour holes or channel bars. Improper placement or sizing of gravel fill can result in erosion from pads or roadbeds adjacent to streams or lakes. Natural drainage patterns can be disrupted when activities or structures divert, impede, or block flow in stream channels, lake currents, or shallow-water tracks. Blockages or diversions to areas with insufficient flow capacity can result in seasonal or permanent impoundments. Diverting stream flow or lake currents also can result in increased bank or shoreline erosion and sedimentation that degrades water quality. Proper location and adequate design capacity of culverts, bridges, pipelines, and other control structures would minimize drainage problems. Winter or low-water construction and transport activities and adequate armoring of fill would minimize erosion and sedimentation problems.

Short-term air quality impacts from leasable minerals development and production would occur from two primary sources: (1) combustive emissions (vehicle tailpipe and exhaust stack emissions) due to the operation of mobile and stationary source construction equipment, and (2) fugitive dust emissions (particulate matter less than 10 microns in diameter[PM10]) due to earth moving activities and the operation of vehicles on unpaved surfaces. Minerals production would generate long-term combustive and fugitive dust emissions from two sources: (1) stationary sources, such as natural gas flaring, natural gas-fired compressors, and storage and handling of equipment; and (2) mobile sources that access and service oil and gas facilities. The planning area is a large region with a maximum east-west extent of 280 miles and a north-south extent of about 150 miles. Given the good air quality that currently exists in the region and the expected separation of sources within the planning area, it is unlikely emissions from Alternative B activities would exceed national or State ambient air quality standards. There could be localized air quality impacts depending on the locations and emissions levels of proposed sources in the area, the surrounding topographical characteristics, and the site-specific meteorology.

Sources of hazardous air pollutants within the planning area would include fossil fuel combustion, fugitive volatile organic compounds, and emissions due to oil and gas production. The accidental release of sour natural gas (rich in hydrogen sulfide (H2S) poses the main risk under Alternative B. Another source of release of H2S is at oil and gas fields where secondary recovery operations are occurring. To mitigate H2S impacts, applications for permit to drill (APDs) in sour gas areas would include a contingency plan that may include requirements to monitor wind speed, wihd direction, and atmospheric stability and to conduct dispersion modeling analyses. These requirements would apply to areas where public health and safety or important resource values are a concern, such as proposed well sites in proximity to residences. If the BLM determines after review of a contingency plan that additional data or safety precautions are needed, the BLM would require these items as conditions of approval (COAs). The potential release of H2S during production operations in sour gas areas may be mitigated by health and safety plans.

The preferred and normal means of disposing of drilling wastes, including muds and cuttings, is reinjection into wells. Cuttings may be stored temporarily to facilitate reinjection and/or backhaul operations. Use of mud pits may be allowed by the Authorizing Officer. If mud and cuttings are stored on the surface, sediments and other contaminants could be flushed into the watershed. However, requirements that wastes be stored in lined and bermed areas and disposed of before spring break-up would reduce the potential of sediments and other contaminants being flushed into the watershed. Adherence to the Required Operating Procedures and Stipulations, and to project-specific requirements by all permitted operations would help prevent pollution to any stream or lake.

Consumptive water use in the summer seldom is a problem on the coastal Bristol Bay Plain, as water generally is abundant. Exceptions would be in small lakes and ponds, smaller coastal streams or most foothill streams during early summer when flow is low, and recently in summer if conditions are hot and dry. In these instances shallow pools might be pumped dry. Depending on the areas leased and number of development wells drilled, annual water usage for development activities under Alternative B would vary considerably. Annual water use during development could be similar to that for exploration (i.e., use for dust abatement). If more than 15 per cent is removed, then fewer lakes would be required, but if it is being used in winter, less of the critical overwintering habitat would remain in the pumped lakes or rivers. Adherence to the Required Operating Procedures and Stipulations for all permitted operations would prevent the unlimited drawdown or pollution of any stream or lake.

While some of the gravel used for the construction off permanent facilities may be obtained from non-BLM managed lands, some of the material sites would probably be located on BLM-managed lands within the planning area. Improper location of gravel-removal operations can result in alteration or destruction of soils, stream channel or lake configuration, stream-flow hydraulics or lake dynamics, erosion and sedimentation, and ice damming and aufeis formation. Locating gravel pits far enough away from streams and lakes to avoid break-up or storm flooding would greatly minimize these effects to water resources.

Under the potential development activities, spills and spill cleanup would involve both crude oil and refined petroleum products, probably from fuel-storage areas or handling operations. Storage of fuel in lined and bermed areas and the onsite availability of absorbents and removal equipment would help ensure that the size of any area affected by a spill and cleanup efforts is kept to a minimum. Crude oil spill cleanup associated with production operations and pipelines is possible and could adversely affect streams and lakes. While the petroleum residue from a spill cold be flushed from streams within a few years, the impacts to lakes and ponds could persist for decades. Spill cleanup in a watershed would involve containing the spill, diverting or isolating it within the waterbody, skimming off the oil, and treating the remaining oil-contaminated water and sediments. Prevention and rapid response with adequate removal equipment would minimize effects. The Required Operating Procedures associated with Alternatives B, C, and D are designed to prevent or otherwise mitigate oil spills in the planning area.

Spills of chemicals and saline waters would be rapidly diluted in a large lake or river. In small lakes, tundra ponds, and shallow water tracks, the impacts would be greater, with waters remaining toxic to sensitive species for several years. These spills could be pumped out of the water body, if confined, or neutralized and then diluted with uncontaminated fresh water. Seppi's (2006) work on lake water chemistry and productivity indicate that many Bristol Bay lakes are chemically sensitive; spills, dilution or neutralization may be detrimental or may create unwanted changes.

Air quality impacts may result from the emissions of hydrocarbons and gaseous byproducts of combustion (Hydrogen sulfide) or wind-borne particulates. Ambient air quality on the North Slope of Alaska, however, is relatively pristine even though oil and gas exploration, development, and production have been under way for more than 30 years. In the Bay planning area, prevailing winds may blow these emissions and particulates to other areas of Alaska, where they might affect air quality elsewhere. Arctic haze is a phenomenon resulting from elevated concentrations of fine particulate matter found over the Arctic, primarily in winter and spring. Scientists believe that most of the pollutants contributing to Arctic haze are from combustion sources in Europe and Asia. It is not known to what extent local sources in Alaska contribute to Arctic haze. However, the Arctic haze phenomenon was first observed in the 1950s, long

before oil development started o the North Slope. Emissions from development resulting from Alternative B would be small compared to the emissions from North Slope oil production.

Effects of Oil, Gasoline, and Diesel Spills - Spills could occur from pipelines, production and exploration pads and ancillary facilities, airstrips, roads, fuel storage containers, and mechanical equipment. Spills that leave the pads and roadbeds could reach one or more of several environments and habitat types, including wet and dry tundra, riparian areas, tundra ponds, lakes, flowing creeks and rivers, the water table, and potentially Bristol Bay. Spills could occur at any time during the year.

Specific primary spill response options include mechanical or physical, chemical, biological, in-situ burning and natural recovery. Mechanical or physical methods are used to control spills through containment and recovery. Physical response methods include but are not limited to:

- Booming
- Skimming
- Barrier/Berm
- Physical Herding
- Debris Removal
- Vegetation Removal
- Manual Removal/Cleaning
- Mechanical Removal
- Sorbents
- Vacuum
- Flushing
- In-situ Burning

In the case of debris removal, vegetation removal, manual removal or cleaning, vacuum, flushing, and in-situ burning, direct effects to the ground surface, to soil, vegetation, and small living things could be expected (USFWS 2005).

Chemical treatment employs the use of dispersing agents that contain surfactants, or compounds that break up substances such as oil into small droplets. Chemical dispersants would only be used when the associated impacts of the dispersed oil would be less harmful than non-dispersed oil (USFWS 2005). Both direct effects and potential indirect effects to wildlife, especially waterfowl, could be anticipated.

Biological treatment uses biological agents such as nutrients, enzyme microorganisms that increase the rate at which natural biodegradation takes place. This is a natural process that slowly removes oil from the environment (USFWS 2005). This method does not work as efficiently in colder climates as it does in temperate climates.

In-situ burning of oil involves the ignition and controlled combustion of a spill. It can be used when oil is spilled on a water body or on land (USFWS 2005). One problem with burning on land is that the vegetation cover would be completely destroyed, and the heat of the fire might sterilize the soil so that native vegetation might not recover, and the area would be susceptible to invasive vegetative species.

Natural recovery, leaving the spill alone, allows natural processes to remove oil from the environment. Natural processes include evaporation, oxidation and biodegradation (USFWS 2005). Natural recovery is not recommended in cases where the spill might migrate into water bodies or into the water table.

Air Quality - Volatiles from the oil spill can present an immediate health hazard to humans and wildlife during the first few hours to days of a spill. The rate at which the volatile (gaseous) component of an oil spill disperses into the atmosphere is dependent upon many factors, including the volume of the spill, the thickness of the oil on the surface, the air and/or water temperature, weather, and the amount of wind (Trust 2006, Pers.Comm.; McClenahan 2006, Pers. Comm). The Northeast Integrated Activity Plan (IAP) and EIS (BLM and MMS 1998) provides a discussion regarding the rate of evaporation, ambient concentrations, and the types of compounds the EPA classifies as hazardous air pollutants. The heavier the compound the longer it takes to evaporate. The EIS discusses the rate of evaporation, ambient

concentrations, and the types of compounds the EPA classifies as hazardous air pollutants. In the event of an oil spill on land, the air quality effects would be less severe than offshore because some of the oil would be absorbed by vegetation or into the ground during months of the year other than winter when everything is frozen.

Diesel fuel oil could be spilled either while being transported or from accidents involving vehicles or equipment. A diesel spill would evaporate faster than the volatiles from a crude oil spill. Ambient hydrocarbon concentrations would be higher than those from a crude oil spill, but would also persist for a shorter time. Since a diesel spill probably would be smaller than a potential crude oil spill, any air quality effects from a diesel spill likely would be lower than those from other types of spills. Fire would be another source of airborne contaminants. Oil or gas blowouts may catch fire. Additionally, in-situ burning during the first few hours after an oil spill is a preferred technique for cleanup and disposal of oil spilled into water. This type of burning would be less likely to be used in the case of oil spilled on land, but the effects to air quality if some of the oil were burned would be similar. Burning could affect air quality in two important ways. For a gas blowout, burning would reduce emissions of gaseous hydrocarbons but would slightly increase emissions of other pollutants temporarily. If an oil spill were ignited immediately after spillage, the burn could combust most of the volatiles that otherwise would evaporate. Incomplete combustion of oil would release an oily soot of unburned hydrocarbons and minor quantities of other pollutants into the air.

Soil and Vegetation Resources - Oil spills could affect vegetation and impact soils, primarily when the surface vegetation is altered. The oil would kill vegetation and/or decrease vegetation growth, but would leave the organic mat largely intact although probably saturated with oil. The depth to which the soil would be saturated would depend on a number of factors, including the amount of oil spilled, the viscosity of the oil, the type of soil present, the permeability of the soil and the covering vegetation mat, ambient temperature, and the presence or absence of frozen ground and/or permafrost. Surface and underground dispersal of the spill would also depend on many of the same factors, as well as the amount and force of water running through the ground at the site of the spill and the degree of slope of the terrain. Snow, ice, and a frozen ground surface would limit oil absorption into the soil and surface organic mat (though not eliminate it), and would simplify cleanup. Spill cleanup, however, is more likely to damage soils when the ground surface is not frozen. Cleanups are not always well controlled; heavy traffic and digging are common, resulting in damaged soils. Oil spill cleanup mitigates impacts on soils only if cleanup methods and operations are very carefully controlled to minimize surface disturbance. The impacts to vegetation and soil resources from surface disturbing activities during oil spill cleanup when the tundra is unfrozen may be greater than the impact of the spilled oil, as the area affected may not be limited to that area immediately adjacent to and covered by the spill.

Water Resources - Small crude or diesel spills (<1 bbl and smaller) are projected to occur onshore. It is likely that all small fuel spills would occur on or near pads or roadbeds, though some fuel may possibly reach adjacent waters. In the case of a complete freeze up of the ground during the winter at the location of a spill, spill response likely would remove almost all of the spill from the frozen tundra prior to snowmelt. During that part of the year when the soil and vegetation are unfrozen, late May through around October 15, spills could reach and adversely impact tundra waters before oil spill response is initiated or completed. Storage of fuel in lined and bermed areas and the onsite availability of absorbents and removal equipment would help ensure that the size of any area affected by a spill and cleanup effort is kept to a minimum. Since most oil exploration and development activities, as well as pipeline and facilities construction, would occur during winter when the ground is frozen, it is likely that most anticipated small fuel spills would be largely contained and removed prior to reaching tundra waters.

In the case of a larger spill, the Northeast NPR-A IAP/EIS (BLM and MMS 1998), analyzed the effects of a 325 bbl spill reaching the Colville River and Teshekpuk Lake in summer, and the effects are incorporated here by reference. In the Colville River, in the view of the analysis, the high rate of water flow would rapidly disperse the spill and preclude any effects on dissolved oxygen concentrations. Direct toxicity in the water column would be minimal and limited to the first few reservoir pools down current of where the spill entered the river. Analysts believe that some toxicity might persist in initial reservoir pools for a few days to weeks until toxic compounds were washed out of the oil trapped in the sediment or the oiled sediment was buried under cleaner sediment. However, based on studies carried out by NOAA at post-

spill areas of the 1989 EXXON Valdez oil spill (EVOS) between 1989 and 2005, researchers found that oil persists in pockets and reservoir pools and in many cases was not washed away. Some of the residual oil weathered and some did not; however, the oil remained toxic with polynuclear aromatic hydrocarbons (PAH) and a suite of persistent organic pollutants (POP) ten to fifteen years after the incident (Short et al. 2001; Rice et al. 2005; Springman et al. 2005; Short et al. 2005; Babcock et al. 1998). Scientific studies of the lingering potency of EVOS oil were carried out on a variety of animal species, including otters, harlequin ducks, rainbow trout, and salmon, and were found to be the source of a variety of adverse physiological responses in these animals (Babcock et al. 1998; Rice et al. 2005; Springman et al. 2005; Short et al. 2005).

According to the Northeast NPR-A analysis (BLM and MMS 1998), the primary effect of an oil spill in tundra ponds would be long-term direct toxicity. Similar effects would be expected for any of the lakes in the planning area should an oil spill occur.

Spill cleanup in a watershed would involve containing the spill, diverting or isolating it within the waterbody, skimming off the oil, and treating the remaining, oil-contaminated water and sediments. Storage of fuel in lined and bermed areas and the onsite availability of absorbents and removal equipment would help ensure that the size of any area affected by a spill and cleanup efforts is kept to a minimum. Prevention and rapid response with adequate removal equipment would reduce effects but probably would not completely eliminate them (Short et al. 2001).

(4) Effects to Soil, Water, Air, and Vegetation Resources from Locatable Minerals and Mineral Materials (Alternative B)

Locatable Minerals. Mining exploration could occur on existing Federal or State claims under any Alternative. However, Under Alternative B, ANCSA 17(d)(1) withdrawals would be revoked, and BLM unencumbered lands would be open to Locatable Mineral exploration and development. The type of mining most likely to occur is placer mining. The range of potential impacts to soil resources includes disturbance and redistribution of gravel, overburden, and soils. The structure of the soil profile could be destroyed and may require decades to recover. Soil development in the Arctic is a slow process. Removal of vegetative cover and soil could cause an increase in erosion, stream sedimentation, and turbidity as well as a decrease in stream channel stability. Water could be contaminated by toxic materials introduced by the mining process. Denuded soil and contaminated soil particulates could become airborne. Some effects may be mitigated by utilizing Required Operating Procedures that protect soil, including separating vegetative cover and soil from mine tailings for future recovery, backfilling and replacing topsoil as appropriate, as mining progresses, and returning the stored soil to the ground surface upon completion of the mining project.

Mineral Materials. Mineral material excavation and disposal may degrade soil resources, and may cause erosion and an increase in stream sedimentation and turbidity. Sites may never recover native vegetative cover due to loss of soil from the site. Construction of access roads to the site may add to the impacts in terms of soil loss, soil compaction, and erosion. The degree of impact would depend on the type of soil present, the type of road, the terrain, and the presence or absence of permafrost.

(5) Effects to Soil, Water, Air, and Vegetation Resources from Recreation Management (Alternative B)

Impacts to air quality, soil, vegetation and water resources from recreation management would be similar to those discussed under Impacts Common to All Alternatives.

(6) Effects to Soil, Water, Air, and Vegetation Resources from Travel Management (Alternative B)

Impacts to air quality, soil, vegetation, and water resources from OHV use and travel management would be similar to those discussed under Alternative A.

(7) Effects to Soil, Water, Air, and Vegetation Resources from Lands and Realty Actions (Alternative B)

Impacts to air, soil, vegetation, and water resources would be similar to those discussed under Impacts Common to All Alternatives. Implementation of Required Operating Procedures would further reduce the potential for impacts compared to Alternative A.

d) Effects to Soils, Water, Vegetation and Air Quality for Alternative C

(1) Effects to Soils, Water, and Air from Vegetation Management (Alternative C)

Impacts to soil, water, and air resources from vegetation management would be similar to those discussed under Impacts Common to All Alternatives.

(2) Effects to Soils, Water, Air and Vegetation Resources from Livestock Grazing (Alternative C)

Impacts to soil, water, vegetation and air resources from livestock grazing would be similar to those discussed under Impacts Common to All Alternatives.

(3) Effects to Soils, Water, Vegetation and Air Resources from Lands and Realty (Alternative C)

In Alternative C, existing ANCSA 17(d)(1) withdrawals would be removed. For those lands currently closed to mineral exploration and development, they would be open with the exception that ANCSA 17(d)(1) withdrawals would be retained at locations where Wild and Scenic Rivers are proposed until Congress has had an opportunity to act. Impacts to soils, air, vegetation and water from minerals exploration and development would be greater than in Alternative A but slightly less than in Alternatives B and D.

Delineating Right-of-Way avoidance areas would have a positive impact on soils.

(4) Effects to Soils, Water, Vegetation and Air from Leasable, Locatable, and Salable Minerals (Alternative C)

Leasable Minerals. Under Alternative C, BLM-managed lands would be open to fluid mineral leasing and those areas subject to leasing under 43 CFR 3400.2 would be open to coal exploration and study. Impacts to soils, vegetation, water and air would be greater than in Alternative A and slightly less than Alternative B. Soils, vegetation, water and air resources would benefit from Required Operating Procedures, Stipulations, and project-specific requirements. Effects from leasable mineral activities would not be expected outside of the Koggiling Block during the life of this plan.

Locatable Minerals and Salable Mineral Materials. Under Alternative C, all unencumbered BLM-administered lands within the planning area would be open to hard rock mineral exploration. Within the Bay planning area, approximately 3,999 acres would remain withdrawn from mineral entry due to withdrawals other than ANCSA 17(d)(1), and ANCSA 17(d)(1) withdrawals at locations of proposed Wild and Scenic Rivers would be retained in place until Congress had had an opportunity to act. Impacts to soils, water, air, and vegetation resources from locatable and salable mineral exploration and development would be expected to be similar to those for Alternative B. However, Required Operating Procedures and project-specific requirements would play a greater role in the two proposed Areas of Critical Environmental Concern. Development of salable minerals on BLM-managed lands is not expected to occur during the life of this plan.

(5) Effects to Soil, Water, Vegetation, and Air Resources from Recreation Management (Alternative C)

Impacts to air quality, soil, vegetation, and water resources would be similar to Alternative B.

(6) Effects to Soil, Water, Vegetation, and Air Resources from Travel Management (Alternative C)

Under Alternative C, impacts from OHV use and travel management would be less than in Alternatives A and B. The planning area would be designated as limited to existing trails by OHVs weighing 2,000 pounds or less Gross Vehicle Weight Rating (GVWR). Sensitive habitat areas would receive additional protection from OHV impacts. The fewest impacts to air, soil, vegetation, and water resources would occur under Alternatives C and D.

d) Effects to Soils, Water, Vegetation and Air Quality for Alternative D

(1) Effects to Soils, Water, Vegetation and Air from Vegetation Management (Alternative D)

Impacts to soil, water, vegetation and air resources from vegetation management would be similar to those discussed under Impacts Common to All Alternatives.

(2) Effects to Soils, Water, Air and Vegetation Resources from Livestock Grazing (Alternative D)

Impacts to soil, water, vegetation and air resources from livestock grazing would be similar to those discussed under Impacts Common to All Alternatives.

(3) Effects to Soils, Vegetation, Water, and Air from Leasable, Locatable, and Salable Minerals (Alternative D)

Leasable Minerals. Under Alternative D, BLM-managed lands would be open to fluid mineral leasing. Impacts to soils, vegetation, water and air would be greater than in Alternative A or C and similar to those in Alternative B. Soils, vegetation, water and air resources would benefit from Required Operating Procedures, Stipulations, and project-specific requirements. Effects from leasable mineral activities would not be expected outside of the Koggiling Block during the life of this plan.

Locatable Minerals and Salable Mineral Materials. Under Alternative D, all unencumbered BLM-administered lands within the planning area would be open to hard rock mineral exploration, and those areas subject to leasing under 43 CFR 3400.2 would be open to coal exploration and study. Within the Bay planning area, approximately 3,999 acres would remain withdrawn from mineral entry due to withdrawals other than ANCSA 17(d)(1). Impacts to soils, water, air, and vegetation resources from locatable and salable mineral exploration and development would be expected to be similar to those for Alternative B. However, Required Operating Procedures and project-specific requirements would play a greater role in the proposed Carter Spit Area of Critical Environmental Concern. Development of salable minerals on BLM-managed lands is not expected to occur during the life of this plan.

(4) Effects to Soil, Water, Vegetation, and Air Resources from Recreation Management (Alternative D)

Impacts to air quality, soil, vegetation, and water resources would be similar to Alternative B.

(5) Effects to Soil, Water, Vegetation, and Air Resources from Travel Management (Alternative D)

Under Alternative D, impacts from OHV use and travel management would be less than in Alternatives A and B. The planning area would be designated as limited to existing trails by OHVs weighing 2,000

pounds or less Gross Vehicle Weight Rating (GVWR). Sensitive habitat areas would receive additional protection from OHV impacts. The fewest impacts to air, soil, vegetation, and water resources from OHV use would occur under Alternatives C and D.

(6) Effects to Soils, Water, Vegetation and Air Resources from Lands and Realty (Alternative D)

In Alternative D, existing ANCSA 17(d)(1) withdrawals would be removed. For those lands currently closed to mineral exploration and development, they would be open. Impacts to soils, air, vegetation and water from minerals exploration and development would be slightly less than Alternative B but greater than in Alternatives A and C.

Delineating Right-of-Way avoidance areas would have a positive impact on soils, vegetation and water resources.

3. Direct and Indirect Effects to Fisheries and Aquatic Habitats

a) Effects Common to All Alternatives

(1) Effects to Fisheries and Aquatic Habitat from Hazardous or Solid Waste Management (Common to All)

The BLM management actions under all Alternatives for hazardous or solid wastes may have localized, beneficial effects on fish habitat quality through prevention measures and mitigation practices as sites become known.

(2) Effects to Fisheries and Aquatic Habitat from Soil, Water, Vegetation and Air Quality Management (Common to All)

All Alternatives propose some activities, such as mining, oil and gas exploration and development, road construction, and the use of OHV trails and stream crossings, which could contribute to erosion and/or sedimentation into streams and rivers. Currently there are no proposals for mining, oil and gas exploration or development, road construction or other development activities for BLM lands in the Bay planning area. Project-specific descriptions would provide information that would help determine what impacts would be expected, and to what degree sedimentation may occur.

Removing the vegetative cover, altering the natural topsoil, or changing the shape of the slope can increase the potential for erosion, increased runoff, and can create additional sediment in waterbodies.

The main factors influencing erosion rate include the volume and velocity of runoff from precipitation, the rate of precipitation infiltration through the soil, the amount of plant cover, the slope length or the distance from the point of origin of overland flow to the point of deposition, and operational erosion control structures (EPA 1997). Accelerated erosion occurs whenever the soil surface is disturbed. Sediments created by accelerated erosion clog streams and fill lakes and impair the water-holding capacity. Erosion decreases the productive value of the soil; additionally, it reduces the quality of the waters that receive the sediment.

Significant increases in sediment yield can lead to alteration of stream channel morphology, substrate composition, and surface-ground water interaction; decreased survival of fish in the egg and young-of-the-year stages; changes in macro invertebrate community structure; and decreased primary production (Madison 1981, Van Nieuwenhuyse 1983, Weber and Post 1985, Bjerklie and LaPerriere 1985, Lloyd et al. 1987, Reynolds et al. 1989, Buhl and Hamilton 1990).

Stream channel instability occurs when excessive sediment deposition leads to destructive lateral erosion of streambank and progressively wider and shallower stream channels (Elmore and Leonard 1998).

Accelerated runoff can trigger downcutting, which lowers the streambed, alters the water table, dries out the riparian area, destabilizes streambanks, increases erosion, and further accelerates runoff. Unless stopped by some form of intervention or a hard geologic formation, downcutting will migrate upstream and eventually disrupt the hydrologic functioning of the entire watershed (Chaney and others 1993).

These changes can lead to decreased survival of fish in the egg and alevin stages; decreased density, biomass, and diversity of aquatic insects the fish depend on for food; and decreased primary fish production (Cordone and Kelley 1961; Cooper 1965; Van Nieuwenhuyse 1983; Webber and Post 1985; Lloyd and others 1987; Buhl and Hamiltion 1990).

Increased turbidity and sedimentation from erosion can inhibit feeding and spawning success. All members of the biotic community have the potential to be affected. Potential effects of sedimentation on benthic macroinvertebrates - which are prey species for fish - include interference with respiration, and interruption of filter-feeding insects' capability to secure food. A more important impact to benthic invertebrates would be smothering of physical habitat by increased sediment loads. A loss of interstitial space in the substrate would be highly detrimental to burrowing species. A decrease in abundance could be expected in these situations. In Arctic environments, where fish depend on summer food sources to grow and reproduce, a reduced prey base may preclude fish from directing energy towards spawning.

Direct threats to fish from sediment include changes to physical habitat, subsequent decreased reproductive success, and loss of rearing habitat. Physical habitat changes from sediments are most often attributed to finer size particles. Developing eggs can be smothered and newly hatched fry can be killed by deposited sediment that prevents emergence from spawning gravels and interferes with respiration. Developing fish eggs and larvae need a constant supply of cold, oxygen rich water which flows through the interstitial spaces in stream gravels. Embedded sediments fill these interstitial spaces and also limit essential winter habitat used by juvenile fish for cover from predators, ice scour, and high-velocity stream flows. The filling of pools with sediment further limits overwintering sites for juvenile and adult fish.

Beneficial effects to fish from proper management of soils, water, and vegetation resources would occur. Implementation of mitigation measures to protect soil, water, and vegetation on a project specific basis, particularly in riparian zones of watersheds, would reduce disturbance to fish habitats and would aid in the recovery of aquatic habitat from permitted uses. Improper management of soil, water, and vegetation resources can reduce the quality of the waters and the productive value of the soil. Climate change and the resultant melting permafrost along stream banks may increase localized input of sediments and decrease bank stability.

Riparian vegetation condition directly influences the condition, quality, and maintenance of aquatic habitat. Riparian plants filter sediments and nutrients, provide shade, stabilize streambanks, provide cover in the form of large and small woody debris, produce leaf litter energy inputs, and promote infiltration and recharge of the alluvial aquifer (Orth and White 1993; Wesche 1993). As a result of these functions, spawning beds for fish and microhabitats for macroinvertebrates remain relatively free of damaging fine sediment deposits. Riparian vegetation reduces sedimentation of pools, thereby maintaining water depths and structural diversity of the channel. Base flow levels are augmented throughout the year by the slow release of water stored in aquifers. Complex off-channel habitats, such as backwaters, eddies, and side channels, are often formed by the interaction of streamflow and riparian features such as living vegetation and large woody debris. These areas of slower water provide critical refuge during floods for a variety of aquatic species and serve as rearing areas for juvenile fish.

The bank stabilizing function of streamside vegetation not only helps reduce erosion and influence channel morphology but also acts to supplement in-stream cover by the developing of undercut streambanks and by providing overhanging vegetation. Well-vegetated stream channels and stable streambanks help reduce turbidity and channel scouring resulting from high runoff rates and, in turn, can enhance primary production. In cold regions well-vegetated stream channels help reduce the formation of aufeis (ice formed by the overflow of water onto existing ice). Aufeis can decrease primary productivity, delay riparian plant growth, increase erosion, tie up water in the form of ice during critical low-flow periods,

and cause the formation of new stream channels due to channel blockage (Churchill 1990; Michel 1971; Slaughter 1990).

(3) Effects to Fisheries and Aquatic Habitat from Fire and Fire Management (Common to All)

Fire effects which directly impact fish populations are increased siltation, altered water quality (dissolved oxygen, pH, suspended and dissolved solids, total hardness, turbidity), and water temperature changes. Indirectly, any alteration of the nutrient flow that adversely affects aquatic organisms or results in a reduction in emergent insect production would also affect fish populations, at least temporarily.

Fish species and aquatic fauna have been exposed to indirect effects of wildland fire for thousands of years. Fire can indirectly influence fish populations or their prey through the factors mentioned previously as well as changes in nutrient input to water system and changes in permafrost status that can lead to altered hydrology. The extent of surface erosion after a fire largely depends on the topography and soil types of the immediate area, and the amount of ice-rich frozen ground within the active layer. Stream siltation is usually negligible from surface erosion on burned sites in interior Alaska due to its gentle topographical features. Siltation may be a factor where severe burns occur on steep slopes or even shallow slopes with ice-rich active layers, where fire has severely damaged riparian protection of bank soils' integrity, or where heavy equipment is used in suppression activities. Lakes are also potentially vulnerable to fire effects of concentration of nutrients, sedimentation, and erosion of riparian protected shorelines from wave and wind action. Response of deciduous riparian foliage after a fire is related to already existing riparian vegetation; the impact of a fire is a change in age structure and short-term productivity.

Data on how fires affect stream temperatures and productivity are currently inadequate to accurately assess the effects of fire on anadromous or resident fish habitats. Much of the published work has focused on changes in lake systems (McEachern et al. 2000, St-Onge and Magnan 2000). Analyses of long-term fire effects on stream ecology are currently under way as part of Frostfire, a landscape-scale prescribed research burn in the boreal forest of Interior Alaska conducted in July 1999.

Fish populations have generally shown a positive response during the initial five-year period after wildland fire where populations exhibit good connectivity with key refugia throughout the watershed (Gresswell 1999; Minshall et al. 1989). Fish will generally reinvade fire-affected areas rapidly where movement is not limited by barriers. These new colonists generally come from areas upstream of the affected area, from surrounding watersheds and from mainstem rivers where migration is not limited. Fish population recovery generally tracks the increase in primary and secondary production that occurs in the early post-fire period. Where sediment is continually delivered into the stream, there could be short-term negative effects on fish and macro-invertebrate communities.

Fuels projects are designed and implemented in a "non-emergency" manner that minimizes impacts to aquatic resources. Although wildland fires may still occur in areas where hazardous fuel loads have been reduced, fires which may occur are expected to be predominately ground fires rather than crown fires. Ground fires are easier to control with lower-impact suppression methods (such as hand-built fire line) that are less likely to adversely affect aquatic resources. In contrast, the crown fires associated with heavier fuel loads often require suppression techniques likely to have greater adverse impacts to aquatic habitats and species.

Competent planning and implementation will minimize the effects of fuels treatments. Some projects involve multiple treatments of the same area. Prescribed fires conducted in the spring (when drainage-bottoms are still snow covered) help to protect riparian vegetation and soils. The primary goal of these projects is to reduce the occurrence, risk, and impacts of wildland fires, not restore the natural capacity of aquatic species to withstand the effects of natural fires.

Removal of vegetation to reduce future fuel loading may be accomplished with minimal impacts in some areas, but in others, sensitivity to ground disturbance from loss of vegetation can cause increased erosion, compacted soils, and a loss of nutrients (FS 2000, Beschta et al. 1995). To protect water quality and the diversity of habitats for fish, amphibians and other aquatic organisms, standard operating

procedures are in place to protect the proper functioning condition of riparian area and stream characteristics.

Impacts to fisheries from fire and fuels management would be the same under all Alternatives. Most of the area within the planning region is in a Limited fire management option designation, which means that the standard response is to monitor fires and only to initiate suppression actions if necessary to protect identified values. In a worst case scenario, there may be some episodic events related to fire suppression that may affect fish and fish habitat. These effects would be from increased erosion and ground-based control, and alterations of water chemistry from aerial applications of fire retardant. Erosion impacts would likely be small in scale and localized, and could be minimized by rapid rehabilitation after the fire is under control, although improperly located bulldozer line firebreaks could greatly increase local stream sediment loads. The use of fire retardant in/near fish bearing streams is a serious threat to these aquatic ecosystems. The by-products of certain retardants are toxic to fish and will result in fish kills. To decrease the potential of affecting fish habitats and stream conditions, it is a standard operating procedure of the suppression agencies to avoid dropping retardant near or in water bodies.

(4) Effects to Fisheries and Aquatic Habitat from Minerals (Common to All)

While the Salmon River mine is operating, currently there are no new proposed projects for mining on BLM lands in the Bay planning area. However, under all Alternatives, some BLM unencumbered lands are available for metalliferous metals exploration and mining. In general, surface mining activities increase erosion and accelerated sediment production and input into nearby streams and lakes. Mine development may also alter the natural input rate of organic matter and nutrients to aquatic systems. Mine sites can include open pits, heap and dump leaches, waste rock and overburden piles, tailings piles and dams, haul roads and access roads, ore stockpiles, vehicle and equipment maintenance areas, and exploration and reclamation areas. These areas are all major sources of erosion and sediment.

Surface mining operations may also disrupt surface and ground water flow patterns. Mining operations also have the potential to release pollutants to surface waters and ground water, the deposition of contaminants into soils, and the eventual incorporation of pollutants into plant tissue. Both water and soil contamination may be harmful to riparian-wetland vegetation.

Naturally occurring substances in the ore may create a major source of pollutants. Mined ore not only contains the mineral being extracted but varying concentrations of a wide range of other minerals. Frequently other minerals may be present at much higher concentrations and can be much more mobile than the target mineral. Depending on the local geology, the ore (and the surrounding waste rock and overburden) can include trace levels of aluminum, arsenic, asbestos, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, selenium, and zinc, as well as naturally occurring radioactive materials.

As with many surface disturbing activities, one of the most detrimental impacts associated with mining is increased sediment yield. Because of the large area of land disturbed by mining operations and the large quantities of earthen materials exposed at sites, erosion can be a major concern at hardrock mining sites. Erosion may cause significant loadings of sediments to nearby waterbodies and associated riparian-wetland areas, especially during severe storm events and high snow melt periods. Placer mining inherently degrades or completely destroys channel features and riparian habitat, resulting in increased erosion and sedimentation.

During placer mining, streams are often diverted into bypass channels while the original channel is mined and then returned to a newly built channel once mining is complete. It has been common practice to construct stream bypasses and new channels with different geometry and physical characteristics (e.g. flood prone and bankfull widths, bankfull depth, sinuosity, slope, entrenchment, and substrate size) than that of the natural channel. This difference is often necessary because of the removal of streamside vegetation and other hard structural elements that help define the natural channel morphology. As a result, new channels are often straighter, have a higher gradient, and consequently have more energy than the natural channel. In addition, new channels often lack the diversity of habitats (pools, glides,

riffles) and cover components (undercut bank, overhanging vegetation, and large woody debris) that enhance the quality of habitat in natural channels.

Mining activities, placer operations in particular, may lead to a loss of riparian-wetland vegetation. All vegetation within the active mining area is removed before and during mine development and operation. Vegetation immediately adjacent may be affected by the roads, water diversions or other development. Riparian-wetland vegetation has a significant influence on the stability of uplands and certain stream types. Changes in the composition, vigor, and density of riparian vegetation can result in changes in sediment input from uplands, stream shade, and protection from instream erosional processes, terrestrial insect habitat, and the contribution of detritus and structural components to the stream channel. Water quality and esthetic values are also affected by disturbance to riparian-wetlands (Rosgen 1996).

The altering of surface hydrology often results in stream conditions that are no longer suitable to species or life stages of fish and other aquatic organisms that occurred before disturbance. For example, increased stream flow may result in water velocities that (1) cause involuntary downstream displacement and mortality of juveniles, (2) result in scour-related mortality of eggs and alevins, (3) accelerate streambank erosion, and (4) over the long term, deplete large woody debris and organic material. The enlargement of stream channels may result in a shallow, slow water environment during periods of low flow. This new environment could result in crowding, loss of spawning habitat, reduced primary and secondary productivity, increased vulnerability to predation, and increased sedimentation (Swanston 1991; Hicks and others 1991; National Research Council 1992; Strouder and others 1997).

The removal of streamside riparian-wetland vegetation during mining would result in loss or degradation of aquatic habitat until proper functioning condition could be reestablished. In general, the time required for riparian-wetland areas to attain proper functioning condition would be dictated by natural processes and may require decades to centuries before it approximates the structure and function of the original aquatic habitat (NCSU 1998; BLM and Montana Dept. of Environ. Quality 1996; BLM 1988).

The current state of knowledge of suction dredging and its impacts on aquatic resources suggests that the practice could be either detrimental or beneficial, depending on site-specific use by aquatic organisms and physical habitat limitations. In either case, evaluation of the location and timing of suction dredging activities would benefit aquatic resources.

Suction dredging has been shown to locally reduce benthic (bottom dwelling) invertebrates (Thomas 1985; Harvey 1986) and cause mortality to early life stages of fish due to entrainment by the dredging equipment (Griffith and Andrews 1981). Suction dredging may also destabilize spawning and incubation habitat, remove large roughness elements such as boulders and woody debris that are important for forming pool habitat and that can govern the location and deposition of spawning gravels (Harvey and Lisle 1998). Suction dredging may also increase suspended sediment, decreasing the feeding efficiency of sight-feeding fish (Barrett and others 1992); reducing living space by depositing fine sediment (Harvey 1986); and cause fish to avoid certain habitats because of their response to divers (Roelofs 1983).

On the other hand, suction dredging may temporarily improve fish habitat by creating deep pools or by creating more living space by stacking large unembedded substrate (Harvey and Lisle 1998). In general, invertebrates and periphyton all rapidly recolonize small patches of new or disturbed substrate in streams as long as the area of disturbance is not so widespread as to limit the number of organisms to recolonize (Griffith and Andrews 1981; Thomas 1985; Harvey 1986). In addition, dredge tailings may increase spawning sites in streams lacking spawning gravel or streams that are armored by substrate too large to be moved by fish (Kondolf and others 1991). In some cases the reduction in the feeding efficiency of fish may be offset by reduced visibility and the corresponding reduced risk of predation at moderate levels of suspended sediment (Gregory 1993).

Bridges, culverts, and low-flow crossings are integral features to road development associated with surface mining. These features can also interfere with stream bedload (substrate) movement, migrations to spawning, feeding, rearing, and overwintering sites if improperly designed. Current concerns related to surface mining and road placement include diverting or eliminating flow from small tributaries that connect lakes or connect lakes and rivers. Fish species found in the planning area that move between these

habitat types are vulnerable to impact. Potential loss of migratory capacity could stress or kill these fish if they are unable to migrate to food-rich habitat in the summer, reach spawning areas, or move into overwintering habitat. Proper placement of these structures is critical in minimizing impacts to fish.

(5) Effects to Fisheries and Aquatic Habitats from Forestry (Common to All)

Some minimal forestry activity generally occurs within the Bay planning area each year, consisting of small-scale localized timber removal for personal use, including gathering firewood and house logs. While it is unlikely that any type of road construction will occur in conjunction with this activity, it is conceivable that short spur or temporary roads may be constructed to access parcels of timber in the future, which could affect fisheries riparian habitat and water quality.

(6) Effects to Fisheries and Aquatic Habitats from Renewable Energy (Common to All)

Proposed renewable energy program sites would be evaluated on a case-by-case basis. Renewable energy programs (i.e., hydroelectric, solar, and wind power generation) in the Bay planning area would generally be expected to be small. Effects from renewable energy programs on fish habitat may include runoff due to the presence of access roads and other structures, which may carry sediment and petroleum hydrocarbons. These programs would not likely affect the mortality of fish to the same degree as mineral resource development.

b) Effects to Fisheries and Aquatic Habitat for Alternative A

(1) Effects to Fisheries and Aquatic Habitat from Recreation Management (Alternative A)

The main impacts on fish would come from a potential for an increased number of OHV trails or roads under this Alternative, which may gather runoff and begin to rut, thereby leading to increased erosion and subsequent sedimentation of fish-bearing streams. It has been documented in Alaska that multiple stream crossings by OHVs can cause alterations of the stream bank's structure and function and may cause the introduction of sediment into the waterway (Weidmer 2002). Extensive adverse effects may occur to fish habitat located in areas of high OHV use.

(2) Effects to Fisheries and Aquatic Habitat from Minerals (Alternative A)

Leasable Minerals. Under Alternative A no lands would be identified as open for fluid mineral leasing. Impacts to fisheries and aquatic habitat would be minimal (where leasing is required to protect hydrocarbon resources from drainage) to non-existent from this activity under this Alternative.

Locatable Minerals. Impacts to fish would be similar in type to those discussed under Impacts Common to All Alternatives. Under Alternative A, few BLM lands not withdrawn under ANCSA 17(d)(1) withdrawals would be available for locatable mineral exploration and development in the planning area.

Salable Materials. There are approximately 1,176,269 acres available for the sale of mineral materials (i.e. sand and gravel). Measures to minimize impacts to fish habitat are considered on a case-by-case basis. Alternative A would have the greatest potential of all the Alternatives for impacts to fisheries habitat from salable minerals. Gravel mining activities conducted in fish-bearing streams or in tributaries to fish-bearing streams can block and reroute stream channels and increase silt concentrations resulting in reduced primary production, loss of invertebrate prey species, and disruption of feeding patterns for sight dependent feeders (Branson and Batch 1971, Cooper 1965). For general mining impacts to fisheries, see *Impacts Common to All Alternatives.*

(3) Effects to Fisheries and Aquatic Habitat from Lands and Realty (Alternative A)

ANCSA 17(d)(1) Withdrawals - Under Alternative A, no withdrawal review would take place and all ANCSA 17 (d)(1) withdrawals would remain in place. These withdrawals would protect fish habitat by excluding mineral leasing and, in some cases, locatable mineral entry.

Rights-of-Way - Rights-of-Way grants and easements may promote the construction of paved or unpaved access roads, gravel pads, railways, all of which may adversely affect fish habitat through runoff that may introduce sediment and contaminants into the water. Under Alternative A, avoidance or exclusion areas would be identified on a case-by-case basis for potential impacts.

(4) Effects to Fisheries and Aquatic Habitat from Recreation (Alternative A)

Under Alternative A, recreation management is custodial and impacts would be similar to those discussed under Impacts Common to All Alternatives. There are no SRMAs that would set recreation objectives or develop visitor use limits. Unmanaged trail proliferation would continue, with no guidance for proper construction and placement of new trails. Of all the Alternatives, Alternative A would have the most negative impacts to fish and fish habitat from recreation activities.

Recreation - Under Alternative A, recreation management is custodial and impacts would be similar to those discussed under Impacts Common to All Alternatives. There are no SRMAs that would set recreation objectives or develop visitor use limits. Unmanaged trail proliferation would continue, with no guidance for proper construction and placement of new trails.

Off-Highway Vehicles (OHV) - Under Alternative A, BLM-managed lands would remain undesignated and impacts would be similar to those discussed under Impacts Common to All Alternatives. There would be no SRMAs that would set recreation objectives or develop visitor use limits. Areas of high OHV use, and any correlations to areas that may include important fish habitat have not been identified. The unauthorized and unmanaged proliferation of trails would potentially increase under this Alternative, with a resulting potential for increase in erosion and sediment impacts.

(5) Effects to Fisheries and Aquatic Habitats from Wild and Scenic River Nominations (Alternative A)

Under Alternative A, there would be no Wild and Scenic Rivers recommended for designation under the National System. Additional protections and regulations to fish habitat would be outlined in the Stipulations, Required Operating Procedures, and project-specific approved Plans of Operations.

c) Effects to Fisheries and Aquatic Habitat for Alternative B

(1) Effects to Fisheries and Aquatic Habitat from Lands and Realty Actions (Alternative B)

Revoking existing ANCSA 17(d)(1) withdrawals that currently withdraw BLM lands from mineral entry could have a negative impact on fisheries and fish habitat with the potential for upcoming land-use development activities. Alternative B would revoke all ANCSA 17(d)(1) withdrawals to allow for increased mineral exploration and development. Potential effects of mineral development on fish habitat under this Alternative are described under Impacts Common to All Alternatives.

Disposal or exchange of BLM lands results in transfer of the land to the State of Alaska, Native corporations, individuals, and local governments. Alternative B identifies two parcels in the Iliamna East planning block and one parcel in on the Iliamna West planning block for disposal or land exchange. Under Alternative B, the lands that are considered for disposal do not provide key fisheries habitat, and have small influence on the fisheries resources. Should other BLM-administered lands currently selected by the State or Native corporations be rejected or revert back to BLM, those lands might also be considered for future exchange. Land disposal could result in loss of valuable fisheries habitat. Should BLM-managed lands be transferred to or exchanged with other Federal agencies (e.g., NPS or USFWS), fish resources would be managed under existing conservation and protective guidelines.

Rights-of-Way grants and easements may promote the construction of paved or unpaved access roads, gravel pads, railways, all of which may adversely affect fish habitat through runoff that may introduce sediment and contaminants into the water. Under Alternative B, avoidance or exclusion areas would be identified on a case-by-case basis for potential impacts.

(2) Effects to Fisheries and Aquatic Habitat from Minerals (Alternative B)

Fluid Leasable Minerals

Alternative B would revoke all ANCSA 17(d)(1) withdrawals to allow for increased fluid mineral leasing. Alternative B anticipates a baseline exploration and development scenario, at least approximately 1,142,775 acres of BLM-administered lands would be available for mineral leasing in the Bay planning area during the life of the plan. These lands in the Bay planning area are currently designated as having low development potential. Oil and gas operations could affect fisheries resources in several ways, as described below.

Effects from Seismic Surveys - Potential threats to overwintering fish from seismic surveys in the planning area would primarily stem from 1) stress associated with acoustic energy pulses transmitted into the ground directly over overwintering pools, and 2) physical damage to overwintering habitat caused by seismic vehicles. Large overwintering pools might allow fish to flee immediate areas of intense stress, whereas fish occupying small pools might not have that option. Depending on proximity, adult fish could suffer no more than temporary discomfort, whereas intense acoustical pulses could be lethal to juveniles. Given that overwintering habitat represents only a small percent of the planning area, it is unlikely that seismic transmissions would occur directly over overwintering sites with any degree of regularity. Furthermore, seismic crews could avoid known overwintering areas. Overall, any affects to overwintering fish caused by winter seismic surveys would be localized and would not be likely to have any effect on fish populations within the planning area.

Effects from Water Demand - Overwintering areas are limited to deep-water pools and channels in rivers and streams and to lakes deep enough to provide sufficient under-ice free water during winter. In standing waters, 7 feet is considered the minimum depth for supporting overwintering fish (Phillips Alaska, Inc. 2002). Moving waters may deter the thickening of ice, thereby providing overwintering habitat at shallower depths.

Under Alternatives B, C, and D, greater levels of water withdrawal would be expected in conjunction with the increased land available for exploration and development activities as compared to Alternative A.

Effects from Exploratory Drilling - Drilling operations require large amounts of water for blending into drilling muds. Operations also produce large amounts of rock cuttings. If an exploratory well were to be plugged and abandoned, drilling muds and cuttings would be re-injected into the bore hole. If the well were to go into production, muds and cuttings would be removed to an approved disposal site. Any chemical leaching into surrounding waters by cuttings temporarily being stored at the drill site could affect nearby fish habitat. Even though the disturbance under Alternatives B , C and D would be greater than the amount of disturbance under Alternative A, the prevention of drilling in rivers and streams would provide fish with adequate protection. In general, it is not expected that exploratory drilling would have a measurable effect on fish populations in and adjacent to the planning area under this Alternative.

Effects from Pad, Road, and Pipeline Construction - Impacts from pad, road, and pipeline constructions are mainly increased erosion and sedimentation, subsurface and surface flow disruption, and increased pollution in runoff.

Effects of Spills - Oil spills can have a range of effects on fish (Malins 1977; Hamilton et al. 1979; Starr et al. 1981). The specific effects depend on the concentration of petroleum present, the length of exposure, and the stage of fish development involved (eggs, larva, and juveniles are most sensitive). If lethal concentrations are encountered (or sub-lethal concentrations over a long enough period), fish mortality is likely to occur. Most acute-toxicity values (96-hour lethal concentration for 50 percent of test organisms)

for fish generally are on the order of 1 to 10 parts per million (ppm). Concentrations measured under the slicks of former oil spills at sea have been less than the acute values for fish and plankton. For example, concentrations of oil 1.6 to 3.3 feet beneath a slick from the Tsesis spill ranged from 50 to 60 parts per billion (Kineman et al. 1980). Extensive sampling following the Exxon Valdez oil spill also found hydrocarbon levels in the water column well below those known to be toxic or to cause sub-lethal effects in plankton (Neff 1991). The low concentration of hydrocarbons in the water column following even a large oil spill at sea appears to be the primary reason for the lack of lethal effects on fish and plankton.

Locatable Minerals. This Alternative would anticipate the greatest exploration and development for locatable minerals given the revocation of all ANCSA 17(d)(1) withdrawals. Dependent on gold prices, a moderate increase in small placer operations on BLM-managed lands could occur during the life of this plan. Large operations could be possible, but would most likely occur on State lands. Roads or infrastructure necessary for those operations, however, could cross BLM-managed lands. For general mining impacts to fisheries, see *Impacts Common to All Alternatives*.

The Required Operating Procedures (ROPs) common to Alternatives B, C, and D are designed to minimize or prevent impacts from erosion, altered stream flow, stream crossings, and riparian impacts. Strict adherence to the ROPs would minimize effects to fish and fish habitat within the planning area. The protection provided to fish and fish habitat under Alternatives B, C, and D would be superior to that provided under Alternative A.

Salable Minerals. There would be approximately 1,142,775 acres available for the sale of mineral materials under Alternative B. Under this Alternative and Alternatives C and D, Required Operating Procedures would minimize the effects of gravel extraction on fish by avoiding gravel mine sites within active channels. The protection provided to fish and fish habitat under Alternatives B, C, and D would be superior to that provided under Alternative A.

Gravel mining activities conducted in fish-bearing streams or in tributaries to fish-bearing streams can block and reroute stream channels and increase silt concentrations resulting in reduced primary production, loss of invertebrate prey species, and disruption of feeding patterns for sight dependent feeders (Branson and Batch 1971, Cooper 1965). For general mining impacts to fisheries, see *Impacts Common to All Alternatives.*

(3) Effects to Fisheries and Aquatic Habitat from Recreation (Alternative B)

Recreation management under Alternative B would be expected to be the same as that for Alternative A. Impacts to fish from recreational use would be the same as discussed under impacts for Alternative A.

(4) Effects to Fisheries and Aquatic Habitat from Off-Highway Vehicles (Alternative B)

Under Alternative B, BLM-managed lands would be designated as "open" to OHV use and, resulting in some continued localized impacts from erosion due mainly to unauthorized stream crossings. Locations that may include important fish habitat have not been identified. Inventoried OHV trails have authorized anadromous stream crossings with a permit from the State Department of Natural Resources. The unauthorized and unmanaged proliferation of trails could increase under this Alternative, with a resulting increase in erosion and sediment impacts. Potential adverse effects to fish habitat from OHV use are discussed under Impacts Common to All Alternatives. There are no SRMAs that would set recreation objectives or develop visitor use limits. Alternative B includes vehicle weight limits for limited areas to 2,000 pounds gross vehicle weight rating (GVWR includes load capacity), which would positively influence environmental conditions.