Chapter IV: Environmental Consequences

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A. Introduction

This chapter describes the anticipated consequences or potential effects on the physical, biological, and human environment from implementation of the Alternatives described in Chapter II. An analysis of the environmental impacts associated with each of the Alternatives is required by BLM planning regulations and by the National Environmental Policy Act (NEPA). The analyses presented in this chapter provide an estimate of the environmental impacts associated with each plan alternative. As required by NEPA, direct, indirect, and cumulative effects are examined. The chapter first provides a summary of the methods and the 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 that are brought about by external actions or events. Effects may be beneficial or adverse, and may be a direct, indirect or cumulative causal effect of a Federal action. Effects are categorized by magnitude (measure of change), extent (size of change), and duration (length of time; e.g. temporary, short-tem or long-term) to ascertain their affect on the environment. Generally, an effect that persists more than a few years is considered long-term. Effects that allow a resource to revert back to a pre-disturbance condition within a few years of the end of disturbance are considered short-term. The magnitude or extent of an effect depends on 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

The Resources, Resource Uses, Special Designations, and Social and Economic sections of this chapter contain analyses of impacts by plan alternative. The order of these sections does not reflect their level of importance.

The sub-section under each heading entitled "Effects Common to All Alternatives" describes impacts that do not vary by alternative. This information is presented to avoid repetition in the Impacts by Alternative sections. Some sections may also include a sub-section entitled "Effects Common to All Action Alternatives (Alternatives B, C, and D);" this section is also intended to avoid repetition. Impacts discussed in either of these two sections will not be repeated. In some instances, the environmental consequences associated with a particular subject may be completely addressed in a discussion under "Effects Common to All Alternatives" – in this case the discussion will not be repeated and the subject may not be addressed again. Impacts that vary between alternatives are addressed under each alternative. Only impacts that arise under an alternative are discussed; conversely, if there are no impacts to a given resource under an alternative, there is no heading or discussion of the resource. Where the resulting impacts from several programs are very similar, they may be grouped under a single subheading (e.g., the Air Quality and Soil and Water Resources section).

Each resource specialist considered the following in their impact analyses: Air, Soil, Water, Vegetation, Fish and Wildlife, Special Status Species, Fire Management and Ecology, Cultural Resources, Paleontological Resources, Visual Resources, Wilderness Characteristics, Forest Products, Livestock Grazing, Minerals, Recreation, Travel Management, Renewable Energy, Lands and Realty Actions, Special Designations (including Areas of Critical Environmental Concern and Wild and Scenic Rivers), Public Safety, Social and Economic Conditions, and Subsistence. If no impacts were identified either by a resource specialist or by the public during scoping, the programs or topics are not discussed further. In cases where impacts may potentially occur, the impacted resource or impacting resource use is discussed in more detail.

Standard operating procedures developed from Federal laws, regulations, and policies are applicable under all alternatives. Standard operating procedures implement policy or management directives, and may result in projects being redesigned or dropped from consideration. Program limitations (e.g., staffing, increased processing times or costs) are not considered impacts and are not discussed in this document. ROPs and Oil and Gas Leasing Stips have been included in Alternatives B, C, and D as plan features in an attempt to eliminate or reduce anticipated impacts.

B. Assumptions and Methods

Information from Chapter III, Affected Environment, was used to identify the effects under each plan alternative. The direct, indirect, and cumulative effects of each and the interplay of those effects with the effects of reasonably foreseeable use and development are analyzed and evaluated in this chapter. The analyses presented are influenced by institutional knowledge of the planning area's resources, information provided by staff and other agency experts, and relevant literature. There are no proposed project developments at the time of this writing.

1. Analytical Assumptions

Assumptions and estimates were made to facilitate analysis. These assumptions establish analytical guidelines and include a reasonably foreseeable (20-year) development model. Assumptions should not be interpreted as constraining or redefining management objectives and actions under the plan alternatives. If no assumptions were made regarding a resource, it is not discussed in the following sections.

- Sufficient funding and personnel would be available for implementation of the final decision.
- Implementation of actions under each plan alternative would be in compliance with State and Federal statutes and regulations, bureau policy, and other guidance and directives.
- The discussion of effects is based on the best available data. Knowledge of the planning area and institutional experience gained from observation and analysis of conditions and environmental responses in similar areas are used to infer environmental effects where data is limited.
- Changing climatic conditions may affect resources in the planning area. Appreciation of climate change may affect future resource management.
- Acreage figures and other numbers used in the analysis are estimates made for comparison and analytic purposes only.
- State and Native entitlements will be met within the next five to ten years. Satisfaction of entitlements will allow for identification of the remaining Federal estate. Resource management of the remaining Federal estate is the focus of this plan.
- State- and Native-selected lands are segregated from mineral entry, 43 *Code of Federal Regulations* (CFR) § 2627.4 (b) and 43 U.S.C. § 1610(a)(1).

- Once land is conveyed out of Federal ownership, resource management on the conveyed land is a prerogative of the new landowner, except fish and wildlife resources management. Per the Alaska Constitution, fish and wildlife management is retained by the State for the common good of all residents.
- Selected but unconveyed land will be managed under this plan, provided the selection is terminated and the land remains in Federal ownership.
- It is currently impossible to identify the location of selected lands that will remain in Federal ownership.
- Interim management (management between selection and conveyance or selection and termination of a selection) is custodial, 43 U.S.C. 1635 (k)(1) and 43 CFR § 2650.1.
- Discontiguous blocks of land present land and resource management challenges. Isolated parcels and parcels identified under the plan alternatives may be considered for exchange or disposal in an effort to consolidate the Federal estate into contiguous blocks of land.

2. Resource Assumptions

a) Air Quality, Soil, and Water Resources

(1) Air Quality

- The air in the planning area is believed to be relatively pristine. Increases in human population, consumption, recreation, tourism and development may affect air quality.
- The most likely causes of deterioration in air quality in the Bay planning area will be smoke and gases from wildland fire, dust from travel on unpaved roads, and dust and exhaust from new construction and development.

(2) Soils

- The majority of the soils present in the planning area are inceptisol (a soil so young that horizons have just begun to form: especially prevalent in tundra areas). Histosol (a worldwide soil type rich in organic matter, as peat, especially prevalent in wet, poorly drained areas) makes up a small percentage of the soils in the planning area. There is very little soil formation with either type, which may present erosion and reclamation challenges.
- Permafrost is found intermittently throughout the planning area. The warming trend is fostering major changes in soil moisture, organic matter, vegetation patterns, and weathering patterns. Changes will affect carbon and nitrogen cycles and gaseous emissions.
- Frost heave and slumping may affect soils.

(3) Water Resources

- Demand for clean water will increase in proportion to increases in population, recreation, and development. Water quality will be managed through implementation of Required Operating Procedures and compliance with applicable Federal and State laws and regulations.

b) Vegetation

- Demand for healthy fish and wildlife habitat, particularly riparian; and wet and dry tundra habitats, will continue and may increase. Subsistence use of various vegetation types present in the planning area will also continue and may increase. Vegetation provides a rich habitat for fish and wildlife. Human use of vegetation includes the gathering of 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.

c) Wetland-Riparian

- It is preferred that wetlands and riparian zones be maintained in a proper functioning condition. Increases in human population, consumption, recreation, tourism and development may stress riparian zones and wetlands. Projects that pose a threat to the proper functioning condition of watersheds, riparian zones or wetlands will be subject to constraints developed through project-specific NEPA analysis. Placer mining will affect the proper functioning condition of watersheds, riparian zones and wetlands.

d) Invasive Plant Management

- Vegetation in the planning area is predominantly pristine and free of invasive non-native plants. Inventory efforts will continue to identify specific occurrences of invasive plant species. Invasive plant species reduce habitat quality and quantity.

e) Wildlife, Fisheries and Aquatic Habitats

(1) Wildlife

- BLM lands provide seasonal and year round habitats that help to sustain the diversity, abundance, productivity and distribution of wildlife populations in the planning area.
- Actions taken to benefit the habitat of a particular species of fish or wildlife may have beneficial or adverse affects on other species that are dependant on the same habitat.
- Demand for a sufficient amount of wildlife habitat, particularly game species habitat, may increase during the life of the plan.
- Wildlife populations will fluctuate in natural cycles during the life of the plan.
- Since wildlife moves freely, it is susceptible to impacts from actions taken by other landowners.
- Habitat disturbance may result in wildlife displacement.
- Climate change may stress some wildlife species. Changes in vegetative regimes will likely result in the displacement of some species while allowing for the immigration of others.

(2) Fisheries and Aquatic Habitats

- Increases in human population and consumption will result in increased pressure on fisheries.
- International and national trends to protect and manage wild fish stocks will continue.
- Increases in human population, consumption and development raise the potential of adverse impacts to aquatic habitat.
- BLM will continue to manage and protect important spawning, rearing, over wintering, and migratory fish habitat.
- BLM will cooperate with the Alaska Department of Fish and Game to preserve the genetic integrity of Alaska's wildstock of resident and anadromous fish populations.

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 BLM lands, or may document the expansion of known ranges of species currently on the BLM Alaska's Special Status Species list.
- Nationally, there will be a continuing need to afford wildlife protection under the Endangered Species Act.

- There are two endangered species, one threatened species, one candidate species, and numerous sensitive species present in the planning area. One plant on BLM-Alaska's Special Status Species list has been documented on BLM lands in the planning area. The need to protect these species will increase as land use and resource development increases.

g) Wildland Fires and Fuels Management

- Fire is an essential renewing force in interior forest (taiga) ecosystems. 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 interior forests (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 planning area may change. Wildland fire frequency may increase as a result of climate change, human population growth and development.

h) Cultural Resources

- Undertakings on BLM lands have the potential to damage cultural resources. Cultural resources are considered before any undertakings are authorized (Section 106 of the National Historic Preservation Act) and damage is avoided or mitigated before an undertaking is begun.
- All cultural resources are treated as potentially eligible to the National Register of Historic Places.
- Inventory efforts to identify cultural resources on BLM lands will continue, and cultural resources are evaluated for eligibility to the National Register of Historic Places.
- Uses of cultural resources include scientific research, interpretation, preservation for future research, and traditional cultural uses. These uses will continue into the future.

i) Paleontological Resources

- Undertakings on BLM lands have the potential to damage paleontological resources (fossils). Significant paleontological resources will be avoided or otherwise mitigated whenever possible.
- Authorized 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 over the life of the plan. Increasing tourism will increase the value of scenic views, undeveloped landscapes and open spaces.

3. Resource Use Assumptions

a) Forest Products

There are few opportunities to utilize forest products for anything other than personal use, as there are few forests on BLM lands in the planning area, and the trees are not considered to be of commercial value. While forests are reportedly expanding due to the warming and 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 livestock grazing. 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 planning area.

c) Minerals

(1) Leasable Minerals

- No leasable mineral development on BLM lands, with the exception of natural gas development, is anticipated to occur within the life of the plan.
- 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-economical.

- Given a 20-year plan life, it is assumed that a total of six 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 (six 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 planning block (this planning block was picked due to its proximity to the Dillingham market). It is assumed that 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 six acres. There would be up to six 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 only link the drilling pads 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 from 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 lands. BLM lands in the planning area are not in proximity to the three largest communities – Dillingham, Naknek and King Salmon. Transportation costs associated with building a gas pipeline would render CBNG development uneconomical.

(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 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 their respective entitlement statutes.

- 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 within the planning area are feasible. These deposits would probably be developed either as a small surface open-cut sluice box operation or as a bucket-line dredge operation (Goodnews Bay Platinum Mine).

- Placer mining activity in the planning area is expected to occur in the Snow Gulch part of the Goodnews Bay/Snow Gulch area on BLM lands. There are expected to be 1 to 3 small scale placer operations employing 3 to 5 people at each location. Activity would most likely 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 new placer mines on BLM 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]) that have occurred in the Broxson Gulch area north of the Denali Highway, East Central Alaska Range. Exploration results in this area indicate that there is potential for a significant discovery of these metals. This interest, coupled with the rising price of platinum, has sparked recent exploration efforts in 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 are 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 land.

- The Pebble property, on State lands near Lake Iliamna, is currently in the pre-production phase of exploration and development. 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, such as the Pebble South and the Big Chunk (BC) properties. More than 100 employees would contribute to the Iliamna area economy and the mine mill complex could draw power from the Homer utility grid.

- Table 4.2 provides information about anticipated new locatable lode exploration projects under each Alternative. Anticipated locatable lode exploration activity in the planning area is expected to occur in the Snow Gulch part of the Goodnews Bay/Snow Gulch and Iliamna/Kvichak areas on BLM lands. There is expected to be 1 to 2 small scale open pit operations employing up to 275 people at each location. Open pit operations would most likely 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. Underground operations would most likely 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 lands	1	2-4	0	2-4

(3) Salable Minerals (Mineral Materials)

- Salable and industrial minerals including sand and gravel, building stone, pumice, clay, and limestone are common throughout the 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 private land. 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 planning area. Most of the sites in the planning area are roadside material sites owned by villages, the State, or private individuals.

- 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 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 land within the planning area consists of isolated parcels that are not accessible by road, recreational activity increases, if any, will be focused on hunting and fishing, recreational OHV use (including snowmachines), hiking, canoeing, and rafting.

- Currently, BLM manages six 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 anticipated to be for large game guided hunting operations in the Iliamna Lake area in the eastern planning area region.

- Local communities and businesses appreciate an economic benefit from professional guide service activities.

- A comprehensive trails and travel management plan is proposed to further assess potential impacts, conflicts, and use levels for SRPs and air transporters, to be completed within five 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.

- Wilderness characteristics of naturalness, solitude, 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 favor a backcountry experience for their activities will also seek lands that have wilderness characteristics (BLM 2005b).

e) Travel Management

- The use of Off-Highway Vehicles (OHVs) for hunting and subsistence activities will remain stable or increase slightly. Recreational use of OHVs is expected to remain stable or increase slightly.

- Changes in OHV design and technology will continue, potentially contributing to reductions in resource impairment although enabling OHV users to range into areas that were once inaccessible.

- Future demand for roads to support mineral exploration and development or other resource developments on or across BLM 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 the planning area.

- It is generally accepted practice that OHV designation starts at the “limited” classification.

- No transportation or utility corridors have been identified in this plan. BLM will entertain transportation and utility corridor requests through project-specific NEPA analyses.

- From public scoping input, there is community support to manage off-highway vehicle use while providing access to public lands.

- The amount and patterns of OHV use in the planning area is unknown. A comprehensive trails and travel management plan is proposed for completion within five years of approval of the Bay plan.

- The use of OHVs within the 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 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 planning area may seek alternative sources of renewable energy. However, BLM lands are not located in proximity to villages, and the probability of receiving applications for use of BLM land for renewable energy development 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 may consider land exchanges to resolve split estate issues. Land exchanges will not be pursued until State and Native entitlements are resolved. Isolated parcels of land in the Iliamna East and Iliamna West Blocks and two sections east of Aleknagik are identified in this RMP/EIS for potential exchange. Isolated parcels that remain in Federal ownership after all land conveyance is completed may also be considered for future exchange. Land exchange identified under Section 206 of the Federal Land Policy and Management Act (FLPMA)(1976) is the preferred method of land ownership adjustment, and will be used to consolidate the larger, discontiguous tracts of BLM lands. Disposals of land through sales will 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 14% of lands currently selected by the State and Native corporations. Once land entitlements are resolved, there may be a need, both internally and externally, for land ownership adjustments to improve the manageability of Federal and non-Federal lands.

- ANCSA 17(d)(1) Withdrawals – Revocation of ANCSA 17(d)(1) withdrawals will open the affected lands to mineral entry. Recommendations for revocation of ANCSA 17(d)(1) withdrawals would be implemented as described in each Alternative. Should new withdrawals be proposed to take their place, existing withdrawals will be retained until new withdrawals are in place.

- Agency Withdrawals, (other than ANCSA 17(d)(1)(FLPMA Section 204)) – Other withdrawals identified in the 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 an ongoing function of 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. Demands for

withdrawal review may increase from the state and local governments. As part of the land planning process, BLM will review existing withdrawals.

- ANILCA 906(e) "TOP FILINGS" by the State of Alaska would fall into place. Presently, State of Alaska "Top Filings" are BLM lands since the State selection is a future interest that has yet to attach. Upon revocation of ANSCA 17(d)(1) withdrawals, a State "Top Filing" will attach, the lands will become State-selected and subject to conveyance out of Federal ownership.

- Land Use Authorizations and Rights-of-Way. As the State and Native land entitlements are met, there will be a decreasing demand for land use authorizations under 43 CFR §2920 and 43 CFR §2800. The remaining Federal estate will require land use authorizations for permitted activities, rights-of-way, R&PP leases, and other realty actions. Demand will fluctuate with the degree of economic growth and infrastructure development occurring within and adjacent to the planning area.

- Energy Development – There may be a future demand for energy related rights-of way such as pipelines, electric power lines, energy development and distribution facilities, roads, and water facilities.

- ANCSA 17(b) Easements - BLM would continue to manage ANCSA Section 17(b) easements.

- ANCSA 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 those agencies or those easements that are wholly within the boundaries of a park, preserve, Wild and Scenic River corridor, or refuge.

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

- BLM reserves easements 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 in implementing an activity or implementation plan.
    - Easements where landowners have made a request to work cooperatively (Often support of the landowner is essential to resolving signing issues, realignment, mitigating damage, and addressing other issues).
    - Easements where signing or education would mitigate environmental degradation.

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

- ANCSA 17(b) access needs are not expected to diminish. BLM is able to transfer jurisdiction of a 17(b) easement to the State of Alaska or to a political subdivision if the State agrees 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.

Rivers found to be suitable for addition to the National Wild and Scenic Rivers System with the publication of the Record of Decision will be managed to protect water quality, free-flowing nature, and Outstandingly Remarkable Values until such time as Congress acts on proposed designation legislation.

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

6. 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 analyses, 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 CFR 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 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.
- 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 corporate lands in support of local communities, and mineral exploration and development.
- Communication site development will increase.

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

- *Irreversible commitment of resources* results from actions in which resources are considered permanently changed.
- *Irretrievable commitment of resources* results 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 1988b; BLM 1999):

1. Air Quality (The Clean Air Act of 1955, as amended)
2. Areas of Critical Environmental Concern (ACECs) [Federal Land Policy and Management Act (FLPMA) of 1976]
3. Cultural Resources (National Historic Preservation Act of 1966, as amended)
4. Environmental Justice [Executive Order (E.O.) 12898]
5. Farm Lands, Prime or Unique (Surface Mining Control and Reclamation Act of 1977)
6. Floodplains (E.O. 11988, as amended)
7. Invasive, Non-native Species (Lacey Act, as amended, Federal Noxious Weed Act of 1974, as amended; Endangered Species Act of 1973, as amended; and E.O. 13112, Invasive Species, 02/03/99)
8. Native American Religious Concerns (American Indian Religious Freedom Act of 1978)
9. Subsistence [Alaska National Interest Lands Conservation Act (ANILCA) of 1980]
10. Threatened or Endangered Species (Endangered Species Act of 1973, as amended)
11. Wastes, Hazardous or Solid (Resource Conservation and Recovery Act of 1976, and Comprehensive Environmental Response, Compensation, and Liability Act of 1980)
12. Water Quality, Surface & Ground (Clean Water Act of 1987; Safe Drinking Water Act Amendments of 1996; E.O. 12088 amended by E.O. 12580, and E.O. 12372)
13. Wetlands/Riparian Zones (E.O. 11990)
14. Wild and Scenic Rivers (Wild and Scenic Rivers Act of 1968, as amended)
15. Wilderness (FLPMA of 1976 and Wilderness Act of 1964)

All of the above but one is addressed in this environmental impact statement. The missing element is Farm Lands. There are no Farm Lands, Prime or Unique, within the planning area.

No Prime or Unique Farmlands, designated Wild and Scenic Rivers, designated ACECs, or designated Wilderness currently exist on BLM lands in the 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 Chapters III and IV.

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 made to acquire and convert resource data into digital format for use in the plan. Data has 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 unavailable included:

- Inventory and assessment of trails
- Detailed soil 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 area identification and delineation
- Watershed assessments
- Cultural Resource inventories of uplands and smaller drainages

Because of these deficiencies, some impacts cannot be quantified. Impacts are projected in qualitative terms or in some cases are described as unknown. Subsequent project-level analysis will provide the opportunity to collect and examine site-specific inventory data necessary to determine the appropriate application of the RMP level guidance. In addition, inventory efforts identified in Chapter II 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 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 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 lands in the planning area. There is a small amount of OHV use on BLM lands in the eastern part of the 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 through project-specific NEPA analysis.

d) Wildlife and Special Status Species

Some sensitive migratory bird species are subject to subsistence hunting by Alaska Natives. 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 US Fish and Wildlife Service (USFWS). Spring and summer migratory bird harvests are managed under regulations implementing the Migratory Bird Treaty Act Amendments. BLM provides input as necessary to the USFWS regarding decisions on harvest regulations but has no direct role in managing the take of these species. BLM is involved indirectly in allowing access across its lands, but

these transportation routes and historic trails serve a multitude of purposes in addition to access for hunting. Activities on BLM lands that require permits are reviewed for consistency with applicable wildlife conservation laws such as the Bald Eagle Protection Act, Migratory Bird Treaty Act, and the Marine Mammal Protection Act.

Mitigation measures are developed through project-specific NEPA analysis to avoid listing BLM sensitive species 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 annual take is managed under provisions 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, any activities on BLM lands that have the potential for accidental release of oil or other harmful materials into the marine and coastal environments receive careful scrutiny for prevention and mitigation 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 activities such as mineral and road development.

BLM is required by law and by its own policies to cooperate and coordinate with the USFWS and National Marine Fisheries Service (NMF) 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 planning area. The policy common to all Alternatives is to be consistent with the ESA.

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 identified on BLM lands in the planning area). Recovery plans have been established for Steller sea lions by the NMF and for Steller's eiders by the USFWS. BLM has not undertaken any specific monitoring or surveys for Special Status Species on its lands.

e) Visual Resources

This analysis considers a range of alternatives for Visual Resource Management (VRM) Classification, as presented in Chapter II. All VRM class assignments are within classes III and IV. Assignment of these VRM classes does not preclude resource development, but assigns VRM objectives for protection of visual resources.

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

Air quality, soils, vegetation, and water resources have been grouped together within this analysis because impact to one resource is typically linked to impact to another resource. For example, vegetative removal results in the loss of protective cover for the soil, subsequently causing erosion by wind and water, resulting in impacts to air and water resources.

a) Effects Common to all Alternatives

Proposed management of the following resources/resource uses/programs would have no anticipated impacts to air quality, soils, vegetation, or water resources: Cultural Resources, Paleontological Resources, Visual Resources, Renewable Energy, Social and Economic Conditions, and Subsistence.

(1) Effects to Soils, Vegetation, and Air from Climate Change (Common to All Alternatives)

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 et al., 1995) and the increased uptake of carbon dioxide and the production of oxygen. Major changes include: (1) changes in soil moisture, with wetter soils experiencing greater leaching, and drier soils accumulating salts, (2) changes in organic matter, which will reach equilibrium at new levels as a function of changing climate-vegetation patterns, and (3) greater weathering will release more nutrients, which could influence biomass production, impacts which will vary from place to place.

Climate change has the potential to impact air quality as soils may become drier resulting in increased erosion potential by wind, thus increasing dust and particulates. The warmer, drier climate may cause increased tree mortality resulting in increased fire frequency (USDA 2004; Juday 1996; Fleming and Volney 1995) in areas that to date have seen few fires (USDA 2004; UAF 1999). Smoke impacts local air quality with potential to provide regional impacts. Fire degrades or eliminates vegetation resulting in increased erosion potential of soil by wind.

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

Effective vegetation management will limit disturbance and thermokarst subsidence to permafrost soils, blowing dust and airborne particulates, and control sediment runoff into waterbodies.

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

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 2004d). 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 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 re-growth 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 in the planning area due to the marine influence on the region's climate and the wet tundra environment. Should the current warming and drying trend continue, the fire regime may change.

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

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

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

There is no commercial use of timber and no associated road construction activity on BLM lands within the 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 current pattern of use continue.

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

Some mineral exploration and development could occur on BLM ands in the planning area, and on existing Federal claims under any Alternative. Where mining occurs, potential effects include disturbance and redistribution of gravel, overburden, and soils. Existing and future locatable mineral activities could unfavorably impact wetlands, stream, riparian and tundra vegetation by stripping away the vegetative mat as part of mining operations. This could increase the potential for the introduction and spread of invasive plant species. The structure of the soil profile and the stability of floodplains are 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 include separating organic overburden from mined gravels for future reclamation, backfilling all mining pits with tailings as mining progresses and spreading the remaining vegetation and overburden piles on the ground surface. Current soil storage handling stipulations do not prevent damage to soil health and viability and this reduces the soil's capability to support re-vegetation.

Impacts to water resources may be both short and long-term depending on the location of claims in relation to water resources and the activities performed. Short-term impacts to water resources may include drawdown of lakes and streams during active operations. Long-term impacts include alteration of instream flow regimes due to changes in stream channel geometry, compaction of soils, or removal of surrounding vegetation. Water quality may also be impacted by mining operations. The impact to water quality is highly dependant on several factors, including the type of operation, geology, soils, and use of chemicals on site. The duration of impacts may be short-term increases in turbidity during active mining operation or long-term impacts from persistent soil erosion or weathering of geologic materials (acid mine drainage).

The prevention of unnecessary or undue degradation of resources is addressed within 43 CFR 3809. In addition, ROPs have been developed to assist with the mitigation of impacts to resources that may result from locatable mineral activities.

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

Few mineral materials requests are anticipated due to the generally isolated and remote location of BLM lands and the activities that are anticipated during the life of the plan. Mineral materials would be needed to support oil and gas development. Oil and gas development on BLM lands may only be economically feasible in the Koggiling Creek planning block. Mineral material extraction can unfavorably impact vegetation by destroying vegetation growing on the site and by compacting and removing soils, hindering plant re-growth. Mineral materials extraction may degrade soil resources. Because soil development and vegetative growth is slow in this region, some sites may recover to the original vegetative cover very slowly or not at all. Soils removed of vegetation may be more easily eroded by wind resulting in minor localized degradation of air quality. Increased emissions from vehicle traffic and facilities may further result in localized impacts to air quality. Water quality may be impacted by increased siltation potential to local water bodies resulting from runoff or atmospheric deposition of soil particles. Increased vehicle traffic and facilities construction may also contribute to degradation of water quality. Impacts would be reduced under all action Alternatives with implementation of Required Operating Procedures. Additional mitigation measures, if necessary, could be developed during NEPA analysis of specific material site disposal actions.

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

Recreational use of the land occurs throughout the 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 as influenced by the movements and abundance of wildlife. Effects include impacts to vegetation and soils from temporary campsites, development of social trails, and aircraft landings. These may result in erosion should the vegetative cover be degraded, and/or through compaction of soils. Repeated scrambling up and down river and stream banks can degrade riparian vegetation, create bank erosion, and affect water quality.

Off-Highway Vehicles (OHVs) are used in 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 recreational 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 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 resulting in diminished water quality. Given the relatively low level of recreational use on the remote BLM lands, these impacts would be minimal overall and degradation of air quality, soil and water resources should not increase in the foreseeable future.

Off Highway Vehicle use in the planning area typically originates from population centers. Where invasive non-native plants occur, seeds can be carried in soil or mud in the tire tread. The potential exists for the spread of invasive non-native plant species from OHV travel across BLM lands.

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

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 impact soils through soil removal. Currently there are no development proposals. Should BLM receive proposals for road or gravel pad construction, impacts would be reduced under all action Alternatives by implementing Required Operating Procedures. Additional mitigation measures could be developed during project-specific NEPA analysis.

Disposals and Acquisitions. Disposal of BLM lands results in removal of the land from the public domain. Should lands be acquired by BLM, they would then be subject to BLM management directives.

Withdrawals. Impacts to soils due to Agency Withdrawals would be the same for all Alternatives. In the planning area these withdrawals include use by the Federal Energy Regulatory Commission or military. Impacts to soils may include localized compaction due to construction of facilities or minor erosion by wind or water due to localized removal of vegetation.

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

(1) Effects to Soils, Water, Vegetation 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. Consequently, mineral development would remain at current levels and there would be fewer impacts to soils, water, vegetation, and air than under Alternatives B, C, or D.

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

Leasable Minerals. Under Alternative A, BLM lands would be closed to fluid mineral leasing; however, BLM has the authority to lease lands where oil and gas are subject to drainage, this activity would have an impact to soils, water, vegetation or air on BLM lands.

Locatable Minerals. Under Alternative A, 138,627 acres of BLM lands within the planning area, acreage currently not withdrawn under ANCSA 17(d)(1), would be open to hard rock mineral exploration. Within the planning area, approximately 3,968 acres would remain withdrawn from mineral entry due to Federal Agency withdrawal. This alternative anticipates a total disturbance of 23 acres on State-selected and private (Federal claim) lands from mining activities at existing claims, mostly from placer mining (BLM 2006). Hard rock mineral exploration and development activities could adversely affect soils, water, vegetation, and air quality as described under Effects Common to All Alternatives. Effects of locatable mineral development could also include impacts to air quality from wind-blown particulates, smoke and exhaust. However, the impacts described are less likely to occur under Alternative A than under Alternatives B, C, or D because there would be less potential for mineral development.

Salable Mineral Materials. Due to the remote locations of most BLM lands, development of salable minerals is not expected to occur.

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

Under Alternative A, the planning area would remain undesignated and cross-country use of OHVs would be allowed throughout. This would result in impacts to soil, water, vegetation, and air as described under Effects Common to All Alternatives. These impacts would be greater than in Alternatives C and D. Sensitive habitat areas would not receive additional protection from OHV impacts.

(4) Effects to Soils, Water, Vegetation, and Air from Recreation (Alternative A)

Recreation management under Alternative A would result in localized impacts as described under Effects Common to All Alternatives. These impacts would be expected to be greater under Alternative A than under Alternatives C or D due to less restrictive OHV use in the planning area.

(5) Effects to Soils, Water, Vegetation, and Air from ACEC Designations (Alternative A)

Under Alternative A, there would be no ACEC designations. Because of the maintenance of ANCSA 17(d)(1) withdrawals in this alternative, there would be no effect to soils, water, vegetation, and air.

(6) Effects to Soils, Water, Vegetation, and Air from Wild and Scenic River Designations (Alternative A)

Under Alternative A, there would be no Wild and Scenic River designations recommended. Because of the maintenance of ANCSA 17(d)(1) withdrawals in this alternative, there would be no effect to soils, water, vegetation, and air.

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

(1) Effects to Soils, Water, Vegetation and Air Quality from Lands & Realty Actions, ANCSA 17(d)(1) withdrawals (Alternative B)

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

(2) Effects to Soils, Water, Air, and Vegetation from Leasable Minerals (Alternative B)

Under Alternative B, all unencumbered lands (1,103,138 acres) would be open for fluid mineral leasing. Based on the Reasonably Foreseeable Development scenario, there is a low leasable mineral development potential for most of the planning area. There is however a medium potential for oil and gas development on the Alaska Peninsula and in the Bristol Bay Nushagak Basin. The Reasonably Foreseeable Development Scenario assumes exploration for gas in the Koggiling Creek planning block on BLM lands in the planning area. There has been no oil or gas exploration in the Bristol Bay Nushagak Basin. The region is remote and lacks infrastructure to deliver the product to market.

Resource Assumptions for Leasable Minerals were formulated using the Reasonably Foreseeable Development Scenario for the planning area. Based on that Scenario, the following effects could occur.

Long-term impacts to soil resources would not be widespread due to modern oil and gas construction and operation practices. Long-term impacts to soil resources include sterilization and contamination which would inhabit vegetative growth, ultimately leading to soil erosion. 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 re-vegetation. 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 re-seeding, re-contouring, and drainage control (see Stipulations, Appendix A). The full magnitude of production effects is dependent upon the location, depth, size, and soil composition of the project area. No oil extraction is expected within the life of the plan, though development associated with gas extraction is expected in the Koggiling Creek planning block.

Coal Bed Natural Gas. This analysis assumes no coal bed natural gas development on BLM lands.

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 planning area during the past 20 years, snow accumulations in some years have been insufficient to drive snowmachines 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, and impacts to the tundra are more likely to occur during camp moves (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 planning area. Varying

levels of disturbance elsewhere have been documented even where the snow depth exceeded two feet (Felix et al. 1989).

Observations by BLM and others (NRC 2003) 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 1% 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 (NRC 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 (Appendix A, ROP Veg-2d, e, f and g), 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 increased 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 vegetation 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, decreased 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 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 exposing 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 alters 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 non-native plants. 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. The extent of these impacts would depend on location of anticipated exploratory drilling

activities. This analysis assumes six exploratory wells over the 20-year life of the plan, each disturbing approximately six acres. Application of ROPs and Stipulations (Appendix A, ROP Water-1 Sequence and ROP Water-3i) would further minimize the extent of these impacts through riparian and wetland avoidance.

Inadequate design or placement of structures or culverts in association with gravel pads or associated roads 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, 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 (H_2S) poses the main risk under Alternative B. Another source of H_2S release is at oil and gas fields where secondary recovery operations are occurring. To mitigate H_2S impacts, applications for permits to drill (APDs) in sour gas areas would include a contingency plan that may include requirements to monitor wind speed, wind 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, BLM would require these items as conditions of approval (COAs). The potential release of H_2S 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 re-injection into wells. Cuttings may be stored temporarily to facilitate re-injection and/or backhaul operations. Use of mud pits may be allowed by the Authorized Officer. If muds 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, Stipulations (Appendix A, ROP OG-1b) and other preventative measures determined as 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). Projects that require water extraction will be required to adhere to the Required Operating Procedures and Stipulations which will prevent unlimited drawdown while maintaining the health and availability of a natural fresh water resource. Water withdrawal and de-watering regimes are subject to constraints developed through project-specific NEPA analysis. Adherence to the Required Operating Procedures and Stipulations and project-specific stipulations for all permitted operations would prevent the unlimited drawdown of any stream or lake (Appendix A, ROP Water-2a).

While some of the gravel used for the construction of permanent facilities may be obtained from non-BLM lands, some of the material sites would probably be located on BLM lands in the planning area. Improper location of gravel-removal operations can result in alteration or destruction of soils, stream channel or lake configurations, 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. 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 the entire 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. Application of hazardous material contract provisions (Appendix A, "Hazardous Material Use and Waste Management") would minimize the potential and the extent of spills occurring from anticipated gas exploration and development activities.

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. Waters may remain 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 planning area, prevailing winds may blow these emissions and particulates to other areas of Alaska, where they might affect air quality. 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 on the North Slope. Emissions from development resulting from Alternative B would be small compared to the emissions from North Slope oil production.

(3) Effects to Soils, Water, Air, and Vegetation Resources from Locatable Minerals and Salable Minerals (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 lands would be open to mineral entry. Additionally, mineral development on State- or Native-selected lands could occur where existing Federal claims are located. The type of mining most likely to occur is placer mining. Under Alternative B, this analysis anticipates 1 – 3 new placer mines and 2 – 4 new locatable lode exploration projects, all on State- or Native-selected lands. Overall, 115 acres of disturbance from mining are projected on BLM-managed lands. This development is projected to occur within the Goodnews Bay/Snow Gulch, Iliamna/Fog, Kasna Creek, Kijik Lake, and Platinum high locatable mineral occurrence potential areas (BLM 2006). Upon revocation of ANCSA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The lands would remain closed to mineral entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under 906(e) of ANILCA. In addition to the effects described under Effects Common to All Alternatives, 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 including separating vegetative cover and soil from mine tailings for future recovery, backfilling and replacing topsoil appropriately as mining progresses, and returning the stored soil to the ground surface upon completion of the mining project. Because of anticipated new development, the effects described here are more likely to occur and would occur to a greater extent under Alternative B than under any other Alternative.

Salable Minerals. Salable materials activities may degrade soil resources, and may cause erosion and an increase in stream sedimentation and turbidity. Sites may never passively 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. Because of the anticipated levels of locatable mineral development and leasable mineral development, this Alternative anticipates more mineral materials development, along with associated impacts, than any other alternative. However, the Reasonably Foreseeable Development Scenario for locatable minerals assumes little to no mineral material development on BLM lands, based on the assumption that most existing gravel pits are located on much more accessible, privately owned land.

(4) Effects to Soils, Water, Air, and Vegetation Resources from Recreation Management (Alternative B)

Alternative B would manage recreation at the Roaded Natural Recreation Opportunity Spectrum (ROS) class. Roaded natural areas are characterized by a generally natural environment. However, this ROS class allows for primitive facility development. This facility development may result in some vegetation clearing. Consequently, impacts to air quality, soil, vegetation and water resources from recreation management as described under Effects Common to All Alternatives would be greater under Alternative B than under any other Alternative.

(5) Effects to Soils, Water, Air, and Vegetation Resources from Travel Management (Alternative B)

Because all lands would be designated as "open" for OHVs, impacts to air quality, soil, vegetation, and water resources from OHV use and Travel Management would be similar to those discussed under Alternative A and more than those anticipated for Alternatives C and D.

(6) Effects to Soils, Water, Air and Vegetation Resources from ACEC Designations (Alternative B)

Under Alternative B, there would be no ACEC designations. Consequently, there would be fewer constraints on development activities.

(7) Effects to Soils, Water, Vegetation, and Air from Wild and Scenic River designations (Alternative B)

Under Alternative A, there would be no recommended national system Wild and Scenic River designations. Consequently, these areas would be open for mineral leasing or location, subject to ROPs and Stipulations.

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

(1) 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 recommended for revocation. Those lands currently closed to mineral entry would be opened with the exception that ANCSA 17(d)(1) withdrawals would be retained at locations where Wild and Scenic Rivers are proposed and within the Carter Spit ACEC. Impacts to soils, air, vegetation and water from mineral entry would be greater than in Alternative A but slightly less than in Alternatives B and D.

Delineating Rights-of-Way avoidance areas within the two proposed ACECs would have a positive impact on soils because road or pipeline construction would likely not occur.

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

Leasable Minerals. Under Alternative C, 1,063,129 acres of BLM lands would be open to fluid mineral leasing. This alternative anticipates similar levels of gas development as described under Alternative B (development of one gas field in the Koggiling Creek planning block). Impacts to soils, vegetation, water and air would be similar to impacts discussed under Alternative B though fewer acres would be available for leasable mineral activities under Alternative C. Comparatively, the magnitude of impacts could be greater under Alternative C than Alternative A, but less than Alternative B.

Alternative C implements a No Surface Occupancy 300-foot buffer on either side of the South East and South Fork Arolik, Faro Creek, South Fork Goodnews River and Klutuk Creek. Although this analysis does not anticipate leasable mineral activities at any of these locations, this buffer would protect riparian areas and soils adjacent to these sensitive riparian habitats. Additionally, no mineral leasing would occur on 12,210 acres of eligible/suitable Wild and Scenic River segments along BLM-managed portions of the Alagnak, Goodnews and Goodnews Middle Fork Rivers and within the Carter Spit ACEC (61,251 acres) due to retention of ANSCA 17(d)(1) withdrawals.

Soils, vegetation, water and air resources would benefit from Required Operating Procedures, Stipulations, and project-specific requirements. Because of the additional constraints described above, long term effects from leasable mineral activities would not be expected outside of the Koggiling Creek planning block during the life of this plan. Overall, less unencumbered BLM land is available for mineral leasing under Alternative C than under Alternatives B or D.

Locatable Minerals. Under Alternative C, 1,063,129 acres of unencumbered BLM lands within the planning area would be open to mineral entry. Within the planning area, approximately 3,968 acres would remain withdrawn from mineral entry due to Agency withdrawals, and ANCSA 17(d)(1) withdrawals would be retained on 12,210 acres of proposed Wild and Scenic Rivers, until Congress had an opportunity to act, and within the proposed Carter Spit ACEC (61,251acres). Upon revocation of ANCSA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The

lands would remain closed to mineral entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under 906(e) of ANILCA. Additionally, Required Operating Procedures provide a 300 foot buffer on either side of the East and South Fork Arolik River, Faro Creek, South Fork Goodnews River and Klutuk River (Appendix A, ROP FW-6a). This analysis anticipates no new placer or lode mining operations on BLM lands, due to retention of ANSCA 17(d)(1) withdrawals within the Carter Spit ACEC and ANILCA 906(e) Top Filed land occurring in an area of high mineral potential. Consequently, the amount of anticipated mining would be more than Alternative A, but less than Alternatives B or D due to the reduced acreage open to mineral entry.

Salable Minerals. Development of salable minerals on BLM-managed lands is not expected to occur during the life of this plan. Salable mineral exploration and development will not be permitted within the proposed Carter Spit or Bristol Bay ACECs.

(3) Effects to Soils, Water, Vegetation, and Air Resources from Recreation Management (Alternative C)

Because BLM lands would be managed for a semi-primitive motorized experience, impacts to soil, water, vegetation, and air quality resources would be similar to those discussed within the "Common to All Alternatives" section. The scale of impacts would be similar to Alternatives A and D.

(4) Effects to Soils, 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). Implementation of the Required Operating Procedures contained in Appendix A will prevent unnecessary or undue degradation resulting from OHV use associated with permitted activities. The fewest impacts from OHV use to soil, water, vegetation, and air resources would occur under Alternatives C and D.

(5) Effects to Soils, Water, Air , and Vegetation Resources from ACEC Designations (Alternative C)

Under Alternative C, there would be two ACEC designations. Within the Carter Spit ACEC, ANSCA 17(d)(1) withdrawals would be retained prohibiting leasable and locatable mineral activities. Delineating Right-of-Way avoidance areas within the two proposed ACECs would have a positive impact on soils because road or pipeline construction would be subject to greater management constraints. ANSCA 17(d)(1) withdrawals would not be retained in the Bristol Bay ACEC, thereby allowing leasable mineral development to occur within the Koggiling Creek planning block. Impacts to soils, water, vegetation, and air resources would be less compared to impacts discussed in Alternative B because the Bristol Bay ACEC would be designated a right-of-way avoidance area and salable mineral activities would be prohibited. This would greatly reduce impacts attributable to road and salable mineral development.

(6) Effects to Soils, Water, Air, Vegetation Resources from Wild and Scenic River Designations (Alternative C)

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. These areas would be closed to all mineral development.

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

(1) 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 recommended for revocation. Once withdrawals are revoked, those lands currently closed to mineral entry would be open. As a result, degradation to soils, water, vegetation and air resources may occur from mineral exploration and

development. A more detailed description of impact to soils, water, vegetation and air resources resulting from mineral exploration and development is contained in the discussion on effects from leasable, locatable, and salable minerals. The amount of lands open to entry would be slightly less than under Alternative B but greater than under Alternatives A and C.

Delineating Right-of-Way avoidance areas within the proposed Carter Spit ACEC would prevent widespread impact to soils, water, vegetation, and air quality because road or pipeline construction would likely not occur. Prevented impacts, resulting from road or pipeline construction, include soil compaction, increased siltation of water bodies, vegetative removal, and degraded localized air quality resulting from dust and vehicle emissions.

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

Leasable Minerals. Under Alternative D, 1,101,304 acres of BLM lands would be open to fluid mineral leasing due to lifting of ANCSA 17(d)(1) withdrawals, including the withdrawals on the proposed Carter Spit ACEC. This Alternative anticipates the development of one gas field in the Koggiling Creek planning block, six exploratory wells over the 20-year life of the plan, each disturbing approximately six acres, and one seismic survey would occur every five years covering 63 linear miles with a total of 250 miles collected over the next 20 years. Impacts from that development would be the same as described under Alternative B. Soils, water, vegetation, and air resources would benefit from implementation of the Required Operating Procedures, and Oil and Gas Lease Stipulations contained in Appendix A and additional mitigation or preventative requirements as identified through project-specific NEPA analysis.

Locatable Minerals. Under Alternative D, 1,102,489 acres of BLM lands within the planning area would be open to mineral entry due to lifting of ANCSA 17(d)(1) withdrawals. Upon revocation of ANCSA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The lands would remain closed to mineral entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under 906(e) of ANILCA Within the planning area, approximately 3,968 acres would remain withdrawn from mineral entry due to Agency withdrawals. Anticipated levels of mining and associated impacts to soils, water, air, and vegetation resources would be expected to be slightly less than those discussed under Alternative B. All proposed new load or placer mining would occur on State- or Native-selected lands due to ANILCA 906(e) Top Filings. Fewer impacts are expected because of the application of Required Operating Procedures under this Alternative, including 300-foot buffers on either side of the East and South Fork Arolik, Faro Creek, South Fork Goodnews River and Klutuk Creek.

Salable Minerals. The development of salable minerals on BLM-managed lands is expected to occur in conjunction with leasable mineral activities within the Koggiling Creek planning block, with effects similar to those described under Alternative B. Salable mineral exploration and development will not be permitted within the proposed Carter Spit ACEC (36,220 acres).

(3) Effects to Soils, Water, Vegetation, and Air Resources from Recreation Management (Alternative D)

Because BLM lands would be managed for a semi-primitive motorized recreation experience, impacts to air quality, soils, vegetation, and water resources would be similar to Alternatives A and C.

(4) Effects to Soils, 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). Implementation of the Required Operating Procedures contained in Appendix A will prevent unnecessary or undue degradation resulting from OHV use associated with permitted activities. The fewest impacts from OHV use to soil, water, vegetation, and air resources would occur under Alternatives C and D.

(5) Effects to Soils, Water, Air, and Vegetation Resources from ACEC Designations (Alternative D)

Under Alternative D, there would be one ACEC designation (Carter Spit ACEC). The use of ROPs and Stipulations will reduce impacts to soils, water, vegetation and air resources due to mineral development and exploration resulting from revocation of ANSCA 17(d)(1) withdrawals. A more detailed description of impact to soils, water, vegetation and air resources resulting from mineral exploration and development is contained in the discussion on effects from leasable, locatable, and salable minerals. In addition, a Plane of Operation will be required for locatable mineral activities occurring in the ACEC, per 43 CFR 3809.11(c)(3), requiring detailed disturbance and rehabilitating planning.

Delineating Right-of-Way avoidance areas within the proposed ACEC would have a positive impact on soils because road or pipeline construction would likely not occur. Potential impacts, resulting from road or pipeline construction include; soil compaction, increased siltation of water bodies, vegetative removal, and degraded localized air quality resulting from dust and vehicle emissions. Avoiding Rights-of-way authorization will prevent degradation to Special Status Species habitat by preventing degradation to soils, water, vegetation and air resources in the ACEC.

(6) Effects to Soils, Water, Air, Vegetation Resources from Wild and Scenic River Designations (Alternative D)

Under this alternative, no WSR would be recommended for designation under the National System. Consequently, these areas would be open to mineral entry.

4. Direct and Indirect Effects to Fisheries and Aquatic Habitats

a) Effects Common to All Alternatives

Proposed management of the following resources/resource uses/programs would have no anticipated impacts to fisheries and aquatic habitats: Cultural Resources, Paleontological Resources, Visual Resources, Renewable Energy, and Subsistence.

(1) Effects to Fisheries and Aquatic Habitat from Recreation and Travel Management (Common to All Alternatives)

Recreation use of BLM lands occurs throughout the 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 fish and wildlife. Effects to aquatic habitat may occur from temporary campsites or development of social trails resulting in degradation of riparian vegetation leading to increased erosion and sedimentation. 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 proximity to villages. Under all Alternatives, there would be some impacts to aquatic habitat resulting from OHV use as no areas would be completely closed to OHV use. 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. General effects of sedimentation on fish and fish habitat are described on page 4-33 below. Given the relatively low level of recreational use on remote BLM lands, these impacts would be minimal overall and degradation of aquatic habitats should not increase in the foreseeable future.

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

The BLM management actions under all Alternatives for hazardous or solid wastes may have localized, beneficial effects on fish habitat through risk management stipulations and mitigation/reclamation of contaminated sites.

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

Beneficial effects to Fisheries and Aquatic Habitat from application of ROPs, Stipulations, and proper management of soils, water, and vegetation resources would occur. Implementation of ROPs and Stipulations to protect soil, water, and vegetation on a project-specific basis, particularly in riparian zones and 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 aquatic habitat.

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

Fire effects which directly impact fish populations include 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 systems 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 soil's integrity or where heavy equipment is used in suppression activities. Lakes are also potentially vulnerable to fire effects of nutrient concentrations, 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 re-invade 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 main stem 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 adverse 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 to 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 to only 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 or 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.

(5) Effects to Fisheries and Aquatic Habitat from Locatable, and Salable Minerals (Common to All Alternatives)

Currently there are no new proposed projects for mineral activities on BLM lands in the planning area. However, under all Alternatives, some BLM lands open to mineral entry. In general, surface mining activities increase erosion and accelerated sediment production and input into nearby streams and lakes. Mining operations 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, 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 potentially large area of land disturbed by mineral activities and the large quantities of earthen materials exposed at sites, erosion can be a major concern. Erosion may cause significant loadings of sediments to nearby water bodies and associated riparian-wetland areas, especially during severe storm events and high snow melt periods. 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 water bodies.

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 their 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 stream banks and progressively wider and shallower stream channels (Elmore and Leonard 1998).

Accelerated runoff can trigger down cutting, which lowers the streambed, alters the water table, dries out the riparian area, destabilizes stream banks, increases erosion, and further accelerates runoff. Unless stopped by some form of intervention or a hard geologic formation, down cutting 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 macro-invertebrates (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 the 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.

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 in-stream 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 stream bank 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 re-established. 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 about 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 re-colonize 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 re-colonize (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.

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

Some minimal forestry activity generally occurs within the 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. Current concerns related to 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. Because of the application of ROPs and the low likelihood of road development in association with limited forestry activities, there would be no significant impacts to fisheries.

b) Effects to Fisheries and Aquatic Habitat for Alternative A

(1) 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, mineral entry.

Rights-of-Way. Right-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.

Because of a low anticipated level of mineral development, Alternative A anticipates fewer Right-of-Way grants and easements than Alternatives B, C, and D.

(2) Effects to Fisheries and Aquatic Habitat from Leasable, Locatable, and Salable Minerals (Alternative A)

Leasable Minerals. Under Alternative A, no lands would be identified as open for fluid mineral leasing. This analysis anticipates no oil or gas development on BLM lands. Under this Alternative, impacts to fisheries and aquatic habitat would be minimal to non-existent.

Locatable Minerals. Alternative A anticipates continuance of mining operations on pre-ANSCA era Federal mining claims. According to the Reasonable Forseeable Development Scenario for Locatable Minerals, a total surface disturbance of 23 acres (BLM 2006), mostly from placer mining activity is expected under Alternative A. Impacts to fish would be similar to those discussed under "Effects Common to All Alternatives" for mining activities, but would occur to a lesser degree than under Alternatives B, C, or D.

Salable Minerals. Due to the remote location of BLM land, salable mineral development is not expected to occur.

(3) 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 "Effects 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. Impacts from recreation would be similar to those anticipated to occur under Alternatives C and D, and less than anticipated impacts under Alternative B.

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

Under Alternative A, BLM lands would remain undesignated and impacts would be similar to those discussed under "Effects Common to All Alternatives". Areas of high OHV use and any correlations to areas that may include important fish habitat have not been identified. Unauthorized proliferation of trails would potentially increase under this Alternative with corresponding increase in erosion and sediment impacts. It has been documented in Alaska that multiple stream crossings by OHVs can cause alterations of stream bank structure and function, and may cause the introduction of sediment into the waterway (Weidmer 2002).

(5) Effects to Fisheries and Aquatic Habitat from ACEC designations (Alternative A)

Under Alternative A, there would be no ACEC designations. ANSCA 17(d) (1) withdrawals would be retained under this Alternative.

(6) 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. ANSCA 17(d)(1) withdrawals would be retained under this Alternative. Consequently, there could be little likelihood of development and associated impacts on BLM lands.

c) Effects to Fisheries and Aquatic Habitat for Alternative B

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

Alternative B would revoke all ANCSA 17(d)(1) withdrawals which could result in 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 land out of Federal ownership. Alternative B identifies two parcels in the Iliamna East planning Block and one parcel in 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 a small influence on fishery resources. Should other BLM lands currently selected by the State or Native Corporations remain in Federal ownership, those lands may be considered for future exchange. Land disposal could result in impacts to valuable fish habitat, if subsequent development were to occur. Should BLM lands be transferred to or exchanged with other

Federal agencies (e.g., NPS or USFWS), fish resources would be managed under that agency's guidelines.

Right-of-Way grants and easements may promote the construction of paved or unpaved roads, gravel pads, or railways, all of which may adversely affect fish habitat through runoff that may introduce sediment and contaminants into water. An increase in Right-of-Way requests would be expected under this Alternative as a result of a greater opportunity for development.

(2) Effects to Fisheries and Aquatic Habitat from Leasable, Locatable, and Salable Minerals (Alternative B)

Fluid Leasable Minerals. Alternative B advocates revocation of all ANCSA 17(d)(1) withdrawals and opening the land to mineral leasing. Under Alternative B, one gas field is anticipated within the Koggiling Creek planning block, six exploratory wells over the 20-year life of the plan, each disturbing approximately six acres, and one seismic survey would occur every five years covering 63 linear miles with a total of 250 miles collected over the next 20 years. Oil and gas operations could affect fisheries resources in several ways, as described below. ROPs and Stipulations (Appendix A) have been developed to minimize impacts associated with mineral development.

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 the immediate area 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 a small percentage 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 likely to have little 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. ROP Water 6a requires that water withdrawals be designed to maintain sufficient quantities of surface water, and contributing groundwater to support fish and wildlife and other beneficial uses.

Under Alternatives B, C, and D, greater levels of water withdrawal would be expected in correlation 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 anticipated development under Alternatives B, C and D would be greater than the development under Alternative A, the prevention of drilling in rivers and streams would provide fish with adequate protection (Appendix A, ROP FW-2f and Oil and Gas Stip-1). 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. Development of one gas field in the Koggiling Block would require the construction of a gravel road system linking the six exploration wells. Impacts from pad, road, and pipeline construction 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. Alternative B assumes the development of one gas field in the Koggiling Creek planning block. Some small-scale spills can be anticipated associated with fueling or storage, but these would be less than one barrel. Transport of crude oil (via pipelines or other modes of transport) would not occur associated with this development, nor is oil development and extraction expected to occur within the life of the plan.

Locatable Minerals. This Alternative allows for the greatest amount of exploration and development for locatable minerals through the revocation of all ANCSA 17(d)(1) withdrawals. According to the Reasonable Forseeable Development Scenario for Locatable Minerals, development of both lode and placer mines may not occur on BLM lands because of the ANILCA 906(e) Top Filings in the Goodnews planning block. Surface disturbance of 115 acres (BLM 2006) is anticipated to occur on State- and Native-selected lands with 18 acres of disturbance on Federal mining claims. Roads or infrastructure in support of mineral development could affect BLM land. For general mining impacts to fisheries, see "Effects Common to All Alternatives." These impacts would occur to a greater degree under this Alternative than under Alternatives A or C and would be similar under Alternative D.

The ROPs (Appendix A) 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. ROP FW-6a, which applies a 300-foot buffer to specific rivers and streams on BLM lands, would not apply under this alternative.

Salable Minerals. Under Alternative B, salable mineral activities may occur. Under this Alternative and Alternatives C and D, Required Operating Procedures would minimize the effects of gravel extraction on fish by avoiding gravel extraction from active channels and anadromous streams. The protection provided to fish and fish habitat under Alternatives B, C, and D would be superior to that provided under Alternative A.

Gravel extraction from fish-bearing streams or tributaries 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). This plan assumes little or no salable mineral activities will occur on BLM lands, except within the Koggiling Creek planning block in support of leasable mineral activities (BLM 2006). This assumption is based on the fact that most existing gravel pits are located on private land and are much closer to existing infrastructure than BLM lands.

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

This Alternative would allow areas currently managed for primitive or semi-primitive recreation opportunities to trend towards a Roaded natural recreation opportunity. A Roaded natural ROS class includes more roads and development though a generally natural setting is still provided. Development of recreation facilities and increased recreation use associated with a Roaded natural recreation setting would result in potentially greater impacts to fisheries and aquatic habitat. This Alternative has more potential for impacts to fisheries and aquatic habitat than Alternatives A, C, or D.

(4) Effects to Fisheries and Aquatic Habitat from Travel Management (Alternative B)

Under Alternative B, BLM-managed lands would be designated as "open" to OHV use, 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. Potentially adverse effects to fish habitat from OHV use are discussed under "Effects Common to All Alternatives."

(5) Effects to Fisheries and Aquatic Habitat from ACEC designations (Alternative B)

Under Alternative B, there would be no ACEC designations. Without ACECs, there would be fewer area-wide constraints on resource development and less resource-specific protective measures applied.

(6) Effects to Fisheries and Aquatic Habitat from Wild and Scenic River Nominations (Alternative B)

Under Alternative B, there would be no Wild and Scenic Rivers recommended for designation under the National System. Additional protections of fish habitat would be limited to those outlined in the ROPs and Stipulations and constraints developed through project-specific NEPA analysis.

d) Effects to Fisheries and Aquatic Habitat for Alternative C

(1) Effects to Fisheries and Aquatic Habitats from Lands and Realty (Alternative C)

Disposal or Land Exchange. Impacts are the same as those discussed under Alternative B.

Withdrawals. Alternative C would retain 17(d)(1) withdrawals for the proposed Wild River segments of Alagnak, Goodnews mainstem, and Goodnews Middle Fork (12,210 acres) and the Carter Spit ACEC (61,251acres). The potential level of withdrawal retention would be greater under Alternatives A and C compared to Alternatives B and D. The protection provided to fish and fish habitat under Alternatives A and C would be superior to that provided under Alternative B and D.

Rights-of-Way. Under Alternative C, the proposed Bristol Bay ACEC (974,970 acres) and the proposed Carter Spit ACEC (61,251acres) would be identified as avoidance areas for Rights-of-Way. The potential level of avoidance for Rights-of-Way would be greater under Alternatives C and D than under Alternatives A and B. The protection provided to fish and fish habitat under Alternative C would be superior to that provided under Alternative A, B, or D.

(2) Effects to Fisheries and Aquatic Habitats from Leasable, Locatable, and Salable Minerals (Alternative C)

Fluid Leasable Minerals. Alternative C would retain ANSCA 17(d)(1) withdrawals for proposed Wild River segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork (12,210 acres) as an interim measure to provide an opportunity for Congressional action. Additionally, ANCSA 17d(1) withdrawals would be retained within the Carter Spit ACEC (61,25 acres). Retention of these ANSCA 17(d)(1) withdrawals would further minimize impacts to fish from what limited leasable mineral activity that might occur. There would also be a 300-foot area of No Surface Occupancy on either side of the East and South Fork Arolik, Faro Creek, South Fork Goodnews River and Klutuk Creek (Appendix A, Stipulation 8). These constraints and protective measures would result in less land being available for mineral leasing than under Alternatives B and D. However, this Alternative still anticipates development of one gas field in the Koggiling Creek planning block. Potential effects to fisheries and aquatic habitats in the Koggling Creek planning block would be similar to those described under Alternative B. The Koggiling Creek planning block is located within the proposed Bristol Bay ACEC which would be designated a rights-of-way avoidance area, resulting in limited road development in support of leasable mineral development. This avoidance area would reduce adverse impacts to Fisheries and Aquatic Habitats associated with road development.

Locatable Minerals. ANSCA 17(d)(1) withdrawals would be revoked and 1,064,313 acres of BLM land would be open to mineral entry. Upon revocation of ANCSA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The lands would remain closed to mineral

entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under 906(e) of ANILCA.

The anticipated level of locatable mineral activity under Alternative C would be similar to that identified under Alternative A. ANSCA 17(d)(1) withdrawals would be retained for proposed Wild River segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork (12,210 acres) as an interim measure to provide an opportunity for Congressional action. The potential level of locatable mineral development could be slightly greater under Alternatives B and D than under Alternative C, but the protection provided to fish and fish habitat under Alternatives B and C would be superior to that provided under Alternative A due to the implementation of Required Operating Procedures.

Salable Minerals. Under Alternative C, the proposed Carter Spit ACEC (61,251acres), the proposed Bristol Bay ACEC (974,970 acres); and the proposed Wild River segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork (12,210 acres) would be closed to salable mineral development. Under Alternatives B, C, and D, Required Operating Procedures would minimize the effects of gravel extraction on fish by avoiding gravel extraction within active channels and anadromous streams. This alternative anticipates no development of salable minerals.

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

Because BLM-managed lands would be managed for a semi-primitive motorized recreation experience, effects to fisheries from recreation would be similar to those described under Alternative A.

(4) Effects to Fisheries and Aquatic Habitat from Travel Management (Alternative C)

Off-Highway Vehicles. Under Alternative C, OHV use would be limited to existing roads and trails, providing less opportunity for potential impact to fisheries and aquatic habitat compared to Alternatives A or B. Under this Alternative, OHV trails would be managed with the objective of minimizing the proliferation of trails. Locations that may include important fish habitat have not been identified. OHV trails crossing anadromous streams will by authorized by permit from the State Department of Natural Resource. Potentially adverse effects to fish habitat from OHV use are discussed under "Effects Common to All Alternatives." These effects would occur to a lesser degree under Alternatives C and D than Alternatives A or B. Alternative C includes a vehicle weight restriction of 2,000 pounds gross vehicle weight rating (GVWR includes load capacity).

(5) Effects to Fisheries and Aquatic Habitat from ACEC designations (Alternative C)

Alternative C would designate two ACECs, Carter Spit (61,251 acres) and the Bristol Bay (974,970 acres). Within the Carter Spit ACEC, ANCSA (d)(1) withdrawals would be maintained, thus prohibiting new leasing or locatable mineral development, providing continued protection to fisheries and aquatic habitat within the proposed ACEC.

Both ACECs will restrict salable mineral activities and be designated as right-of-way avoidance areas providing additional protection to fisheries and aquatic habitat. Designating Right-of-Way avoidance areas within the proposed ACECs would provide protection to natural resources because road or pipeline construction would likely not occur. Potential impacts to fisheries and aquatic resources, resulting from road or pipeline construction include; vegetative removal leading to increased siltation of water bodies.

The use of ROPs and Stipulations will reduce impacts to fisheries and aquatic habitat due to mineral development and exploration resulting from revocation of ANSCA 17(d)(1) withdrawals in the proposed Bristol Bay ACEC. A more detailed description of impact to fisheries and aquatic habitat resulting from mineral exploration and development is contained in the discussion on effects from leasable, locatable, and salable minerals. In addition, a Plane of Operation will be required for locatable mineral activities occurring in the ACEC, per 43 CFR 3809.11(c)(3), requiring detailed disturbance and rehabilitating planning.

(6) Effects to Fisheries and Aquatic Habitat from Wild and Scenic Rivers (Alternative C)

Under Alternative C, BLM would propose Wild and Scenic River designation for the Alagnak River, Goodnews River mainstem, and Goodnews River Middle Fork river segments.

This proposal would provide protections from development and would provide a mechanism for management of the river's resources. Wild Rivers would allow unobtrusive development and activities, but typically do not allow motorized use. Because of the maintenance of ANSCA 17(d)(1) withdrawals, new mineral entry or leasing would not be permitted; only existing valid claims could be developed. Impacts to fisheries and aquatic habitat from recreation activities may be greater than Alternative A due to the anticipated increase in visitation due to WSR designation. Impacts from mining activities would be similar to Alternative A but less than Alternatives B and D.

e) Effects to Fisheries and Aquatic Habitat for Alternative D

(1) Effects on Fisheries and Aquatic Habitat from Lands and Realty (Alternative D)

ANCSA 17(d)(1) withdrawals. Same as Alternative B. ANCSA 17(d)(1) withdrawals would be recommended for revocation. This would open BLM lands to potential leasable and locatable mineral development. Upon revocation of ANCSA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The lands, selected under ANILCA 906(e), would remain closed to mineral entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under ANILCA 906(e) of ANILCA. Fisheries and aquatic habitat on Top Filed lands would be afforded similar protection upon revocation of ANCSA 17(d)(1) withdrawals. Impacts to fisheries and aquatic habitat on BLM lands not Top Filed would be mitigated through the use of ROPs and Stipulations (Appendix A).

Rights-of-Way. Under Alternative D, the Carter Spit ACEC (36,220 acres) would be managed as a right-of-way avoidance area. In most cases, rights-of-way for roads, pipelines, or other developments would not be approved for this area, thus providing a degree of protection for fish and aquatic habitat in the area. Outside of the ACEC, applications for rights-of-way would be handled on a case-by-case basis but appropriate ROPs for protection of fish and aquatic habitat would be applied. Alternative D anticipates a higher level of development than Alternatives A or C and slightly less than B.

(2) Effects to Fisheries and Aquatic Habitat from Leasable, Locatable, and Salable Minerals (Alternative D)

Fluid Leasable Minerals. Under Alternative D, ANCSA 17(d)(1) withdrawals would be recommended for revocation, thus making 1,101,304 acres of BLM land available for mineral leasing. This alternative designates an area of No Surface Occupancy 300 feet on either side of the East and South Fork Arolik, Faro Creek, South Fork Goodnews River and Klutuk Creek (Appendix A, ROP FW-6a and Stipulation 8). However, this alternative still anticipates development of one gas field in the Koggiling Creek planning block, six exploratory wells (each disturbing approximately six acres) and one seismic survey would occur every five years covering 63 linear miles with a total of 250 miles collected, over the next 20 years. Potential effects to fisheries and aquatic habitats would be similar to those described under Alternative B.

Locatable Minerals. Under Alternative D, the anticipated level of locatable mineral development would be the same as identified under Alternative B, 115 acres, all on BLM, State- or Native-selected or Native (Federal Mining Claim) lands. Upon revocation of ANCSA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The lands would remain closed to mineral entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under 906(e) of ANILCA. All BLM lands would be subject to Required Operating Procedures (Appendix A). The potential for locatable mineral development is greater under Alternatives B and D compared to Alternatives A and C. Effects would be similar to those described under Alternative B.

Salable Minerals. The anticipated level of exploration and development for salable minerals under Alternative D would be similar to that described under Alternative B, but the proposed Carter Spit ACEC (36,220 acres) would be closed. This analysis assumes that there would be little to no mineral material development on BLM lands under this alternative (BLM 2006). According to the RFD for Leasable Mineral, gravel may be required to support gas development operations within the Koggiling Creek planning block.

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

Because BLM-managed lands would be managed for a semi-primitive motorized recreation experience, effects to fisheries from recreation would be similar to those described under Alternative A.

(4) Effects to Fisheries and Aquatic Habitat from Travel Management (Alternative D)

Alternative D includes a limited designation and vehicle weight limit of 2,000 pounds gross vehicle weight rating (GVWR includes load capacity) for all BLM lands. OHV use under Alternative D would be restricted to existing roads and trails, resulting in fewer potential impacts to fish and fish habitat from stream crossings. Additionally, a Travel Management plan would be created (within 5 years of RMP acceptance) for BLM lands, including Carter Spit ACEC, which would designate specific trails for OHV use. This would minimize the proliferation of trails and unauthorized stream crossings in that area. Because of these proposed constraints, this Alternative is expected to result in fewer impacts from OHVs than Alternatives A or B but similar impacts compared the Alternative C.

(5) Effects to Fisheries and Aquatic Habitat from ACEC Designations (Alternative D)

Alternative D would designate the Carter Spit ACEC (36,220 acres). Management within the ACEC would provide stronger protection to fisheries and aquatic habitat through the following measures:

- Requiring Plans of Operations for any mining operation.
- Managing the area as a right-of-way avoidance area, thus avoiding potential impacts from road or pipeline construction.
- Developing a transportation plan that identifies specific designated trails for OHV use.

The ACEC will restrict salable mineral activities and be designated rights-of-way avoidance areas providing additional protection to fisheries and aquatic habitat. Designating Right-of-Way avoidance areas within the proposed ACECs would provide protection to natural resources because road or pipeline construction would likely not occur. Potential impacts to fisheries and aquatic resources, resulting from road or pipeline construction include; vegetative removal leading to increased siltation of water bodies.

The use of ROPs and Stipulations will reduce impacts to fisheries and aquatic habitat due to mineral development and exploration resulting from revocation of ANSCA 17(d)(1) withdrawals in the proposed ACEC. A more detailed description of impact to fisheries and aquatic habitat resulting from mineral exploration and development is contained in the discussion on effects from leasable, locatable, and salable minerals. In addition, a Plane of Operation will be required for locatable mineral activities occurring in the ACEC, per 43 CFR 3809.11(c)(3), requiring detailed disturbance and rehabilitating planning.

(6) Effects to Fisheries and Aquatic Habitat from Wild and Scenic Rivers (Alternative D)

This Alternative would not recommend any rivers for inclusion in the National Wild and Scenic River system. ANCSA 17(d)(1) withdrawals would be recommended for revocation allowing for mineral entry.

f) Essential Fish Habitat

Although there are no Federally-managed fisheries on BLM land in the planning area, the ranges of the five species of Pacific salmon found within the plan boundaries are under the jurisdiction of the North Pacific Fisheries Management Council. The Magnuson-Stevens Act calls for direct action to stop or reverse the continued loss of fish habitats for species that are under this jurisdiction. Essential Fish Habitat (EFH) is a specific classification term that only applies to the habitat of Pacific salmon and not to any other species in the planning area. EFH is defined as those waters and substrate necessary to salmon for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of EFH, "waters" include aquatic areas that are used by fish and their associated physical, chemical, and biological properties and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' entire life cycle (National Marine Fisheries Service 2005).

For Alaska, freshwater EFH includes all streams, lakes, ponds, wetlands, and other waterbodies that have been historically accessible to salmon. A significant body of information exists on the life histories and general distribution of salmon in Alaska. The locations of many freshwater waterbodies used by salmon are described in documents organized and maintained by the Alaska Department of Fish and Game. Alaska Statute 16.05.870 requires ADF&G to identify the various streams that are important for spawning, rearing, or migration of anadromous fish. The agency met its statutory obligation with publication of the *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes* (ADF&G 1998a) and the *Atlas to the Catalog of Waters Important for Spawning, Returning or Migration of Anadromous Fishes* (ADF&G 1998b). The catalog lists waterbodies documented to be used by anadromous fish. The atlas shows locations of these waters and the species and life stages that use them Maps 3.13 a-d show the location of these streams in the planning area.

Potential impacts to the salmon that inhabit the planning area would be the same as described for other fish. Consequently, impacts to salmon as part of EFH, have been evaluated in the general fish analysis above. For the reasons described under Alternatives B and D and through adherence to protective ROPs and Stips, EFH is likely to be largely unaffected under the proposed development activities probable during the life of this plan.

5. Direct and Indirect Effects to Wildlife and Wildlife Habitat

a) Direct and Indirect Effects to Wildlife Common for All Alternatives

Proposed management of the following resources/resource uses/programs would have no anticipated impacts to wildlife management: Air Quality, Fisheries Management, Special Status Species, Cultural Resources, Paleontological Resources, Visual Resources, Forestry, and Subsistence.

(1) Effects to Wildlife from Soil, Water, and Vegetation and Air Management (Common to All Alternatives)

There would be beneficial effects to wildlife and wildlife habitat from proper management of soils, vegetation, and water resources. Implementation of ROPs and Stipulations to protect soil, water, vegetation, and air would reduce habitat disturbance and aid in the recovery of habitat from permitted uses.

(2) Effects to Wildlife from Fire and Fuels Management (Common to All Alternatives)

A large percentage of the planning area is comprised of herbaceous or shrub habitats. Fire is less prevalent in these vegetation types compared to boreal forests; therefore, effects of fire on wildlife and habitats are lower in the planning area than for Interior Alaska.

Fire has both direct and indirect effects on wildlife and their habitats. These effects are described in detail in the Land Use Plan Amendment for Wildland Fire and Fuels Management for Alaska (BLM 2004). Generally, the effects on habitat are much greater than the effects on resident animals. Short-term negative impacts from fire on resident wildlife include displacement, disruption of reproductive activities, and occasional mortalities. However, populations of certain species can recover quickly if suitable habitat is available. Adverse effects to current individuals are generally offset by the advantages of beneficial habitat changes for future generations.

Fire helps maintain a mixture of vegetation types and age classes that provide habitat and forage for a variety of wildlife. Fire alters habitats and may improve habitat components for some species while degrading habitat for other species. Over time, as vegetation recovers from fire disturbance, various species of wildlife will benefit from various successional stages of vegetation. Herbivores are directly affected by the changes in vegetative cover and forage associated with fire, whereas predators respond to both changes in cover and abundance of prey.

Wildlife has evolved in the presence of fire and has adapted to it. Overall, a natural fire regime has a beneficial effect on maintaining a diversity of wildlife and wildlife habitats. Grasses, sedges and herbaceous plants that quickly re-sprout after fire, provide forage and cover for small mammals, wet and alpine tundra birds, and grazing species. Browsers such as moose, hares, and ptarmigan benefit from fire when trees and shrubs re-establish themselves. If fires are not too severe, sprouting of some shrub species will occur soon after burning.

Moose generally benefit from fire due to increased production of high quality browse for 23-30 years after fire (McCracken and Viereck 1990). Prescribed fires are a management tool used to increase moose habitat. Moose populations generally react in a strongly positive manner to areas with increased browse. The level of effect is variable, depending upon the health of the moose population prior to the fire and the amount of browse available. If browse is not a limiting factor on moose populations, then fire will have little impact on populations over the short-term (BLM 2004b).

The short-term effects of fire on caribou winter range are negative, and vary depending upon the severity of the burn. Lichens, which are primary winter forage for caribou, are highly susceptible to wildland fire. Impacts to habitat include reduced availability of forage lichens for up to 80 years after a fire (Klein 1982, Joly et al. 2003). On caribou summer ranges, forage quality of vascular plants is improved by fire. Fire also affects caribou movement patterns. Research has shown that caribou actively avoid burned areas for 35-50 years after a fire (Joly et al. 2003). Over the long-term, fire is likely beneficial to caribou as it helps maintain the ecological diversity of the habitat and may prevent mosses from out-competing forage lichens. Light fires may rejuvenate stands of lichen and replace old forest stands where lichen has been replaced by moss. Periodic fires create a mosaic of fuel types and fire conditions that naturally preclude large, extensive fires (BLM 2004b).

Fire is very rare in subalpine habitats used by Dall sheep. Fire may enhance sheep habitat by reducing encroachment of shrubs and spruce into subalpine habitats. Fire can also increase the amount or quality of herbaceous and graminoid forage available, and reduce cover used by bears and wolves when hunting sheep.

Fire has both beneficial and negative effects on bears. Beneficial effects include increasing the availability of forage plants such as berries, grasses and forbs. On the negative side, some forage species may be reduced or temporarily eliminated by fire. Moose calves are an important prey item for both black and grizzly bears. Early stages of plant succession due to fire tend to increase moose

production, resulting in more calves available for prey (BLM 2004b). Fire has little direct effect on grizzly bears as it is infrequent in tundra habitats, and tundra fires tend to be small.

The effects of fire on furbearers are variable, depending on the species. Carnivorous furbearers (e.g., coyote, fox, wolf, wolverine, lynx) respond to fire in a manner similar to their prey species, though there tends to be a lag period. If prey species benefit from fire, predators do as well. Snowshoe hares, voles, and other small mammals tend to respond positively to vigorous re-growth triggered by wild fires. Species such as marten and lynx tend to increase as well, tracking these prey species (Johnson et al. 1990). Fire is not common in the coastal habitats favored by Arctic foxes, and so they are minimally affected. Herbivorous furbearers (such as muskrats) may benefit from fire due to rejuvenation of forage plants and maintenance of open water. Beavers may be negatively affected by severe fires until forage species re-colonize the area.

Fire near wetlands can consume dead grass and sedges, opening up dense marsh vegetation to maintain habitat for waterfowl. Burning also stimulates new shoots that have greater forage value. Under the right conditions, fire may create new ponds or prevent old ponds from filling in with vegetation. Fire can have short-term negative effects on waterfowl when it occurs during nesting or molting periods, or when it eliminates woody vegetative cover (BLM 2004b).

(3) Effects to Wildlife from Hazardous Materials (Common to All Alternatives)

Hazardous materials in the planning area have the potential to enter the food chain and contaminate wildlife species that are consumed by humans, causing negative health effects. This could occur in sport hunted species, and particularly in subsistence species where human consumption levels are higher. Hazardous materials may also directly and indirectly affect wildlife by causing direct mortality, reduced survival, and reduced productivity, thereby reducing species abundance.

The hazardous materials program could have a beneficial effect on wildlife by identifying and rehabilitating hazardous sites.

(4) Effects to Wildlife from Mineral Development (Common to All Alternatives)

Locatable Minerals. Locatable mineral exploration and development may occur under every Alternative. Potential impacts to wildlife would include temporary displacement in localized areas, temporary and long term loss of habitat, long-term degradation of habitat, and possible direct mortality of small mammals or nestlings and brooding birds. Both direct and indirect impacts may be reduced under all Alternatives with implementation of the Required Operating Procedures (Appendix A).

Salable Minerals. Salable mineral activities have both direct and indirect impacts on wildlife and their habitat. Habitat is degraded or destroyed, depending upon the location of the material site. Some sites may recover to the original vegetation cover within a relatively short time frame. Other sites may never passively recover to the original vegetative cover due to loss of soil from the site. In some cases, disturbance to the site by mining of mineral materials may result in improved habitat for species which depend upon habitats in a low seral stage. Temporary displacement and disturbance impacts would occur to larger and more mobile animals. Direct mortality may result to smaller and less mobile animals such as lemmings, voles, or nestling birds. Both direct and indirect impacts may be reduced under all Alternatives with implementation of mitigation measures developed through project-specific NEPA analysis.

Impacts to wildlife from mineral materials mining on BLM lands would be minimal under all Alternatives. Sufficient material sources exist on private lands to meet the needs of most communities within the planning area (BLM 2006).

(5) Effects to Wildlife from Recreation Management (Common to All Alternatives)

There may be impacts to wildlife from both commercial and non-commercial recreation activities. The primary impacts may be temporary stress, displacement, or habitat abandonment of wildlife due to recreational activities, or to recreation associated access (aircraft overflight and landing in remote areas). In areas that are repeatedly used for camping sites, there may be minor, site-specific degradation of habitat. Special recreation permits for guiding and outfitting may result in population effects on caribou, moose, and bears.

(6) Effects to Wildlife from Travel Management (Common to All Alternatives)

The noise and activity associated with OHV use (including snowmachines) can adversely affect wildlife both directly and indirectly. Direct effects include stress and displacement of animals, possibly to less suitable habitats, especially in important seasonal habitats. Stress and displacement may result in reduced productivity (ADF&G 1990). Changes to traditional movement patterns and distribution and behavior of wildlife can result from exposure to OHVs. Wildlife are particularly vulnerable to disturbance at periods of time and in areas of concentration such as caribou calving grounds, or during stressful periods during their life cycle (i.e. caribou and moose calving, post calving aggregations, winter habitats, bear natal dens and foraging concentrations, bird nesting and staging areas). OHV use may result in habitat abandonment or changes in density or species population, age, and sex composition in the vicinity of trails.

Indirect effects include habitat degradation and alteration, and increased access into habitats. Remote areas will become more accessible over time as OHVs become more powerful and as the human population in the planning area increases. Improved technology and increased demand for resources may lead to increased harvest of wildlife. Snowmachine use compacts snow and may inhibit movement under the snow by small rodents. Fragile habitats such as wetlands and riparian areas may be degraded seasonally by OHV use.

(7) Effects to Wildlife from Renewable Energy (Common to All Alternatives)

Renewable energy sources such as wind could be developed on BLM lands within the planning area under all Alternatives. Should such development take place, there would be both direct and indirect impacts on wildlife. Direct impacts would include disturbance during construction and maintenance activities, mortality due to bird strikes on wind towers, and mortality of small, less mobile animals such as small mammals or nestling birds during construction and maintenance. Indirect impacts would include minor loss of habitat due to facility construction. Higher mortality may be expected if wind towers are sighted in bird movement corridors. To be most useful, these types of development need to be located near population centers. However, most land near villages is private. Due to the remoteness of BLM lands, little renewable energy development is anticipated. Actual impacts would be minimal and would not have population level effects. The increasing cost of fuel may make wind energy more cost effective in the future, including power for mineral development. At this time, solar energy technology options do not appear to have the potential for impact on wildlife on BLM lands. Limited opportunity for using available geothermal energy, and local, small scale opportunity for use of solar energy would result in insignificant impacts.

(8) Effects to Wildlife from Climate Change (Common to All Alternatives)

The climate within the Bay planning area is described as maritime near the coasts, and more transitional farther inland. Current scientific evidence suggests that climate warming in Alaska can be linked to changes occurring in the structure and function of terrestrial ecosystems throughout the state. These changes include the thawing of permafrost, the conversion of tundra to more shrub habitats, and the drying and decrease in areas of closed basin lakes, causing alteration and conversion of wildlife habitats. Climate change has also been linked to changes in disturbance regimes such as fire potential and insect outbreaks, further affecting ecosystem processes and causing habitat changes in some areas. Warming climates may be instrumental in the introduction of disease and parasites previously unknown in the

planning area. Current research suggests that these trends will continue, and will likely occur to a greater extent and magnitude at higher latitudes first. These climatic changes and subsequent habitat changes will impact wildlife by expanding habitats for some species, and limiting habitat for other species, thereby altering the distribution and abundance of some species, particularly those dependent on wetlands, tundra, shrub or closed forest habitats. BLM lands in the planning area will be subjected to these climate and habitat changes.

(9) Effects to Wildlife from Lands and Realty Actions (Common to All Alternatives)

There would be both direct and indirect impacts to wildlife from lands and realty actions under all Alternatives. Wildlife may be temporarily displaced or disturbed or movement patterns disrupted during activities authorized under this program. There may be direct mortality and/or habitat abandonment by wildlife species from activities authorized under permits or leases. Wildlife habitat may be destroyed, fragmented, or degraded. Acquisitions and exchanges may benefit wildlife by consolidating land ownership patterns and protecting important wildlife habitats. Disposal action may fragment Blocks of land, remove protections for wildlife habitats, and make them available for other uses detrimental to wildlife.

(10) Effects to Wildlife from Forestry (Common to All Alternatives)

Some minimal forestry activity generally occurs within the 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 spurs or temporary roads may be constructed to access parcels of timber in the future. If roads were constructed, there could be localized impacts to habitat, migratory patterns, and wildlife abundance and distribution. Direct habitat loss may lead to wildlife displacement and habitat fragmentation. Surface disturbing activities may displace animals into lower quality habitat and increase competition for available resources with other species. Because of the application of ROPs and the low likelihood of road development in association with limited forestry activities, there would be no significant impacts to wildlife or wildlife habitat from forestry activities under any Alternative.

b) Effects to Wildlife for Alternative A

Under the current management system, Alternative A, compliance, monitoring, and mitigation requirements for wildlife are determined on a case-by-case basis during the permitting process.

(1) Effects to Wildlife from Reality and Lands Actions (Alternative A)

Impacts to wildlife would be the same as discussed under those Common to All Alternatives. Under this Alternative, no lands would be identified for disposal or land exchange and ANCSA 17(d)(1) withdrawals would be retained. The degree of impacts that would occur to wildlife and wildlife habitat under this Alternative would be less than under Alternatives B, C, or D. Avoidance or exclusion areas and specific mitigation requirements would be identified on a case-by-case basis for Rights-of-Way, including access and utility corridors and ancillary facilities.

(2) Effects to Wildlife from Leasable, Locatable, and Salable Minerals (Alternative A)

Leasable Minerals. Alternative A would retain all ANCSA 17(d)(1) withdrawals, thus preventing mineral leasing on most BLM lands. This analysis assumes no leasable mineral activities on BLM lands for the life of the plan.

Locatable Minerals. Under Alternative A, most BLM lands within the planning area would remain closed to mineral entry due to existing ANCSA 17(d)(1) withdrawals. However, some pre-ANSCA claims exist on BLM lands where some mining may take place or continue. These operations and any future proposals for locatable mineral exploration and development would be subject to review through Notice Level

Administration or administration of Plans of Operations. Measures to maintain the integrity of wildlife habitat in these areas would be developed through project-specific NEPA analysis. This analysis assumes disturbance of 23 acres of BLM and Native (Federal claims) lands under this Alternative, mostly from placer mining operations (BLM 2006). Effects from mining as described under "Effects Common to All Alternatives". are less likely to occur than under any other Alternative.

Salable Minerals. Potential impacts to wildlife would be the same as under "Effects Common to All Alternatives." No impacts would be expected in areas withdrawn from mineral entry and this analysis assumes no salable mineral activities on BLM lands (BLM 2006) due to the remote location of BLM lands in the planning area.

(3) Effects to Wildlife from Recreation Management (Alternative A)

Under Alternative A, both commercial and non-commercial recreation would continue to be managed on a case-by-case basis. No areas would be identified for commercial or non-commercial use limits. No recreation facility construction would be considered. There may be localized habitat degradation at heavily-used and dispersed campsites. Impacts to wildlife would be the same as discussed under "Effects Common to All Alternatives."

(4) Effects to Wildlife from Travel Management (Alternative A)

Under Alternative A, there would be no OHV designations within the Bay planning area. No vehicle weight limit would be imposed, and there would be no route restrictions. Cross country travel would not be restricted. Impacts would be similar to those discussed in "Effects Common to All Alternatives." The degree of potential impacts to wildlife and wildlife habitat from travel management would be greater than in Alternatives C or D.

(5) Effects to Wildlife from ACEC Designations (Alternative A)

Under Alternative A, no Areas of Critical Environmental Concern would be recommended in the planning area. BLM would manage wildlife habitat and would address concerns on a case-by-case basis during the review of permits. ANCSA 17(d)(1) withdrawals would be retained resulting in little impact differential from that which would occur under an ACEC designation.

(6) Effects to Wildlife from Wild and Scenic River Nominations (Alternative A)

Under Alternative A, no Wild and Scenic Rivers would be recommended in the planning area. These areas would be open to all multiple use activities permitted on BLM lands except mineral entry due to retention of ANCSA 17(d)(1) withdrawals.

c) Effects to Wildlife for Alternative B

(1) Effects to Wildlife from Lands and Realty Actions (Alternative B)

Land Exchanges. Large blocks of BLM lands would be retained in Federal ownership, reducing the potential for habitat fragmentation. Small isolated parcels identified in Alternative B for disposal could result in privatization of some tracts and could increase levels of access and human activity in wildlife habitat. Wildlife may be displaced from preferred habitats, and habitat may be destroyed or degraded. Exchanges could result in larger, contiguous blocks of BLM lands that are of high wildlife value.

Withdrawals. ANCSA 17(d)(1) withdrawals would be recommended for revocation under this Alternative. Because of the constraints currently in place under these withdrawals, revocation of the withdrawals could increase potential resource development and wildlife and habitat disturbing activities. Associated impacts to wildlife and wildlife habitat would be expected from minerals activities. Activity level proposals