BLM-AK-ES-88-009-3809-918

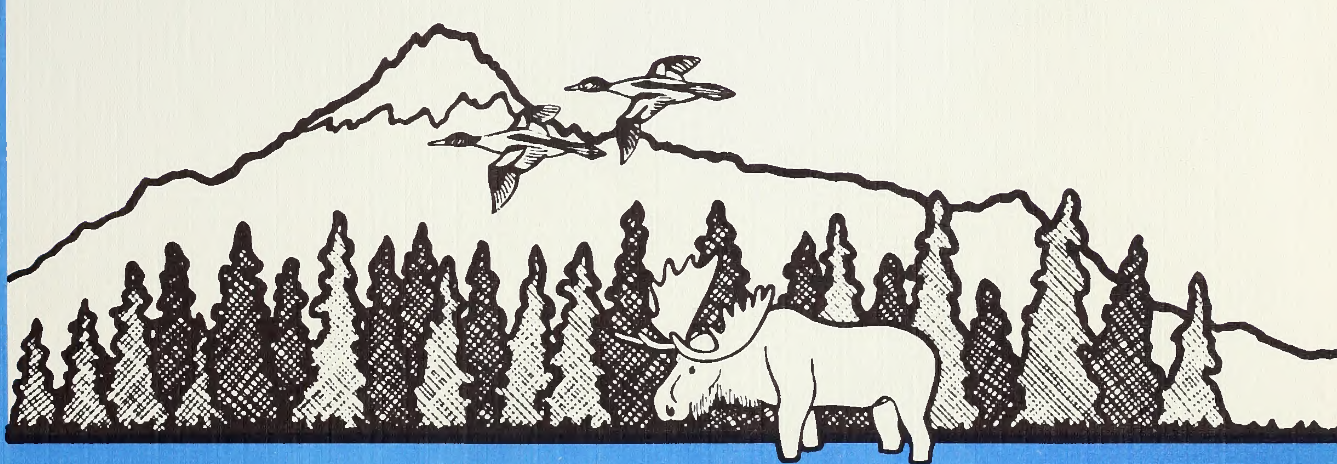
BEAVER CREEK

Placer Mining

Draft Cumulative

ENVIRONMENTAL IMPACT STATEMENT

Department of the Interior
Bureau of Land Management
Alaska State Office
1988



ENVIRONMENTAL IMPACT STATEMENT

Draft Cumulative (XX) Final ( )

BEAVER CREEK
ALASKA STATE OFFICE
ANCHORAGE, ALASKA

Lead Agency: U.S. Department of the Interior

Cooperative Agency: U.S. Army Corps of Engineers

Type of Action: Administrative (XX) Legislative ( )

ABSTRACT

This Draft Environmental Impact Statement assesses the cumulative impacts of placer mining on the Beaver Creek watershed as required by the U.S. District Court (District of Alaska) memorandum and order dated May 14, 1987, as amended, in Civil Case A86-083. A Proposed Action and four alternatives incorporating management options ranging from emphasizing regulation under 43 CFR 3809 to a "no mining" alternative as outlined by the Court are presented. The Proposed Action was selected to evaluate BLM's surface management practices in the affected watershed. The environmental consequences of all the alternatives are analyzed and presented.

For further information about this environmental impact statement, you may contact:

Michael J. Penfold
Attention: Richard Dworsky, Project Manager
Bureau of Land Management
Alaska State Office
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Anchorage, Alaska 99513
Telephone: (907) 271-3114

Dear Reader:

Enclosed for your review is the Draft Environmental Impact Statement (DEIS) for the Beaver Creek watershed. The U.S. District Court (District of Alaska) in civil case A86-083 filed on May 14, 1987, as amended, required BLM to prepare an EIS for Birch Creek watershed, and required an evaluation of the need for an EIS on the Fortymile, Minto Flats, and Beaver Creek watersheds.

The Bureau of Land Management (BLM) manages a substantial portion of the federally-owned land in Alaska that is open to mining activity. Until recently we issued permits under 43 CFR 3809.1-3 for mining operations that disturbed no more than five acres per year cumulatively.

Because placer mining activity has affected the water quality of several Alaskan streams, environmental organizations in Alaska are concerned that BLM procedures are inconsistent with its responsibility under the National Environmental Policy Act of 1969 (NEPA) to incorporate environmental reviews in decision-making procedures. These organizations also raised the question whether mining has an adverse effect on subsistence activity, and whether BLM permitting procedures are consistent with the Alaska Native Interest Lands Conservation Act (ANILCA).

Any person or group who has an interest in the findings of this Draft EIS may comment on it during the public comment period. The comment period begins the day the notice of filing is published in the Federal Register by the Environmental Protection Agency and ends 45 days later. Written comments may be submitted to: Richard Dworsky, Bureau of Land Management, 701 C Street, Box 13, Anchorage, Alaska 99513, or through attendance at one of the hearings scheduled during the comment period. We will announce the times and places of the public hearings in the Federal Register and in local newspapers. Public meetings will be held in Anchorage, Fairbanks, and those rural villages in the area affected. They will comply with the requirements of Section 810 of ANILCA. You should retain this draft EIS because of the possibility that the Final EIS will be published in abbreviated form. If that occurs, you will need this document for reference.

Any change to this DEIS made as a result of the public comment period will be made available for public review in the publication of the Final EIS.

I want to personally thank those of you who have contributed to and participated in the development of this Draft EIS. I hope your involvement will continue as we move forward into the formulation of the Final EIS in the coming months.

Sincerely yours,

Michael J Penfold

Michael J. Penfold
State Director

Figure 1-2 illustrates some of the different guidelines and responsibilities of BLM, other federal agencies, and the State of Alaska in managing placer mining on the public lands.

BLM manages mining under the General Mining Law of 1872, 30 U.S.C. 22 et seq., as amended, and the Federal Land Policy and Management Act (FLPMA) of 1976, 43 U.S.C. 1701 et seq. The 1872 Mining Law provides for the exploration, development, production, and purchase of mineral resources of the public lands, as well as the implied right of statutory access to mining claims.

The Beaver Creek watershed is located approximately 50 air miles north of Fairbanks and encompasses nearly 1.2 million acres of land. Most of the upper portion of the drainage lies within the White Mountains National Recreation Area. This EIS focuses on that particular portion of the Beaver Creek watershed within the National Recreation Area. A map entitled "Area Map" depicting major features, one entitled "Status" showing land status, and the "Tributaries and Main Physical Features Map" showing topography can be found in Chapter One.

As required by NEPA regulations, BLM used an open process to gather public input. To this end, a Notice of Intent to prepare environmental impact statements was published in the Federal Register on August 18, 1987, and in local newspapers in late August 1987. BLM also conducted a series of public, or "scoping" meetings in locations throughout the affected area between July and September 1987. At the same time, more than 450 notices of the public meetings were sent out to miners, environmentalists, native groups, and other members of the public.

The BLM also invited participation from other government agencies, private organizations, the placer mining industry, and any other concerned individuals. At the scoping meetings a description of the EIS process and the proposed activity was provided by the appropriate BLM District Manager. The meetings were then opened to members of the public to voice their concerns and ask any questions about the issues.

Significant issues include:

- What are the impacts of placer mining operations on water quality?
- How are water quality standards regulated and enforced and who performs this function?
- What are the impacts of placer mining on terrestrial habitats?
- Have reclamation practices and improved management under the 3809 regulations occurred since 1981?
- What are the impacts of other agency laws and regulations on the placer mining industry?
- What are the impacts of mining on subsistence activities ongoing in the region?

Specific coordination meetings were held with various State of Alaska agencies such as the Department of Natural Resources, Department of Environmental Conservation (ADEC), Department of Fish and Game, and the Office of Management and Budget, Office of the Governor. Meetings were also held with the Federal Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (COE), the National Park Service, and the U.S. Fish and Wildlife Service.

Summary

Introduction

A United States District Court for the District of Alaska Memorandum and Order (A86-083 Civil) filed on May 14, 1987, instructed the Bureau of Land Management (BLM) to cease approving Plans of Operations for federal placer mines after October 1, 1987, in the Birch Creek watershed pending completion of an adequate cumulative effect Environmental Impact Statement (EIS). On May 28, 1987, additional injunctions followed covering the watersheds of Beaver Creek, the Fortymile River, and Minto Flats (which is comprised of the Chatanika River, Tolovana River, and Goldstream Creek). On July 22, 1987, the Court issued an amendment to the May 14 and May 28 orders, extending the date of cessation to the November 15, 1987. The term "Sierra Club lawsuit" hereafter refers to the above orders and injunctions.


Sandhill Crane

This draft EIS analyzes the cumulative impacts of placer mining on the Beaver Creek watershed, as directed by the District Court in the Sierra Club lawsuit.

There are two primary objectives of this EIS. The first is to identify and consider performance standards under which placer mining may be conducted on federal lands in the area. The second is to comply with the Court Orders and to conduct evaluations and prepare the associated documents under the National Environmental Policy Act (NEPA) and the Alaska National Interest Lands Conservation Act (ANILCA) subsistence requirements (found in Section 810 of ANILCA).

At issue are the cumulative impacts of multiple mining operations on the environment. Initially under these injunctions, only Plans of Operations on federal claims were affected. Mines operating under Notices (operations disturbing five acres or less) were not affected; however, the impacts of such mines must be included in the evaluations. A subsequent court order of November 6, 1987, requires a Plan for all operations regardless of size, or land withdrawn from mineral entries, with a one-year exception for those mines operating in 1987.

This EIS will be an overarching environmental document from which more site-specific environmental assessments can be tiered. Tiering is an interrelationship in which reference from a more general NEPA document such as this EIS can be made to a more specific one, thus avoiding duplication. A more specific environmental assessment will not change or modify decisions resulting from this analysis, but will, on a case-by-case basis, identify more detailed and site-specific actions and mitigation measures to reduce environmental impacts.

Summary of Alternatives and Environmental Consequences

Under all of the land management alternatives described in this EIS, the BLM would manage lands under its authority to meet requirements found at 43 CFR 3809 (surface management regulations). The descriptions for each alternative will evaluate the cumulative impacts under various administrative conditions and requirements of not only the BLM, but also that of the State of Alaska, Environmental Protection Agency, and the U.S. Army Corps of Engineers.

Proposed Action

The Proposed Action for this EIS is to continue management of mining claims on federal lands as they were managed during the summer of 1987. Mining activities under the Proposed Action would be similar to the activity that occurred during the 1987 mining season. BLM would manage placer mining in the Beaver Creek drainage according to State of Alaska water quality standards with variances. In 1987, however, BLM required a zero discharge system from the one operation in the drainage.

Reclamation activities would reshape tailings to approximate the surrounding physiography and spread the overburden and available topsoil over the reshaped tailings. Settling ponds would be similarly reclaimed. The stream bypass would be stabilized or reinforced to make it the permanent channel. The reclaimed site would be allowed to revegetate naturally.

The water quality performance standards would be the current EPA effluent guidelines and ADEC water quality standards, or the existing EPA/ADEC variance for the operation. The performance standards are 0.2 ml/l of settleable solids and 5 Nephelometric Turbidity Units (NTU) above natural conditions when natural turbidity is 50 NTU or less, and not more than a 10% increase in the turbidity when the natural turbidity is 50 NTU, not to exceed a maximum increase of 25 NTU at the mine effluent discharge point.

Consequences

In the Proposed Action, the BLM reasonably foresees that a total of five mines would be operating continuously for the next ten years. There should be no significant cumulative impacts on topography or mineral resources. While the soil profile would be completely altered by mining operations on approximately 115 acres of ground, there should be no irreversible or irretrievable commitment of soil resources.

Water quantity would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. There would be short- to long-term increases in suspended sediment and turbidity, and accelerated local erosion resulting in a possible increase in sediment introduced into the stream bypass in the vicinity of the disturbed area. These impacts are not expected to be significant downstream in Beaver Creek. The impact on chemical water quality is not expected to be significant.

The vegetation cover would be destroyed in the areas of the mines and roads, resulting in an unavoidable short-term loss of productivity. Twenty-eight acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 8.6 acres would regrow within 50 years on mining disturbance in creek bottoms. At the end of ten years, 78 acres of new mining disturbance would still be sparsely vegetated. However, it is expected that reclamation at the end of the mine life would be undertaken on all disturbed lands which remain. This acreage would be an irretrievable and irreversible loss of vegetation resources.

Approximately 676 acres of wildlife habitat would be physically altered due to mining and related activities. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 115 acres of moose winter habitat range for a period of 50 years. This long-term cumulative loss of habitat to mining activities in these areas would probably contribute to a minimal reduction in moose population potential. There would be no irreversible or irretrievable commitment of fisheries resources.

Cumulative impacts on cultural and paleontological resources in the Beaver Creek drainage do not appear to be significant, in part because field inventory work in the area has not resulted in the discovery of significant remains. Unanticipated finds, however, could occur during mining, although the likelihood of that happening is not high.

The upper portion of the Beaver Creek watershed is not notably used for subsistence purposes now, nor has it been in the recent past. Subsistence activities such as hunting, fishing, and trapping are limited primarily to the lower portions of the drainage, far from the mined areas, with primary participants being residents of Birch Creek village. It is projected that no significant restriction to subsistence uses would occur in the region because potential impacts to subsistence users and resources would be negligible. This is because water quality and fish resources would not be negatively impacted in areas downstream from mining.

Visual resources could be reduced slightly in the immediate area by additional roads. No mining is expected within the Wild and Scenic River Corridor.

If the number of mines increased from one to five, direct employment would increase by 38 work months per year and annual wages would increase by an estimated $45,000.

Under the Proposed Action, a total of approximately $500,000 in gold would be mined in the Beaver Creek drainage. Annual costs for each of the five mining operations would be $26,000 for water treatment and $10,000 for reclamation. Administration and enforcement of the Surface Mining Program for placer mining would cost the BLM about $9,000 (all values are in 1987 dollars).

Alternative A

This alternative would regulate mining under the BLM Surface Management regulations in 43 CFR 3809. The water quality performance standards would be the current EPA/ADEC standard of 0.2 ml/l of settleable solids and 5 NTU turbidity when measured 500 feet below the mine discharge point. No water quality variances would be incorporated in this alternative. Soils and stream channels would be stabilized, and restoration and revegetation would be allowed to proceed by natural processes.

Consequences

The effects of Alternative A are based on four mines operating continuously for the next ten years. This number is derived from a compliance cost in water quality to the mine operator of 13% more than current costs, and a reduction of the number of miners who might be able to comply with water quality regulations.

Under Alternative A, there should be no significant impacts or topography, mineral resources, and water quality. There would be some short- to long-term adverse increases in suspended sediment and turbidity, and accelerated local erosion, resulting in a possible increase in sediment introduced into the stream system. Water quality would, however, return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. The impact on chemical water quality would not be significant.

The vegetation cover would be destroyed in the areas of the mines and roads, resulting in an unavoidable short-term loss of productivity. Twelve acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 7.5 acres would regrow within 50 years on mining disturbance in creek bottoms. At the end of ten years of mining, 80 acres of new mining disturbance would remain sparsely vegetated. However, it is expected that reclamation at the end of the mine life would be undertaken on all remaining disturbed lands. This acreage would be an irretrievable and irreversible loss of vegetation resources.

Approximately 634 acres of wildlife habitat would be physically altered due to mining and related activities. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 100 acres of moose winter habitat range for a period of 50 years. This long-term cumulative loss of habitat to mining activities in these areas would probably contribute to a minimal reduction in moose population potential. There would be no irreversible or irretrievable commitment of fisheries resources.

There would not be any significant cumulative impacts to cultural or paleontological resources in the Beaver Creek drainage for reasons noted earlier. Subsistence activities and resources in the lower Beaver Creek watershed would not be significantly restricted by mining also for the same reasons given under the Proposed Action.

Certain recreational activities would be enhanced due to the access provided by additional mining roads and the proposed BLM road along Nome Creek. Visual resources would be slightly reduced by the increased road mileage. No mining is expected within the Wild and Scenic River Corridor.

If the total number of mines increased from one to four, direct employment would increase by about 30 work months per year and annual wages would increase by an estimated $34,000.

Under Alternative A, approximately $400,000 in gold would be mined in the Beaver Creek drainage. Annual costs for each of the four mining operations would be $36,500 for water treatment and $1,000 for reclamation. Administration and enforcement of the Surface Mining program for placer mining would cost the BLM about $6,000 (all values are in 1987 dollars).

Alternative B

This alternative would combine the standards from 43 CFR 3809 with standards established to meet the management goals of the various Resource Management Plans for the watershed.

Water quality performance standards would be defined by current EPA/ADEC regulations as 0.2 ml/l settleable solids and 5 NTU turbidity when measured 500 feet below the mine discharge point. Stabilization of soils and creek channels would be constructed so that natural recovery and revegetation processes would be enhanced.

Consequences

The consequences of Alternative B would be similar to Alternative A. There would be slight variations in rates and acreage of revegetation due to different reclamation techniques. If the total number of mines increased from one to four, direct employment would increase by about 30 work months and annual wages would increase by an estimated $34,000.

Annual costs for each of the four mining operations would be $36.500 for water treatment and $2,000 for reclamation. Administrative and enforcement costs to the BLM would be approximately $9,000.

Alternative C

This alternative would focus on various standards proposed or under discussion by EPA and the U.S. Army Corps of Engineers.

The water quality performance standards for this alternative would be zero ml/l settleable solids and zero NTU turbidity above natural conditions. Reclamation standards would emphasize restoration of naturally appearing contours, creek channels, and native vegetation. Mining activities would be conducted to minimize impacts to wetlands and riparian zones.

Consequences

The effects of Alternative C are based on three mines operating continuously for the next ten years. This number is derived from a compliance cost in water quality to the mine operator of 27% more than current costs and a reduction of the number of miners who might be able to comply with water quality regulations.

Alaska placer miners circa 1928 or 1929. Photo courtesy of the Anchorage Museum of History and Art.

Under Alternative C, there would be no significant impacts on topography, mineral resources, and water quality. There would be some short- to long-term adverse increases in suspended sediment and turbidity, and accelerated local erosion, resulting in a possible increase in sediment introduced into the stream system. These impacts would not be significant downstream on Beaver Creek. The impact on chemical water quality would not be significant.

The vegetation cover would be destroyed in the areas of the mines and roads, resulting in an unavoidable short-term loss of productivity. Twenty-one acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional

16.5 acres would regrow within 50 years on mining disturbance in creek bottoms. At the end of ten years of mining, 47 acres of new mining disturbance would still be sparsely vegetated. However, it is expected that reclamation at the end of the mine life would be undertaken on all of the disturbed lands which remain. This acreage would be an irretrievable and irreversible loss on vegetation resources.

Approximately 589 acres of wildlife habitat would be physically altered due to mining and related activities. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 100 acres of moose winter habitat range for a 30 year period. This long-term cumulative loss of habitat to mining activities in these areas would probably contribute to a minimal reduction in moose population potential. There would be no irreversible or irretrievable commitment of fisheries resources.

There would not be any significant cumulative impacts .to cultural or paleontological resources or subsistence activities and resources in the lower Beaver Creek watershed for the same reasons given before for the other alternatives. Visual resources would be slightly reduced by the increased road mileage. No mining is expected within the Wild and Scenic River Corridor.

If the total number of mines increased from one to three, estimated total annual employment would increase by about 22 work months and annual wages would increase by an estimated $25,000.

Under Alternative C, there would be approximately $300,000 of gold recovered in the Beaver Creek drainage. Annual costs for each of the three mining operations would be $47,000 for water treatment and $3,400 for reclamation. Administration and enforcement of the Surface Mining Program for placer mining would cost the BLM and the COE about $8,000 (all values are in 1987 dollars).

Alternative D

This is the "no mining" alternative defined by the District Court in its Memorandum and Order of May 28, 1987, as amended. Under this alternative, no applications for mining claims, under either Plans of Operations or Notices, would be processed or approved by the BLM. Validity examinations would be conducted for each properly recorded federal mining claim, and the owner would be compensated accordingly. Stabilization of surface disturbance occurring since January 1, 1981, would be required on all federal claims, and restoration would be allowed to proceed by natural processes.

This action, however, violates current regulations (43 CFR 2091.1 for accepting applications and 43 CFR 3809.1-6 for processing applications) and would therefore require changes in the regulations for legal implementation.

Consequences

The effects of Alternative D are based on no further placer mining disturbances in the Beaver Creek watershed. There would be no further impacts upon topographic or water resources. Mineral resource development would cease. No soils would be disturbed further, but erosion from unreclaimed areas may introduce sediment into the stream system.

The vegetation cover destroyed on areas previously mined would result in an unavoidable long-term loss of 346 acres of vegetation resources. This acreage would be an irreversible and irretrievable loss of vegetation resources. Approximately 300 to 320 acres of moose winter range would remain lost because of past physical alterations. There would be no impacts to fisheries resources.

There would be no significant cumulative impacts to subsistence or cultural and paleontological resources due to implementation of this alternative. Visual resources would remain the same as they are today.

If the only mine in the watershed were to shut down, annual employment would decrease by an estimated two work months and annual wages would decrease by almost $3,000.

Under the no-mining alternative, the federal government would be required to provide compensation for closing down valid federal mining claims. The present net value of the claims is roughly estimated to be between $1.6 million and $44 million. Validity examinations on all properly recorded federal mining claims would cost the BLM approximately $262,000 to complete (all values in 1987 dollars).

After the public comment period following the release of this document, a management decision will be made which incorporates and addresses the comments. This management decision will be included in the Final EIS and Record of Decision.

BEAVER CREEK

Draft
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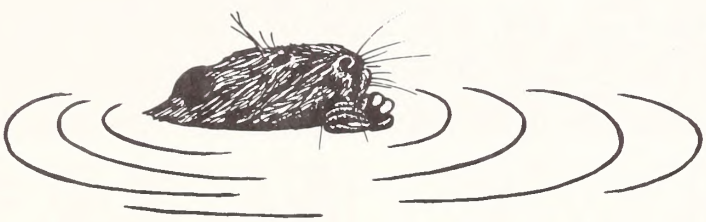
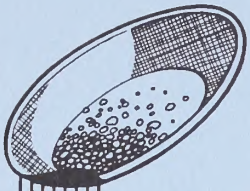
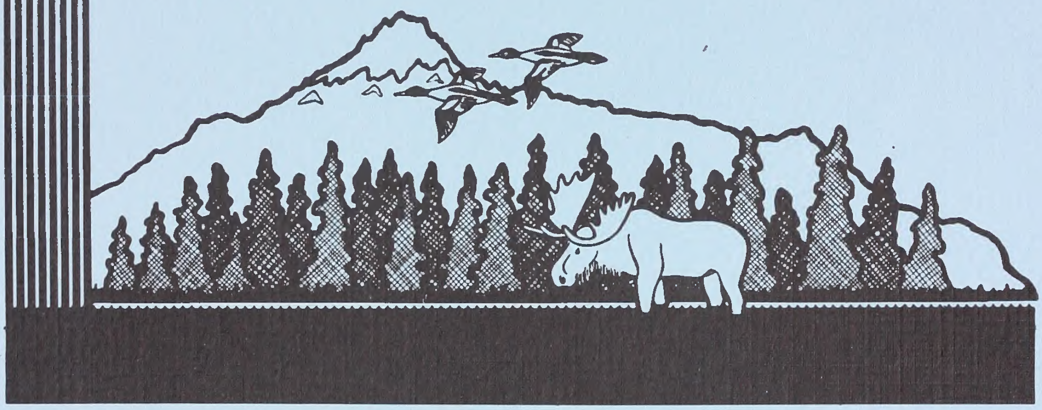
ENVIRONMENTAL IMPACT STATEMENT





Chapter I
Purpose and Need for Action

CHAPTER MAPS



BEAVER CREEK

1.1 Purpose and Need

There are two primary objectives of this Environmental Impact Statement (EIS). The first is to identify and consider performance standards under which placer mining may be conducted on Federal lands in the area, including methods and procedures which will be utilized "...when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character and taking into consideration the effects of operations on other resources and land uses, including those resources and (43 CFR 3809.0-5(k)) uses outside the area of operations." Figure 1-1 identifies the directives from the various court orders and injunctions pertaining to this placer mining EIS, and the products of the EIS process which respond to these directives. The second objective is to comply with the Court Orders (described in Section 1.2) to conduct evaluations and prepare the associated documents under the National Environmental Policy Act (NEPA) and the Alaska National Interest Lands Conservation Act (ANILCA) subsistence requirements (ANILCA Section 810).

COURT DIRECTIVES	EIS PRODUCTS
1. Identify the degree of environmental harm (and benefits-added by team).	• Assess cumulative impacts • Consultant studies - e.g. water, fish, and wildlife • Chapter 4
2. Identify the extent that environmental harm can be prevented.	• Identification of alternative actions identified in Chapter 2 and evaluated in Chapter 4 • Record of decision • Management under 3809 program model • EA consultant contract
3. Identify the expense of preventing some or all of the harm.	• Economic study • Chapters 2 and 4 and the Appendix
4. Identify the economic and social benefits and costs of the matter being evaluated.	• Economic study • Subsistance evaluation • Chapter 4
5. Assess cumulative environmental impacts of water quality and subsistance.	• Consultant studies including water quality, fish, and aquatic habitats, visual study and subsistence • Chapters 2 and 4

Figure 1-1. Directives of the District Court Memorandum and the products of the EIS in response.

1.2 Introduction

A United States District Court for the District of Alaska Memorandum and Order (A86-083 Civil) filed on May 14, 1987, instructed the Bureau of Land Management (BLM) to cease approving Plans of Operations for Federal placer mines in the Birch Creek watershed after October 1, 1987, pending completion of an adequate cumulative effect Environmental Impact Statement (EIS). On May 28, 1987, injunctions followed which covered the watersheds of Birch Creek, Beaver Creek, the Fortymile River, and Minto Flats (which is comprised of the Chatanika River, Tolovana River, and Goldstream Creek). On July 22, 1987, the Court issued an amendment to the May 14 and May 28 orders, extending the date of cessation to November 15, 1987. The term "lawsuit" hereafter refers to the above orders and injunctions.

At issue are the impacts of multiple mining operations on the environment, including the cumulative impacts, especially on water quality, visual, and subsistence resources. Initially, under these injunctions, only Plans of Operation on Federal claims were affected. Mines operating under Notices (those disturbing five acres or less) were not affected; however, the impacts of such mines are included in this EIS. A subsequent court order of November 6, 1987, requires Plans of Operations for all operations on claims with valid existing rights, regardless of size, on land withdrawn from mineral entry, with a one-year exception for mines which operated in 1987.

An EIS describes, for public review and consideration, a proposed Federal action that could significantly affect the human environment. In this case, the Court felt that cumulative environmental impacts for all placer mining, on State and private, as well as Federal lands, should be addressed, rather than the current practice of completing an environmental review of individual mining Plans of Operation.

This EIS is based on the National Environmental Policy Act of 1969 (NEPA) and Council on Environmental Quality (CEQ) regulations. Per CEQ regulations, the BLM used an interdisciplinary team in a systematic approach to analyze the affected area, to estimate the environmental effects, and to write this statement. Where data gaps appeared, the BLM used contract services to collect and analyze additional information. The contractors included the State of Alaska and private consulting firms. A list of the consultant contracts is included in Appendix A-1. A list of the EIS preparers is included in Chapter Five.

This EIS is in itself not a decision document, to change the land use classifications established in prior planning documents. However, if the decision is made in the Record of Decision (ROD) to modify existing land use classifications, then plan amendments would be developed. The ROD will, however, define the overarching terms and condition under which placer mining can be conducted.

The regulations in 43 CFR 3809.2-1 require preparation of at least an Environmental Assessment (EA) for the approval of a placer mine Plan of Operations. These EA's will tier off this EIS. Tiering is an interrelationship in which reference to a more general NEPA document such as this EIS can be made in a more specific one, thus avoiding duplication. No Plans of Operations will be approved based solely on this EIS. Also, a more specific environmental assessment will not change or modify decisions resulting from this analysis, but will, on a case-by-case basis, identify more detailed and site specific actions and mitigation measures to reduce environmental impacts. Tiering can also be used by other agencies, such as the U.S. Army Corps of Engineers (COE). The COE may use this EIS as a generalized document for reviewing work in the watershed under the Alaska COE regulatory program relative to Section 404 of the Clean Water Act.

During 1987, five Plans of Operation were filed with BLM for mining in the Beaver Creek drainage. However, additional Plans of Operation on the Federal mining estate are anticipated within the next ten years. While environmental analysis and appropriate documentation of each Plan of Operation will occur, this document analyzes the cumulative impacts of anticipated future mining activities.

1.3 Background

BLM manages mining under the General Mining Law of 1872, 30 U.S.C. 22 et seq, as amended, and the Federal Land Policy and Management Act (FLPMA) of 1976, 43 U.S.C. 1701, et seq. The 1872 Mining Law provides for the exploration, development, production, and purchase of mineral resources on public lands, as well as the implied or statutory right of access to mining claims.

FLPMA provides that, in managing the public lands, the Secretary of Interior shall take any action required to prevent "unnecessary and undue" degradation of the land. This FLPMA provision is implemented by the Code of Federal Regulations (CFR) section covering surface management (43 CFR 3809). Additionally, specific terms and conditions for placer mining and other land uses are defined in The White Mountains National Recreation Area Resource Management Plan (RMP), and under The Beaver Creek Wild River Management Plan.

The crux of the present concern is the nature, degree, and extent of the cumulative impacts of mining and related activities on the physical, biological, and socio-economic environment in the four watersheds the Court identified. In particular, the cumulative effects and impacts of placer mining need to be clearly explained and fully analyzed. The CEQ regulations at 40 CFR 1508.7 define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time."

Because of uncertainty surrounding the number of mines that may operate in the reasonably foreseeable future, a methodology was established by forecasting the price of gold in the future and the number of mines that BLM might expect to operate in the next ten years. Additionally although it is believed to be highly unlikely, a worst case scenario was developed and analyzed.

This EIS will focus on the portions of the Beaver Creek watershed (Status Map, Chapter One) within the National Recreation Area that drain into the river corridor.

1.4 Geographic Setting and Land Status

The Beaver Creek watershed is located approximately 50 air miles north of Fairbanks and encompasses nearly 1.2 million acres of land. This EIS will focus on the portion of the Beaver Creek watershed within the National Recreation Area. The headwaters and most of the drainage lies within the White Mountain National Recreation Area (WMNRA). The Area Map in this chapter shows major features, the Status Map in this chapter depicts the land status, and the Tributaries and Main Physical

Features Map (the foldout in this chapter) shows the area in greater detail. The majority of the watershed lies within the Yukon-Tanana Uplands physiographic province, which consists of rounded hills around a high central area of rugged mountains (Selkregg 1974). The province is bounded on the north by the Yukon River and on the south by the Tanana River.

The highest point in the study area is Mount Prindle (5,286 feet above sea level), located on the eastern border of the drainage. Other peaks of note are Rocky Mountain, also known as Lime Peak (5,082 feet), to the north of Mount Prindle; Cache Mountain (4,772 feet), near the center of the study area; and Wickersham Dome (3,207 feet), on the southwest corner of the WMNRA. The lowest point in the study area, approximately 600 feet, is in the Yukon Flats on the northern boundary.

Beaver Creek itself is formed at the confluence of Champion and Bear Creeks, which flow from Mount Prindle in the southeast portion of the study area. Other tributaries include Nome, Quartz, Colorado, Trail, Wickersham, Fossil, O'Brien, and Victoria Creeks. The approximate length of Beaver Creek is 303 miles from its headwaters on Mount Prindle to its mouth at the Yukon River near the village of Beaver. (The uppermost 127 miles of Beaver Creek are in the study area).

The climate of the Beaver Creek area is fairly typical of Interior Alaska with cold, dry winters and warm, but short, summers. The mean January temperature is -10° to -20° F and the mean July temperature is about 70° F, although temperatures can dip as low as -70° F some winters and reach as high as 95° F some summers. Precipitation averages 11 inches per year, including 70 inches of snow which falls during the autumn, winter, and spring.

The lands in the Beaver Creek watershed are predominantly managed by BLM as the White Mountains National Recreation area. The northeast portion of the watershed is located within the Yukon Flats National Wildlife Refuge, which is managed by the U.S. Fish and Wildlife Service.

The BLM lands are managed in accordance with the provisions of the Wild River Management Plan for Beaver Creek, a Wild River of the National Wild and Scenic River System, and by the RMP for the White Mountains National Recreation Area.

1.5 Scoping and Major Issues

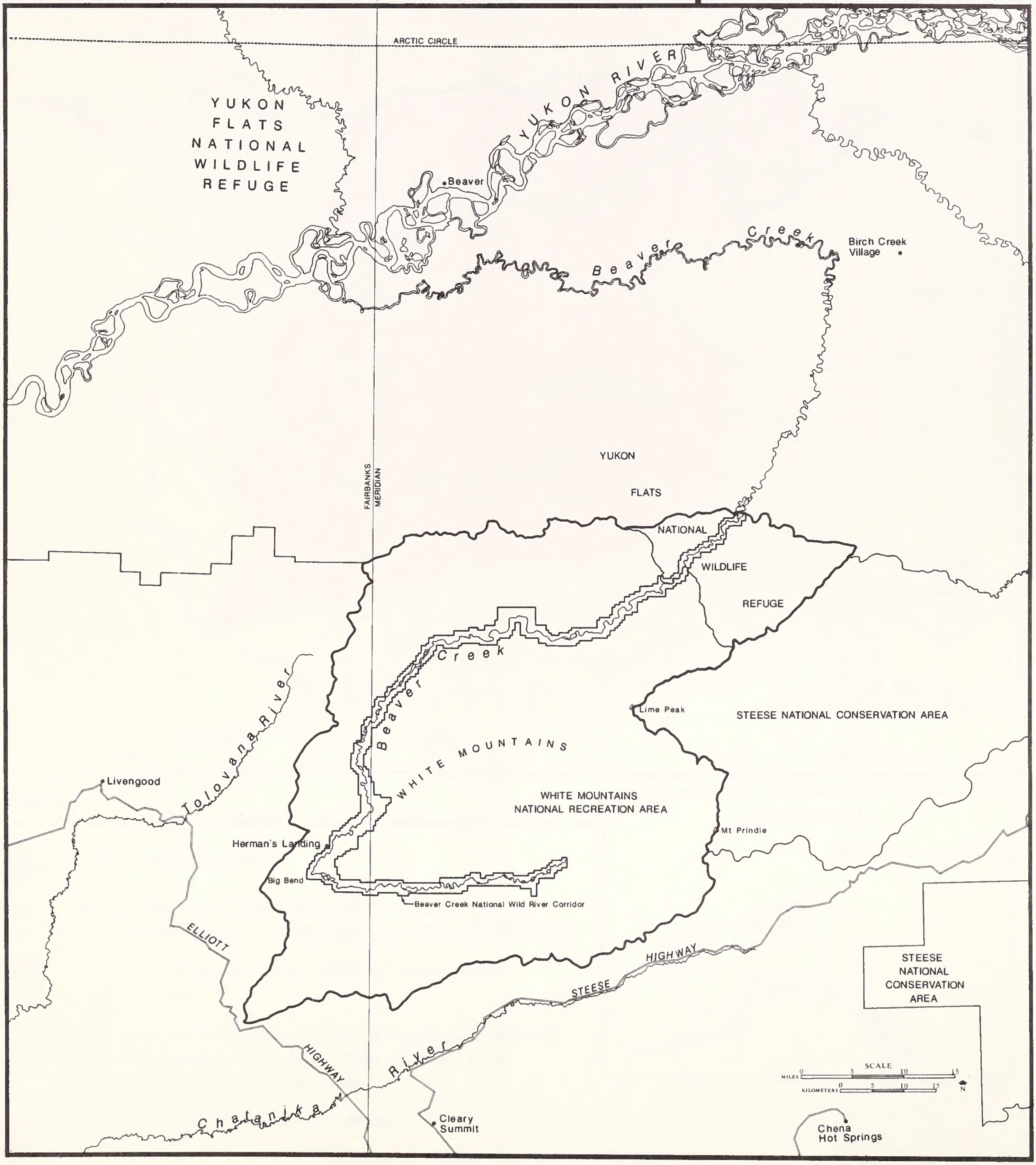
As required by NEPA regulations, BLM used an open process to gather public input. Initially, this was accomplished by conducting a series of public meetings in locations throughout the affected area in September and October 1987.

The Notice of Intent to prepare the environmental impact statements was published in the Federal Register on August 18, 1987, and in local newspapers in late August 1987.

Scoping meetings were held between September 9. and October 6, 1987, at Livengood, Minto, Central, Chicken, Birch Creek Village, Fairbanks, and Anchorage, Alaska. At the same time, more

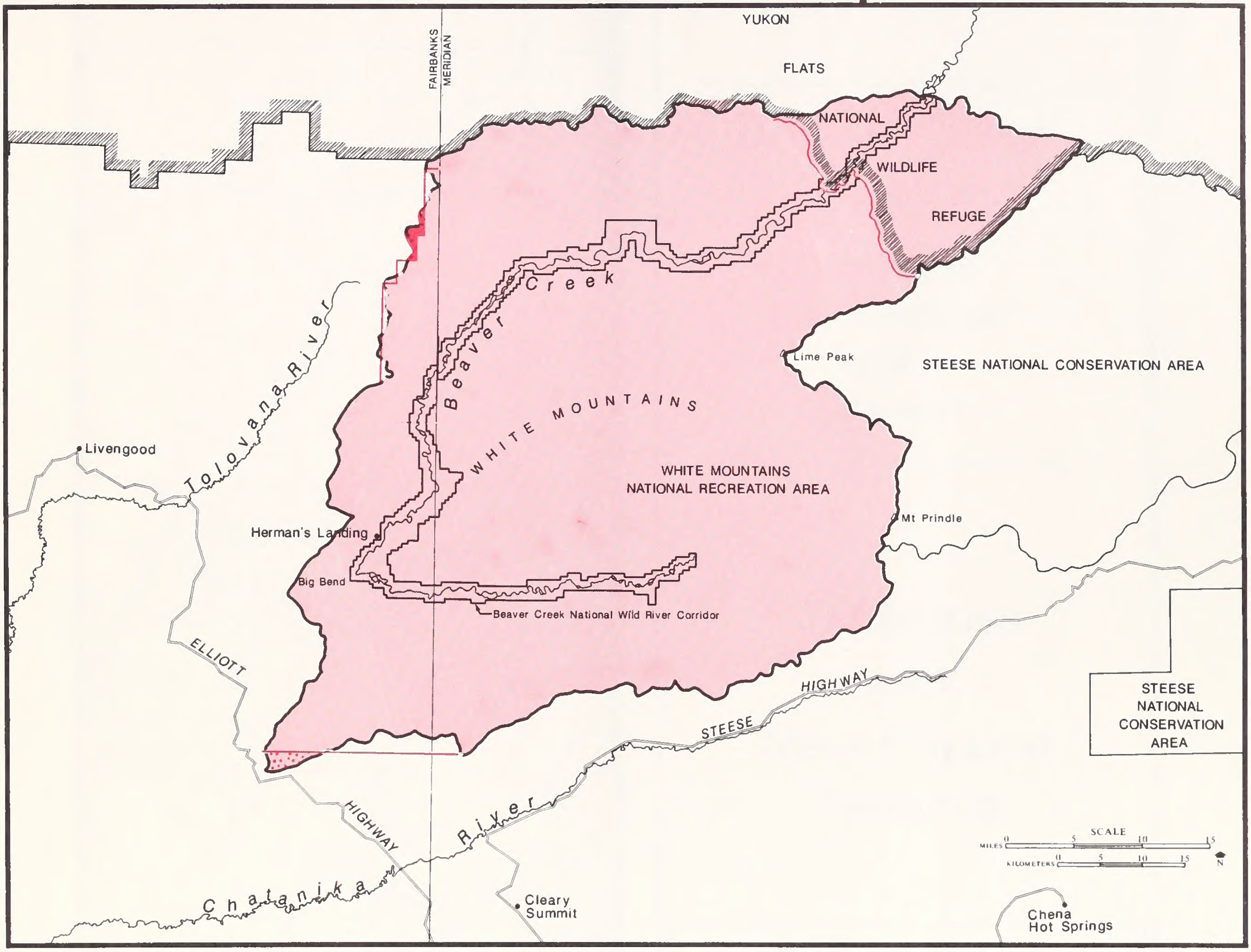
Beaver Creek
DRAFT
Cumulative Environmental Impact Statement

Area Map



Beaver Creek DRAFT Cumulative Environmental Impact Statement

Status



Legend

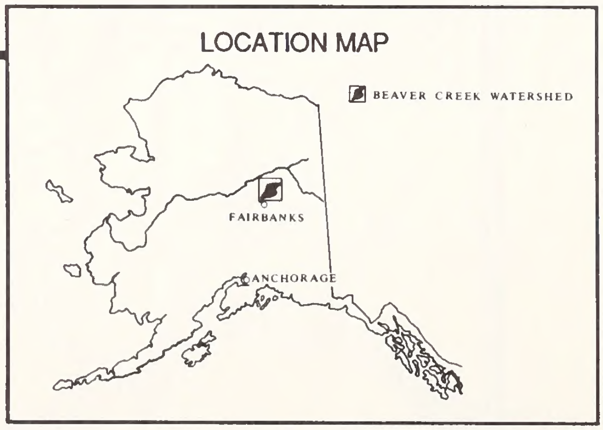
Beaver Creek watershed

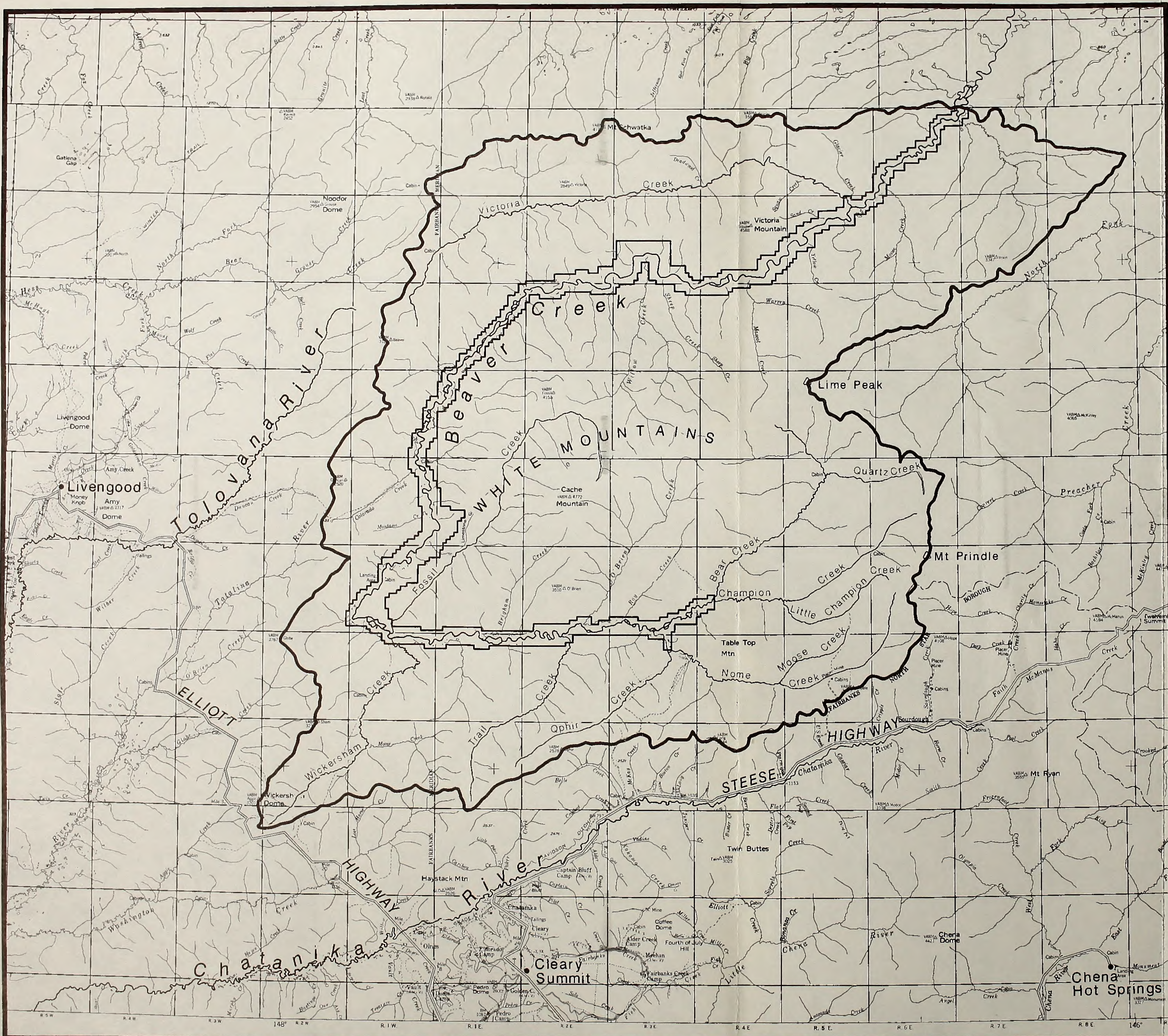
Topfiled State selected lands-within watershed only (This area not open to State selection under PLO 5150)

Tentatively approved State selected lands-within watershed only

Administrative boundary for White Mountain National Recreation Area, shown only when different from Beaver Creek watershed boundary

Yukon Flats National Wildlife Refuge

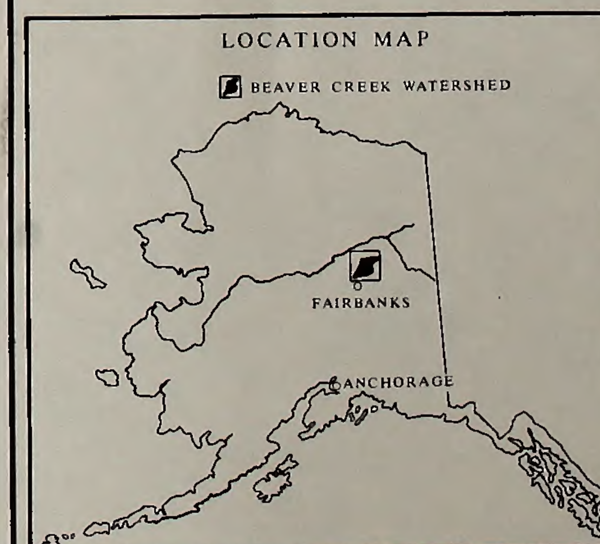




Beaver Creek DRAFT

Cumulative Environmental Impact Statement

Tributaries and Main Physical Features



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than 450 notices of the public meetings were sent out to miners, environmentalists, native groups, and other interested publics.

The BLM also invited participation from other government groups, private organizations, the placer mining industry, and concerned individuals. At the scoping meetings a description of the EIS process and the proposed activity was provided by the appropriate BLM District Managers. The meetings were then opened to members of the public to voice their concerns and to ask any questions about the issues. All comments were recorded on tape. Members of the public wishing to submit written comments on scoping and issues were requested to do so before October 20, 1987. All written and oral presentations were considered and incorporated into a list of significant issues.

Significant issues include:

- **What are the impacts of placer mining operations on water quality?**
- **How are water quality standards regulated and enforced and who performs this function?**
- **What are the impacts of placer mining on terrestrial habitats?**
- **What are the impacts of placer mining on subsistence?**
- **Have reclamation practices and improved management under the 43 CFR 3809 regulations occurred since 1981?**
- **What are the impacts of other agency laws and regulations on the placer mining industry?**

Specific coordination meetings were held with various State of Alaska agencies such as the Department of Natural Resources (ADNR), Department of Environmental Conservation (ADEC), Department of Fish and Game (ADF&G), and the Office of Management and Budget, Office of the Governor. Meetings were also held with the Federal Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (COE), the National Park Service (NPS), and the U.S. Fish and Wildlife Service (USFWS).

By December 1, 1987, more than 32 written responses were received. Chapter Five, Consultation and Coordination, identifies the contacts, participation, and coordination more fully.

1.6 Relationship to BLM Policies, Plans and Programs

Management on BLM lands is guided by existing laws, established planning documents, and programmatic and regulatory guidelines.

For the Beaver Creek EIS this includes:

- The Beaver Creek River Management Plan - 1983
- The White Mountains National Recreation Areas (WMNRA) Resource Management Plan and Environmental Impact Statement - 1986
- Water Rights Assessment of Beaver Creek National Wild River, Alaska - 1987

- Surface Management of Public Lands Under the U.S. Mining Laws, 43 CFR 3809 - 1980
- Surface Management - BLM Alaska State Handbook Supplement - 1986
- Alaska National Interest Lands Conservation Act (ANILCA), P.L. 96-487 (94 Stat. 237), Dec. 2, 1980
- Federal Land Policy and Management Act (FLPMA), 43 U.S.C. 1707, et seq. - 1976
- Other regulations found in the Code of Federal Regulations.

The above plans, laws, and policies identify the general standards under which placer mining can take place in the Beaver Creek drainage. Among other considerations, ANILCA closed the area for further new placer claim staking under the 1872 Mining Law, while recognizing valid existing rights. Further, leasing for placer mining is also precluded. The Wild and Scenic River Corridor is closed to all new mineral entry or leasing. BLM is developing a program under the framework of the White Mountains National Recreation Area RMP for the leasing of non-placer mineral resources elsewhere within the National Recreation Area.

The overall management strategy for the White Mountains National Recreation Area is to provide for a variety of public outdoor recreation opportunities emphasizing existing primitive and semi- primitive values, to protect and/or improve the water quality of Beaver Creek, and to provide for multiple use of other resource values which are compatible with the recreation goals. The actions proposed by this EIS are compatible with the RMP goals. Where necessary, specific stipulations may be attached to mining Plans of Operations to meet the goals.

Congress, in FLPMA, 43 USC 1732(b), provided that "in managing the public lands the Secretary shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands."

The regulations in 43 CFR 3809.0-5(k) define "undue or unnecessary degradation" as "surface disturbance greater than what would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of a similar character...." Failure to initiate and complete reasonable reclamation may, and failure to comply with applicable environmental statutes will, constitute unnecessary or undue degradation. The BLM has recognized this by making compliance with these laws a specific requirement for any mining operation (43 CFR 3809.2-2).

The principal Federal regulatory device to ensure water quality is the Clean Water Act, 33 USC 1251, et seq. However, water quality and its associated environmental problems are extensively regulated by other statutes (Section 1.8) which BLM does not administer.

Water pollution control is specifically regulated and permitted on the federal level by the EPA and the COE (33 USC 1311, 1342, 1344), and by the State of Alaska (A.S. 46.030.50). Water quality standards are established and certified by the State (33 USC 1313, 1341). Other agency permits are summarized in Section 1.7.

BLM would continue to review and authorize individual Plans of Operation for placer mining under 43 CFR 3809 and the Alaska 3809 Handbook, as well as other applicable laws and regulations. BLM land use plan amendments may be needed if it appears that any land use classification needs to be changed.

Figure 1.2 illustrates some of the different guidelines and responsibilities of BLM, other federal agencies, and the State of Alaska in managing placer mining on the public lands. The following section more fully describes the roles of other agencies.

Agency	Legal Guidelines & Plans for Management	Responsibility of Agency	Enforcement Responsibility of Agency
BLM	Resource Management Plan 43 CFR 3809 regulations	Surface management	Due and neccessary mining action
EPA	Section 401 of Clean Water Act	Water quality	Water standards
COE	Section 404 of Clean Water Act	Water quality Wetlands	Dredge and fill standards
State of Alaska	Clean Water Act State regulations	Water quality Anadromous fish	State standards

Figure 1-2. General responsibilities of applicable agencies concerning placer mining. This table applies to State, Federal and private mines. BLM evaluates the cumulative impacts of all mines, but can only manage within its jurisidiction.

1.7 Relationship to Non-BLM Policies, Plans and Programs

Approval of Plans of Operation is contingent on the operator meeting all other applicable State and federal laws and regulations. These include appropriate water quality standards promulgated by EPA and Alaska DEC.

> "Where the BLM has evidence of suspected noncompliance with the State or Federal water quality laws and regulations, the appropriate office of the EPA and/or DEC will be notified. The EPA and/or DEC have the responsibility for enforcement of the Federal Water Pollution Control Act and applicable regulations" (DOI 1986c).

This EIS evaluates standards of various agencies in the alternatives. While BLM can not implement or evaluate other agency standards, it can assess the cumulative impacts of these standards. In the case of the COE and EPA the standards are under discussion and this evaluation is not meant to suggest these are the final agency recommendations.

Additionally, the BLM will coordinate with other agency plans. Plans of agencies with adjacent land holdings include:

- Alaska Interagency Fire Management Plan Upper Yukon, Fortymile River, BLM - 1984

- The Tanana Basin Area Plan for State Lands. State of Alaska - June 1985
- Yukon Flats National Wildlife Refuge Final Comprehensive Plan - October 1987
- Fairbanks Northstar Borough Comprehensive Land Use Plan - 1988

After review of these plans, the BLM finds no inconsistencies between its management direction and the other plan recommendations.

1.8 Applicable Laws and Regulations

BLM must comply with a multitude of other laws. regulations. and Federal Executive Orders such as the Alaska National Interest Lands Conservation Act, the Wild and Scenic Rivers Act, 1968; Federal Water Quality Requirements (Clean Water Act, Federal Water Pollution Control Act, Safe Drinking Water Act), the Coastal Zone Management Act of 1972, Federal air quality requirements (Clean Air Act), Federal solid waste requirements (Solid Waste in Disposal Act, Resource Recovery Act), endangered and threatened wildlife and plants (Endangered Species Act), Archaeological Resources Protection Act of 1979, preservation of antiquities (Antiquities Act), historic and prehistoric resources (National Historic Preservation Act, Executive Order 11593), Areas of Critical Environmental Concern [FLPMA Section 202 (c) 3], Flood Plains (Executive Order 11988 and FLPMA), Wetlands (E.O. 11990 and 11988), Prime Farm Land, wilderness, and the National Environmental Policy Act. Additionally, placer miners may have to obtain numerous permits and approvals from Federal and State agencies in order to mine (Appendix A-2).

1.9 Cooperating Agency

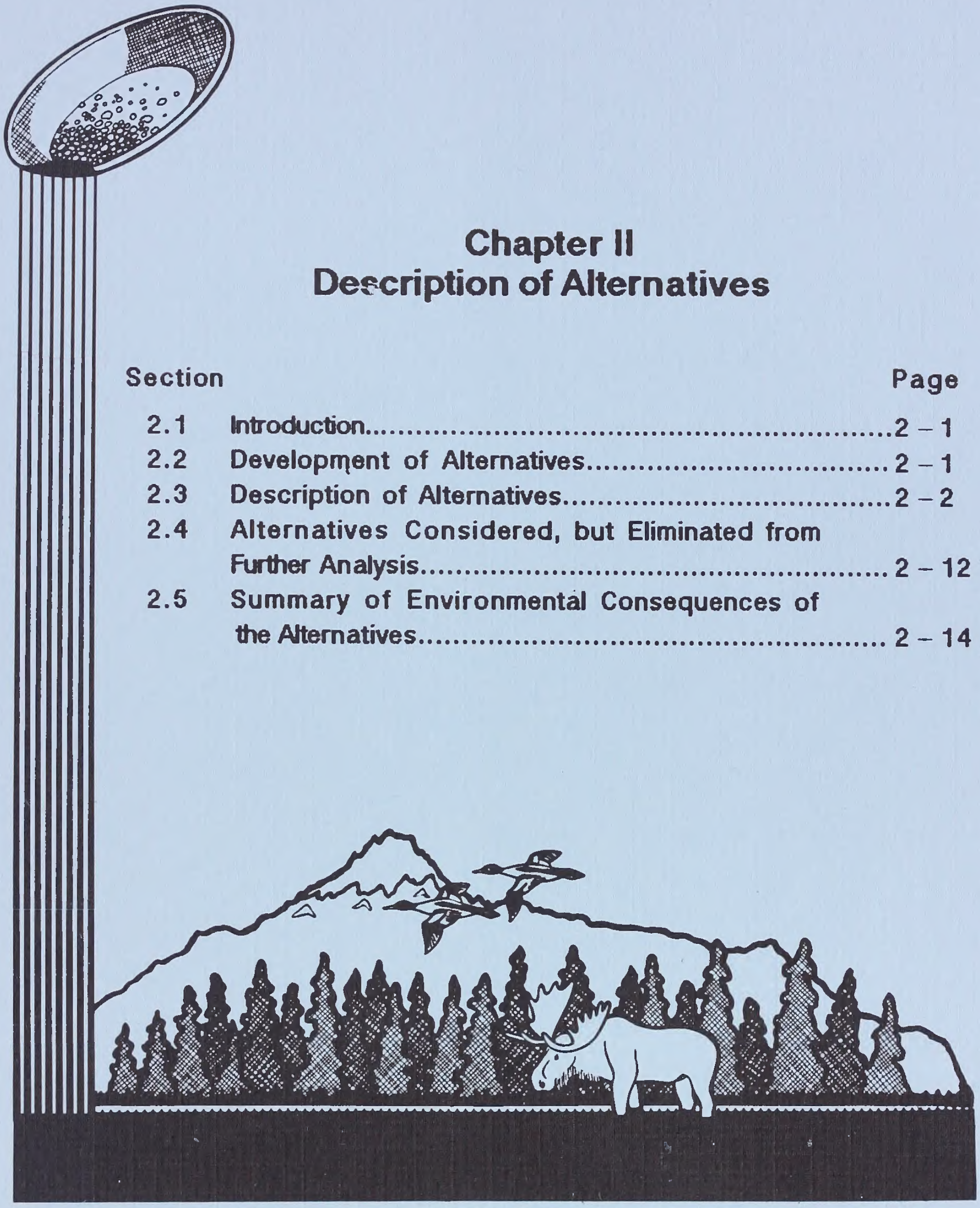
The U.S. Army Corps of Engineers is a cooperating agency on this EIS. To the extent possible, this EIS incorporated NEPA documentation required by the COE for their permitting activities, thus reducing duplication of effort by both agencies.

Numerous activities associated with placer mining require Department of the Army authorization pursuant to Section 404 of the Clean Water Act. Activities requiring authorization include, but are not limited to, the following: placement of dredged and/or fill material into waters of the United States including wetlands, stockpiling overburden and placer-bearing deposits, construction of stream diversions, construction of roads and foundation pads, reclamation, and similar works.

As a cooperating agency, the COE assisted BLM in scoping processes and in reviewing the development of this draft Environmental Impact Statement. The review and comments pertain to COE areas of jurisdiction and authority, i.e., flood control, navigation, and regulatory functions. Members of the COE staff have contributed consultation and document review throughout the preparation of the EISs to ensure that the procedural and statutory requirements of the COE are satisfied.

Chapter II
Description of Alternatives

Section | Page



BEAVER CREEK

2.1 Introduction

The National Environmental Policy Act (NEPA) and the corresponding Council on Environmental Quality (CEQ) regulations require development of alternatives for a proposed action. This proposed action and the alternatives to it are the base for the comparative analysis of environmental consequences of an action. The purpose of the alternatives is to provide a range of management options for the final decision about the proposed action. See Figure 2-7 at the end of this chapter for a comparison of pre-1981 impacts with those of the 1987 mining season, and projected 1998 impacts under the proposed action and the alternatives.

2.2 Development of the Alternatives

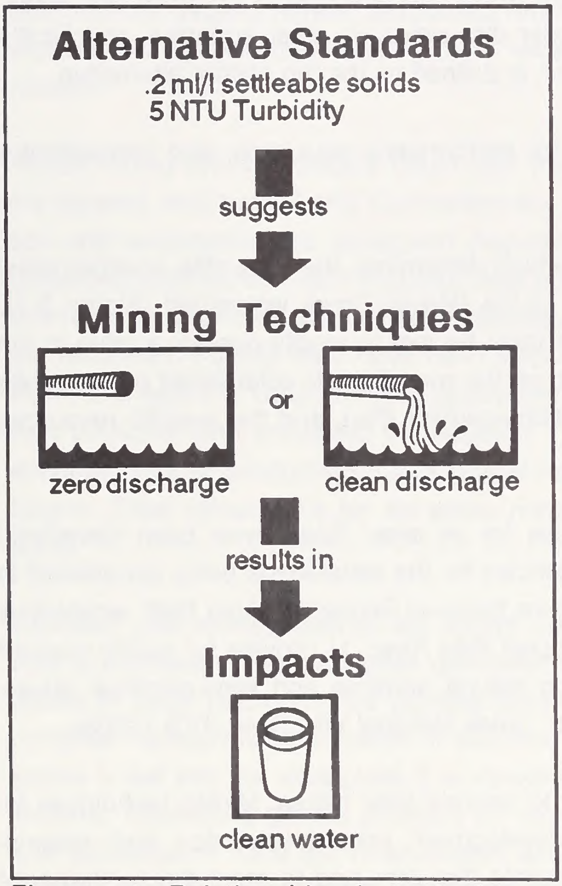


Figure 2-1. Relationship of standards, mining techniques, and impacts.

The alternatives have been designed to address the two major objectives of the study (Section 1.1): 1) consider performance standards under which placer mining may be conducted on federal lands in the area, and 2) comply with court orders to conduct a cumulative impact environmental analysis for the Beaver Creek watershed and prepare the corresponding documents.

Additionally, issues and concerns raised by the public and other agencies during the scoping process were carefully considered and incorporated into the final alternatives where appropriate. Public comments from scoping are summarized in Chapter Five.

An initial set of alternatives was published in the Notice of Intent for the preparation of this and the three other placer mining EISs (DOI 1987e). These alternatives provided a basis for discussion with interested public groups, individuals, and other agencies during the scoping period. After scoping by interested public groups and other agencies, the alternatives were finalized (Section 2.3). These alternatives are the framework for the analysis of the environmental effects and the cumulative impacts of these effects. Action scenarios were developed for the standards outlined in each alternative. These are mining techniques that could be used to meet the performance standards. Environmental impacts were analyzed from these mining techniques (Figure 2-1).

2.3 Description of the Alternatives

Alternatives for this study are based on a range of performance standards. For BLM, the standards are based on the jurisdiction BLM has within the 43 CFR 3809 regulations and the relevant RMP, River Plan, other plans, and mandates of the court injunctions. Other standards used to evaluate cumulative impacts lie within the regulatory and enforcement authority of other State and federal agencies.

The 43 CFR 3809 regulations are general, and allow some interpretation in two main areas: 1) the application of the definition of undue and unnecessary degradation to the environment and specific operations and 2) reclamation of surface disturbance. For simplicity BLM is defining "undue and unnecessary" to mean customary and prudent placer mining operations.

Performance standards are used to form the spectrum of the EIS alternatives for these two areas. One alternative addresses performance standards under discussion by other agencies, specifically EPA and COE. Alternative D, the "no mining" alternative, is defined as the "no action" alternative.

As used in this document, these are the definitions for performance standards, and management goals and mining techniques:

A **performance standard** is a measurable quantity which determines the allowable environmental impacts resulting from mining and related activities in the Beaver Creek watershed (Figure 2-1). These standards set maximum or minimum limits that must be met to legally operate a mine in the watershed. The standards for the watershed are based on the overall goals established by the White Mountains National Recreation Area RMP, the River Management Plan, and the specific resources present.

A **management goal** is a broad overarching purpose for an area. Goals have been developed through the planning processes of BLM and other agencies for the watersheds being considered in this and other studies. For example, the White Mountains National Recreation Area RMP establishes two goals for management of Beaver Creek as a National Wild River: 1) provide for public outdoor recreational opportunities that emphasize the existing natural primitive and semi-primitive values, and 2) protect and maintain the water quality of Beaver Creek National Wild River (DOI 1986a).

Mining techniques are the methods miners employ to operate their mines. Mining techniques include activities associated with exploration, access, development, mineral extraction, and reclamation. Techniques used for mining and mitigation measures that are used to meet the performance standards are often site specific and are defined in the appropriate Environmental Assessment (EA) for a Plan of Operation.

Action Scenario for Mining and Reclamation Activities

There are several mining methods available that could be used to achieve the identified performance standards. One such scenario is presented here as an example. Other methods are presented in varying detail in numerous publications, such as "Best Management Practices for Placer Mining" (ADF&G 1986b) and "Placer Mining Demonstration Grant Project Final Report" (ADEC 1987c). These other mining methods and their associated surface disturbances are similar to the mining method and surface disturbance descriptions that follow.

After mining equipment has been transported to the site, a camp is set up for the duration of the season. The mining season generally lasts from June until the ground freezes in late September or October. The camp usually accommodates two to five miners with support facilities for maintenance and storage. After the camp is established, the associated physical mining infrastructure is constructed with a bulldozer or other earth moving equipment. This infrastructure usually consists of two or more settling ponds, associated diversion dikes and spillways, drainage ditches to prevent erosion and collect run-off and ground water, and working areas for the washplant, pumps, and motors.

Actual mining activities usually begin after the infrastructure has been constructed. Trees and brush are cleared, and topsoil and overburden are stripped from the area to be mined. The stripped topsoil and overburden are stockpiled (separately if possible), usually near the mine cut, and are protected from erosion and flooding. With adequate planning, these stockpiles may be placed in a manner that promotes efficient site reclamation through reduced material handling and shorter hauling distances. Topsoil may have been stripped during the preceding mining season to allow permafrost in layers of overburden or gold-bearing gravel to thaw. If not, frozen overburden and topsoil may be ripped and stockpiled by bulldozer. The extent of the area to be stripped depends upon the expected rate of production. On a typical mine, one acre is usually stripped before actual mining begins. Total disturbance for an entire mine at any one time averages between three and eight acres.

Exposed gold-bearing gravels are mined using a bulldozer that pushes and stockpiles the gravel near a washplant. The stockpiled gold-bearing gravel is then fed into the washplant by a front-end loader or large backhoe. This practice promotes equipment efficiency by allowing the bulldozer to continue mining while the loader or backhoe feeds the washplant at a steady rate. When the mined gravel is fed into the washplant, it is classified by particle size using various stationary or vibrating screens. Classifying gravels provides for more efficient gold recovery, reduced water consumption, and facilitation of mine site rehabilitation, and is practiced by most operators. The oversize material, usually larger than two inches, slides out of the washplant into a pile where it can be moved by a front-end loader or bulldozer. The undersize material and gold-bearing gravel is mixed with water and flows through the sluicebox where the gold and heavy black sands are concentrated. Tailings are gravel, sand, and other materials accumulated at the end of the sluicebox. Tailings are routinely moved away from the sluicebox by a loader or bulldozer.

The water that carries the gold-bearing gravel through the sluicebox becomes sediment-laden and turbid. This "dirty" process water flows from the end of the sluicebox over a pile of fresh tailings into a series of settling ponds. These ponds are designed to hold the "dirty" water long enough for the fine sediments to settle. The physical design of the ponds depends upon the amount of water flowing through the system, the sediment characteristics of the gravels being worked, and the physical characteristics of the site. Most mines use a series of small settling ponds to permit more flexible water management. Small ponds are usually easier to build, repair, clean, replace, bypass, and rehabilitate than larger ponds. The use of "pre-settling ponds" is encouraged. A pre-settling pond is located in the tail race between the sluice and the first settling pond. Sands and other heavy settleable solids are collected here where they are easy to wash.

Settling ponds also hold sediment-laden surface runoff water from excavated or stripped areas that would otherwise pollute "clean" surface and runoff water. Another water management practice is to divert clean runoff or ground water around the operation and into an adjacent stream or bypass. This minimizes the amount of clean water that flows into the settling ponds. These water management practices are commonly practiced by most operators. If these practices are not used by the operator's own initiative, they may be suggested as a mitigating measure to improve mine effluent treatment efficiency. These are mitigating measures which ADEC, EPA, and ADF&G apply to priority streams in order to attain State water quality standards.

Water used in the sluicing process is pumped from the nearby stream through the washplant and into the settling ponds. Water intake from the stream is suspended when the ponds contain enough water to support continued sluicing operations by recycling pond water to the washplant. In some cases, groundwater seepage into the settling ponds may be sufficient to eliminate the need for adding stream water to the system.

A mitigating measure placed on the Nome Creek mining operation was that zero discharge of mine effluent into Nome Creek, a tributary of Beaver Creek, was required to protect its water quality and resident fish. The term zero discharge, or no discharge, implies that no mine effluent will be discharged into the adjacent stream either by a direct discharge or through seepage. However, most so-called zero discharge systems do have occasional discharges, usually due to seepage through settling pond dikes. This seepage almost always meets the settleable solids effluent standards, and in most cases the seepage discharge is of better quality with less settleable solids and lower turbidity than the water discharged directly from a settling pond. The practice of zero discharge and the recycling of mine water contributes to compliance with State water quality standards and Federal effluent limitations.

For the typical placer mine on Federal claims, reclamation begins upon completion of the final mine cut or at the end of the mining season. If mining has been completed at the location, tailings are moved into the mine cut and the site is leveled or reshaped. The leveled tailings are then covered with available overburden and topsoil. These actions are usually completed with a bulldozer. Settling ponds may be reclaimed by stopping water inflow and allowing the ponds to drain. Tailings are then pushed over the ponds to contain the captured settleable solids and armor the basins from future erosion. Overburden and topsoil, if available, are spread over the armored ponds as well. The reclaimed site is allowed to revegetate naturally.

If mining has not been completed at the location, the mine site is stabilized in preparation for the next mining season. Settling ponds that will be used in future operations are isolated from additional water inflow, while ponds of no further use are reclaimed as discussed above. Berms around ponds, stream bypasses, and the active mine site are reinforced and equipment is moved to high ground.

2.3.1 Actions Common to all Alternatives

Existing Laws and Regulations

Some management actions which are applied to mining under all alternatives are those established by existing laws, regulations, or RMP decisions (Sections 1.6 & 1.8). BLM provides overall management of placer mining on public lands under the 43 CFR 3809 surface management regulations and other agencies manage water quality, fish and game populations, and other resources under their corresponding laws and regulations.

Inspections and Bonding

BLM compliance officers conduct inspections of placer mining operations on Federal claims. Currently, all operations are inspected at least once each year, and most are inspected at least once during the mining phase of the operation and once at the end of the season after site reclamation has been completed. The primary concern of the compliance inspector is that the miner is operating appropriately and that reclamation work is acceptable. During each compliance visit, an inspection record is completed that describes the inspector's observations of the operation. If any problems or violations exist at the mine site, the compliance inspector discusses them with the operator, sets a time frame for correction of the situation, and issues a notice of noncompliance, if necessary. The mine site is revisited to ensure that corrective actions have taken place.

Bonding of placer mine operators on federal claims is a management tool which is authorized by the surface management regulations in 43 CFR 3809.1-9. Bonding can ensure that a mine site is reclaimed to the satisfaction of the authorized officer. By Bureau policy, bonding of mining operations at the plan level is a discretionary action; however, bonding is required when an operator has established a record of noncompliance. "A record of noncompliance is established when an operator: a) fails to take necessary actions on a notice of noncompliance issued under an approved plan, a previous plan, or a notice, until enjoined in a proper court, or b) conducts operations other than casual use without submitting a Notice or acquiring an approved Plan and fails to file a Notice or a Plan until served a notice of noncompliance" (DOI Manual, DOI 1985). The bond amount is usually equal to the estimated cost for the BLM to complete adequate reclamation at the mine site.

Access

From Fairbanks, the area is reached via the Steese Highway and northbound US Creek Road to Nome Creek. These gravel roads are maintained by the State and are capable of handling the transportation of heavy equipment used by placer miners. Mines along Nome Creek are reached by traveling over old, leveled dredge tailings. Sites not located along Nome Creek are reached by miners and their equipment over existing unimproved two- tracked trails used by four-wheel drive trucks and wheeled or tracked off-road vehicles. These roads, trails, and the major tributaries of the Beaver Creek drainage are shown on the Placer Mining Operations and Access Roads Map in Chapter One. Mining equipment is transported to the more remote areas during the winter or early spring over winter trails. Access to remote sites in the summer is routed along approved trails and monitored by the BLM. No new trails were built this year; however, BLM is planning to build a recreational road along Nome Creek that would also result in better access to some mining claims.

2.3.2 Proposed Action (Status Quo)

The proposed action for this EIS would continue the management of mining for claims on federal lands as it was conducted during the summer of 1987 under 43 CFR 3809. In 1987, there was one working mine in the Beaver Creek watershed which operated with a "zero discharge" water treatment system. Analysis of the cumulative effects of this Proposed Action includes the past, and projected future impacts from Federal mines and other non-mining activities in the region.

Standards

The water quality performance standards of significance would be the current EPA effluent guidelines and ADEC water quality standards or the existing EPA/ADEC variance for the operation. The performance standards would be .2 ml/l of settleable solids and 5 Nephelometric Turbidity Units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and not more than 10% increase in turbidity when the natural condition is more than 50 NTU, not to exceed a maximum increase of 25 NTU at the mine effluent discharge point (18 Alaska Administrative Code 70.020, ADEC 1987b). This detailed turbidity standard will be referred to throughout the EIS as the **5 NTU turbidity standard**.

Reclamation under the Proposed Action calls for soils and creek channel to be stabilized, and natural revegetation and restoration.

Action Scenario Under This Proposed Action

Mining activities under the Proposed Action would be very similar to the actual mining activity that occurred during the 1987 mining season. The water quality standards could be met through the utilization of a zero discharge water treatment system, similar to the system used in the 1987 mining operation. The zero discharge system was a mitigating measure required by the BLM authorized officer to ensure the present water quality of Beaver Creek. Improvements in future zero discharge water treatment systems should occur through evaluation and analysis of past operations and advances in this technology.

Reclamation activities under the Proposed Action would be to reshape tailings to approximate the surrounding topography and to spread overburden and available topsoil over the reshaped tailings. Settling ponds would be reclaimed as previously described and the stream bypass stabilized or reinforced to make it the permanent stream channel. The reclaimed site is allowed to revegetate naturally.

In calculating cumulative impacts one should know about the past, present, and reasonably foreseeable future. In this EIS, the past number of acres of disturbance has been calculated by BLM. Reports like that of Hagler, Bailly and Co. (1987) have summarized historical data of the Beaver Creek drainage. The present is calculated using BLM knowledge and field work, and resources such as the Annual Placer Mining Applications. The future is projected using the methodologies given in Appendix B- 1. For the purpose of the present analysis, it is appreciated that the actual interrelationships are complex and largely unknown. Cumulative impacts must be dealt with in the only manner possible under the circumstances, and are considered simply to be additive.

The following figures are used to evaluate the present number of mines and to project the future number of mines and concomitant roads, disturbances, reclamation, and environmental impacts, and place placer mining in perspective as a use of public lands.

Figure 2-2 compares the number of mines in 1987 to the expected number in 1998 under each alternative.

Figure 2-3 is a reclamation and disturbance summary of present mining (1987), used as the baseline, and the projected mining situation for each alternative. Figure 2-4 is a summary of the present (1987) miles of roads and trails and the number of miles of roads and trails projected for each alternative. (Appendix B-1 for methodology).

2.3.3 Alternative A

This alternative would emphasize mining activity as regulated by 43 CFR 3809 and the minimum actions needed to implement the regulations. These regulations identify guidelines for "undue and unnecessary degradation to the environment" and reclamation. Figure 2-5 shows a comparison of the performance standards between alternatives.

Standards

The water quality performance standards would be the current EPA/ADEC standard of .2 ml/l settleable solids and the 5 NTU turbidity standard when measured 500 feet below the mine discharge point. No water quality variances would be incorporated in this alternative. Soils and stream channels would be stabilized, and natural restoration and revegetation would be allowed to proceed. All federal claims meet these standards.

	1987	Projected 1998				
		Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Federal Mines	1	5	4	4	3	0
State Mines	0	0	0	0	0	0
Total	1	5	4	4	3	0

Figure 2-2. Comparison of 1987 State and federal mines against projected 1998 State and Federal mines under the Proposed Action and the alternatives.

Pre-1981 Disturbance-352	Projected 1998					
	1987	Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Federal Disturbance	3	115	100	100	84	0
State Disturbance	0	0	0	0	0	0
Total	3	115	100	100	84	0
Federal Reclamation	3	80	70	70	58	0
State Reclamation	0	0	0	0	0	0
Total	3	80	70	70	58	0

Figure 2-3. Comparison of 1987 State and federal mine disturbance and reclamation by acres against projected 1998 figures under the Proposed Action and the alternatives.

1987			1998 PROJECTION									
			Proposed Action		Alternative A		Alternative B		Alternative C		Alternative D	
Jurisdiction	Roads	Trails	Roads	Trails	Roads	Trails	Roads	Trails	Roads	Trails	Roads	Trails
Federal	5.2	23.3	31.4	21.0	27.1	18.3	27.1	18.3	22.4	15.3	5.2	23.3
State/Priv.	2.0	0	2.0	0	2.0	0	2.0	0	2.0	0	2.0	0
Joint	0	0	0	0	0	0	0	0	0	0	0	0
Total	7.2	23.3	33.4	21.0	29.1	18.3	29.1	18.3	24.4	15.3	7.2	23.3

Figure 2-4. Comparison of various 1987 road/trail jurisdictions and projected 1998 jurisdictions by miles.

Action Scenario Under This Alternative

Many of the streams in the Beaver Creek drainage are clear- flowing during part or all of the mining season. It is unlikely that a mine could discharge any mine effluent into the stream and meet the turbidity standard without the expenditure of considerable effort and money for a complicated water treatment system. For the average-sized mine, it would be simpler and more cost-effective to operate by recycling mine water and allowing no discharge into the stream, similar to the actions of the mine that operated on Nome Creek in 1987.

Performance standards for reclamation of fish and wildlife habitats, and soil and vegetation stabilization would be less restrictive to mining activities than those standards required by current practices. Under Alternative A, disturbed topsoil and overburden would be stabilized to prevent erosion into the watershed, but the redistribution of these materials over the tailings would not be required. Tailing piles and open mine cuts would be stabilized and reshaped to allow for natural restoration. This would probably be accomplished by leveling the mine cut and tailing piles with a bulldozer. Any constructed stream bypass would be stabilized or reinforced to make it the permanent stream channel.

2.3.4 Alternative B

This alternative would combine the standards from the 43 CFR 3809 regulations with emphasis on standards established to meet management goals defined in the Records of Decision of the various plans for the watershed. For a clear portrayal of the differences between the alternatives, see Figure 2-5.

Standards

Water quality performance standards would be defined by current ADEC and EPA regulations as .2 ml/l settleable solids, and the 5 NTU turbidity standard when measured 500 feet below the mine discharge point. Stabilization of soils and creek channel would be conducted so that natural recovery and revegetation processes would be enhanced.

Action Scenario Under This Alternative

Performance standards for water quality would be the same as those under Alternative A. Reclamation standards require that disturbed topsoil and overburden would be stabilized to prevent erosion and soil loss during operations. After completion of mining on a site, the stockpiled material would be redistributed over the shaped mine site to facilitate natural revegetation. Any stream bypass would be stabilized to allow for natural recovery of the stream channel.

OPERATIONS	Proposed Action	Alt. A	Alt. B	Alt. C	Alt. D
Water Discharge, including runoff	.2ml/l, 5 NTU turbidity. EPA variances	.2ml/., 5 NTU turbidity, no variances	.2ml/., 5 NTU turbidity, no variances	0 ml/l, 0 NTU turbidity, no variances	N / A
In-stream channel ops.	No limits	No limits	No limits	Careful/limited	N / A
Vegetation Stripping of area	No limits	No limits	No limits	No limits	N / A
Soils Topsoil	Save, stabilize against erosion	Stabilize against erosion	Save, stabilize against erosion	Save, stabilize against erosion	N / A
Shape of site	Stabilize to reduce erosion	Stabilize to reduce erosion	Stabilize to reduce erosion	Stabilize to reduce erosion	N / A
Access	Per RMP	Per RMP	Per RMP	Per RMP	N / A

RECLAMATION

Water Creek configuration	Remain in bypass	Remain in bypass	Remain in bypass	Reestablish grade & configuration in floodplain	Remain in bypass
Fish habitat	Provide for fish passage; comply with ADF&G regs.	Provide for fish passage; comply with ADF&G regs.	Provide for fish passage; comply with ADF&G regs.	Rebuild w/rocks, pools, riffles, etc.	No requirements
Soils Shape of site	Reshape to approximate surrounding physiography	Stabilize to reduce erosion	Reshape to approximate surrounding physiography	Reshape to approximate surrounding physiography	Reshape to approximate surrounding physiography
Fines-ponds	Protect from erosion	Protect from erosion	Protect from erosion	Respread over tailings	Protect from erosion
Topsoil	Respread over tailings	No requirements	Respread over tailings	Respread over tailings	No requirements
Vegetation Revegetation	Natural succession	Natural succession	Natural succession	Fertilize & reseed w/native species	Natural succession
Refuse Human waste	Keep out of stream	Keep out of stream	Keep out of stream	Keep out of stream	Keep out of stream
Garbage	Remove	Remove	Remove	Remove	Remove
Chemicals	Remove	Remove	Remove	Remove	Remove

Figure 2-5. Comparison of the alternatives.

Mining methods similar to those used in the Beaver Creek drainage in 1987, as discussed in the Proposed Action, could be used to achieve the standards outlined in this alternative. A design that results in zero discharge may be necessary to meet the water quality standards. Reclamation of the creek channels and soils, with redistribution of topsoil over reshaped tailings, would meet the standards of enhancing the natural recovery processes.

2.3.5 Alternative C

This alternative focuses on various standards proposed or under discussion by EPA and COE during 1987 (COE 1987). All mining operations in the watershed would meet the proposed standards. Figure 2-5 shows a clear comparison of performance standards used for this and other alternatives.

Standards

The discharge water quality performance standard for this alternative would be zero ml/l settleable solids and turbidity of zero NTU above natural conditions. Reclamation standards would emphasize restoration to a naturally-appearing landscape configuration, rehabilitation of creek channels, and regrowth of native vegetation. Mining activities would be conducted to minimize impacts to wetlands and riparian zones.

Action Scenario Under This Alternative

Alternative C water quality performance standards would be more stringent than those proposed in Alternatives A and B. Under this alternative, the miner would have two realistic options in choosing an appropriate water treatment method for the operation. These options would be: 1) to employ a chemical treatment system to reduce mine effluent settleable solids to zero and turbidity to acceptable levels, or 2) to not discharge any effluent to the stream.

Given these choices, most operators in this drainage would probably choose a zero discharge operation because it is presently more reliable and more cost effective than a chemical system. Chemical treatment systems employ technology which has thus far had only limited success for mining operations in Interior Alaska.

Reclamation standards would be similar to those imposed on current operations, except that restoration would be enhanced. Reclamation may include the removal of captured fine sediments from settling ponds for distribution over shaped tailings, selective seeding or planting of reclaimed areas as appropriate, or constructing habitat to enhance fish populations within disturbed streams.

Mining techniques that could be used to meet these performance standards would require very careful planning and infrastructure design before operating. The current zero discharge mine design meets the water quality standards. Further work may be required to meet the reclamation standards of Alternative C. This may include actions such as fertilizing and seeding or planting with native species, and rebuilding the creek channel in the original floodplain. The creek would be designed to have pools, riffles, and other natural features. Fine materials from settling ponds may be removed and redistributed over the tailings. Original design and construction of access roads and camps would reduce impacts on wetlands (COE wetland definition) and riparian zones. Actions of these types would be required on all mining operations, regardless of land status or size.

2.3.6 Alternative D

Alternative D is the "no action" alternative defined by the District Court. See Figure 2-5 for a comparison of performance standards between alternatives.

Standards

Under this alternative, no applications for Plans of Operations or Notices would be processed or approved by BLM. This action would violate current regulations (43 CFR 2091.1 for accepting application, and 43 CFR 3809.1-6 for processing applications). This action would also violate the 1872 Mining Law which gives a mining claimant the right to operate subject to surface management regulations. Changes would be required in these regulations and laws for legal implementation.

Validity examinations would be conducted for each properly filed mining claim, and the owners of valid claims would be compensated accordingly. Stabilization of surface disturbance that has occurred since 1980 would be required on all federal claims. Further restoration would be allowed to proceed by natural processes.

Action Scenario Under This Alternative

This alternative would require that mining cease on all federal claims within the watershed. BLM would conduct validity exams for all recorded claims, and the owners would be compensated for their interest in the claims. This would require Congressional appropriation of funds. Reclamation standards would be similar to those imposed under Alternative A. Areas disturbed after 1980 would be stabilized with minimal work, and reclamation would be allowed to proceed by natural processes.

2.4 Alternatives Considered, But Eliminated From Further Analysis

During the scoping process, many alternatives were suggested that were considered for analysis but not selected for further study:

1) Various levels of BLM enforcement, including compliance visits and administration of Plans of Operation applications.

Various levels of enforcement have been included in evaluating the alternatives.

2) Requiring specific mining and reclamation methods. This range of alternatives was not selected for three reasons: 1) The variation in the natural and mineral-bearing characteristics of the mining areas requires site-specific methods. Limiting all operations to a predetermined set of mining methods would reduce flexibility, and could increase environmental impacts. 2) Mining and reclamation technology is in a state of development and transition. Specific methods would rapidly become out of date and limiting. Emerging technologies are generally better both for mineral recovery and for environmental reclamation, and requiring static technology would restrict both activities. 3) These types of factors receive site-specific consideration in the preparation of EA's required for each Plan of Operations.

3) Changes in regulations and standards by other agencies.

This idea was partially used in Alternative C. The changes in standards are limited to those that were actually being proposed by EPA or being discussed by the COE at the time BLM developed the alternatives in July- November, 1987. Other changes were not incorporated because other agencies are mandated with those tasks, and these standards are outside immediate BLM jurisdiction.

4) Various alternatives which result in less restrictive standards, especially for water quality.

Water quality alternatives are developed from existing and proposed agency standards. This EIS will calculate the cumulative effects of these standards, and BLM's posture is to require the operator to comply with all existing State and federal water quality standards.

Pursuant to 33 USC 1371(c)(e), BLM may not impose effluent limitations that are different from those established by EPA and ADEC.

5) Alternatives that would redesignate Beaver Creek, including removing the Wild River status of the stream, or changing the drinking water standard to the industrial standard.

These alternatives were not used because they would require action by Congress or the State of Alaska. This was not considered to be a "reasonable" alternative for implementation at this time. This alternative was evaluated in the EIS for the D2 actions which designated Beaver Creek as a National Wild River (DOI 1974) The Wild River status could be reconsidered as a separate action with an attendant EIS.

6) An alternative with no performance standards and no regulation.

This alternative was not used because it would essentially revisit the issue that the 43 CFR 3809 regulations were originally intended to address. The no regulation alternative is the "no action" alternative evaluated in 1980 in the EIS for Surface Management of Public Lands Under the U.S. Mining Laws, 43 CFR 3809 (DOI 1980). A variation of this alternative would set low performance standards, and issue miners a "license" to mine.

2.5 Summary of Environmental Consequences of the Alternatives

Cumulative Impacts

The evaluation of cumulative impacts requires the integration of time, space, mining/non-mining and federal/non-federal actions in a complex and dynamic environment. This section summarizes the cumulative impacts of multiple placer mines in the Beaver Creek watershed. The spatial aspect is covered by considering the impacts of multiple mining operations in the headwaters of Beaver Creek (Placer Mining Operations and Access Roads Map, Chapter One). Time is considered by evaluating the past, present, and reasonably foreseeable actions of placer mining. Past and present impacts are part of the existing environment, discussed in detail in Chapter Three, Affected Environment. The projected number of mines, acreages of disturbance, and miles of roads and trails were calculated using methods outlined in Appendix B-1, and are summarized in Figures 2-2, 2-3, and 2-4. Further details on future impacts are in Chapter Four, Environmental Consequences. There are only federal mining claims in this watershed, so impacts from non-federal mines are not of concern. Non-mining actions are discussed in Chapters Three and Four as appropriate.

Figure 2-7 at the end of Chapter Two, illustrates the impacts by showing past, 1987, and projected 1998 impacts for the Proposed Action and each Alternative.

Projection of Mines

Five mines were selected to represent the projected number of placer mines that would operate in the Beaver Creek drainage over the next 10 years under the Proposed Action. This number of mines was chosen because it corresponds with the number of mining proposals the Steese/White District received for the drainage in 1987, and because five mines represents a reasonable estimation of mining activity within the foreseeable future. This level of mining may be high in estimating future mining activity, since only one mine has operated at any given time over the past six or seven years.

Projecting the number of mines that would operate under Alternatives A, B, and C was based on the compliance costs of these alternatives as compared to the Proposed Action's compliance costs. These costs are listed in Figure 2-6, and a comparison clearly indicates that the estimated water treatment costs for Alternatives A, B, and C are significantly higher than those estimated for the Proposed Action. Due to the significant increase in compliance cost, BLM estimated that only four mines would operate under Alternatives A and B. Similarly, three mines would operate under Alternative C due to increases in water treatment and reclamation costs.

The water treatment costs cited in Figure 2-6 were taken from an EPA report (EPA 1987) that analyzed the economic impact of effluent standards on the placer mining industry. In the EPA report, six water treatment technology options were outlined and their associated costs for Alaska were estimated. BLM reviewed these options and selected the three treatment technologies that came closest to meeting the various water quality standards of the Proposed Action and Alternatives A, B, and C. It is anticipated that a zero discharge system with some water seepage would meet the water quality standards, with EPA variances, for the Proposed Action. Alternatives A and B, with water quality standards of .2 ml/l settleable solids and 5 NTU turbidity, and no EPA variances, would require operating with no seepage of effluent to the stream, or the Option Four water treatment technology listed by EPA. Alternative C, with water quality standards of zero ml/l settleable solids and zero NTU turbidity increase, would require operations comparable to the Option 6c water treatment technology, including zero discharge, 100% recycling of water, and flocculants. The costs in Figure 2-6 represent a mine that processes 150,000 cubic yards per mining season.

A worst-case scenario to describe a level of placer mining more intense than expected was analyzed to predict those possible cumulative environmental impacts. This scenario could occur if unforeseeable circumstances caused this high level of activity, such as the price of gold increasing to $2,000 per ounce. This analysis is presented in Figure 2-8, with methodology in Appendix B-2.

2.5.1 Proposed Action (Status Quo)

The effects of the Proposed Action are based on five mines operating continuously for the next ten years.

There should be no significant cumulative impacts on topography. There would be some short-term modification of site aspect during mining which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization.

There should be no significant impacts on mineral resources.

The soil profile would be completely altered by mining operations on approximately 115 acres of ground. Soil conditions may be impacted by access roads and trails through direct disturbance of the soil profile, enhanced erosion, or from compaction.

Water quantity would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. Unavoidable adverse impacts would be significant short- to long-term increases in suspended sediment and turbidity, and accelerated erosion resulting in a possible increase in sediment (343 tons per day) introduced to the stream system, and changes in channel morphology (1.25 miles) in the vicinity of the disturbed area. Short-and long-term impacts are not expected to be significant downstream on Beaver Creek. The impact on chemical water quality is not expected to be significant.

The vegetation cover would be destroyed in mine and road areas. A short-term loss of productivity is unavoidable. Twenty-eight acres would regrow to a riparian tall shrub community within 30 years of reclamation, with an additional 8.6 acres within 50 years on mining disturbance in creek bottoms. Seventy-eight acres of new mining disturbance would remain barren or sparsely vegetated.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities would have no known direct effect upon the one endemic plant specie involved, *Poa porsildii.*

Approximately 676 acres of wildlife habitat would be physically altered due to mining related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 38,420 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 115 acres of the moose habitat winter range for a 50-year period. The long-term cumulative loss of habitat to mining activities in these areas and adjacent State lands would probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if mining activity and human use of the area increases greatly in crucial wildlife habitats.

There are five to eight nests for peregrine falcon in the watershed. Protective measures would be required for any mining activity planned within one mile of these nests.

Direct effects on fish habitat could be alleviated through adherence to performance standards and use of mitigation measures. Unavoidable adverse impacts from sediment would reduce fish habitat, fish populations in areas below mining, and opportunities for sport fishing; but upon cessation of the mining operations and completion of reclamation, these short-term effects would cease. There would be no irreversible or irretrievable commitments of fishery resources.

Cumulative impacts on cultural resources in the Beaver Creek drainage do not appear to be significant.

The upper portion of Beaver Creek drainage is not notably used for subsistence purposes now nor has it been in the recent past. Subsistence activities, including hunting, trapping, and fishing are pursued in the lower Beaver Creek drainage by residents of area villages. There is no indication, however, that past or present (1987) mining in upstream areas has significantly restricted subsistence uses or resources along the river. There are no communities downstream from mining which rely on Beaver Creek for drinking water. While some opportunities for more hunting, fishing, and trapping may result from improved access into the headwaters of Beaver Creek, those activities would be regulated by the Alaska Department of Fish and Game (ADF&G). Much of any new use likely would be by non-subsistence persons, with hunting, if any, affecting game stocks distinct from those harvested downstream for subsistence purposes. Ongoing trapping and berry picking are generally not significantly impacted by mining activities and are not being done in the upper portions of Beaver Creek drainage by any documented village-based subsistence users.

Some recreational activities would be enhanced due to the increased access provided by additional mining roads and the proposed BLM road along Nome Creek.

Visual resources would be reduced slightly by the increased road mileage. No mining would occur along the Wild and Scenic River Corridor.

If the total number of mines increased from one to five, direct employment would increase by 38 work months per year, and annual wages would increase by an estimated $45,000.

Annual costs for water treatment and reclamation for all five mining operations would be $26,000 and $10,000 respectively. Administration and enforcement of the Surface Management program for placer mining would cost BLM about $9,000 annually (all values in 1987 dollars). Figure 2-6 is a summary of the estimated cost associated with the implementation of each alternative.

Costs Per Mine	1987 (1 mine)	Proposed Action (5 mines)	Alternatives			
			A (4 mines)	B (4 mines)	C (3 mines)	D (No mines)
Reclamation Cost	$1,500	$2,000	$1,000	$2,000	$3,400	NA
Water Treatment Cost	$5,200	$5,200	$36,500	$36,500	$47,000	NA
BLM Administrative Cost	$1,800	$1,800	$1,400	$2,200	$2,600	See Caption

Figure 2-6. Estimated costs associated with implementation of each alternative. Sources: BLM, EPA, NPS. For Alternative D, validity examinations and appraisals were estimated to cost $2,000 per claim, and the net present value of each claim was estimated to be between $12,000 and $335,000. See Appendix B-3 for methodology for computing costs.

2.5.2 Alternative A

The effects of this alternative are based on four relatively small mines which would operate continuously for the next ten years.

There should be no significant cumulative impacts on topography. There would be some short-term modification of site aspect during mining. There may be discernible modifications of overall landscape aspect, since reclamation requirements would only stabilize disturbed areas. The scale of these alterations in aspect would be relatively small.

There should be no significant impacts on mineral resources.

The soil profile will be completely altered by mining operations on approximately 100 acres of ground. Soil conditions may be impacted by access roads and trails through direct disturbance of the soil profile, enhanced erosion, or compaction.

Water quantity would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and stream channel. Unavoidable adverse impacts are significant short- to long-term increases in suspended sediment and turbidity, and accelerated erosion resulting in a possible increase in sediment (325 tons/day) introduced to the stream system, and changes in channel morphology for the one mile of disturbed stream in the vicinity of the disturbed area. Short-and long-term impacts are not expected to be significant downstream on Beaver Creek. The impact on chemical water quality is not expected to be significant.

The vegetation cover would be destroyed in the areas of the mines and roads. A short-term loss of productivity would be unavoidable. Twelve acres would regrow to a riparian tall shrub community within 30 years of reclamation, and an additional 7.5 acres within 50 years on mining disturbance in creek bottoms. Eighty acres of new mining disturbance would remain barren or sparsely vegetated.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities have no known direct effect upon the one endemic plant specie involved, *Poa porsildii*.

Approximately 634 acres of wildlife habitat will be physically altered due to mining related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 33,348 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining will be the unavoidable loss of approximately 100 acres of the moose habitat winter range for a 50 year period. The long-term cumulative loss of habitat to mining activities in these areas and adjacent State lands will probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if mining activity and human use of the area increases greatly in crucial wildlife habitats.

There are five to eight nests for peregrine falcon in the watershed. Protective measures would be required for any mining activity which is planned within one mile of these nests.

Direct effects on the fish habitat from water quality changes caused by mining development activities would be alleviated through adherence to standards and use of mitigation measures. Unavoidable adverse impacts from sediment would reduce fish habitat, fish populations in areas below mining and opportunities for sport fishing; but upon cessation of the mining operations and completion of reclamation, these short-term effects would cease. There would be no irreversible commitments of the fishery resources.

Cumulative impacts on cultural resources in the Beaver Creek drainage do not appear to be significant.

Subsistence activities and resources in the lower Beaver Creek drainage would not be significantly restricted, if at all, by mining under this alternative. Potential impacts to fish, wildlife, and water quality would be mitigated in the upstream areas where mining occurs so that any impacts would be negligible in subsistence use areas. As a result, no cumulative impacts would be likely to occur.

Recreational activities would be enhanced due to the increased access provided by additional mining roads and the proposed BLM road along Nome Creek.

Visual resources would be reduced slightly by the increased road mileage. No mining would occur along the Wild and Scenic River Corridor.

If the total number of mines increased from one to four, direct employment would increase by about 30 work months per year and annual wages would increase by an estimated $34,000.

Annual costs for water treatment and reclamation for all four mining operations would be $146,000 and $4,000 respectively. Administration and enforcement of the Surface Management program for placer mining would cost BLM about $6,000 annually (all values in 1987 dollars).

2.5.3 Alternative B

The effects of this alternative are based on four relatively small mines which would operate continuously for the next ten years.

There should be no significant cumulative impacts on topography. There would be some short-term modification of site aspect during mining which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization.

There should be no significant impacts on mineral resources.

The soil profile would be completely altered by mining operations on approximately 100 acres of ground. Soil conditions may be impacted by access roads and trails through direct disturbance of the soil profile, enhanced erosion, or compaction.

Water quantity would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and the stream channel. Unavoidable adverse impacts would be significant short- to long-term increases in suspended sediment and turbidity, and accelerated erosion resulting in a possible increase in sediment (325 tons per day) introduced into the stream system, and changes in channel morphology for the one mile of stream in the vicinity of the disturbed area. Short-and long-term impacts are not expected to be significant downstream on Beaver Creek. The impact on chemical water quality is not expected to be significant.

The vegetation cover would be destroyed in mine and road areas. A short-term loss of productivity would be unavoidable. Twenty-five acres would regrow to a riparian tall shrub community within 30 years of reclamation, with an additional 7.5 acres within 50 years on mining disturbance in creek bottoms. Sixty-eight acres of new mining disturbance would remain barren or sparsely vegetated.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities have no known direct effect upon the one endemic plant specie involved, *Poa porsildii*.

Approximately 634 acres of wildlife habitat would be physically altered due to mining-related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 33,348 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 100 acres of moose habitat winter range for a 30 to 50 year period. The long-term cumulative loss of habitat to mining activities in these areas and adjacent State lands would probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if mining activity and human use of the area increases greatly in crucial wildlife habitats.

There are five to eight nests for peregrine falcon in the watershed. Protective measures would be required for any mining activity planned within one mile of these nests.

Direct effects on fish habitat from water quality changes caused by mining development activities would be alleviated through adherence to standards and use of mitigation measures. Unavoidable adverse impacts from sediment would reduce fish habitat, fish populations in areas below mining, and opportunities for sport fishing; but upon cessation of the mining operations and completion of reclamation, these short-term effects would cease. There would be no irreversible commitments of the fishery resources.

Cumulative impacts on cultural resources in the Beaver Creek drainage do not appear to be significant.

Subsistence activities and resources in the lower Beaver Creek drainage would not be significantly restricted, if at all, by mining under this alternative. Potential impacts to fish, wildlife, and water quality would be mitigated in the upstream areas where mining occurs so that any impacts would be negligible in subsistence use areas. As a result, no cumulative impacts are likely to occur.

Recreational activities would be enhanced due to the increased access provided by additional mining roads and the proposed BLM road along Nome Creek.

Visual resources would be reduced slightly by the increased road mileage. No mining would occur along the Wild and Scenic River Corridor.

If the total number of mines increased from one to four, direct employment would increase by about 30 work months per year and annual wages would increase by an estimated $34,000.

Annual costs for water treatment and reclamation for all four mining operations are $146,000 and $8,000 respectively. Administration and enforcement of the Surface Management program for placer mining will cost BLM about $9,000 annually (all values in 1987 dollars).

2.5.4 Alternative C

The effects of this alternative are based on three mines operating continuously for the next ten years.

There should be no significant cumulative impacts on topography. There would be some short-term modification of site aspect during mining which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization.

There should be no significant impacts on mineral resources.

The soil profile would be completely altered by mining operations on approximately 84 acres of ground. Soil conditions may be impacted by access roads and trails through direct disturbance of the soil profile, enhanced erosion, or compaction.

Water quantity would not be significantly affected and water quality would return to approximately natural conditions after successful stabilization of the disturbed area and the stream channel. Unavoidable adverse impacts would be significant short- to long-term increases in suspended sediment and turbidity, and accelerated erosion resulting in a possible increase in sediment (306 tons per day) introduced into the stream system, and changes in channel morphology, (0.75 miles), in the vicinity of the disturbed area. Short- and long-term impacts are not expected to be significant downstream on Beaver Creek. The impact on chemical water quality is not expected to be significant.

The vegetation cover would be destroyed in mine and road areas. A short-term loss of productivity would be unavoidable. Twenty-one acres would regrow to a riparian tall shrub community within 25 years of reclamation, with an additional 16.5 acres within 50 years on mining disturbance in creek bottoms. Forty-seven acres of new mining disturbance would remain barren or sparsely vegetated.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed. Mining and associated activities have no known direct effect upon the one endemic plant specie involved, *Poa porsildii*.

Approximately 589 acres of wildlife habitat would be physically altered due to mining-related activities. Periodic disturbances to wildlife due to the operation of vehicles and machinery, and human habitation affecting 27,972 acres could result in a low to moderate level of short-term cumulative effects. The principal long-term adverse effect of mining would be the unavoidable loss of approximately 100 acres of the moose habitat winter range for a 25-35 year period. The long-term cumulative loss of habitat to mining activities in these areas and adjacent State lands would probably contribute to a low to moderate reduction in moose population potential. The potential exists for long-term cumulative adverse effects to wildlife if mining activity and human use of the area increases greatly in crucial wildlife habitats.

There are five to eight nests for peregrine falcon in the watershed. Protective measures would be required for any mining activity planned within one mile of these nests.

Direct effects on fish habitat from water quality changes caused by mining development activities would be alleviated through adherence to standards and use of mitigation measures. Reclamation measures to restore stream channels and construct habitat to enhance fish populations within the disturbed streams would alleviate potential sedimentation, turbidity, and degradation of available fish habitat. Unavoidable adverse impacts would be increased sedimentation, turbidity, and erosion from disturbed areas of active mining, and following reclamation and stream enhancement construction. There would be no irreversible commitments of the fishery resources.

Cumulative impacts on cultural resources in the Beaver Creek drainage do not appear to be significant.

Subsistence activities and resources in the lower Beaver Creek drainage would not be significantly restricted, if at all, by mining. Potential impacts to fish, wildlife, and water quality would be mitigated in the upstream areas where mining occurs so that any impacts would be negligible in subsistence use areas. As a result, no cumulative impacts are likely to occur.

Recreational activities would be enhanced due to the increased access provided by additional mining roads and the proposed BLM road along Nome Creek.

Visual resources would be reduced slightly by the increased road mileage. No mining would occur along the Wild and Scenic Corridor.

If the total number of mines increased from one to three, estimated total annual employment would increase by about 22 work months and annual wages (income) would increase by an estimated $25,000.

Annual costs for water treatment and reclamation for all four mining operations are $141,000 and $10,000 respectively. Administration and enforcement of the Surface Management program for placer mining will cost BLM and the COE approximately a total $8,000 annually (all values in 1987 dollars).

2.5.5 Alternative D

The effects of this alternative are based on no further placer mining disturbances being allowed in the watershed.

Cessation of mining would end further short- and long-term impingements upon topography.

Placer mining activity would cease and gold resources would remain undeveloped.

No new soils would be disturbed by mining and there would be no further irretrievable or irreversible commitment of soil resources.

Erosion from unreclaimed areas may introduce sediment into the stream system, particularly during periods of high flow. There would be no irreversible or irretrievable commitment of water resources and no effect on long-term productivity.

The vegetation cover has been destroyed on mine sites and roads, resulting in a short-term unavoidable loss of productivity. There is a long-term unavoidable loss of 346 acres of the vegetation cover in the area from historic mines and roads.

There are no "listed" or "candidate" threatened or endangered plant species within the watershed.

Approximately 300 to 320 acres of moose winter range would remain lost because of past physical alterations. Disturbances to wildlife from mining vehicles, machinery, and human habitation in the Beaver Creek watershed will cease. Recreation use of existing roads and trails would facilitate increased harvest of wildlife. The principal long-term adverse effect of past mining would be the unavoidable loss for approximately 50 years of 33% of the previously disturbed moose winter range in the Nome Creek watershed.

The five to eight nests for peregrine falcon in the watershed would not be effected.

There would be no further fisheries impacts except effects on habitat from non-point source erosion from unreclaimed areas.

Cumulative impacts on cultural resources in the Beaver Creek drainage do not appear to be significant.

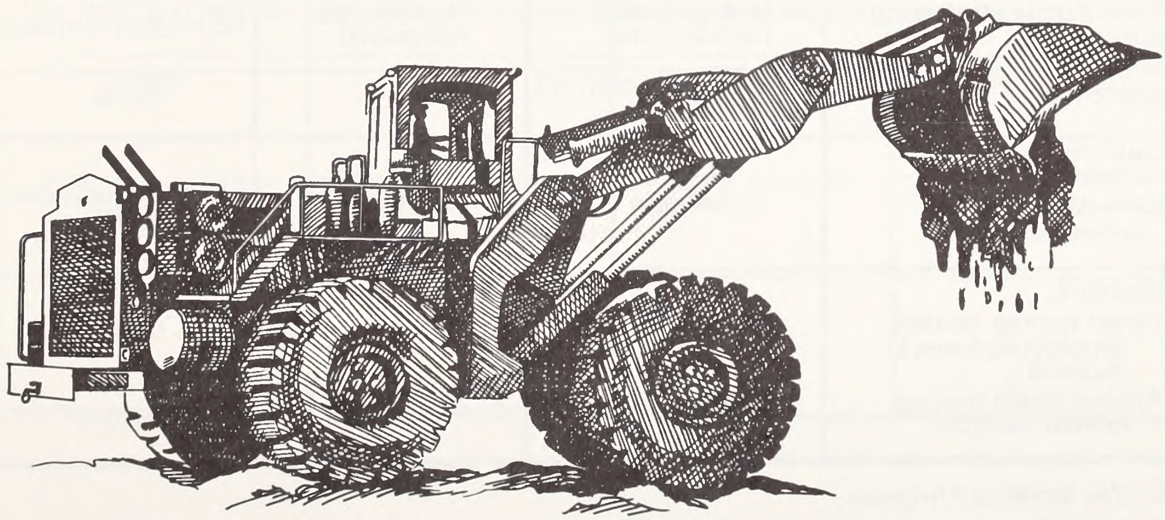
Subsistence activities and resources in the lower Beaver Creek drainage would not be significantly restricted, since no mining would occur. Potential impacts to fish, wildlife, and water quality would be avoided so that no impacts would occur in subsistence use areas. As a result, no cumulative impacts would occur.

Recreational activities would be enhanced due to the increased access provided by the proposed BLM road along Nome Creek; however, no new access would be created through mining activity.

Visual resources would remain the same as they are today.

If the only mine in the watershed were to shut down, annual employment would decrease by an estimated two work months and annual wages (income) would decrease by almost $3,000.

Validity exams on all properly filed claims will cost the BLM approximately $262,000 to complete, and the estimated net present value of the claims is between $1,572,000 and $44,000,000 (Appendix B-3).



Front-end Loader

Components	Past < 1981	Present 1987	Proposed Action 1998
Number of Mines	Unknown	1	5
Acreage Disturbed	352	3	115
Acreage Reclaimed	40	3	80
Topography	300 acres tailings	Minimal impacts	NSI
Minerals	*NSI on development	NSI on development	NSI on development
Soils:			
-Acres of soil disturbed	352	3	115
Water Resources:			
-Channel morphology miles	8	.25	1.25
-Sediment load tons/day	More than 256	273	343
-Toxic substances	NSI	NSI	NSI
Landcover:			
-Permanently barren from mining	300	2.50	78
-Years to regrow to shrub community	50	50	30-50
-Threatened & endangered plants	Unknown	None perceived	None expected
Wildlife:			
-Acres of habitat permanently lost	44	44	202
-Acres of habitat disrupted	20,524	20,524	38,420
-Acres of habitat lost for x years	352 acres/unknown yrs.	2.5 acres/50 yrs.	115 acres/50 yrs.
-Acres of habitat physically altered	352	352	676
-Threatened & endangered animals	NSI	NSI	NSI
Aquatic fauna:			
-Miles of habitat disturbed	8	0.25	1.25
-Fish populations	Unknown	Short term impacts	Short term impacts
Cultural & paleontological resources	Mining created historical sites	No new sites discovered	No change in impacts
Subsistence	Minor impacts only. not significant	None	None
Recreation & visual resources			
-Estimated value of recreation use	Unknown	$237,000	Increase, unknown magnitude
Economics:			
-Direct mining related employment-work months	Unknown	2	40
-Annual direct mining related income	Unknown	$3,000	$48,000

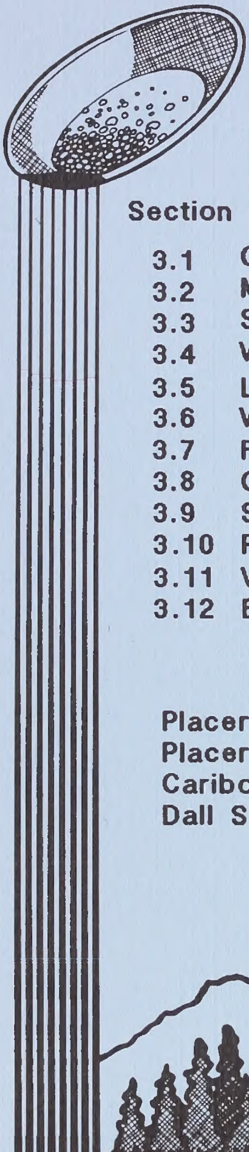
*NSI - No Significant Impacts

Figure 2-7. Comparison of pre-1981 impacts with those of the 1987 mining season and projected 1998 impacts under the proposed action and the alternatives.

Alternative A 1998	Alternative B 1998	Alternative C 1998	Alternative D 1998
4 100 70	4 100 70	3 84 58	0 0 0
Minimal impacts NSI on development	NSI NSI on development	NSI NSI on development	No further impacts No further mining
100	100	84	0
1 325 NSI	1 325 NSI	.75 306 NSI	0 256 NSI
80 50 None expected	68 30-50 None expected	47 25-30 None expected	0 Not applicable None expected
176 33,348 100 acres/50 yrs. 634 NSI	176 33,348 100 acres/30-50 yrs. 634 NSI	148 27,972 100 acres/25-30 yrs. 589 NSI	44 20,524 40 acres/50 yrs. 352 NSI
1 Short term impacts	1 Short term impacts	.75 Minimal impacts	0 No further impacts
No change in impacts	No change in impacts	No change in impacts	No further impacts
None	None	None	None
Increase, unknown magnitude	Increase, unknown magnitude	Increase, unknown magnitude	Increase, unknown magnitude
32 $37,000	32 $37,000	24 $28,000	0 0

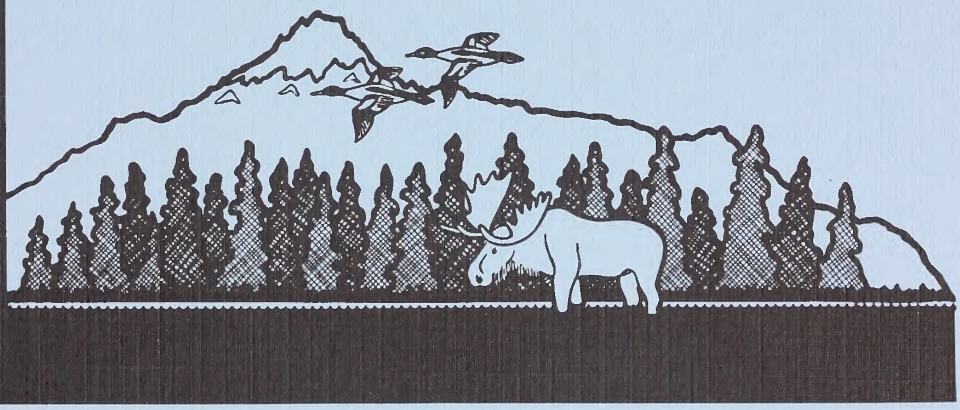
Components	Worst Case Scenario
Number of Mines	26 mines operating annually
Acreage Disturbed	1,300 acres total mining disturbance (350 ac. old tailings and 950 ac. new disturbance)
Acreage Reclaimed	1,300 acres to Proposed Action performance standards
Topography	No significant impact
Minerals	No significant impact on development
Soils:	
-Acres of soil disturbed	1,300 acres cumulative disturbance
Water Resources:	
-Channel morphology miles	13 miles annual disturbance
-Sediment load tons/day	1,000 tons per day
-Toxic substances	No significant impact
Landcover:	
-Permanently barren from mining	680 acres
-Years to regrow to shrub community	30 to 50 years
-Threatened & endangered plants	None expected
Wildlife:	
-Acres of habitat permanently lost	202 acres due to permanent roads
-Acres of habitat disrupted	38,420 acres due to roads and trails
-Acres of habitat lost for x years	1,300 acres for 30 to 50 years
-Acres of habitat physically altered	1,500 acres total (roads and mined acreage)
-Threatened & endangered animals	No significant impact
Aquatic fauna:	
-Miles of habitat disturbed	13 miles annual disturbance
-Fish populations	Significant short term impact to local populations
Cultural & paleontological resources	No significant impact
Subsistence	No significant impact
Recreation & visual resources	Significant local impact
Economics:	
-Direct mining related employment	208 work months
-Annual direct mining related income	$235,000

Figure 2-8. Summary of Worst Case Scenario.



Chapter III
Affected Environment

CHAPTER MAPS



BEAVER CREEK

Introduction

This chapter profiles the environmental resources in the Beaver Creek drainage within the White Mountains National Recreation Area. It is not intended to be an encyclopedic description, rather it discusses the physical, biological, social, and economic materials and conditions that would change under the implementation of the Proposed Action or an alternative, and thus may aid a reader in understanding the alternatives.

Three of the required elements (Areas of Critical Environmental Concern, Farm Land, and Wilderness) listed in Chapter One (Section 1.7) were not discussed or analyzed in this chapter because such resources do not exist within the affected area. A fourth element, Air Quality, is only discussed here in the introduction.

There is currently no quantitative information on air quality for this watershed. Because there are few industrial operations or cosmopolitan centers in the area, it is assumed the only pollutant sources are fugitive dust from travel on gravel roads, forest fires, and localized smoke from cabins. Occasional large forest fires in Interior Alaska can cause short-term air quality problems such as reduced visibility and discomfort over large areas. In general, however, the air quality in the area is assumed to be excellent on observational evidence. Under all alternatives there are no anticipated long-term or cumulative impacts to the air quality in the area. Very localized deterioration of air quality will occur in the immediate vicinity of internal combustion engines employed by mining operations. Dispersion of exhaust will quickly make levels of pollution undetectable.

General Considerations and Interrelationships Among Geology, Soils, and Sediments

The intent of this section is to briefly consider those geologic properties and controlling processes that occur at or near the earth's surface. What should be appreciated in particular are the interrelationships among physical substrates, erosion, and the properties of soils (Section 3.3) and other surficial materials, as well as the relationships to other aspects of the environment. Mineral resources (Section 3.2) are an additional fundamentally related concern.

The set of processes collectively known as erosion involve the detachment and transport of materials from place to place on and adjacent to the land surface. These processes are active in different areas and at different rates, depending on such factors as the mechanical strength of materials, climate conditions, local geology and topography, and vegetation.

Erosion as used here, includes both the movement of products by the transport agents, and their temporary or permanent deposition. Water, particularly streams, is the most important transport agent. The products of erosion are transported in streams as dissolved load, suspended sediment, and bedload.

These natural processes have various effects. For example, continual erosion replenishes the stream gravels necessary for a viable fishery. However, some mining practices tend to enhance erosion processes. Accelerated erosion is caused by exposure of soil and by loss of vegetation cover, with a resultant decrease in the ability of the soil substrate to naturally regenerate. Additionally, deposition of the eroded materials may occur in places where it is unwanted and/or in excessive volumes, especially in streams where it can adversely affect downstream resources and uses. Disturbance or removal of permafrost may, locally, enhance biological productivity, although such actions also encourage also encouraging erosion.

Because of these various effects, it is desirable to avoid or control mining practices that accelerate erosion, or at least to ameliorate their effects. Erosion may be divided into two general types, here termed surface erosion and mass movement.

Surface Erosion

Surface erosion refers to the movement of individual soil particles in response to gravity and/or fluid flow. It includes:

1) **Dry ravel:** movement of dry soil particles.

2) **Ice movement:** slow movement as a result of growth and melting ice needles.

3) **Rainsplash erosion:** displacement of particles due to the impact of raindrops.

4) **Sheetwash erosion:** movement due to shear stress exerted by a thin layer of water flowing over the ground.

5) **Gullying:** erosion of rills in previously unchanneled slopes.

These processes are usually minor in vegetated or undisturbed lands, although storm spikes or snowmelt runoff may overwhelm the ability of the lands to accommodate the water and may temporarily increase surface erosion. Surface erosion becomes important when land is disturbed either by nature (wildfires, landslides) or by human activities such as mining or road construction.

Mass Movement

Mass movement is a general term for a group of processes by which a fairly large volume of earth is moved at various rates of speed under the influence of gravity. A fluid may or may not be involved, but rates of occurrence and velocities are usually increased by the presence of a fluid. Mass movement is generally caused by long-term weathering and reduction of strength, but individual occurrences are usually caused by environmental events such as heavy rainstorms. There are several kinds of mass movement processes:

1) **Rockfall and rockslides:** the rapid movement of bedrock.

2) **Creep:** the slow movement of the soil mantle in response to gravitational stress.

3) **Slump-earthflow:** the rotational movement of a block of material along a slip surface.

4) **Debris avalanche:** a shallow mass failure that moves rapidly down steep hillslopes by falling, sliding, flowing, or some combination thereof.

5) **Debris torrent:** a highly erosive mixture of slurry, rock, and organic debris that moves down a defined channel. Such torrents can scour steep channels to bedrock, undercut valley sides, and deposit large piles or rock and mud downstream and in alluvial fans. Annual breakup results in the same type of effects.

Under natural and disturbed conditions, mass wasting processes are, in the short-term, the most significant means of erosion in terms of environmental considerations. Debris torrents are perhaps the most important erosional agent because of their long reach, their ability to damage downstream structures and resources, and the long periods required for channel recovery.

General Soil Properties

Soil characteristically consists of a layer of organic material underlain by several layers or "horizons" of mineral soil. The properties of each horizon vary as a result of the interplay of soil-forming processes; in particular climate, vegetation, and topography. These act on the parent material over time.

Weathering of rock-forming minerals at the earth's surface is the first step in soil formation. Chemical weathering along with physical weathering form the more stable clay minerals, concentrate iron and aluminum oxides, and release the major plant nutrients such as potassium, phosphorus, and sulfur. This contributes to the solute composition of the soil water, and ultimately of groundwater and streamwater.

Soil fertility and its contribution to productivity depend upon the physical, chemical, and biological properties the soils.

Soil Physical Properties

Soil physical properties control the drainage and availability of soil, water, and air to the root zone, affecting both root growth and nutrient movements. Physical soil properties include texture, structure, and density. Texture refers to the relative abundance of sand, silt, and clay-sized particles in the soil, and is often used as an approximate indicator of potential vegetation productivity. Structure is the spatial arrangement and bonding together of soil particles, and is important to drainage, aeration, and erosion resistance. Density refers to the soil's relative compactness, and is important to root distribution and water retention.

Vegetation and related soil biological processes are very important to the development of soil physical properties. Development of soil organic matter contributes to water-holding capacity, maintains aggregate stability, and improves soil resistance to erosion. This organic matter is the main energy source for the micro- and macroorganisms that play an active role in controlling both chemical and physical soil properties. Any change in the quality or quantity of vegetation, air temperature, water regime, or a host of other environmental variables will cause a change in soil physical properties.

The most direct changes to physical properties caused by mining practices are probably compaction or change in the soil's bulk density, and direct disruption of the structure.

Soil Chemical Properties

Soils are generally composed of some 15 chemical elements. Of these, seven (iron, calcium, potassium, magnesium, phosphorus, sulfur, and manganese) are important plant nutrients derived from soil weathering.

Soil chemical properties can be affected by any mining practice that tends to change the dissolved ionic composition of the soil water. Of particular concern are removal of nutrients or losses which exceed replenishment as well as persistent changes to processes that control rates at which soil nutrients are made available to plants.

Soil Biological Properties

Soil biology generally refers to the organisms that inhabit the soil. Most contribute to beneficial processes such as weathering of parent material, soil aggregation, organic matter decomposition, nitrogen transformation and fixation, retention of other substances that would otherwise be lost by leaching, and protection of roots from pathogens.

Growth and activity of soil organisms are affected by water, temperature, aeration, acidity, food supply, and biological factors. In undisturbed lands, populations of soil organisms reach a dynamic equilibrium; seasonal changes occur, but annual populations are relatively stable. Major site disturbances disturb this equilibrium.

Human activities such as mining practices, as well as various natural events may affect these processes through physical soil disturbance and modification or removal of vegetation.

3.1 Geology and Topography

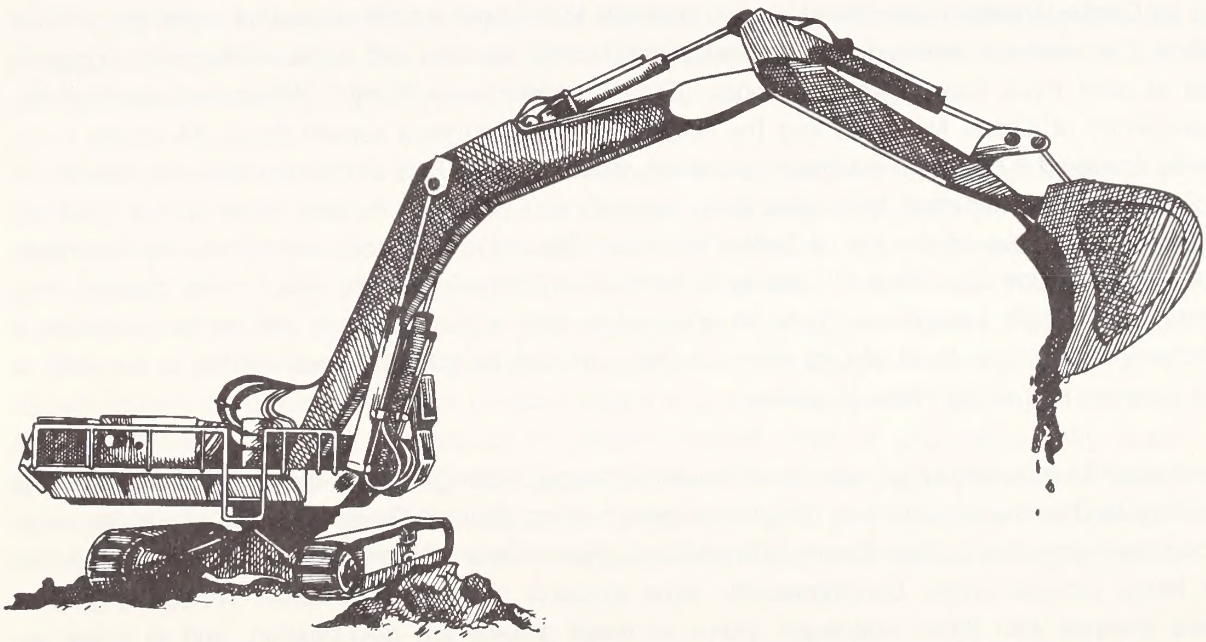
The Beaver Creek watershed study area lies within the Livengood, Circle, Fort Yukon, and Beaver quadrangles, as mapped at a scale of 1/250,000 by the U.S. Geological Survey (USGS).

Much of the following discussion in this Section and Section 3.2 is based on and/or has been freely excerpted from several key references. A principal source for more in-depth treatment is the "Administrative Report on the Mineral Resource Assessment for Part of the White Mountains National Recreation Area, Alaska," prepared for the BLM by the USGS (USGS 1987a). The other relevant references used are "Mineral Assessment of the Lime Peak - Mt. Prindle Area, Alaska," prepared by the State of Alaska, Division of Geological and Geophysical Surveys, 1987 (ADGGS 1987), covering portions of the WMNRA, as well as portions of the Steese National Conservation Area immediately to the east of the WMNRA; "Alaska Regional Profiles: Yukon Region," prepared by the University of Alaska, Arctic Environmental Information and Data Center (Selkregg 1974); "The Alaska Mineral

Resource Assessment Program: Background Information to Accompany Folio of Geologic and Mineral Resource Maps of the Circle Quadrangle Alaska," (USGS 1987b); and maps and text of USGS Open File Report 83-170-A,B,C (USGS 1983) on the Circle quadrangle. These references include extensive lists of previously published information, and should be consulted for this purpose, as well as for more detailed discussions of the geology, topography, and mineral resources of the study area. Included as Appendix C-1 is a generalized version of the geologic time scale.

A major portion of the Beaver Creek watershed lies within the WMNRA. This area is part of the Yukon-Tanana Upland physiographic province, which is a semi-mountainous area in east-central Interior Alaska, bounded by the Yukon and Tanana Rivers. The WMNRA is approximately 1,150 square miles, and contains a variety of topographic features. It includes most of the upper drainage of Beaver Creek. From its headwaters near Mt. Prindle (elevation 5286 feet), Beaver Creek flows across the WMNRA in a generally westerly direction, before turning northward to continue into the Yukon Flats and its eventual confluence (at approximately 380 feet elevation) with the Yukon River. The course of Beaver Creek thus defined extends about 303 miles. Major tributaries include Nome Creek, Bear Creek, Wickersham Creek, Fossil Creek, Willow Creek, and Victoria Creek (Tributaries and Main Physical Features Map, Chapter One).

The Yukon-Tanana Upland is underlain by a variety of metamorphic, sedimentary, and volcanic rocks, which are transected locally by granitic rocks, some occurrences of which are of batholithic dimensions. The WMNRA is made up geologically of a variety of bedrock types, which are juxtaposed structurally in a moderately complex manner. The principal disruptive structural features include major thrust faults, and strike - slip faults related to the Tintina Fault Zone. The Tintina Fault Zone is a very large- scale zone of regional faulting, hundreds of miles in surface- length, and of fundamental significance to the overall geologic framework of Interior Alaska. A portion of this zone extends along a northwest-southeast trend across the northern part of the study area. The bedrock



Excavator

underlying the WMNRA ranges from Precambrian to Tertiary in age, and consists of quartzitic, pelitic, calcic, and mafic sedimentary and metasedimentary rocks, as well as some mafic and felsic metaigneous rocks. These have been extensively intruded by younger (Mesozoic and Cenozoic) magmas which resulted in the formation of appreciable amounts of granitic rocks, as well as minor amounts of intermediate and mafic igneous rocks.

The White Mountains proper consist of a relatively narrow area underlain by bedded volcanic rocks and limestones which form an area of rugged relief in the core of the WMNRA. The White Mountains are so-named due to the constituent light-colored Tolovana limestone bedrock unit, which when illuminated under bright sunlight contrasts strongly with the adjacent darker- colored Fossil Creek Volcanics unit. The highest elevation is in the northern part of the White Mountains, 4,163 feet at the peak designated "VABM Fossil." In places the limestone beds are oriented nearly vertically, in the axes of narrow bedrock folds, and erode to form spectacular topographic features such as crags and spires. One such place, north of Windy Gap, has been called "The High Jags." A natural arch, "Windy Arch," occurs in limestone on the southeast side of Windy Gap.

Other prominent topographic features in the study area include Victoria Mountain (4,588 feet), which stands high above the east end of the ridge between Beaver and Victoria Creeks. Relief in the vicinity of Beaver Creek is some 3,700 feet. Cache Mountain, south and east of the White Mountains, has an elevation of 4,772 feet. Several prominences in excess of 5,000 feet occur on the crest of a ridge which extends to the northeast from Cache Mountain. This trend includes Rocky Mountain (5,062 feet). Mt. Schwatka is a flat-topped prominence which reaches 4,177 in elevation in the northern part of the area, adjacent to the Yukon Flats.

Although the upland areas in the WMNRA are neither exceptionally high nor very extensive areally, there is evidence of Pleistocene glaciation, particularly in the vicinity of Cache Mountain, Victoria Mountain, and to some extent on the north side of the White Mountains. All of the streams originating on Cache Mountain have the U-shaped profile in their upper reaches typical of a glacially eroded valley. The evidence (valley form, location of fragmental moraine and outwash deposits) suggests that at least three major glacial episodes (Early ? Pleistocene - Early ? Wisconsin) modified the topography of Cache Mountain and the ridge extending northeast toward Rocky Mountain (Lime Peak). During the period of maximum glaciation, perhaps some 65% of the mountainous area in the vicinity of Cache Mountain may have been covered with perennial ice and snow, and a small ice cap may have covered the top of Cache Mountain. Glaciation also occurred on Victoria Mountain, but was less extensive, since it is not quite so high as Cache Mountain, and is more isolated from other high terrain, hence less prone to accumulate and retain snow and ice. At least one small glacier formed at the head of Lost Horizon Creek, as well as across several divides to the east, in the northern part of the White Mountains.

During the Pleistocene large volumes of water discharged from glaciers in the mountains eroded the existing land surface to form a prominent terrace along Beaver Creek. Terraces of similar origin occur on Nome Creek, Bear Creek, O'Brien Creek, Fossil Creek, Willow Creek, and to a small extent on lower Victoria Creek. Simultaneously, large amounts of outwash material, principally gravels, were dumped into these drainages. Some of these gravels are gold-bearing, and in some appropriate positions natural concentrations of gold resulted, forming placer deposits. Some of these have been recognized and mined, particularly in the Nome Creek area. These outwash gravels of old floodplains subsequently were covered by reworked silt and organic materials. The resultant topography is rather flat, the ground is poorly- drained and is presently frozen, with visible ice-wedge features in many places. Such permafrost conditions are pervasive throughout the study area, since the entire Interior Alaska region is within the zone of discontinuous permafrost (cf. Williams 1970). Specific relationships with permafrost in any given site result from a complex array of geologic and topographic factors.

Mertie (1937) discusses the nature, distribution, and origins of the various Pleistocene - Recent surficial deposits recognized within the Yukon-Tanana Upland:

> "...earliest Pleistocene deposits consist of silt, sand, and gravel ... These deposits occur in many different sites in the present valleys. Some of them lie 200 feet or more below the present surface.... Others occur on stream terraces, well above the present valley floors. At some places they lie deeply buried in old channels, separated from the present stream channels by bedrock reefs; and at other places the old and the new valleys have nearly the same courses, so that the present streams are now dissecting the older gravel. Many of the richer gold placers in the Yukon-Tanana region occur in these older deposits.... These older deposits occur in all the principal mining areas of the region, including the Fairbanks, Hot Springs, Rampart, Circle, Seventymile, and Fortymile districts....
>
> "After the deposition of the older Quaternary gravel there began, in this region, a different type of sedimentation. Most of the older gravel deposits are overlain by a varying thickness of silt, containing much vegetal material. This silt is black when wet but is light to dark gray after the moisture has been removed.... Some evidence leads to the belief that a considerable part of this material is wind-borne. At the top of such deposits, and locally in layers throughout them, the silt is mingled with much vegetal material, which gives it a black color; and locally beds of peat form a part of the sequence. These deposits of silt containing considerable vegetal material are called "muck" by the miners; but because all the silt is dark- colored when wet the term "muck" is loosely applied to all the dark-colored silts.
>
> "These silt deposits, as well as the gravel below them, are usually frozen in whole or in part in Interior Alaska. The silt, however, is much more likely to be solidly frozen than the gravel. It also contains beds and lenses of clear ice, practically free of sediment, which are believed in large part to have formed after the original deposition of this material. These beds of silt in some localities are only a few feet thick, but in other places,as in the Fairbanks district, they may have a thickness of 100 feet or more. The silt beds are not uniform in character throughout, for mining has shown the presence in them of inlaid lenses of grit or even gravel, showing that conditions of alluvial accumulations were by no means uniform, even at any one locality. Such deposits, overlying the older gold-bearing gravel, present one of the great difficulties of placer mining in Interior Alaska. The silt itself is practically barren of gold, and in order to reach the underlying placers this overburden must either be removed, or else underground mining methods must be utilized....

"The Recent alluvial deposits are composed mainly of gravel, sand, and silt. Much of the coarser debris has been eroded from bedrock sources and laid down by the present streams. The silt has been derived in considerable measure from the reworking of the older silt, although a certain proportion has also been deposited by recent streams. Certain solifluxional processes peculiar to sub-Arctic regions have also tended to produce fine sediments of this type....

"Stream detritus originates largely by mechanical and chemical weathering of the regional bedrock, but in Interior Alaska the relative importance of these methods is modified by local conditions. Chief among these are the low mean annual temperature and the vegetation. The mean annual temperature of the Yukon-Tanana region is about 9° below freezing, which alone is capable of producing a condition of permanent frost in the subsurface. In addition to this, the valley floor and sides and also the ridge tops up to an elevation of 3,000 feet are covered with a mantle of mosses and other vegetation, which act as an insulator and tend to prevent the summer heat from penetrating far into the frozen ground below. And these two conditions combine to produce a curious disposition of the local precipitation, for the frozen condition of the deeper ground prevents deep circulation of water, and the mosses prevent a rapid surface runoff of the rainwater. Therefore, the moisture is conserved in a spongelike mossy mat close to the surface, where it favors the growth of vegetation much denser than might be expected in a region where the annual precipitation is only 11 or 12 inches.

"The customary distinction between the water table and the zone of weathering above the water table is in this region hardly valid, for much of the subsurface water, where present, is frozen. Hence the solvent and depositional effects of circulating ground water are almost lacking, and the chemical effects of oxygen and carbon dioxide are sharply restricted, because these reagents are not carried in solution. Chemical weathering, therefore, is much less important as an agent of weathering than in regions farther south.

"The surface of the ground in summer, however, is in a state of alternate thawing and freezing that produces marked mechanical weathering, due to the effects of frost heaving and related processes. The bedrock is loosened and fractured by the freezing and thawing of water, and an angular rubble that shows little oxidation is produced. This rubble tends to accumulate on the ridges as residual material. But the same thrusting forces that fracture and comminute the bedrock are also effective as a means of transportation, for the rock debris is thrust upward and laterally away from its place of origin and begins to move slowly down the hill slopes into the valleys below. Such moving sheets of alluvial material often develop characteristic flow lines along the sides of the valleys so that they resemble successive waves on a shallow body of water...

"Although chemical weathering in the headwater regions of the streams is sharply restricted, and mechanical weathering is seasonal, nevertheless the total amount of debris that is moved by the processes above outlined is remarkably great. It is not uncommon to observe sheets of such alluvial material impinging from both sides of a valley upon a headwater stream at a rate faster than the stream can transport the material downstream, so that the stream tends to flow in a narrow channel, sometimes several feet deep and only a foot or two wide; and in places the lateral debris has actually coalesced over the running water. This residual and semiresidual material is unsorted and includes rock fragments of all sizes, embedded in fine silt. Where the alluvial sheet has moved laterally a considerable distance from its place of origin to a drainage channel, the angular debris becomes rounded to a considerable degree. As soon as this material is exposed to the effects of running water, it begins to move downstream, the silt rather rapidly, especially in times of flood, and the larger rubble more slowly. From this stage onward, however, the erosional processes are essentially similar to those that prevail in more southern latitudes, and the results are essentially the same. The headwater gradients are normally steeper than the gradients of the lower valleys, and at some point or rather some zone in the valley stream action changes from transportation to deposition. As the regional relief is reduced and the headwater gradients are diminished, this zone of deposition moves upstream, thus developing progressively upstream a fluviatile gravel sheet. As the upper part of the gravel sheet is extended upstream, finer sediments cover the lower part, with the final result that the coarser and heavier sediments form the base of the alluvial section. The uniformity of this process is interrupted by floods, which carry coarse material farther downstream than it would ordinarily go and deposit it on top of finer material, thus resulting here and there in alternating beds of fine and coarse material. This general process of stream alluviation is also modified by local conditions....

"Another condition that modifies the character of the Recent alluvial deposits is the effect of winter ice.... In some of the smaller streams the ice increases greatly during the winter, both in thickness and in area, as a result of overflows of water, acting under hydrostatic pressure from upstream. Such bodies of ice do not move downstream in the spring with the normal winter ice but are dissected by the streams and often remain as valley ice, or "aufeis", nearly all summer. Such deposits of aufeis also have the effect of widening valley floors, for in spring, when the water first begins to flow, channels may be cut along the sides of the ice, thus diverting the stream against the valley walls and producing lateral erosion. Many stretches of wide flat valley floor on the tributaries of the Yukon have been produced in this manner, and it is quite possible that the same process, acting on a larger scale during the glacial epoch, may have been a powerful accessory factor in the development of the Yukon Flats."

3.2 Mineral Resources

The USGS has recently investigated the mineral resources of a major portion of the WMNRA (USGS 1987a), while the State of Alaska has carried out similar work in the remainder, as well as in an adjacent portion of the Steese National Conservation Area (SNCA) immediately to the east (ADGGS 1987). A synopsis extracted, with minor modifications, from the former (USGS 1987a) report follows:

The potential mineral resources for a major portion of the WMNRA have been assessed using the concept of geologic deposit models. A deposit model is defined as the set of attributes common to a particular class of mineral deposit. Most of the deposit models considered can be found in USGS Bulletin 1693 (Cox and Singer 1986). The deposit models were used to identify areas within the WMNRA that exhibited features common to a particular model. The identification of each area was based on detailed geologic mapping, interpretation of geophysical and geochemical data, and examination of the known mineral occurrences. For each identified area, subjective estimates of the number of undiscovered deposits were combined with grade-tonnage data for the respective model to produce estimates of the contained metal content. The assessment methodology used is described by Drew and others (1986) and is embodied in a computer program known informally as MARK3.

Subjective probabilistic estimates of the existence and the number of undiscovered deposits have been combined with grade- tonnage models for eight major deposit types (indicated to be present or possibly present) to produce estimates of the contained content for eight different metals and one non-metallic mineral within the part of the WMNRA assessed (USGS 1987a). Within this area, it is estimated that there is an expected 46,000 oz. gold, 4,200,000 oz. silver, 310,000 tons zinc, 180,000 tons lead, 500 tons tin, 2,100 tons tungsten, 7,000 tons thorium, and 6,000 tons rare earth oxides in undiscovered deposits. Overall, it is estimated that there is an expected 6,900,000 tons of undiscovered metallic ore-bearing material. For non-metallics, it is estimated that there are 27 billion tons of exceptionally pure high-calcium limestone. At the present time, significant undiscovered resources of chromium, asbestos, nickel, or diamonds are not predicted. A recent report of the occurrence of platinum in gold samples in the nearby Tolovana mining district makes platinum worthy of further consideration as a potential metallic resource.

Early Interior placer mining operation. Photo courtesy of Anchorage Museum of HIstory and Art.

A summary of the probabilistic estimates of the existence and the number of undiscovered deposits within the WMNRA for the deposit types considered was given by the USGS (1987a). For most of the deposit types, the probability that one or more undiscovered deposits exist is low. Largely, this is due to the overall lack of evidence of mineralization in the rocks that are exposed at the surface and the degree of weathering that has occurred. It is reasonable to assume that estimates of the existence and of the number of undiscovered deposits might be different if more were known about the subsurface.

The ADGGS (1987) study indicates, additionally, the potential for mineral deposits featuring tin, silver, tantalum, tungsten, uranium, rare-earth elements, and gold in bedrock environments in the Lime Peak - Mt. Prindle area.

Mertie (1937) presents a useful general discussion of the modes of origin and types of placer deposits found within the Yukon- Tanana Upland. Placer gold has been recovered from the upper tributaries of Beaver Creek since the turn of the century. Placer gold deposits have been located in Bear, Champion, Nome, Trail, and Ophir Creeks. Nome Creek and its major tributary, Ophir Creek, are similar to neighboring creeks in the Fairbanks mining district. The gold in Nome Creek most likely had a common source with the gold in Sourdough Creek, since both drain the same geologic terrane - a small granitic pluton intrusive into metamorphic rocks. Both stream and bench placer gold deposits occur in the area. In addition to gold, other noteworthy minerals which have been recognized in the placers include cassiterite, topaz, monazite, and tourmaline. In terms of known value and production levels, gold is the most important mineral resource in the area of Nome Creek. The cumulative production of placer gold to date from Nome Creek and its tributaries within the WMNRA is estimated to be 29,000 oz. For Nome Creek and its tributaries, it is estimated that there is an additional 6,500 oz. of gold yet to be recovered, and beyond that, it is estimated that there is an expected undiscovered 4,700 oz. and possibly as much as 21,000 oz. of gold within the part of the WMNRA that was assessed (USGS 1987a).

The bedrock underlying the Lime Peak - Mt. Prindle area (ADGGS 1987) consists of a metamorphosed stratigraphic sequence of Proterozoic(?) to Ordovician age that was subsequently intruded by an alkalic igneous suite about 85 to 90 million years ago, and by the Hope granitic suite 57 to 66 million years ago. The regionally metamorphosed and folded bedrock units in the project area have been intruded by three large, multiphase, biotite granite bodies, which are informally known as the Hope granitic suite, and include the Lime Peak, Quartz Creek, and Mt. Prindle intrusive bodies. All three plutons have been dated at about 57 to 66 million years by potassium/argon methods, and all are differentiated, composite intrusions. In addition to the large plutons of the Hope granitic suite, five other types of intrusive rock are present in the Lime Peak - Mt. Prindle area. They include 1) an 85 to 90 million year old alkalic suite of hornblende quartz monzonite, lamprophyre, and syenite, 2) the Pinnell Trail monzogranite, 3) felsite dikes and stocks that appear to be associated with the alkalic suite, 4) sills and dikes of gabbro and minor amounts of ultramafic rock in the northwest part of the area, and 5) gabbro dikes that intrude the Hope suite granitic rock.

Surficial deposits produced mainly from mass-wasting processes mantle much of the bedrock in the Lime Peak - Mt. Prindle area. Glacial, glacio-fluvial, and fluvial processes have also contributed to local surficial deposits. Bedrock-rubble colluvium and solifluction lobes include reworked drift in cirque valleys, and are present on high, steep slopes. Drift with morainal form is present in the highest elevation cirque valleys. Low-slope colluvium and alluvial-fan deposits are present on lower slopes and along the flanks of larger stream valleys. Alluvium and outwash are present in small terraces and along active stream channels.

Mineral assessment investigations (ADGGS 1987) in the Lime Peak - Mt. Prindle area have documented a high favorability for lode mineral deposits. Lode mineral deposits that are present or are likely to be present fall into two categories: those which are related to plutonic rocks and those which are stratabound.

Plutonic-related deposits are associated with:

1) The Hope granite suite, which forms three large plutons in the study area and is very similar to productive tin granites elsewhere in the world. The three plutons have associated mineral occurrences and alteration zones that contain local tin concentrations of 0.1 to almost 2%. The Lime Peak intrusive system includes six prospect areas, and is the most favorable of the three Hope Suite plutons for potential economic deposits of tin, with associated silver, tantalum, and tungsten.

2) Small syenite bodies near the western edge of the study area are similar to nearby syenites in the Livengood Quadrangle that host uranium and rare earth-bearing veins.

3) Unexposed intrusive rocks similar to the Pinnell Trail monzogranite are thought to be associated with numerous small tungsten/gold skarns in the Table Mountain area.

4) Moderately alkalic felsite dikes and stocks in the Hope Creek - Table Mountain area appear to be genetically linked to gold enrichment in adjacent sulfide-bearing hornfels (up to 0.5 ppm) and in sulfide-tourmaline-quartz veins (up to 120 ppm).

Stratabound lode mineral potential is confined to the Cleary sequence (?), a volcanogenic unit that has a recognized spatial correlation with gold placer deposits in the study area.

Probabilistic estimates were made (ADGGS 1987) for lode mineral resource potential in the Lime Peak - Mt. Prindle area by comparing various attributes of the observed geology, geochemistry, and mineralization with similar, well-studied mining districts worldwide. This methodology gives a range of potential resources at various levels of certainty. The results indicate that three-quarters of the potential mineral resource is in tin-silver deposits, and about one-quarter is in gold deposits. The quantitative estimates suggest a fair probability (50%) that the Lime Peak - Mt. Prindle area contains as much tin and silver as moderate-sized producing tin districts worldwide (320,000 tons of tin, and about 10 million ounces of silver - a gross metal value of $3 billion at current commodity prices). A small probability (5%) exists that the study area contains three times that amount of tin and silver. Approximately two-thirds of the tin-silver endowment is associated with six prospect areas in the Lime Peak pluton; the remainder of the endowment is distributed through other parts of the Lime Peak pluton, the Quartz Creek pluton, and the Mt. Prindle pluton.

The bulk of uranium and rare-earth potential is confined to the syenite intrusives at the western edge of the Lime Peak-Mt. Prindle area. At a 50% probability, the syenites would contain at least 250 tons of uranium and 520 tons of rare-earth elements (approximately $40 million current gross metal value).

Lode gold is mostly restricted to a belt along the southern part of the Lime Peak-Mt. Prindle study area, and is present primarily in quartz-tourmaline vein-associated occurrences and alkalic- igneous rock-related deposits, with a small contribution from stratabound deposits and skarns. Most of the endowment potential is in large volume, low-grade, disseminated and vein-aggregate deposits. Gold content of the favorable areas at the 50% probability level is equivalent to a large Alaska gold district (1.5 million ounces, $675 million current gross metal value). A low probability (5%) exists that the area could contain ten times as much gold.

3.2.1 Mining in the Study Area

Gold has been a major concern during the recent history of the Beaver Creek area, but mining activity has taken place there since 1873. This mining has principally involved placer gold deposits. In 1980, ANILCA designated Beaver Creek as a National Wild and Scenic River, and the upper watershed as a National Recreation Area.

Any mining activity within this portion of the Beaver Creek watershed would be conducted on federal claims regulated by the BLM. There are no State lands or patented mining claims in the White Mountains National Recreation Area.

The most complex issue confronting the miner is compliance with the State of Alaska and EPA water quality standards. Two other issues affecting miners in the Beaver Creek Watershed are: 1) the permits the COE issue, and 2) the outcome of this pending litigation and EIS. Resolution of these issues is progressing, and delay will probably contribute to the reduction of mining operations within the drainage.

Water quality standards in some form have been in effect for placer mining for over ten years. EPA began issuing National Pollutant Discharge Elimination System (NPDES) permits in 1976 and has changed the permit requirements several times since then (Hagler, Bailly and Company 1987). Permits have required varying mine effluent limitations for settleable solids and turbidity, and over the years requirements have become more stringent.

Nevertheless, Alaska's placer mining industry was growing in the late 1970's due to increases in the price of gold. Although water quality standards were in effect, enforcement of mining water discharge standards was nonexistent or minimal at best, and many miners operated without employing wastewater treatment techniques. By the early 1980's, it became obvious to the State of Alaska that water quality of mined streams was suffering and that the then current mining practices were not adequate to meet the water quality standards. To evaluate and attempt to resolve the problem, the

Alaska Department of Environmental Conservation (ADEC) and other State agencies initiated numerous studies of placer mining's potential effects on the aquatic environment. They also sponsored projects to develop and field test wastewater treatment techniques.

One of the first field projects, a 1981 study on settling ponds, revealed that "the effluent from placer mines typically does not meet all State and federal water quality standards. The standards for turbidity and arsenic were almost never met and the standard for settleable solids was met with various degrees of success. The pH and temperature standards were met most of the time, and the standard for dissolved oxygen was met all the time" (ADEC 1982). Seven of the nine project mines with settling ponds met the settleable solids standards.

Follow-up studies and projects have shown that properly designed and operated settling ponds can effectively remove settleable solids, allowing compliance with the settleable solid standard. These studies have also shown that arsenic and mercury are effectively reduced to non-hazardous levels with simple settling of mine effluent (EPA 1987). Knowing the value of effective settling ponds, miners began constructing and using ponds to treat their mine discharge water, and by 1987 most mines met the settleable solid limitation of 0.2 ml/l (EPA 1987; Hagler, Bailly and Company 1987; and observations of BLM mine inspectors, DOI 1986b and 1987c).

Meeting the effluent turbidity limitations has proven to be more difficult than meeting the settleable solids standard. Simple settling is not effective to meet the turbidity requirement (EPA 1987), so other techniques have been tried to reduce turbidity to acceptable levels. These techniques included classification, clean water bypass, recycling mine water, tailing filtration, and coagulation/flocculation. The first four techniques worked well to reduce water used in the mining process or the amount of effluent discharged and helped to improve the overall water quality of the receiving stream. Although these treatment techniques helped to improve water quality, the effluent discharge still was not in compliance with the standards.

The last treatment listed, coagulation/flocculation, involves mixing chemicals with mine process water. The chemicals, known as flocculants, react with sediment particles suspended in the process water, causing them to fall out of suspension. This treatment must be tailored to each mining operation and requires technical expertise to select and design an application system (ADEC 1987a). Unfortunately, flocculation systems have not consistently produced mine effluent that meets the water quality standards, and the long-term cost of such a system is somewhat uncertain (ADEC 1987a). Given these circumstances, few mine operators are willing to invest time and money into a system that cannot ensure compliance, especially if their current operation is not cited for noncompliance of turbidity standards. The State and EPA have not rigorously enforced this standard at most mine locations (Hagler, Bailly and Company 1987).

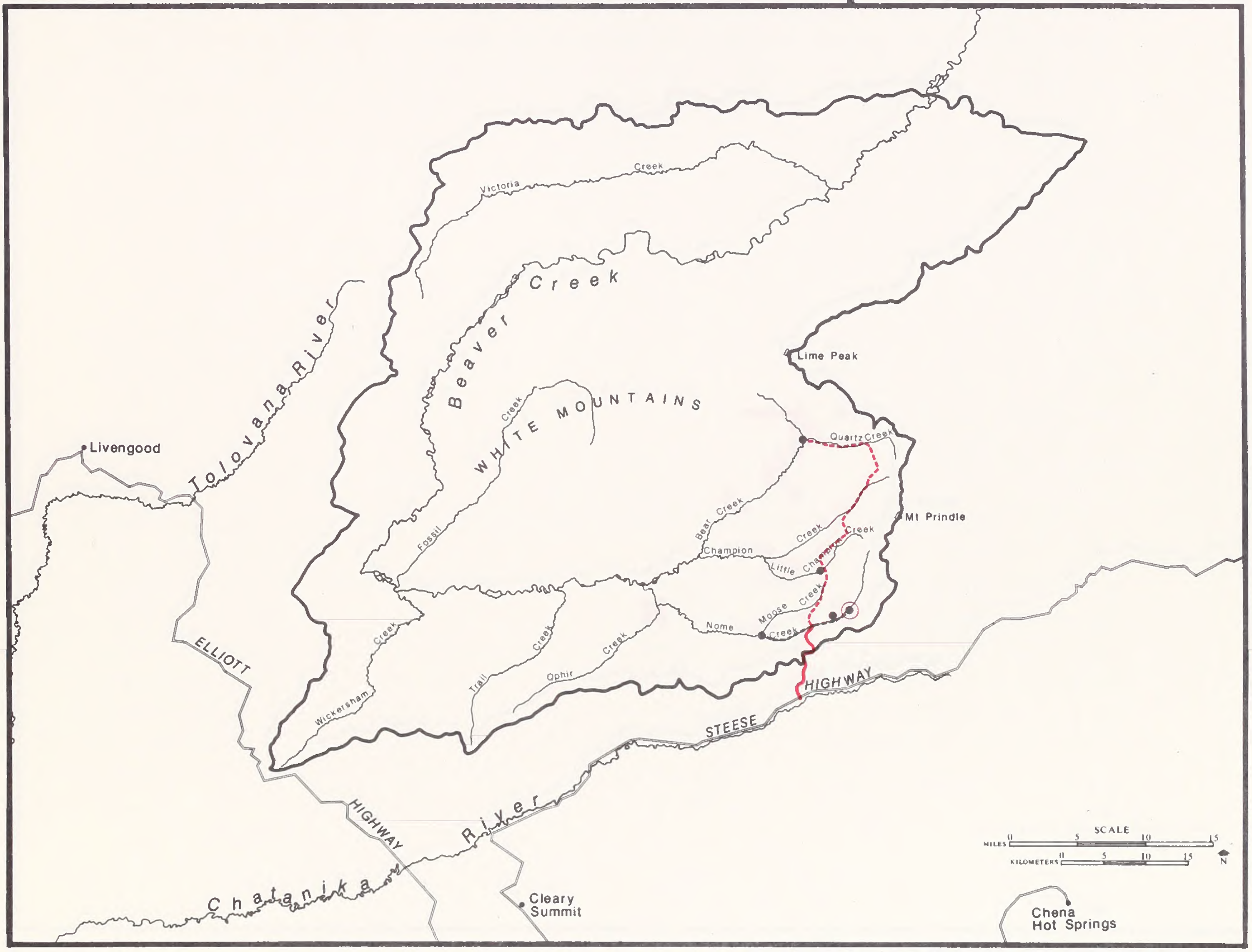
Beginning in 1988, the COE will require miners to obtain a permit for operations that discharge dredge or fill materials into waters and wetlands and/or that obstruct or alter these waters. This requirement is not new, but few miners have obtained these permits in the past. Reclamation standards may be similar to those currently required of federal operators. Meeting reclamation standards to comply with various requirements may increase costs for some mine operations.

Beaver Creek

DRAFT

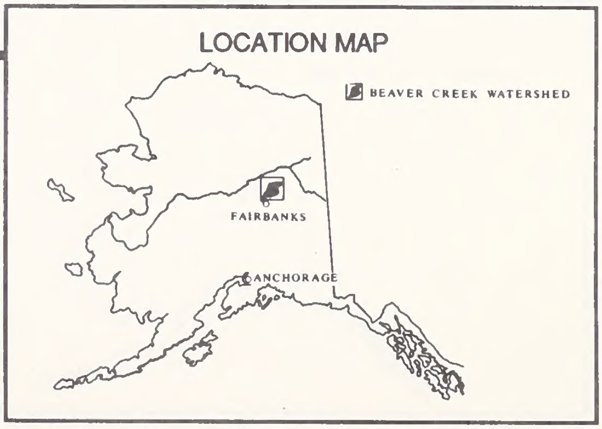
Cumulative Environmental Impact Statement

Placer Mining Operations and Access Roads



Legend

- Working 1987 Federal operations *
- Planned 1987 Federal operations *
- US Creek Road
- Trail
- Unimproved gravel road



* There are approximately 148 active Federal mining claims located in the Beaver Creek watershed according to BLM records. The operations depicted above include only those active claims for which Annual Placer Mining Applications were filed for the 1987 field season.

Beaver Creek

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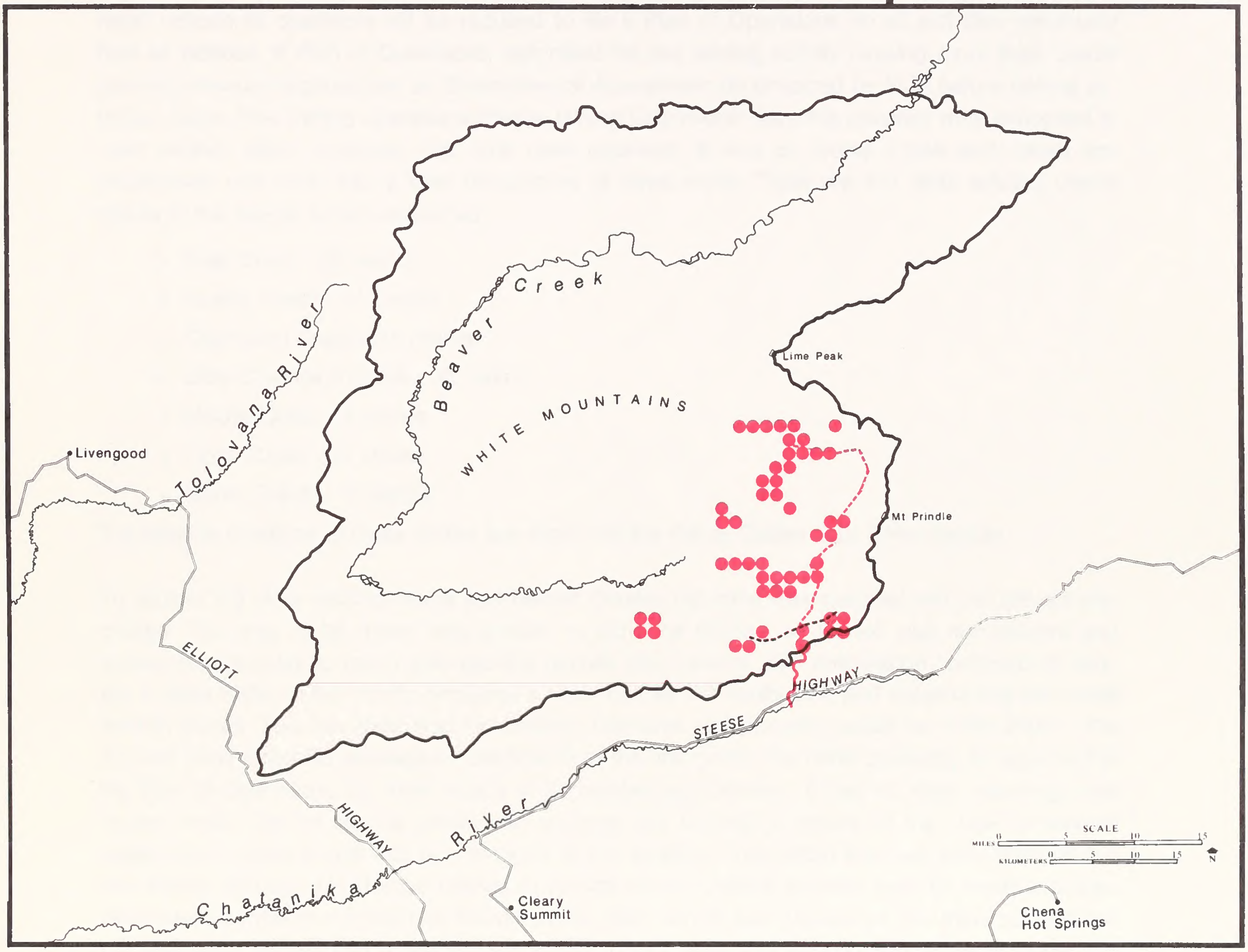
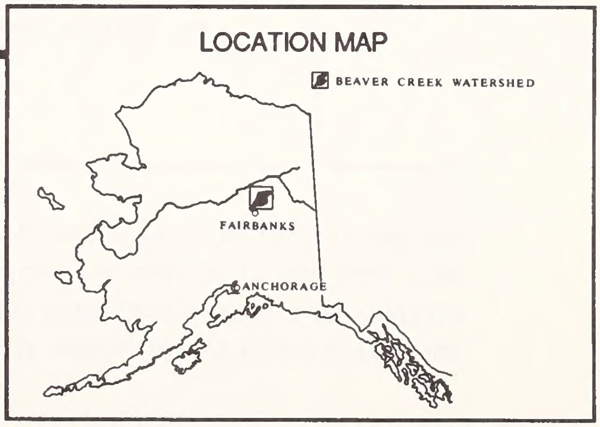
Cumulative Environmental Impact Statement

Placer Claims



Legend

- Active placer claim(s)*
- U.S. Creek Road
- Trail
- Unimproved gravel road



* Mining claims shown as active on BLM records, but not actually operating in 1987. One dot may represent more than one claim.

3.2.2 Active Mines

The entire study area is within the White Mountains National Recreation Area, and as a result of court actions all operators will be required to file a Plan of Operations on all activities previously filed as Notices. A Plan of Operations, submitted for any mining activity causing more than casual use disturbance, requires that an Environmental Assessment be prepared by BLM before mining activities begin. Five mining operations (Placer Mining Operations Map, this chapter) were proposed in 1987 (ADNR 1987); however, only one mine operated. It was on Nome Creek and mined approximately one acre, with a total disturbance of three acres. There are 131 valid existing placer claims in the Beaver Creek watershed:

- Bear Creek - 26 claims
- Quartz Creek - 13 claims
- Champion Creek - 31 claims
- Little Champion Creek - 30 claims
- Moose Creek - 3 claims
- Ophir Creek - 12 claims
- Nome Creek - 16 claims

The general locations of these claims are shown on the Placer Claims Map (This chapter).

To protect the clear-running Nome and Beaver Creeks, the mine was operated with no effluent discharge. The area to be mined was located in old mine tailings, so topsoil was non-existent and overburden removal to reach gold-bearing gravels was minimal. Site preparation consisted of hauling a small trailer to the camp, preparing a work pad for the washplant, and constructing two small settling ponds. The first pond was for settling sediments and providing water for recirculation. The second pond collected seepage or overflow from the first pond. The mine operated, as approved in the Plan of Operations, for three weeks in September and October. It had no direct discharge into Nome Creek, but the settling ponds had seepage that clouded a portion of the creek for several miles (Nome creek is split into two channels at this location). This turbid flow had sufficiently diluted and filtered through old dredge tailings to reduce Nome Creek's turbidity level to nearly undetectable levels by the time it reached Beaver Creek. After mining was completed, the mine cut and tailing piles were leveled and reshaped, the settling ponds were shut off from further water inflow and covered with tailings, and the overburden was spread over the reconfigured site.

3.3 Soils

There are three broad soil associations within the Beaver Creek watershed (DOA 1979). These associations are only general descriptions of the specific soil types that may occur and have only been identified through interpretation of vegetation patterns from aerial photography. There may be considerable variation in the specific soil properties within each association. All of the soils in the area are cryogenic; that is, soils formed under cold conditions which show cold soil temperatures. Due to seasonally cold temperatures, the entire Yukon - Tanana region is underlain by discontinuous, moderately thick to thin permafrost. Pewe (1982) describes permafrost as:

> "...naturally occurring material with a temperature colder than 32° F for at least two years. Permafrost is defined exclusively on the basis of temperature.... Most permafrost is cemented by ice, but permafrost without water, and thus without ice, is termed dry permafrost. The upper surface of permafrost is known as the permafrost table. In permafrost areas, the layer of ground that freezes each winter and thaws each summer, called the active layer, -- varies in thickness according to its moisture content. Generally, this thickness is from one-half to one foot in wet, organic sediments and up to six to nine feet in well- drained gravels.... When the mean annual air temperature drops below 32° F, ground frozen during the winter may not completely thaw in the summer, and a layer of permafrost may form. This layer may continue to thicken below the seasonally frozen ground. The thickness of the permafrost layer is controlled by the balance between the mean annual air temperature and the geothermal gradient.... In the northern hemisphere, perennially frozen ground is differentiated into two broad zones of lateral continuity: the continuous permafrost zone and the discontinuous permafrost zone. In the continuous zone, permafrost is present everywhere except under lakes and rivers that do not freeze to the bottom. The discontinuous zone includes numerous permafrost- free areas that progressively increase in size and number from north to south."

The three general soil associations in the Beaver Creek watershed are:

3.3.1 The Typic Cryochrepts Soil Association

This association occurs extensively in the uplands of Interior Alaska and constitutes the major soil association in the Beaver Creek drainage. It occurs on high rounded ridges and hills, and valley side slopes typical of the Tanana hills region. Elevations can range from 1,000 to 3,500 feet and can occasionally exceed 4,500 feet. These soils have developed from a variety of parent materials. On the hills they have formed from material weathered from the local bedrock. In the valleys they have formed from deep loamy sediment washed from the surrounding uplands. These soils are almost universally underlain by permafrost.

The vegetation patterns for this association are dictated mainly by the patterns of permafrost. On the south-facing slopes where the permafrost table is deep or occasionally absent and the soils are well-drained, the vegetation consists mainly of white spruce, aspen, and paper birch. At the higher elevations the soils are covered by alpine shrubs, sedges, lichens, mosses, and forbs. On north-facing slopes where the permafrost is continuous and shallow, the vegetation is mainly black spruce with an understory of mosses, tussocks, and low shrubs.

The soils in this association are generally not suitable for cultivation and present severe construction or engineering restrictions. There are only limited areas suitable for commercial forestry or cultivation of vegetable crops. Those areas are located in the bottom of broad valleys where slopes, if disturbed, remain stable. Disturbance of the insulating vegetative mat on these soils can result in severe erosion. When this mat is disturbed or removed, the underlying permafrost begins to thaw and the loamy texture of the soil is susceptible to rapid erosion. On sideslopes this erosion can appear as gullying, mudslides, slope failures, and other forms of mass movement. In level areas the thawing can produce thermokarsts, which are areas of local subsidence resulting from the thawing of underground ice. Thermokarsts can become quite large and may eventually become lakes or ponds.

3.3.2 The Pergelic Cryaquepts-Pergelic Cryochrepts Soil Association

This association occurs on steep unglaciated hills and mountains in the Interior highlands. Most of these soil types have developed above treeline from very gravelly or flaggy colluvial material weathered from the local bedrock. Elevations range from 1,000 to 5,000 feet, with some mountain peaks over 6,000 feet. The soils in this association are predominantly poorly drained, and ice-rich permafrost occurs on north facing slopes.

Soils at the higher elevations and in well-drained areas at lower elevations are covered by a layer of sparse, shrubby vegetation. The highest elevations can develop patterned ground features such as solifluction lobes, stone stripes, and frost boils. At the lowest elevations and in natural waterways, the vegetation consists of a mixed white spruce/birch/aspen forest. Soils which are dominated by permafrost at shallow depths, such as on the north-facing slopes, support black spruce and sedge tussocks.

Soils in this association are too cold and steep for cultivation and support only very limited harvesting of commercial timber. These soils present severe restrictions for road location, building sites, or off-road traffic.

3.3.3 The Lithic Cryorthents Soil Association

This association occurs in the high mountainous regions of the area. Characteristically, the topography is very rough with deeply dissected valleys and sharp rocky ridges. Soils at the higher elevations are too shallow for ice-rich permafrost to develop, but it can occur at the lower elevations. In this area these soils occur at elevations of at least 5,000 feet.

The highest areas are barren of vegetation or support a sparse cover of alpine tundra. The lower elevations and the valley bottoms support a shrubby vegetation, with black spruce forest at the lowest elevations. These soils are too steep and cold, and occur at elevations too high to support any cultivation or forestry. The steep slopes and occasional permafrost severely restrict construction or engineering within these soils.

3.4 Water Resources

3.4.1 Interrelationships and Overview

Water enters the watershed in three primary ways: as precipitation, intercepted atmospheric moisture, and condensation. Some of this water adheres to the leaves and branches of vegetation and is either adsorbed, drips to the vegetated floor, or evaporates.

Precipitation reaching the vegetated floor contributes first to surface storage on the vegetated litter, or it is ponded in depressions, or held in the snowpack. It then infiltrates the soil or runs off as overland flow. Water infiltrates, flows laterally, and eventually surfaces as streamflow.

Infiltrated water is detained temporarily by the soil as it percolates toward groundwater or streams, but a portion is retained, eventually to be evaporated or transpired. The amount of water retained and available for use by vegetation depends on soil density, structure, depth, and organic matter content. Evapotransportation is related to the regional climate and to the microclimate as controlled by local slope, aspect, elevation, and vegetation.

Yield is defined as water not evaporated, transpired, or retained by the soil to satisfy future evapotranspiration needs. It includes both surface runoff as the streamflow, and subsurface losses to groundwater. Streamflow is the product of input (precipitation) minus loss (evapotranspiration, contribution to groundwater aquifers, and the capacity of the soil to store water).

While it is generally apparent that water exerts a major control over vegetation, vegetation has some control over water. Natural or human-caused modification of the vegetative cover has the potential for affecting all segments of the hydrologic cycle such as:

1) The distribution of water and snow on the ground.

2) The amount of water intercepted or evaporated by foliage.

3) The amount of water that can be stored in the soil or transpired from the soil by vegetation.

4) The physical structure of soil which governs the rate and pathways of water movement to stream channels.

In turn, any of these changes can have a major effect on streamflow. Streamflow characteristics potentially altered by human activities such as placer mining, as well as natural events such as wildfire or loss to disease, include annual yields and peak flows.

Atmospheric moisture contains dissolved gases and chemical ions, including some caused by human activities. Generally, precipitation has a low dissolved ions content, and streamflow quality is largely determined by the remainder of the ecosystem. Water quality variables of concern include stream temperature, dissolved substances, and suspended sediment.

Stream temperature is controlled by exposure to direct solar radiation and the temperature of inflowing tributary or ground water. Stream temperature may be affected by practices which remove shade from streamside areas or alter channel morphology.

Aspects of concern regarding the chemical composition of stream water include acidity, inorganic cations and anions, and organic substances. The chemical constituents and acidity are controlled principally by mineral weathering in the parent materials and soils.

The sediment load of a stream (both suspended and bedload) is determined by such characteristics of the drainage basin as soils, vegetation, precipitation, topography, and land use. Sediments enter the stream system by a variety of erosional processes. To achieve stream stability, an equilibrium must be sustained between sediment entering the stream and sediment transported through the channel. Human activities such as mining practices as well as natural events which change sediment loading can upset this balance and result in physical and biological changes in the stream system.

Water yield is the final product of the hydrologic cycle and reflects water-soil-vegetation interactions. Of concern are such runoff characteristics as the amount and temporal variations, and quality as indexed by temperature, dissolved constituents, suspended sediments, and bedload.

Basin Characteristics

Beaver Creek is a non-glacial, Interior stream which originates in the White Mountains approximately 50 miles to the northeast of Fairbanks, Alaska. The drainage lies within what is known as the Interior climatic zone. Average annual precipitation is 15- 20 inches, with three to four inches of water equivalent occurring as snow (15-20 inch snow pack). Large storm patterns generally originate from the west to northwest. Localized thundershowers are characteristic during the summer months. Basin soils are characterized by a high permafrost content and a shallow active layer.

Beaver Creek originates at the confluence of Champion and Bear Creeks and flows generally in a northerly direction. For the first 135 miles it passes through the White Mountains Recreation Area at a gradient of approximately eight feet per mile. This is the reach which has been designated a Wild River. Just below the confluence with Victoria Creek the gradient decreases to two feet per mile as the stream meanders through the Yukon Flats for the remaining 170 miles to its mouth at the Yukon River.

There is no long-term record of water resources available for the basin. Most of the data which have been gathered for Beaver Creek is the result of an instream flow quantification conducted by the BLM during the summer of 1986 (DOI 1987a). During late July-early August 1986, investigations were conducted on Beaver Creek, from its headwaters to a point approximately 85 miles downstream, as part of a water rights assessment for Beaver Creek (DOI 1987a). Included in this assessment are descriptions of hydrology and channel morphology that provide essentially the only available data of this type for the Beaver Creek drainage. Observations have been recorded as well by ADF&G and BLM field personnel. An analysis of basin characteristics in combination with available information and data from adjacent drainages can be used to derive a reliable estimate of streamflow characteristics. Estimated streamflows for Beaver Creek at the headwaters (mile 0.0), just above "Big Bend," and above Victoria Creek (mile 112) are shown in Figure 3-1.

The linear configuration of Beaver Creek, shallow active soil layer, and lack of surface storage indicate a stream which responds rapidly to precipitation and maintains minimal flows during the dry winter. Peak flows occur during spring break-up, with minor peaks occurring during summer storms. Large storms may generate 2.5 or more inches of rain (Weather Bureau 1963), creating flooding of the lower reaches. Minimum flows are augmented by the presence of the springs at the "Big Bend" of Beaver Creek, a probable result of solution-enhanced porosity of the limestone bedrock of the White Mountains. These springs create a significant wintering habitat for grayling and long stretches of open water even during the most severe winters (Webb 1987).

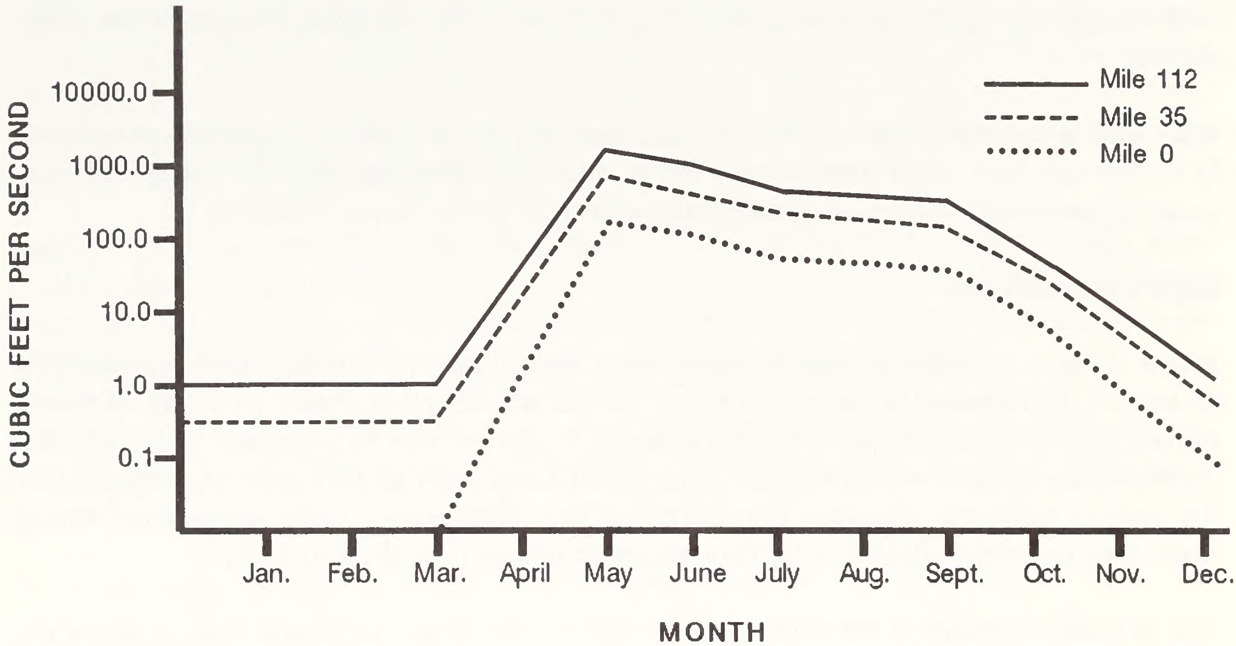


Figure 3-1. Estimated streamflows for Beaver Creek.

The geology of the basin (Section 3.1) would lead one to expect generally good water quality. This is borne out by what little information is available. Analysis of water samples collected by the BLM during the summer of 1986 indicate neutral acidity, and low dissolved ionic and total solid constituents. An appreciable portion of this material is probably organic in nature. As the capacity of the stream increases during high flows the percentage composition of inorganic material increases. Rates of sediment transport are very low even during these periods (Figure 3-2). Drawing on data presented in the Beaver Creek report (DOI 1987a), and assuming these conditions to be representative of the stream during the month of August, estimates may be made of the total amount of material transported. The sediment load at the headwaters (mile 0.0) would be 0.2 tons per day (1.0 mg/l sediment at 71 cfs). Similarly, the sediment load of the main stream just above Victoria Creek would be approximately 80 tons per day (46 mg/l at 649 cfs). The increase in sedimentation can be attributed to the normal increase in particulate matter loading as stream flow increases. These figures are relatively low, and compare favorably with the information presented by Selkregg (1974) concerning sediment transport by streams throughout the region.

An evaluation of the current contribution of disturbed areas to water quality in Beaver Creek hinges on an understanding of the roles of settleable solids and turbidity, two of the current standards used in such evaluations. Settleable solids are those materials in suspension in the water column which drop out as stream flow decreases. The amount of material which settles is dependent on stream velocity, time, and the characteristics of the particulate matter (relative size, shape, density, etc.). The slower a stream moves, and the longer that it remains in this state, the more material will settle out. This is the function of certain types of waste water treatment, such as settling ponds. Research indicates that to reduce the effects of sediments on aquatic environments to acceptable limits certain standards must be achieved. The current standard is that no more that a trace (0.2 ml/l) of sediments drop out of a column of water which remains still for one hour.

The following discussion addresses the relationship between turbidity and suspended sediment and is essentially an extraction from ADEC (1985). Analysis of suspended solids concentrations is conducted as a gravimetric determination of the particulate matter in a given volume of water. The results are usually expressed as milligrams per liter. Turbidity, on the other hand, is a measure of the optical properties of the water column, and the way that light is deflected or absorbed by particulates. This is affected by such characteristics as size and size distribution, shape, refractive index, and absorption spectral properties. While "suspended solids" measures particle mass; turbidity measurements are more of a determination of the effect of suspended sediments on the transmission of light, and therefore, the impact to the biological community. There is no direct relationship between these parameters, other than that they are both methods of measuring particulates. In part, due to the cost and effort required to conduct the required laboratory analysis, turbidity has been used as an indirect measure of suspended sediments.

Category	1987				
	Annual Tonnage Rate of sediment per square mile	X	Square miles of a category in Beaver Creek watershed	=	Annual Tonnage Rate of sediment per category in Beaver Creek
Forest	24	X	1,683.00	=	40,392
Abandoned Surface Mines	2,400	X	0.55	=	1,320
Active Surface Mines	48,000	X	0.005	=	240
Construction	48,000	X	0.2	=	9,680

Figure 3-2. Methodology used to obtain annual tonnage sediment rates for various categories in Beaver Creek watershed. Square mile sediment rates taken from EPA (1973). Beaver Creek watershed is approximately 1,870 square miles in area according to BLM records. Forested lands (including covered ground) are estimated to be 90% of basin.

There has been some placer mining and road construction activity in the Beaver Creek watershed which has caused deterioration of water quality in the basin. Most of the activity has taken place in the Nome Creek watershed and its small tributaries. Nome Creek itself was dredged from the 1920's to 1940's, presumably with very little or no measures taken for wastewater treatment. Currently, there is no overt evidence of sedimentation in the first 135 miles of the Beaver Creek channel from this historic mining. In the 1970's and 1980's, Nome Creek was mined periodically by small to medium-sized placer operations. These operations have caused noticeable and sometimes dramatic increases in the turbidity of Nome Creek and downstream on Beaver Creek. Webb (1982) reported that muddy water discharges into Beaver Creek from mining activities on Nome Creek were visible as far as 50 miles downstream. These increases in turbidity have not been persistent and do not appear to create long-term alterations in stream attributes. There are no data available to determine aggradation or degradation of the channel due to possible sedimentation from mining activities, but analysis of aerial photography and field observations do not indicate any abnormal changes or adjustments in channel morphology due to sedimentation of Beaver Creek (Vogler pers. ob.). During the 1987 mining season, one mining operation was active in the Nome Creek drainage. This operation was only active during late August through September; a 100% recycling system was used with two ponds, one for recycling and one for overflow. Any excess water was routed out of the second pond into a ditch to be filtered into the ground. The filter system was not entirely effective and there were some noticeable turbidity increases in Nome Creek. By the time Nome Creek entered Beaver Creek the dilution was sufficient to make any indication of increased turbidity undetectable by the eye.

Observations of impacts from non-point sources, such as the older unreclaimed disturbances, have been documented. ADF&G (1987) reports that the unstable channel in upper portion of Nome Creek causes periodic sediment discharges. Additionally, fine grained deposits were observed in wooded areas downstream from mining activities on Nome Creek. There are no data available to quantify the degree of impact from these sources. The majority of these impacts probably occur during periods of high flow such as spring breakup and after large storm events.

The following are prominent streams of concern in the headwaters area of the drainage:

Bear Creek

Bear Creek is a clear, rapid stream (average gradient of 0.85%) containing long riffle areas with relatively few pools. The substrate is a non-embedded gravel-cobble mixture (75-200 mm in diameter) particularly in the lower reaches of the stream. The substrate in the upper reaches is predominantly cobble. Bear Creek is seldom deeper than ten feet and in places the stream channel may be up to 115 feet wide, with rocky gravel bars present throughout. Riparian vegetation consists of a willow/white spruce mixture.

Quartz Creek

Quartz Creek is the major tributary entering Bear Creek and has a gradient of 1.4%. It is a clear stream composed almost entirely of riffle areas. The substrate is generally a non-embedded gravel-cobble mixture; however, a braided area approximately two miles upstream of the Quartz-Bear

Creek confluence supports a substrate composed of finer materials that tend to accumulate in back-water areas. Quartz Creek ranges in width from up to 55 feet in its braided area to less than 28 feet for the majority of the creek. It is generally less than five feet deep. Riparian vegetation is a spruce/willow mixture, with willow predominating at higher elevations.

Champion Creek

Champion Creek joins Bear Creek to form Beaver Creek. Upper Champion Creek is a clear stream composed almost entirely of riffle areas and has a gradient of 1.6%. The substrate ranges from gravel to large cobble (75-305 mm in diameter) and is not embedded. Upper Champion Creek rarely exceeds 47 feet in width or five feet in depth. Lower Champion Creek has a lower gradient (0.8%) than upper Champion Creek, is larger and deeper, has more meanders, and has a finer substrate, the result of flow from Little Champion Creek and the decrease in gradient from the widening of the valley. Lower Champion Creek has long riffle areas and occasional short pools, may be up to 105 feet wide, and is generally less that ten feet deep. Riparian vegetation along lower Champion Creek consists primarily of willow, white spruce, and blueberry, and is similar to that found in the upper reaches.

Little Champion Creek

Little Champion Creek, a tributary to Champion Creek, has a high gradient (1.9%), is composed almost entirely of riffles, averages one to two feet in depth, and is seldom wider than 28 feet. The non-embedded substrate ranges from gravel to small boulders (75- 305 mm in diameter), with cobble-sized rocks most common. Riparian vegetation consists primarily of willow and white spruce. Post (1986b) reported that the upper portion of Little Champion Creek contained about a 2.55% gradient, and that the stream was wooded.

Nome Creek

Placer gold deposits were first discovered on upper Nome Creek in 1910, and later mined (along with tin) in the 1920-1940 period by a bucket line dredge (DOI 1983). Approximately eight miles of Nome Creek have been mined to date (Post 1986a). Post (1986b) observed in 1986 that the stream channel in upper Nome Creek near the headwaters above the mined area was about 4% gradient and contained few resting places for arctic grayling. The water in the upper portion of the creek was clear in June 1986. Post further observed that the lower portion of the stream contained pools and eddies that could offer holding areas for arctic grayling. Post (1986b) described the upper Nome Creek drainage as follows:

> "The upper portion of Pavey's former operation consists of a large stripped area. The strippings have been pushed to the north side of the valley floor where they form a long vegetated stockpile. Some willow regeneration is apparent in the stripped area, and ground cover is present.... Below the stripped and unmined area...Nome Creek has a poorly defined channel that may be a barrier to fish passage at low summer flows. It is unclear whether this area was mined or just bladed without mining. There are no large tailings piles in this reach, but several old diversion

channels are present. The natural stream pattern has been obliterated.... The visual observation...of what appeared to be an arctic grayling (in the old settling) ponds is evidence that fish could benefit from rehabilitation of these features."

3.4.2 Physical Changes to Stream Channel

Effects to the Channel Bed

Approximately nine miles of Nome Creek have been mined (Post 1986b). Nome Creek, in the section disturbed by mining, is characterized by straight, shallow, high velocity, and frequently split stream channels that make their way through dredge and dozer tailings. The stream channel in the uppermost mined section of Nome Creek is quite unstable and is eroding adjacent tailing piles, creating periodic sediment pollution.

Sediment Deposition

No data discussing sediment deposition within the stream channels of Beaver Creek or its tributary streams were located. Refer to Section 3.4.1 for a general discussion of this topic.

Degradation and Cementing of Streambed

No data discussing degradation and cementing of streambeds in the Beaver Creek drainage were located. Refer to Section 3.4.1 for a general discussion of this topic.

Increased Aufeis Formation

Heavy accumulations of aufeis have been observed in disturbed portions of Nome Creek, including the area near the mouth of Moose Creek and the area near the end of U.S. Creek Road (Post, pers. comm. 1987). To what extent these observed conditions differ from pre-disturbance conditions is unknown.

3.4.3 Changes in Water Quality

Heavy Metals

No data discussing heavy metals for the Beaver Creek drainage was located. Refer to Section 3.4.1 for a general discussion of this topic.

Non-point Sources of Sediment at Breakup

Post (pers. comm. 1987) observed the confluence of Nome Creek and Beaver Creek from the air on June 9, 1986. Nome Creek was visibly more turbid than Beaver Creek, a difference attributed to extensive mining-related disturbance in the Nome Creek drainage. Aufeis was still present on this date. On the following day, Post and BLM personnel observed that lower Nome Creek was too high and fast to wade in hip boots. Turbidity was sufficiently high to obscure the bottom of the stream.

Post (1986b) observed evidence of active erosion of tailing piles containing fine-grained material from dozer mining in the "Pavey" section of Nome Creek (above Sumner Creek) during periods of high flow. Further evidence for non-point sources of suspended solids in the upper reaches of Nome Creek is the observation by Post (1986b) of cloudy water at the end of the U.S. Creek Road on June 25, 1986, during a period of high flow. A camper reported that the stream had been very high and turbid on the previous day. Post (1986b) found that water clarity was excellent above the mined portion of Nome Creek on the former date.

Hazardous Materials

Most mining operations in Alaska use only a limited variety of materials which are currently catagorized as hazardous. In the Beaver Creek drainage these are currently limited to fuels and solvents. We do not anticipate the use of explosives or the chemical processing of gold-bearing ores, the other sources of hazardous materials in placer operations, within the time constraints encompassed by this analysis. Regulations at 40 CFR require that operators of facilities with fuels stored in excess of 660 gallons per single container or 1,320 gallons in aggregate prepare and implement Oil Sill Control and Countermeasures (SPCC) plans. Secondary containment, such as provided by a continuous berm or dike, is required in conjunction with the plan. The purpose of the regulation is to reduce the likelihood of a spill reaching navigable waters and to reduce the extent of damage if such a spill should occur. Operators are required to report spills entering navigable waters or adjoining shorelines to the National Response Center.

State regulations (18 AAC 75) require differing levels of response depending on the amount of hazardous material spilled. However, any spill must be reported. Ultimate disposal of hazardous substances must be approved by the Department of Environmental Conservation (DEC), however, no permit is required. While little attention has been given disposal of solid wastes in the past, the DEC intends to require compliance with the regulations in the future. The current recommendation for such waste disposal is burning combustibles and back-hauling non-combustibles. Landfills may be permitted on a site-specific basis.

3.5 Landcover

3.5.1 Introduction

The vegetation components of an ecosystem grow in response to the elements in the environment. As discussed previously in the Soil and Water Resources sections, vegetation influences and is affected by the complex interrelationships of biotic and physical factors. The resultant vegetative communities vary in the species present (flora), the percentage of these species (composition), the spatial and vertical arrangement of the plants (structure), and in the productivity of organic material (function).

The vegetative cover of an area is an integrated expression of historic and present conditions and disturbances. Burned areas are visible in the mosaic of vegetation patterns over 100 years after the wildfire. Riparian vegetation on floodplains results from ice-free well-drained soils. Prostrate alpine vegetation has adapted to short growing seasons and exposure to desiccating winds throughout the year. Shallowly rooted black spruce grow on ice-rich permafrost soils. The ground cover of *Sphagnum spp.* moss insulates the soils and contributes to the lowered soil temperatures which result in permafrost. Wetland communities grow in response to a high water table, and serve as a buffer to fluctuations in the water table.

Vegetation is an important component of habitat for wildlife and human populations. Vegetation is used for food and shelter by most species in the watershed. Sometimes, fauna impacts the vegetation sufficiently to change the community on a site. Moose may severely overbrowse the willows of an area, beaver may flood out sedge/shrub meadows, or humans may remove the vegetation entirely for mining activities.

After various disturbances, the vegetation usually grows back on a site. A series of different communities usually replace each other as environmental conditions change. This process is succession. The community composition and rate of change result from the severity and size of the disturbance, the soils and climatic conditions on the sites, the availability of reproductive materials, and conditions for establishment of seeds or vegetative propagules.

The distribution patterns of landcover types in the Beaver Creek watershed are fairly typical of patterns throughout Interior Alaska. The mosaic of vegetation communities within the watershed has developed in response to a variety of environmental factors, including climate, physiography, surficial geology, soil character, discontinuous permafrost, and disturbances such as fire, flooding, and human actions, including placer mining. Portions of the riparian zone in the upper reaches of the Beaver Creek watershed have been influenced by placer mining over the past 90 years, as have most other drainages in the Yukon-Tanana watershed.

3.5.2 Description of Vegetation Types

Most of the major landcover types typical of Interior Alaska are represented in the Beaver Creek watershed (Figure 3-3). The landcover types are based on the Alaska Vegetation Classification System (Viereck, et al. 1986 and 1987). This five-level classification system is specifically designed to describe vegetation associations from a general level (Level I including forest, scrub, and herbaceous) to a detailed description (Level V, which incorporates the scientific names of the species of plants in the associations).

The upland areas of the watershed are characterized by alpine tundra types and by a diversity of forest types whose distribution is affected by such factors as slope, aspect, soils, permafrost, and repeated fire patterns. Riparian areas along stream channels on current and former floodplains and old terraces support a variety of forest, shrub,and herbaceous types in various stages of succession, dependent upon a site's history of fire, floods, and mining.

Alpine tundra and sparsely vegetated communities grow in the White Mountains above 3000 feet. The alpine tundra areas have plant associations of *Dryas* dwarf scrub, plants belonging to the heath ericaceous family; and dwarf scrub of bearberry, blueberry, and mossberry. *Cassiope* is widespread on moist alpine sites, as is willow tundra. The lichen components are variable and include fruticose and crustose growth forms.


White Spruce Branch

Lower rolling slopes support communities of dwarf and low shrubs, and sedge/shrub tundra. Mixed in with the forest components are tall and low scrub communities of alder, willow, and ericaceous shrubs such as Labrador tea, blueberry, and dwarf birch. On the better-drained slopes the ground layer may be composed of dry herbaceous plants, mosses, and lichens such as the *Cladina* groups (reindeer moss), and some graminoids. The poorly drained and wetter slopes are characterized by more alder and some willow with a ground layer of *Sphagnum*, sedge tussocks, other mosses, and foliose lichens like *Peltigeria*, Tussock tundra grows on the large, gentle, northwest-facing slopes between Colorado and Sheep Creeks.

Deciduous forests occur on steeper southerly facing slopes on the west side of Beaver Creek below Colorado Creek. Black spruce and low shrub/moss types cover the gentle slopes between Nome and Colorado Creeks on both sides of the Beaver Creek drainage and along old terraces of Beaver Creek.

Open white spruce and white spruce/black spruce stands are commonly found on the drier, well-drained south and west-facing slopes throughout the watershed. Birch, birch/aspen, and spruce/birch stands are vegetation associations found on these slopes, but are successional to stands of

LEVEL I CLASS	COMMUNITY	LEVEL IV CLASS	PLANT CANOPY DESIGNATION
Forest	Riparian	White Spruce	closed, open, woodland
	Riparian	Black Spruce	closed, open, woodland
		Black spruce-white spruce	closed, open, woodland
		Black spruce-tamarack	open, woodland
	Riparian	Balsam poplar	closed, open
	Successional	Birch	closed, open
	Successional	Aspen	closed, open
	Successional	Birch-aspen	closed, open
	Riparian	Spruce-birch	closed, open
		Aspen-spruce	closed, open
	Riparian, Successional	Poplar-spruce	closed, open
Scrub	Riparian	Tall willow	closed, open
		Tall alder	closed, open
	Riparian	Tall alder-willow	closed, open
	Riparian	Low willow	closed, open, sparse
		Low willow-alder	open
	Riparian	Mixed shrub-sedge tussocks	open
		Mesic shrub birch-ericaceous shrub	open
	Riparian	Ericaceous shrub bog	open
	Riparian	Shrub birch-willow	open
	Riparian	Willow-gramnoid bog	open
Dwarf shrub		Dryas tundra	
		Dryas sedge tundra	
		Vaccinium tundra	
		Cassiope tundra	
		Willow tundra	
Herbaceous		Midgrass shrub	
		Midgrass herb	
	Riparian, Successional	Bluejoint-herb	
	Riparian	Tussock tundra	
	Riparian	Sedge-dwarf birch tundra	
	Riparian	Wet sedge meadow tundra	
	Riparian	Wet sedge-herb meadow tundra	
		Subarctic lowland sedge wet meadow	
		Subarctic lowland sedge moss bog meadow	
		Alpine herb-sedge	
		Fresh herb marsh	

Figure 3-3. Landcover types in the Beaver Creek watershed (Viereck 1986).

white spruce as the climax vegetation. Well-developed stands of birch may be found on silt loam ridges on these slopes. Open black spruce and black spruce/ aspen stands are common on poorly drained, cold sites on north and east-facing slopes. These slopes are underlain by permafrost.

The vegetation communities in the riparian zone along the stream floodplain and lowland areas of the valleys are most impacted by placer mining, and will have the greatest variation in the resultant impacts associated with the various alternatives (Section 4.5). The riparian zone along Beaver Creek supports a community of white spruce and cottonwood in the lower reaches, and a community of low and tall shrubs in the upper parts of the drainage. The areas of Nome Creek which have been dredged are mostly barren, with some shrub regrowth.

A prescribed burn to improve wildlife habitat was conducted by BLM in summer 1987. The burn improved approximately 2,000 acres in the upper Bear and Quartz Creeks drainage. The original vegetation in the area of the burn was predominately sparse black spruce forest and spruce/birch mixed forest. Species characteristic of early successional stages, including willows, other shrubs, and herbaceous plants, have regrown in the burned areas.

Riparian Forest

The closed needle/leaf forest (canopy cover greater than 60%) types include white spruce along the rivers and drainages located on well-drained permafrost-free soils, black spruce generally occurring on poorly drained organic soils which are often underlain by permafrost, and black spruce/white spruce forests on the river terraces.

The closed broadleaf forest (canopy greater than 60%) is represented by the balsam poplar which occurs most frequently on river floodplains. There is a closed, mixed forest type of poplar/spruce which is an intermediate successional stage leading to the white spruce climax on floodplain sites.

Riparian Scrub

Tall scrub includes willow thickets which are especially characteristic of floodplains and river banks, and shrub swamps of alder and willow which occur on floodplains and in drainageways.

Low scrub stands occur in wet stream bottoms, poorly drained lowlands underlain by permafrost, and floodplains. These communities include dwarf birch/ericaceous shrub bog, mixed shrub/sedge tussock bog, ericaceous shrub bog, shrub birch/willow, and willow/graminoid bog.

Recently disturbed gravel bars and tailings support sparse shrub communities, usually willow, alder, and balsam poplar seedlings.

Riparian Herbaceous

Wet sedge/herb meadows and lowland sedge wet meadows are common on very wet, poorly drained sites with standing water such as oxbow lakes, floodplains, and margins of ponds, lakes, and sloughs.

Another herbaceous type is the pioneering community of grasses and forbs on recently disturbed gravel bars or tailings.

Wetlands

Wetlands, an important component of the ecosystem, act as a buffer for water quality affects, and are subject to long-term effects after disturbances. Wetlands have been defined by the COE in 33 CFR 323 as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support,and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." The COE definition allows that any vegetated area which is underlain by ice-rich permafrost typically meet wetland definition. Therefore, many areas in the Beaver Creek watershed which are below the alpine zone are wetland in character subject to Section 404 of the Clean Water Act. The COE definition of wetlands is different from that of other wetland definitions used in Alaska. Other definitions of wetlands which are commonly used in Alaska are based on water saturation of the upper strata of the substrate, and standing water at the surface. These types usually do not include all black spruce and many scrub communities as wetlands.

3.5.3 Successional Patterns

The major causes of disturbance in the Beaver Creek valley are wildfires and placer mining. After a site has been disturbed, a series of vegetation communities sequentially develops, one gradually replacing its predecessor in a systematic, successive manner. The process of succession is "the more or less orderly pattern of events and processes in nature whereby plant and animal species replace each other as a result of a changing environment" (Komarek 1971). The rate of succession results from the type, frequency, duration, and intensity of disturbance, and the basic environmental factors of a site. One simplified example of succession would be vegetation types of grass and forbs, replaced by deciduous shrubs, which are replaced in turn by a climax community of coniferous trees on a site. A disclimax community is maintained in an area subject to continuous repeated disturbance (Daubenmire 1968). For example, aspen and birch stands are often maintained on south-facing slopes by repeated fires when white spruce would be the "normal" climax stage.

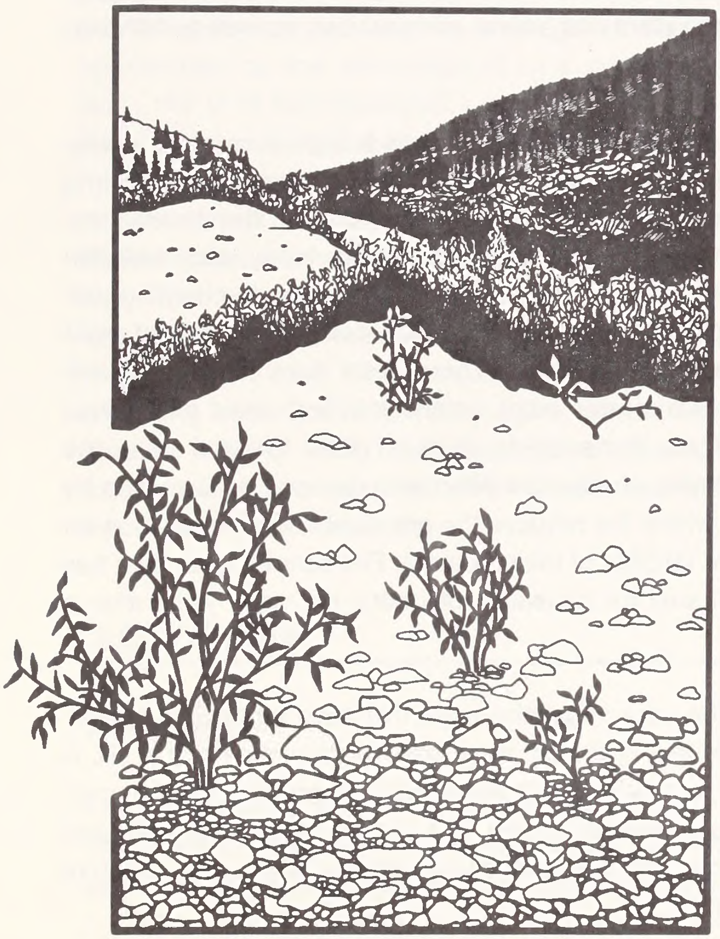
Succession in Mined Areas

Succession in placer mine tails depends very heavily on the percentage of fine-grained materials or "fines" in the substrate (Holmes 1981, Rutherford and Meyer 1981). Fines (particles of silt and clay size) directly control the water, oxygen, and nutrients available to plant root systems, and the quality of the initial seed or rooting bed. Other important considerations are micro-relief and sources of seed or vegetative propagules. Vegetation of mine tailings is considered an example of primary succession because the tailings are usually undifferentiated mineral materials with little or no organic content or seed bed.

Typically, mine tailings are initially invaded by annual grasses and forbs such as *Calmagrostis* and fireweed, with lupine and other legumes following. Scattered seedlings of willow and alder invade next, intermixed with birch or balsam poplar in some locations. Rose or bearberry may also occur, and initial bryophytes are usually *Sterocaulon* and hairy cap moss.

As the cover of shrubs expands, the ground cover increases and more species become established. Mosses such as *Hylocomium* and *Drepanocladus*, and lichens including *Peltigeria*, *Cladina* spp., and *Cladonias* comprise the ground cover. At this stage, ericaceous shrubs usually colonize, including blueberry, cranberry, Labrador tea, and mossberries. Spruce seedlings also begin to grow under the shrub cover during this period. The composition of the resultant community may be fairly stable for tens of years.

In cooler and wetter areas, the organic layer accumulates, *Sphagnum* mosses flourish, and permafrost redevelops. Eventually, a black spruce/low shrub/*Sphagnum* moss type covers the site.



Revegetation

In warmer, well-drained areas, a mature, single-aged birch and/or aspen stand usually develops, with alder, willow, and white spruce saplings in the understory. If left undisturbed for a long enough period, mature white spruce with scattered birch, aspen, or balsam poplar develops on the site. Riparian communities often develop old stands of 200-300 year old white spruce and balsam poplar. Above the limits of tree growth, riparian zones usually consist of tall willow and alder.

The rate of succession seems to be heavily influenced by the proportions of particles of silt and clay size in the surface layer of the tailings. Rutherford and Meyer (1981), reporting on 30-40 year old communities on dredged tailings in the Tuluksak River, documented that the growth of sparsely vegetated shrubs through dense tall shrub stands depended on soil particle size. With an increase in fines from 10% to greater than 50% there was a corresponding increase in the amount of cover, vegetation height, and species diversity. Holmes (1981), working on 50 year old dredge tailings on Goldstream Creek at

Fox, reports similar findings, with slightly longer time frames. This would be in keeping with the more northerly site. Halloran (1986), working on both recent and old tailings in the Birch Creek drainage, Circle mining district, found that vegetation development was enhanced in areas with greater fines content. This work included data on an undisturbed site with fines content of greater than 50%, while tailing samples ranged from less than 10% to approximately 50% fines.

Observations by BLM (Spencer 1987) during the summer of 1987 support these interpretations. Small willow seedlings from five to seven years old located on tailings with moderate fines content on Faith and Portage Creeks were seen, along with tall willows aged 17 years on tailings over 30 years old at the tailings/water interface on Deadwood Creek, a tall alder/willow community on old, well-drained tailings aged approximately 40 years on Switch Creek, and dense grasses and willow shoots covering areas that had been stripped the previous year, but not sluiced.

Fire Succession

Past fire history and fire patterns have also influenced the distribution of landcover within the watershed. Fire changes the relationships between the plant and animal communities, as well as between the plants and the climate.

Often fire has positive benefits. For instance, the ash resulting from fires is high in calcium, potassium, phosphorous, and other minor elements that have been released from the organic matter in a usable, soluble form. Releasing these nutrients from the biomass is beneficial in the Alaskan environment because other processes of nutrient recycling such as weathering, decay, and oxidation are exceedingly slow in the arctic and subarctic biomes. The variations caused by fire burning patterns and the adaptations of different plant species to fire also creates a complex mosaic of plant communities and ecotones in various stages of succession. These plant communities provide habitats for a large variety of animal species. Fire creates more variations in both plant and animal communities than probably any other natural force. For example, in much of the forested areas, the variations of fire intensity and frequency determine whether the affected region will be occupied by moose or caribou. In waterfowl nesting areas where fire reduces the graminoid cover, predation on the waterfowl is often decreased due to greater visibility of the predators. Fire-scarred landcover has a visual impact on the esthetic qualities of an area for recreation utilization for many years after a burn (Komarek 1971).

Often fire or fire suppression activities affect the thick vegetative mats that have a principal insulating effect on the soil thermal regime. When this mat is altered, the frozen subsoil, often rich in silt, is released when the permafrost melts. Surface slumping and sedimentation of streams are common results of this thermal disruption and can affect even flat terrain. The overall moisture relation and thermal effects from fire are more pronounced on the south-facing slopes where the moisture balance is more critical (Lotspeich and Mueller 1971).

Lotspeich and Mueller (1971) speculate that the vast majority of Interior Alaska has been burned over within the past 200- 250 years, though that time period could possibly be too long when compared to the normal species rotation ages. They estimate rotation ages of white spruce at 100-150 years, birch at 80- 100 years, aspen at 60-80 years, and black spruce at 60-80 years.

Fire has less impact on white spruce stands which are found on valley floors and terraces of the riparian zone where the burning may be less severe. White spruce also lack ladder fuels, which reduces their susceptibility to crown fires. Black spruce, which frequently burns, is well adapted to fire because of serotinous cones which can release a viable seed crop shortly after a fire. However, repeated fires can convert spruce areas to birch and aspen stands which are then maintained as a disclimax. Deciduous broadleaf trees, due to the nature of their branching, are not so affected by crown fires. Aspen usually regenerates by vegetative reproduction from root suckers if the fire does not burn down to the mineral soil (Barney 1969).

3.5.4 Threatened & Endangered Plants

Within the Beaver Creek drainage there are no formal "listed" or "candidate" threatened or endangered plant species. Candidate species are those plants included in the Federal Register "Notices of Review" listing that are being considered by the Fish and Wildlife Service (USFWS) for listing as threatened or endangered. Threatened plant species are those so restricted in distribution that they are likely to become endangered. The designation of endangered status means that a species may be lost throughout all or a significant part of its region due to current or planned activity. The BLM has developed a category of "endemic" species for use in managing their lands. The intent is to encourage better management practices to prevent these species from being listed as threatened or endangered. Endemic species are those considered vulnerable because of a significant current or predicted reduction of populations, numbers, or habitat (Murray, Lipkin 1987). Beaver Creek watershed contains only one of these endemic species, *Poa Porsildii*. These species are endemic to the area where found. Beaver and Birch Creek drainages are the two known localities in which these plants exist in Alaska. It also occurs in a few more areas in the Yukon Territory, with the main concentration being in southwestern Canada. It is usually found on or under persisting snow beds within dry alpine areas (Hulten 1968). The possibility of additional sensitive species existing within the watershed of Beaver Creek is a distinct possibility because some localities are so remote that collections are sparse. Taxonomic studies are being inventoried, but at this time they are incomplete.

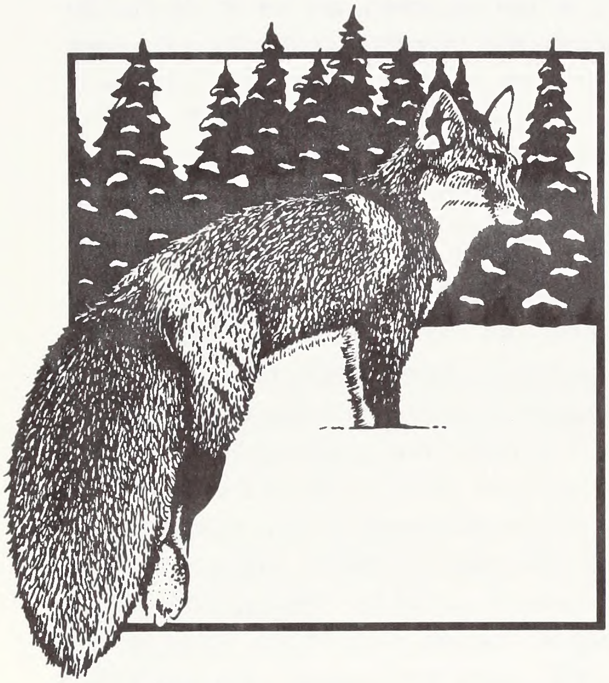
3.6 Wildlife

Introduction

Terrestrial wildlife includes all animals that inhabit the upland and riparian portions of the physical environment. The mammal and bird species of most importance to humans for food, recreation, or economic purposes, and their associated habitats are emphasized in this analysis.

Wildlife <u>habitat</u> provides food, cover, water, and living space. Habitat is used by wildlife for all life-sustaining activities including breeding, foraging, drinking water, hiding and resting, and movement and protection. The number, types, and availability of wildlife habitats present and how they may be affected by mineral development in the area can be better understood by focusing on vegetation, a principle component of terrestrial habitat. The various successional communities of vegetation are primarily a function of the frequency and distribution of disturbances like fire, and the substrate (soils) in the area. These vegetation patterns play an important role in influencing habitat diversity and, therefore, the number and type of habitats utilized by the various species.

Species and Habitats Present



Red Fox

The combination of rugged mountain peaks of the White Mountains, and rolling hills and many stream valleys of the upper Beaver Creek watershed provide habitat for many species typical to Interior Alaska. Caribou, moose, Dall sheep, grizzly bear, black bear, and wolf are the big game species most commonly present. Furbearers of economic importance in the area include marten, lynx, red fox, beaver, otter, and mink. Small game species include, spruce, ruffed and sharp-tailed grouse; willow and rock ptarmigan; and snowshoe hare. The peregrine falcon, an endangered species, inhabits the area as do other raptors, including the bald eagle and red-tailed hawk. Many non-game mammal and bird species are also found throughout the area. The upper reaches of Beaver Creek support relatively few numbers of breeding waterfowl due to the narrow floodplains of the river and stream valleys. Waterfowl use occurs in this area during spring and fall migration periods. Beaver Creek drains north into the Yukon Flats where extensive lowlands and broad floodplains support large numbers of breeding ducks, geese, swans, and cranes. Additional information concerning species descriptions and distributions is available in "Alaska's Wildlife and Habitat" (ADF&G 1978c), "Alaska Wildlife Management Plans - Interior Alaska" (ADF&G 1976), and "Alaska Habitat Management Guide for Mammals, Birds, and Human Use" (ADF&G 1986c).

The area contains year-round habitat for the White Mountains caribou herd (see Caribou Range Map) and has been historically occupied by the Fortymile caribou herd. The White Mountains caribou herd currently numbers approximately 1,000 and may have arisen from remnants of the larger Fortymile herd of the 1950's. At present, winter range of the White Mountains herd is west of Beaver Creek in the upper Tolovana River and Victoria Creek watershed. Summer use areas of the White Mountains caribou is primarily in the upland areas of the White Mountains (Cache Mountain, Lime Peak, Mt. Prindle). Some use of the area by the Fortymile herd still occurs during summer and fall in the Lime Peak and Mt. Prindle areas. (Durtsche 1984a). During years in which the Fortymile herd numbered approximately 50,000 or more (1930 to 1962), the principal calving area was in the White Mountains, and movements traversed the Steese Highway between the 12 Mile Summit and Eagle Summit areas (Davis, et al 1976) (Caribou Range Map). Recently the Fortymile Herd has increased from a low of about 5,000 in 1976 to the current estimate of approximately 16,500 (Valkenburg and Davis, pers. comm.). The current ADF&G population goal is 50,000 caribou.

Dall sheep occupy alpine areas in the vicinity of Mt. Prindle, Lime Peak, Cache Mountain, White Mountains proper, Victoria Mountain, and Mt. Schwatka (Dall Sheep Range Map). Current numbers of approximately 240 probably represent a stable population after a decline of about 60% during the early 1970's (Crain and Durtsche, unpub. data). Sheep habitat is limited by a relative shortage of escape terrain and areas over 2,500 feet in elevation. Sheep often travel considerable distances through forested areas to reach mineral licks or other suitable habitat (Durtsche 1984b). This combination of forested areas and the scarcity of rugged escape terrain in the alpine areas may make these sheep vulnerable to predation and the disruption of traditional movements and seasonal use areas.

Moose populations in the area are relatively low. The population is not increasing because calf survival is poor due to high mortality of calves during the summer months (Nowlin, 1987). Predation by bears and wolves appear to be the main causes of calf mortality (Durtsche, unpub. data). A total number of approximately 400 moose seen during a 1985 survey (Haggstrom and Durtsche, unpub. data) on upper Beaver Creek may indicate a stabilization in the population following the downward trend of recent years. Moose habitat is dominated by spruce forest, with stands of riparian willow along rivers and streams which provide important late winter browse (Moose Range Map). Early successional stages of vegetation following fires are commonly utilized by moose in early winter, but are only a small portion of the moose habitat in the area. The quantity and quality of moose range in the overall area has been reduced by past wildfire suppression activities and habitat loss from placer mining in the Nome Creek valley. Recent investigations concerning moose seasonal distribution and habitat use in upper Beaver Creek indicate a portion of the moose population wintering in Beaver Creek utilize areas in the Fairbanks vicinity during spring calving, summer, and fall (Durtsche, unpub. data). The preliminary data indicate that availability, quality, and quantity of winter range utilized by moose in upper Beaver Creek may influence the number of moose available for human use in the Fairbanks area.

Little data are available for location of crucial use areas, population numbers, trends, productivity or survival of grizzly bear, black bear or wolves. Similarly, specific data on population size, trend, productivity, and use areas for raptors (Wildlife Raptors Map), furbearers, small game, and nongame species are also lacking.

Present Situation in Relation to Mineral Development

Construction of approximately 7.2 miles of permanent gravel roads in the Beaver Creek watershed has resulted in the permanent loss of 44 acres of wildlife habitat in the Nome Creek drainage. The establishment and use of 23.3 miles of primitive roads and trails, in addition to permanent roads, has resulted in 19,200 acres of wildlife habitat being subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The present low level of vehicular use of roads and trails is periodic and has not resulted in significant alteration of wildlife movement routes, or disturbance or disruption of seasonal use areas. Improvement and expansion of access trails into Quartz Creek and other areas of Beaver Creek has indirectly resulted in increased harvest pressure on moose, caribou, Dall sheep, grizzly bear, black bear, and other species. Improving access and establishing new access for mining and other activities into remote areas has indirectly facilitated more wildlife habitat loss and disturbance in wildlife use areas over the long term by enhancing the feasibility of mining more and larger areas.

Birch Branch

The presence of facilities and structures associated with mining activities in Beaver Creek has resulted in the long-term loss of two acres of winter range for moose in the Nome Creek drainage. Similarly, 18 acres of riparian habitat used by moose and other species are unavailable for the short term due to frequent human disturbance near the facilities during May through October. Grizzly or black bears have been removed as nuisance animals because of their attraction to refuse or other solid waste in the vicinity of mining facilities.

Activities associated with stripping, mine cuts, stockpiles, and settling basins have resulted in physical alteration of about 352 acres of moose winter range in the Nome Creek valley. Approximately 310 acres of this previously-mined habitat has recovered over the last 40-50 years to provide about 30-50 acres of usable browse for moose. Since 1984, about 40 acres of the previously-mined area has been mined again. Reclamation of the 40 acres has been facilitated through spreading of tailings. Revegetation in this area has and will continue to require approximately 50 years (Figure 4-3) to reach a stage suitable as moose browse. Short-term avoidance during the summer mining season of approximately 502 acres of riparian and upland habitat also occurs in the Nome Creek area due to noise from machinery and other mining activities. The possibility of hazardous materials spills such as diesel fuel has been recognized, but no appreciable contamination or loss of wildlife habitat has been known to occur.

Conclusions

Between 300-320 acres of moose late winter range have been physically altered by mining-related activities in the Nome Creek area of Beaver Creek. Disturbances to wildlife due to use of roads and trails, operation of vehicles, machinery, and human habitation in the Beaver Creek watershed has resulted in a minimum level of short-term adverse effects in localized areas during the summer. Minimum harvest of wildlife resulting directly from mining activities has occurred in Beaver Creek. The principle long-term adverse effect of mining in Beaver Creek is the loss of between 32-34% of the moose late winter range in the Nome Creek watershed. The long-term loss of habitat to mining in this portion of Beaver Creek may have contributed to a slight to low level reduction in moose population potential.

Beaver Creek
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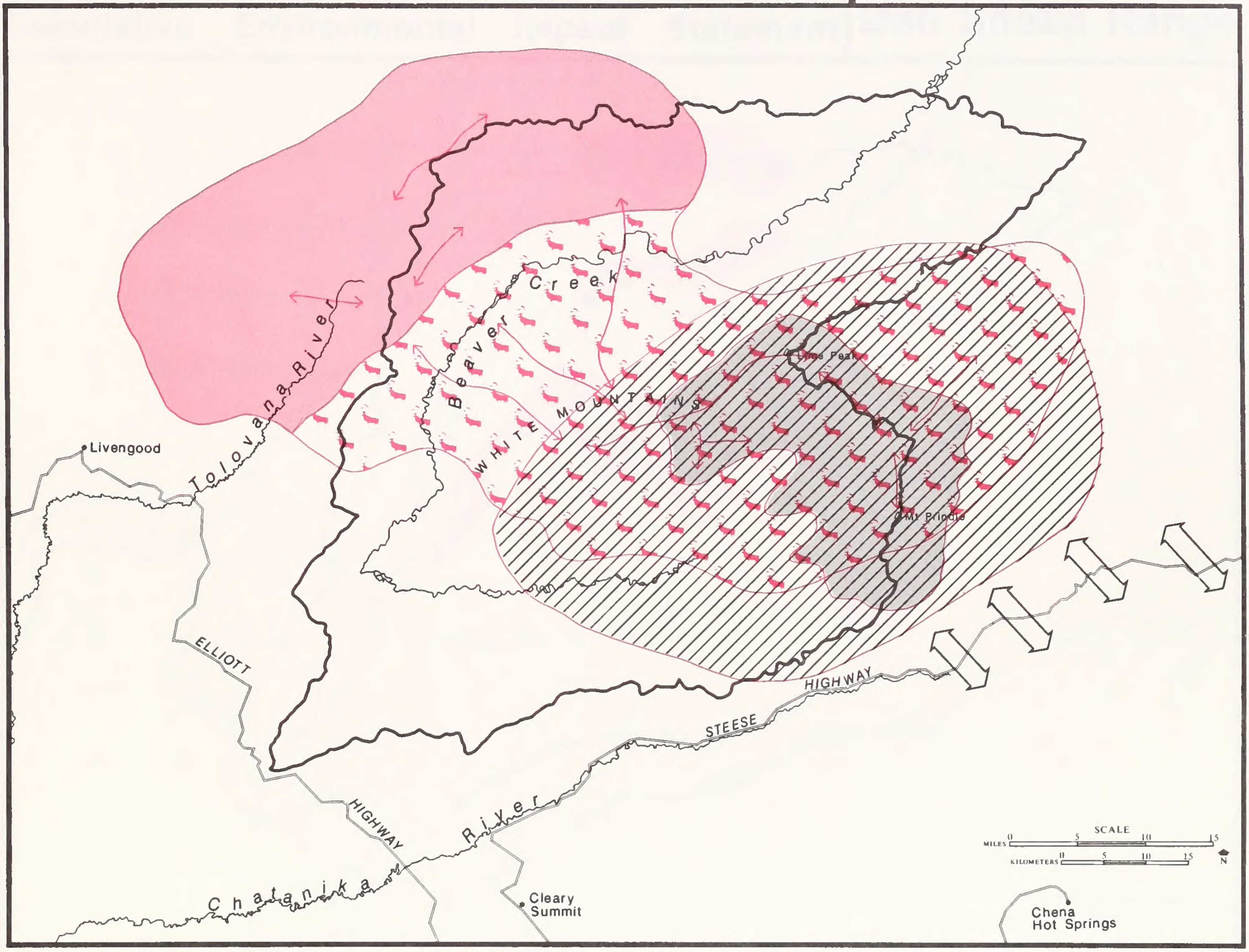
Cumulative Environmental Impact Statement

Wildlife

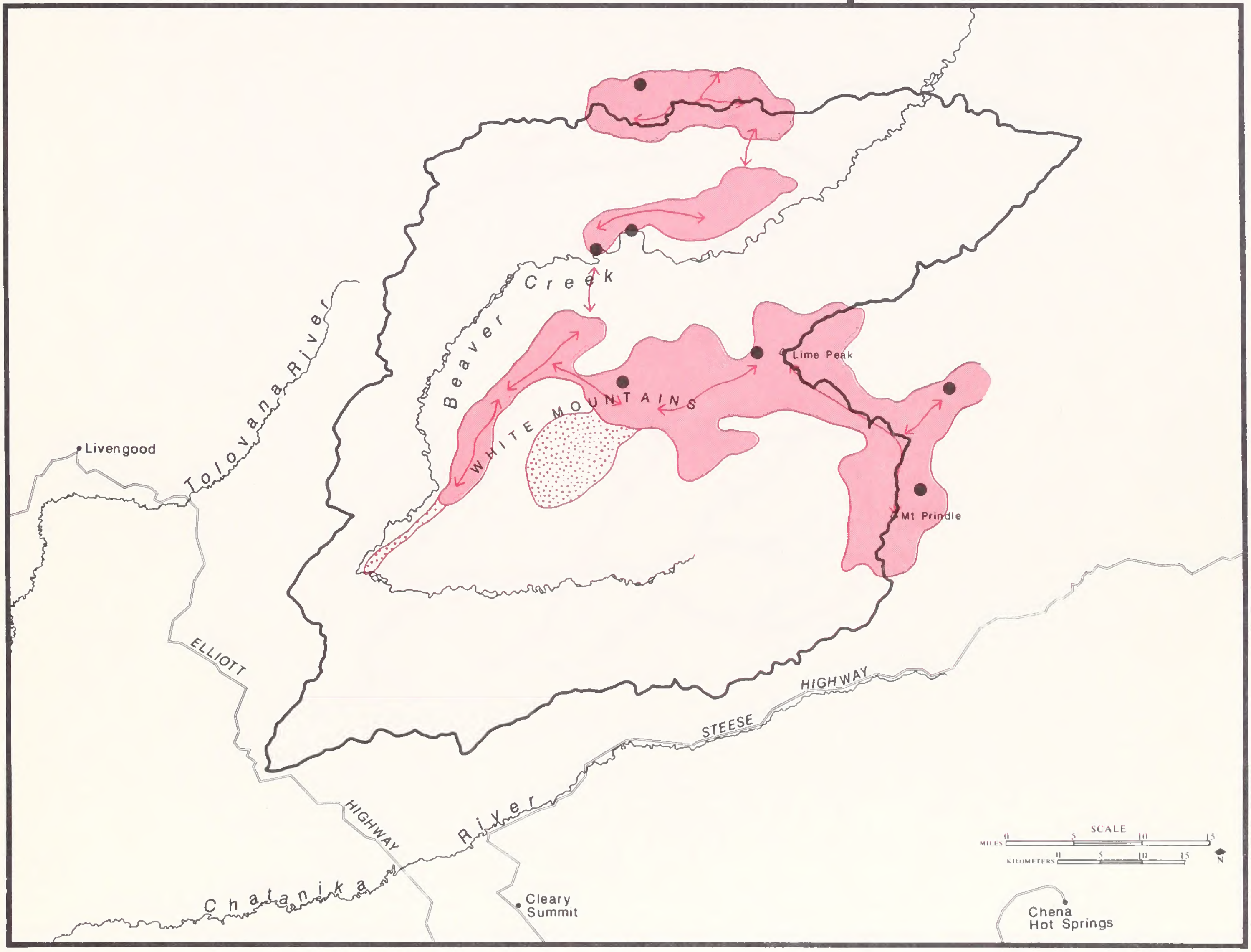
Caribou Range



Legend

- Winter distribution of White Mountain caribou herd
- Summer distribution of White Mountain caribou herd
- Movement routes of White Mountain caribou herd
- Historic calving area for Fortymile caribou herd 1950-1962
- Historic core calving area for Fortymile caribou herd 1950-1962
- Principal historic movement routes for Fortymile caribou herd in White Mountains

Dall Sheep Range



Legend

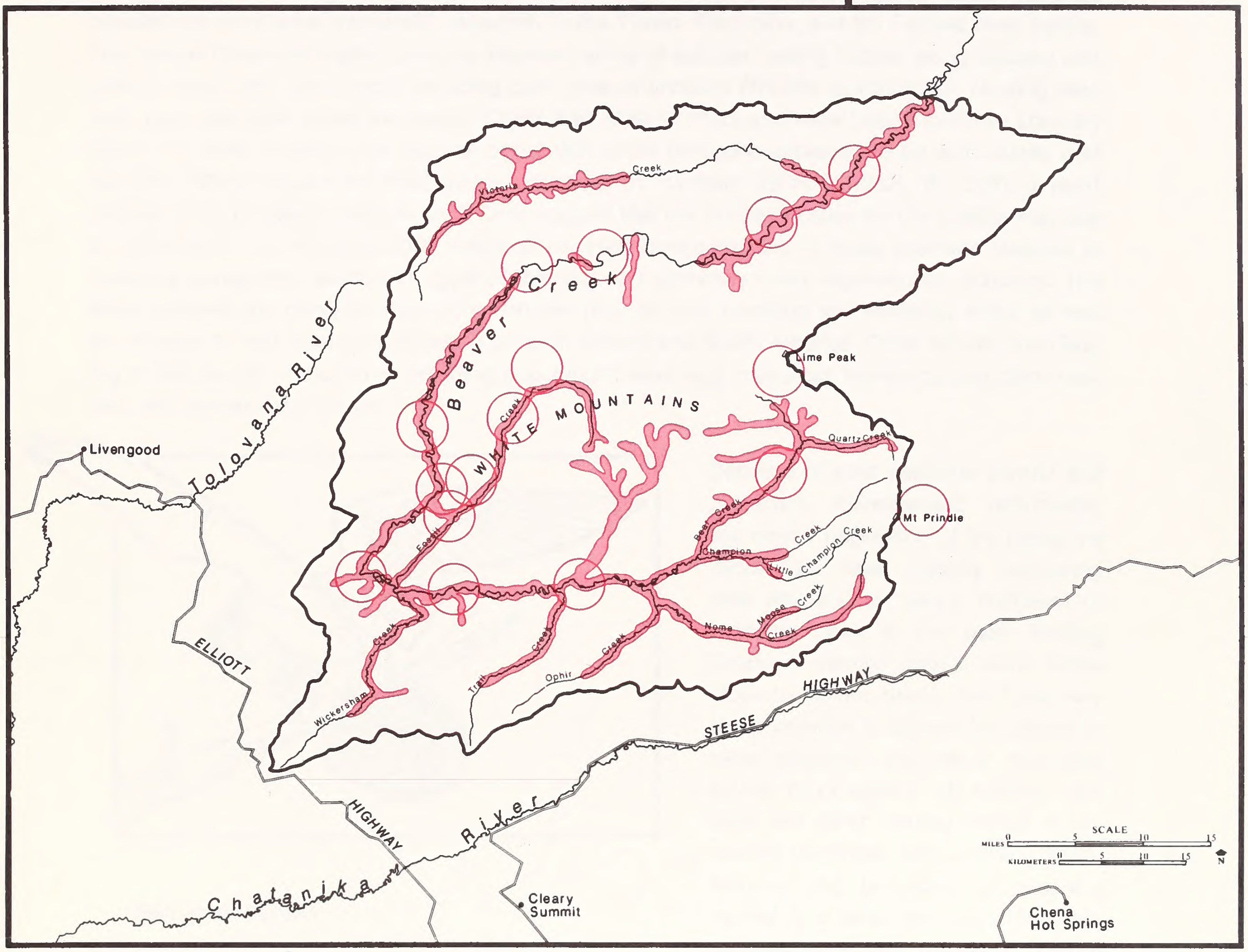
- Present distribution of Dall sheep in White Mountains
- Historic distribution of Dall sheep in White Mountains
- Movement route
- Mineral lick

Beaver Creek

DRAFT

Cumulative Environmental Impact Statement

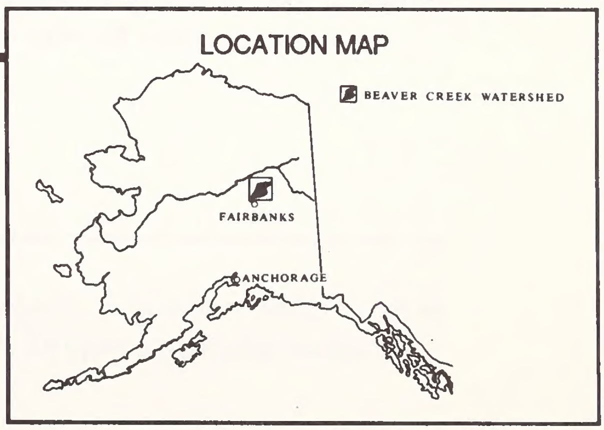
Wildlife Raptors and Moose Range



Legend

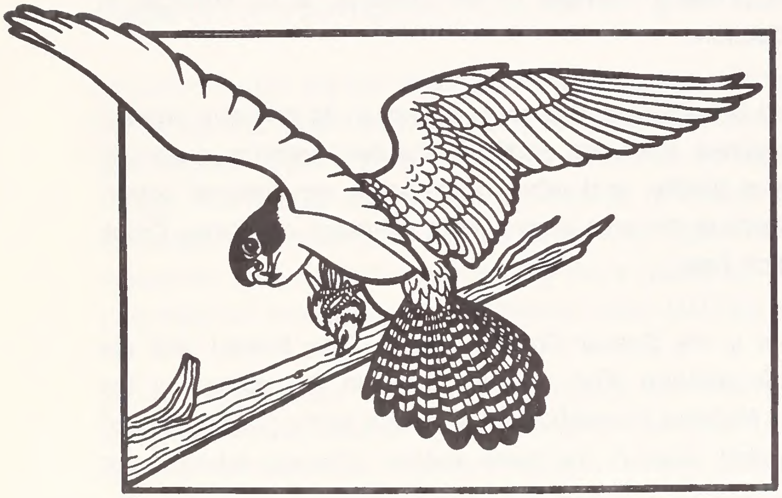
Winter high use areas for Moose

Known raptor nesting habitat



3.6.1 Threatened or Endangered Animals

The only threatened or endangered species present within the Beaver Creek watershed is the peregrine falcon. Peregrine falcons nest in the boreal forest of Interior Alaska where historical populations were quite substantial, especially in the Yukon, Porcupine, and the Tanana River basins. The Beaver Creek watershed contains extensive areas of suitable nesting habitat along streams and upland areas, with five to eight breeding pairs present annually (Wildlife raptors map). Nesting sites have been identified within the Beaver Creek Wild River Corridor and have been monitored annually (Durtsche, pers. comm.). The regional population of the peregrine appeared to be quite stable until the mid 1960's, except for local minor reductions in numbers (USFWS 1982). By 1970, a rapid decline in the population was evident. Data suggest that the principle cause for the decline was due to chlorinated hydrocarbons (DDT metabolites). High concentrations of these pesticide residues in breeding peregrines resulted in eggshell thinning and ultimately lower reproduction numbers. The birds obtained the pesticide from contaminated prey on their breeding and wintering areas, as well as en route to and from their wintering areas in Central and South America. Other factors contributing to the overall reduction in breeding populations were egg collection, human-caused disturbances, and habitat destruction.



Peregrine Falcon

Because of strict pesticide control and protective management nationwide, the overall population of the peregrine falcon has been steadily increasing over the last few years. Numbers of breeding pairs in the main nesting areas in Interior Alaska have come close to historic levels, and it appears the population is approaching levels to allow dispersal into other drainages where reoccupation of historic nest sites and other nesting habitat is occurring (Ambrose, pers. comm.). Maintenance and protection of breeding habitat is a basic step towards establishment of a self- sustaining population (USFWS 1982).

3.7 Fisheries

Fisheries resources include fish and benthic organisms that depend on bodies of water for all or part of their life cycle. There are four basic physical requirements for optimum fisheries habitat:

1) Streamflow: the volume of water carried in a stream and the gradient of its flow. Relatively stable streamflows without extreme freshets and droughts characterize the better fish streams.

2) Substrate: the bedrock, boulders, cobbles, gravels, sands, and silts making up the streambed. Spawning requires clean, stable gravel of various diameters, depending on fish size, which permits an intergravel flow of water adequate to provide embryos and alevins with good concentrations of dissolved oxygen and to remove metabolic wastes.

3) Cover: the plants, rocks, deep water, turbulence, shade, and organic debris used by fish for shelter and protection from adverse conditions and predation. Cover also provides feeding stations, food sources, and overwintering sites. Streamside cover or vegetation provide insect drop and allochthonous matter.

4) Migration Route: used for movement by adult fish upstream to spawning and feeding areas, and by fry and juveniles seeking rearing habitat.

In determining effects of mining practices on fisheries, the primary emphasis is on potential changes to fish habitats. Habitat may be altered by physical changes to the channel, or by changes in biologic components necessary for fish production.

Beaver Creek's designation into the Wild and Scenic River System is based on its primitive character, exceptional grayling fishing, aesthetic qualities, abundant wildlife in the river corridor, outstanding novice and family canoeing, good water quality, and other outstanding recreational opportunities. In this discussion, upper Beaver Creek is the area above the confluence of Moose Creek within the White Mountains National Recreation Area.

Anadromous and resident fish species occur in the Beaver Creek drainage. Only limited data are available for resident species, notably arctic grayling. Fish species found in the portion of the streams which lie within the White Mountains National Recreation Area include arctic grayling, round whitefish, burbot, sheefish, northern pike, slimy sculpin, longnose sucker, chinook salmon, and chum salmon.

Salmon are present in limited numbers in Beaver Creek as determined from observations of live fish or carcasses along the shoreline (ADF&G 1987a). Upper Beaver Creek is not a salmon spawning stream of any consequence (Webb 1982). With the exception of slimy sculpin and the longnose sucker, species description and distribution maps can be found in "Alaska's Fisheries Atlas" (ADF&G 1978a, b). The majority of data collected for Beaver Creek resident fish address summer distribution and aspects of life history; limited work has been done concerning overwintering aspects of fish biology in this drainage.

Aquatic habitat is generally pristine with the exception of the Nome Creek tributary where placer mining for gold continues. Both permanent and temporary habitats are used by fish, especially grayling, and this use depends upon the water levels and flows in Beaver Creek. Rising levels and increased flows cause inundation of backwater areas, side channels, oxbows, and depressions along the shoreline. Grayling seek refuge in these habitats to rest, feed, and escape predation and fast flows. Some fish may become trapped in these backwaters and oxbows when water levels drop, and those remaining may die due to insufficient depth to sustain them over the winter (DOI 1987a).

Habitat requirements for anadromous and resident fish species in Beaver Creek for spawning, rearing, migration routes, and overwintering areas need further verification and documentation. However, previous fishery studies (Webb 1982-86) found that grayling spawning habitats may be available throughout Beaver Creek. Upper Beaver Creek is utilized to a limited extent for spawning based on studies by Rhine (1985) and Kretsinger (1986). Data are not available on precisely when or where grayling spawning occurs in Beaver Creek. Apparently spawning occurs downstream in late May. In the upper Beaver Creek and isolated areas, spawning may take place in the middle or latter part of June.

Rearing areas for fish species in Beaver Creek vary and overlap somewhat. In July 1986, observers (DOI 1987a) reported grayling fry and fingerlings in the shallow backwater and depressions along the mainstem. Large springs above Wild River Mile (WRM) 39 may serve as a rearing site for species other than grayling. Sloughs connected to Beaver Creek were observed to be seasonally utilized by fry, fingerlings, and adults for rearing and feeding.

Migration routes are not precisely known, but it is believed that the mainstem serves grayling movements up and down Beaver Creek. Grayling migration through the disturbed area of Nome Creek (the Beaver Creek tributary) may be impeded by high water velocities and lack of pools (Post 1986b, Post 1986a) caused by the presence of dredge tailings and channelization. The stream splits at several locations and rejoins at several points downstream. Because of this diversion the mainstem appears to be the primary route based on depth and flow. Possibly all species use the mainstem for movements within Beaver Creek (ADF&G 1987a).

Overwintering areas may exist throughout the Beaver Creek watershed, but are possibly in very short supply in extreme upper Beaver Creek. One site has been delineated about a mile above WRM 39 (Webb 1986). It is here that several large springs keep a two-mile river section open during the winter. Other overwintering areas for Beaver Creek have been delineated by Webb (1982-86).

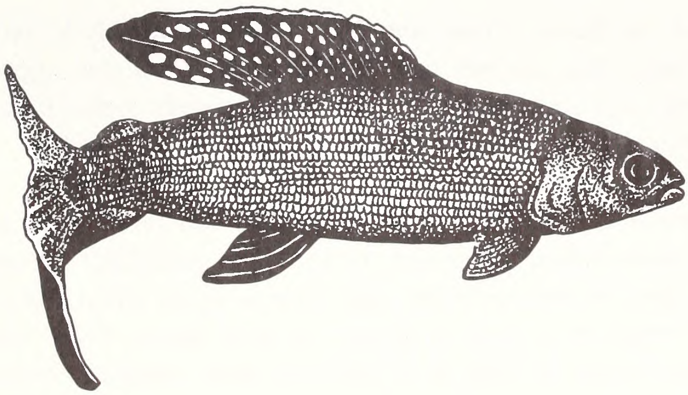
The main channel pools provide crucial overwintering habitat in Beaver Creek. Also, pools serve as feeding, escape cover sites, and resting areas during migrations. Winter water availability for fish overwintering is in low supply due to low base streamflow in the upper Beaver Creek (Webb 1982). Any loss of pool depth would adversely impact the overwintering survival of all Beaver Creek fish. The few deep water pools provide the prime refuge for adult fish in upstream areas. Adult fish movements between pools is essentially impossible in low flow areas. Based on winter observations (Webb 1982), the potential deep pool refuge areas for adult fish during late winter must be at least eight feet deeper than the upstream riffle to maintain a four- foot water depth below the ice. Therefore, no reduction in winter low flow can be tolerated by fish.

Limited information is available regarding aquatic macroinvertebrates. Stomach contents of 63 grayling examined in 1986 indicated that 75% of the food consisted of beetles, crane and black flies, mayflies, snails, nematodes, chironomids, and caddisflies (DOI 1987a). Mayflies were found to be the most abundant invertebrates in Beaver Creek. Rhine (1985) examined Bear, Quartz, and Champion Creeks and classified these streams as being less productive for invertebrates, containing only moderate populations of a few species.

Limited water quality data for Beaver Creek and its headwater tributaries are available (DOI 1987a). BLM obtained grab water quality samples from 12 locations on Beaver Creek in July and August 1986 (Figure 3-4) and analyzed them for specific conductance, acidity, total dissolved solids, total suspended solids, total solids, and percent of volatile organics (DOI 1987a). In general, Beaver Creek has good water quality and the analysis suggests that most of the turbidity consisted of organic material at all but the highest flow (DOI 1987a, Table 12).

Spring runoff and summer rainfall provide flows needed to sustain fish species; however, the critical need is during the winter. No published data was available on mid-winter baseflow conditions on Beaver Creek. However, Webb (1982) noted long reaches of open water below WRM 39, along the flank of the White Mountains. In addition, several prominent groundwater upwellings were observed in this reach. It is hypothesized that the White Mountains, a limestone formation, provide significant groundwater to Beaver Creek between WRMs 39 and 45. Unpublished USGS data suggests that 1951 midwinter Beaver Creek flows at the confluence of Fossil Creek ranged between 35 and 80 cfs (data taken from ADF&G, 1987b). This would represent a large and significant groundwater contribution from the White Mountains, well downstream of mining activities. This contribution might also be extremely significant during periods of unusually low summer flows. These flows contrast with extremely low flows observed during midwinter fishery surveys upstream from the White Mountains (Webb 1982).

Arctic grayling is the most abundant species and is most prized by sport anglers. Grayling populations are lightly utilized due to low public use of the area. Most fishing is associated with recreational floating. Increased access would provide more opportunity to catch grayling and possibly other species.



Grayling

There was a commercial fishery for whitefish during the 1950's and 1960's in the vicinity of Herman's Landing (Winters pers. comm. 1987). Hundreds of fish were netted in open water in the spring of these years by a land owner/trapper at Herman's Landing (Aquatic Fauna Map) and sold in Fairbanks area stores.

The contribution of Beaver Creek salmon to the Yukon River commercial fishery is not known. Personal communication (Carufel 1986) with the land owner/trapper at Victoria Creek indicated that chinook and chum salmon were taken below Victoria Creek for subsistence purposes. Other than this, data are not available on subsistence use by people living below Victoria Creek.

Beaver Creek

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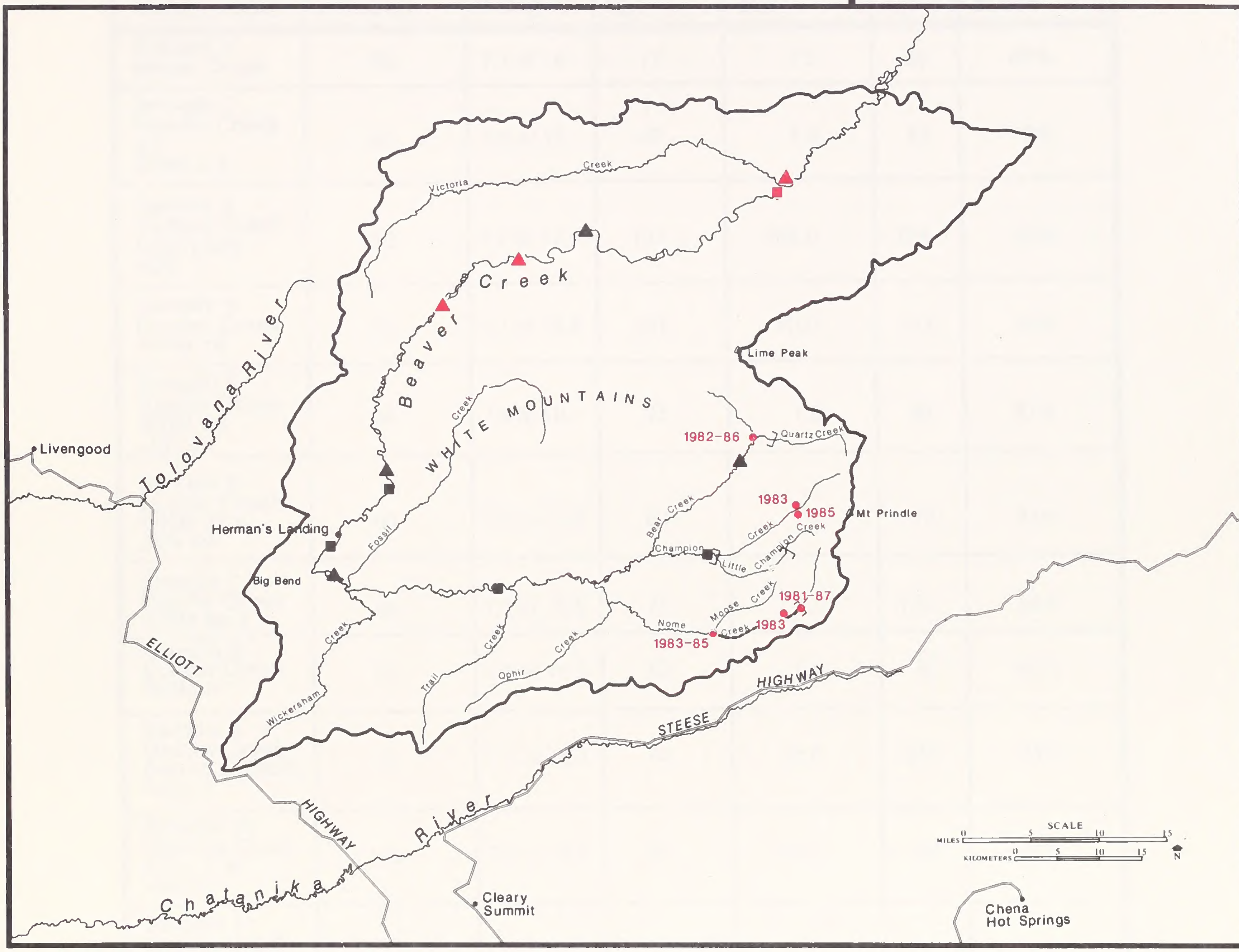
Cumulative Environmental Impact Statement

Aquatic Fauna



Legend

- Locations of observations of chum salmon
- Locations of observations of chinook salmon
- Location of recent mining activity from Annual Placer Mining Applications
- Observed overwintering area for fish
- Potential overwintering area for fish
- Most upstream recorded observations of arctic grayling

Sample Identification	Specific Conductance ushos/cm	pH Units at Deg. C.	Total Dissolved Solids ag/l	Total Suspended Solids ag/l	Total Solids ag/l	Percentage of Volatile Solids
Sample 1 Nome Creek	70	7.1 at 18	71	2.0	90	62%
Sample 2 Beaver Creek #1 WRM 0.0	55	7.0 at 18	47	1.0	84	76%
Sample 3 Victoria Creek High Flow, Aug. 1	120	7.2 at 17.1	131	162.0	378	22%
Sample 4 Beaver Creek WRM 10	62	7.1 at 18.6	101	19.0	114	56%
Sample 5 Beaver Creek WRM 54, July 29	84	7.3 at 18.7	93	1.0	94	57%
Sample 6 Beaver Creek WRM 37.5, July 29	60	6.9 at 18.3	80	7.0	74	81%
Sample 7 Beaver Creek WRM 68.5	85	7.2 at 18.6	71	9.0	120	65%
Sample 8 Beaver Creek WRM 8	71	7.1 at 18.5	53	5.0	80	55%
Sample 9 Beaver Creek Above Victoria, Aug. 2	89	7.1 at 19.3	82	52.0	254	33%
Sample 10 Victoria Creek Aug. 2, at mouth	115	7.2 at 18.6	97	168.0	496	25%
Sample 11 Beaver Creek & WRM 109.5 High Flow, Aug. 1	103	7.1 at 17.4	79	46.0	212	40%
Sample 12 WRM 68.5, July 31 Day after rain	85	6.9 at 17.9	71	21.0	154	49%

Figure 3-4. **Beaver Creek water quality data.** (Van Haveren et al 1987)

Efforts have not been made to delineate the economic value of commercial, recreational, and subsistence fish resource use. Possibly some economic value can be determined once the amount of harvest is known and recreation uses of time, equipment investment, and supplies are documented.

Occasional increases in turbidity in the upper 30 miles of Beaver Creek (normally a clear stream) are due primarily to placer mining activities and erosion from disturbed areas on Nome Creek (DOI 1983b). Webb (1982) reported that muddy water discharges into Beaver Creek from mining activities on Nome Creek were visible as far as 50 miles downstream. Placer mining activities in the Bear, Champion, and Ophir creek drainages may cause seasonal increases in turbidity in these streams and upper Beaver Creek (DOI 1983). Additionally, however, visually noticeable amounts of suspended sediments due to natural rainfall have been observed on unmined tributaries (Vogler, Durtsche, pers. comm. 1988).

No data are available regarding primary production on Beaver Creek or its tributaries. However, because water quality is expected to be good over much of the stream due to limited mining influence, primary productivity would be expected to be reflective of unmined natural conditions for subarctic Alaskan streams.

The presence of at least nine species of resident fish and perhaps two species of anadromous fish should be considered indicative of good habitat conditions within the mainstem. The presence of fly-in recreational fisheries on this stream is further evidence of a quality fishery (ADF&G 1987b). Support of substantial fish populations is dependent on maintenance of adequate food supplies which are in turn dependent on the primary producers and detrital inputs of the system. The fact that fish populations do exist in the mainstem is evidence that the general condition of the stream regarding productivity and food organisms is good. More data on water quality, primary productivity, aquatic invertebrates, and fish populations would be necessary to quantify the extent and magnitude of mining impacts in this basin.

3.8 Cultural Resources

3.8.1 Prehistory

It is now well accepted that, during the late Wisconsin glaciation, Alaska and Siberia were part of a single continental land mass known as Beringia. Much of the ice-free interior of Alaska at that time consisted of a steppe-tundra environment that supported animals such as bison, horse, and mammoth. This rich fauna also provided a support base for humans. Cultural finds throughout Interior Alaska indicate the presence of humans as early as 11,000 years ago.

Although work undertaken by West (1964) and Will (1986) did not find prehistoric archaeological sites in the Beaver Creek drainage, sites found along the Yukon River, the Porcupine River, Birch Creek, the Livengood vicinity, at Fairbanks, and isolated finds throughout the Tanana-Yukon Uplands indicate potential for discovering cultural resources in the drainage.

Several of the isolated finds were reported by early miners, and it is probable that more material was discovered in the past than was reported. This is because much of the earlier mining consisted of hand work and hydraulic mining, which are techniques more likely to reveal cultural resources than destroy them, as heavy equipment frequently does. There are no known sites in the drainage that have been identified as eligible to the National Register of Historic Places.

3.8.2 Ethnographic History

Ethnographic literature for the Beaver Creek area is extremely limited. Most of the early reports concern adjacent Birch Creek, which flows very near Beaver Creek in places, and the Yukon River. Osgood (1936) reported in 1932 that the "Birch Creek" or Tennuth Kutchin people occupied the area drained by Birch Creek and much of the Beaver Creek drainage, but he felt that these people had been largely wiped out by epidemic disease soon after their discovery by whites. During the 1860's as much as 80% of the population of the area died during a scarlet fever epidemic (Osgood 1936), and the present inhabitants appear to have their roots in the remnant population (Slaughter n.d.).

Contact with Europeans may have occurred as early as 1845 when John Bell of the Hudson's Bay Company entered the area (Slaughter n.d.). In 1847 Fort Yukon was established as a Hudson's Bay Company trading post. The Russians entered the area by 1863 according to British observations (Sherwood 1965). Not only did the presence of a Hudson's Bay Company post offer new goods and technologies to the Gwich'in, but their lifestyles began to change as well. Firearms, iron tools, beads,and tobacco were the most important trade goods (Slaughter n.d.). The use of furs as a trade item also meant an increase in the importance of furbearers, if not a major shift in the economy (Nelson 1973), and the introduction of dog sleds by the British (Slaughter n.d.) brought an easier way of transportation. The use of dog sleds, and the resultant need for dogs, has been cited as a cause of semi-permanent settlements, as well as a greatly increased use of fish in subsistence (McKennan 1969a, 1969b). After the purchase of Alaska by the United States in 1867, the Hudson's Bay post in Fort Yukon was abandoned, then reoccupied by the Alaska Commercial Company for a few years. The post was again abandoned and reopened during the gold rush of the latter 19th century (Slaughter n.d.).

According to Caulfield (1983) current Birch Creek village residents consider themselves the Dendu Gwich'in who traditionally occupied the Yukon Flats region south of the Yukon, and portions of the Crazy and White Mountains.

David James, a Birch Creek village resident and son of Birch Creek Jimmy, told Caulfield that his father had said the original Dendu Gwich'in were "mountain people" who lived principally in the foothills of the White Mountains and utilized primarily caribou and sheep. The Gwit'ee Gwich'in were said to be the band who lived along Birch Creek and their name meant "people living under," perhaps referring to the fact that they lived at the base of the White Mountains. The name Dendu Gwich'in, meaning "people of the other side," was apparently a name assigned to the band by another group and was not traditionally used by the band to describe itself.

Traditional use of the White Mountains area is reflected by the Kutchin place name Luw donaa, meaning "white mountain"; the Dinkjuk vadzaih ttnal, referring to the moose and caribou fence located on the north side of the White Mountains; and accounts of sheep hunting in the Victoria Mountain area before Birch Creek Jimmy's time. These places have not been identified as Native religious or ceremonial sites.

Since early Native people used a variety of resources and traveled extensively, it is not unreasonable to think that groups from Birch Creek, the Yukon, the Minto Flats area, or as far as the Salcha and Tanana Rivers might have traveled and hunted in the Beaver Creek drainage.

3.8.3 Mining History

Typical placer mining dredge, located on Jack Wade Creek, circa 1920's. Photo courtesy of the Anchorage Museum of HIstory and Art.

Gold has undoubtedly dominated the more recent history of the Beaver Creek area. In 1863 Rev. Robert McDonald, the first white man known to have traveled into the country, reported finding fossils and gold at a site called "Kotlo" located probably somewhere on Preacher or Birch Creek. In 1873 Jack McQuesten (1952) and companions spent the winter at the mouth of Beaver Creek and did some prospecting. The amount of gold they found did not appear to justify further efforts, but by 1900 there were 60 recorded claims in the "Beaver River Mining District." Brooks (1905) reports the first gold rush to Victoria Creek in 1904; however, it was not until 1910 that any real activity took place. Claims were developed on Trail, Ophir, and Nome Creeks. In 1926 the Nome Creek Dredging

Company built and operated a small dredge on Nome Creek. It burned in 1932 and was replaced with a dredge from Deadwood Creek in 1939 which was worked for two years, shut down during the war, and operated again from 1945 to 1947 (Ducker 1983).

Mining activity in the Beaver Creek drainage and Chandalar District encouraged travel, and in 1909-1911 a winter trail and cabins were built along the Chatanika-to-Beaver route by the Alaska Road Commission (Board of Road Commissioners 1912). Shelter cabins were later built along the trail running parallel to Beaver Creek itself. The river ice was rarely used due to warm springs and overflow (Board of Road Commissioners 1931).

Although trapper/prospector cabins, which generally date from the 1930's or later, can still be found throughout the area, most of these are collapsed ruins with few associated artifacts. Prior to helicopter access, undisturbed cabins with artifacts undoubtedly existed, but most of these have been impacted. There is little other evidence of early activity. The remains of the dredge on Nome Creek are scattered along the valley amidst the dredge tailings.

3.8.4 Paleontology

The Beaver Creek drainage undoubtedly has potential for paleontological material. McDonald's 1863 report of fossils, bones eroding from bluffs near Victoria Creek (Will 1986), and much older material such as early Siluria Brachiopods and Late Ordivician megafossils (USGS 1987) from the limestone outcrops of the White Mountains, are all indications of the area's potential. Little has been done with this resource, largely because of the remoteness of the area. Past mining and prospecting may have had some impact on discovery and recovery of paleontological material, but the lack of extensive activity along Beaver Creek where most of the Quaternary alluvium exists, probably resulted in little significant impact. Little systematic work has been done in the higher areas around the limestone outcrops. The dredge activity along Nome Creek may well have had a detrimental impact on paleontological resources in that valley.

3.8.5 Discussion

The existing knowledge of prehistory in Interior Alaska is limited. The remoteness of the country and relatively few sites, combined with dense vegetation and permafrost, make cultural resources generally difficult to find.

There is a curious relationship between mining and cultural resources. On one hand, mining has promoted understanding of the past because of artifacts collected from sluiceboxes, fossils exposed during hydraulic stripping, and site locations identified during exploration or prospecting. On the other hand, mining operations often destroy cultural material. Current mining practices are much more destructive than early-day techniques. And ironically, today's mining often destroys evidence of earlier mining which may, in itself, be of historic interest.

Most mining today takes place on previously disturbed ground. This trend is likely to continue for some time with the development of improved gold recovery techniques. Most of the damage to cultural and paleontological resources has probably already taken place in the drainages currently available for mining.

There are conflicts between Section 106 of the National Historic Preservation Act and the CFR. Section 106 requires that BLM identify all cultural resources that may be eligible to the National Register of Historic Places and allow for comment by the State Historic Preservation Office (SHPO) (15 days) and Advisory Council of Historic Preservation (ACHP) (30 days) prior to allowing activity that may impact such sites (36 CFR 800). In contrast, 43 CFR 3809.1-6(5)(c) states that BLM or the operator shall have 30 days to complete an appropriate cultural resources inventory prior to approval of a Plan of Operations. Cultural resources are not covered under Notices other than under "undue or unnecessary degradation." Should cultural resources be discovered during operation under a Plan, the operator must leave the discovery intact and notify the Authorized Officer who has 10 days to remove or protect the resource before allowing the operator to proceed [43 3809.2-2(e)].

It is physically and economically impossible to locate and recover all cultural and paleontological resources prior to surface disturbing activity. However, if they were left permanently protected in the ground, we would have virtually no knowledge of prehistory in Alaska. Since locating these resources in river valleys is rare, frequent monitoring of mining operations and good working relationships with the operators have proven more effective in identification and recovery of inadvertently discovered cultural and paleontological materials. Education, crediting the discoverer, and making research or analysis results available to the public help protect and mitigate any adverse affects to such resources.

3.9 Subsistence

3.9.1 Introduction

The lower Beaver Creek drainage is used for subsistence by people from Birch Creek Village, Beaver, and Fort Yukon (Caulfield 1983). People from all three villages had traditional place names for locations along Beaver Creek (Caulfield et al. 1983, and Section 3.8.2). The Alaska Department of Fish and Game (ADF&G 1986a) has compiled statistics on socioeconomic profiles of Alaska communities. Birch Creek Village had a population of 31 in 1984 and 97% were Native Alaskan. There are no data on cash income or amount of subsistence use per capita. Fort Yukon had a population of 665 (71% Native) and Beaver 65 (99% Native). Per capita taxable income in 1982 in Fort Yukon was $14,152 and in Beaver, $7,856; the state average was $21,127. Per capita harvests of all subsistence foods are estimated at 862 pounds in Beaver and 707 pounds in Fort Yukon.

Until the 1950's, Beaver and Birch Creek villages were used only as a seasonal base (Shimkin 1955), but today both are permanent settlements (Sumida and Alexander 1985). People in both villages have close kin relationships, in effect, large extended families (Caulfield 1983, Schneider

1976). Supplies are transported by barge or boat from Fort Yukon or by air from Fairbanks. Opportunities for wages are limited in the villages, and subsistence plays an important role in the lives of the people.

3.9.2 Subsistence Uses

The general area along Beaver Creek used for subsistence is shown in Subsistence Maps 1 and 2. By the mid-to-late 1800's, contemporary accounts by outsiders who visited the area included information on traditional subsistence patterns. Typical of other Interior Alaskan Natives, Beaver Creek region inhabitants participated in a seasonal round of subsistence activities (Caulfield 1983). In general, the Gwich'in in the Beaver Creek area hunted caribou from the Porcupine herd north of the Yukon River, and perhaps the Fortymile herd, southeast of the area (Caulfield 1983). Summers were spent in fish camps on the Yukon River catching and drying salmon for winter use, for both dog and human food. Before freezeup, people moved to winter residences elsewhere in the area to hunt moose and waterfowl, and also to fish for whitefish. After freezeup, traps were set, and much of the winter was spent harvesting furbearers and preparing furs for trade. In the spring, after breakup, fish traps were set, and muskrats were hunted in the lakes and sloughs. By the mid-19th century, trapping achieved new importance in the subsistence round because of demand for furs throughout the world. Traditional trapping to supply localized needs shifted increasingly to a situation where furs went to white traders for values linked to the fluctuating world markets. Thus, the overall subsistence and trading economies of the Gwich'in changed (Caulfield 1983).

Further, when gold was discovered in the Upper Yukon drainage, as early as 1863 on Preacher Creek, the influx of whites, particularly in the 1880's and 1890's, brought the Beaver Creek area even more under the influences of non-local events. Yet despite the changes that ensued, the importance of subsistence activities, both economically and culturally, remain. Today, subsistence activities remain important to area village inhabitants. Also, some harvest of Beaver Creek drainage wild and renewable resources occurs around the confluence of Beaver and Victoria Creeks by a resident family otherwise engaged in mining (DOI 1984).

3.9.3 Affected Subsistence

Traditionally, subsistence activities in the Beaver Creek area were tied to the availabilities of a variety of wild and renewable resources, including moose, caribou, fish, waterfowl, furbearers, and other natural products (Caulfield 1983).

Moose

Moose are an important subsistence specie, not only for the amount of meat they produce, but also for hides and other uses. Meat is usually distributed among all the villagers, and has cultural significance as a traditional food for funeral and memorial potlatches (Sumida and Alexander 1985, Olson 1981, Osgood 1936). By 1955, moose provided up to 50% of all meat and fish consumption by weight (Shimkin 1955).

Caribou

Moose hunting is regulated throughout the state by the Alaska Department of Fish and Game; the Beaver Creek area is in Game Management Unit 25(d) West. Only subsistence hunting has been allowed in this unit since 1983-1984 (Sumida and Alexander 1985). By 1986-1987, total moose harvest was limited to no more than 35 bulls, allowed to taken only by eligible hunters from Birch Creek village, Beaver village, and Stevens Village (Nowlin, pers. comm. 1988). Reports show Birch Creek hunters harvested two moose in 1983-84 and three in 1984-85; hunters from Beaver harvested seven moose in 1983-84 and 12 in 1984-85. Typically, three periods of hunting are allowed: September 10-30, December 1-10, and February 18-28 (ADF&G 1987a).

Moose habitat requirements are discussed in the wildlife section of this chapter. The ADEC study (1986) suggests that moose and other wildlife are affected by mining only in the actual mined area, which does not include the subsistence use areas on Beaver Creek. The moose populations hunted there are distinct from those in the upstream mined areas. Nevertheless, the moose habitat in the hunting unit is degraded, for reasons not clear (DOI 1987a), with total moose numbers in the area relatively low.

Caribou

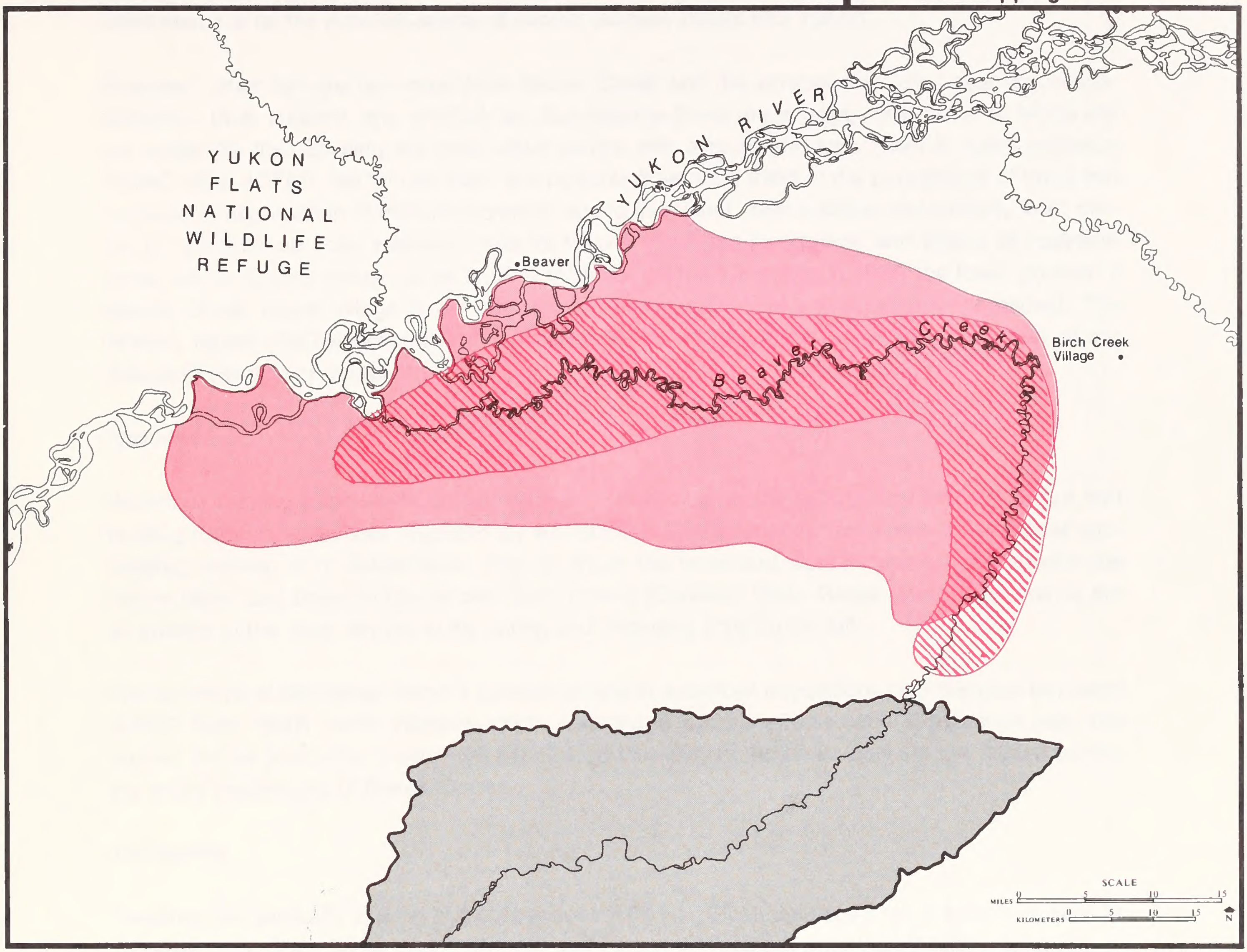
Caribou have been important to the people in the Beaver Creek area, although recent use has declined with the movement of caribou migration away from the immediate vicinity (Caulfield 1983). Historically, residents of Beaver, Fort Yukon, and the Birch Creek village area traveled up the Yukon River to the Charley River to obtain caribou (Schneider 1976). Shimkin (1955) states that caribou had become rare on Yukon Flats by the mid- 1950's, but Fort Yukon residents harvested 300 animals on the Porcupine River in 1957 (USFWS 1964). Birch Creek Village residents report that after 1940 few caribou were available near the village (Caulfield 1983), although isolated animals are taken by trappers in the White Mountains. Thus, caribou are hunted when they are available, but are not consistently a part of the subsistence pattern of the area.

Fish

Fishing occurs in the Beaver Creek drainage, the Yukon River, and in the lakes and sloughs in the area (See Subsistence Map 2). Salmon fishing occurs during the summer in fish camps along the Yukon. Three species of salmon are present and harvested (ADF&G 1987b), but residents indicate that the salmon harvest has declined in recent years. The ADEC's report (1986) quotes a resident of Birch Creek village who usually caught up to 400 salmon (dates not stated, however) having a catch

Subsistence

Subsistence Uses within Beaver Creek Drainage: Moose Hunting Fur Trapping



Legend

- Moose hunting area*
- Fur Trapping area*
- Northern area of Beaver Creek watershed

* Data derived from Sumida and Alexander (1985), Caulfield (1983) and Slaughter (n.d.) for villages of Birch Creek and Fort Yukon.

Note: Data for the communities came from the Alaska Department of Fish and Game, Division of Subsistence, which qualifies such maps by stating: 1. subsistence use areas depicted are based on information obtained from a sample of community households; 2. subsistence patterns of household resource use may change from year to year while information is collected for specific periods; 3. therefore, all maps can be considered potentially only a partial representation of areas important to local village residents.

of 10- 20 salmon in 1985. The Yukon River salmon fishery is probably more affected by commercial fishing of migrating salmon before they enter the river system, and perhaps by downstream catchment than it is by the possible effects of mining (ADF&G 1986b, DOI 1987a).

However, other fish are harvested from Beaver Creek and the sloughs and lakes near the village. Whitefish, pike, suckers, and sheefish are harvested in these areas using nets, some of which are set under the ice. Grayling are most often caught with a hook and line. There is some evidence (ADEC 1986, ADF&G 1987a) that there is a possible downward trend in the populations of these fish because of degradation of their environment due to increased sedimentation and turbidity from mining or non-point sources. However, data for Beaver Creek are incomplete, and effects of upstream mines on the fishery remain to be studied (ADF&G 1987b). Currently, in 1987, the lower portion of Beaver Creek where village-based subsistence fishing occurs is not significantly impacted. The ADF&G report (1987b) concludes, "Cumulative effects of mining on the fishery resources of the Beaver Creek system appear to [be] minor."

Waterfowl

Waterfowl hunting traditionally provides the first fresh meat in the spring (Caulfield 1983), but bird hunting today is seasonally regulated by the ADF&G. The most important areas for waterfowl subsistence hunting (See Subsistence, Map 2) are in the lakes and sloughs downstream toward the Yukon River, and between Beaver and Birch Creeks (Caulfield 1983). Geese, ducks, and cranes are all present in the area, arriving in the spring and migrating south in the fall.

The residents of the village report a general decline in waterfowl populations over the past few years (ADEC 1986, Birch Creek Villagers 1987), resulting in serious effects upon subsistence use. The causes for the population decline are not clear to the villagers; however, they are not related to mining in the headwaters of Beaver Creek.

Furbearers

Traplines are generally located in the downstream Beaver Creek drainage (See Subsistence Map 1). Trappers from Birch Creek Village, Beaver, and Fort Yukon use the area (ADEC 1986). Time and effort spent on trapping depends largely upon fur prices (Caulfield 1983), but some animals such as muskrat are used for food, and some such as wolf have traditional cultural value as well (Osgood 1936).

A variety of species are trapped, with marten being the most abundant and economically important (ADEC 1986). Beaver are also important, but somewhat less abundant, and harvest is limited to 25 per trapper by Alaska game regulations. Lynx and wolf are present, but are apparently rarely trapped (ADEC 1986). Muskrat are trapped and hunted, but the current low price for muskrat fur means that few people spend time hunting them except for food (Caulfield 1983). Residents also report a decline in overall muskrat populations, caused by sedimentation of stream bank areas according to residents (ADEC 1986). However, this condition is not notable in the lower Beaver Creek area.

Other Resources

Other resources utilized in the subsistence system of Beaver Creek are plant foods, small game, and trees. Blueberries, cranberries, and other edible plants are available and harvested locally near the villages in the Flats areas. Trees are utilized for heating or building; they are cut upstream and floated down to the village. Snowshoe hares, grouse, and ptarmigan are snared near the village (Caulfield 1983). There is no indication from the villagers that these resources are declining for any reason.

Native Allotments

Native allotments have been provided for by legislation dating back to 1906; those along Beaver Creek are shown in the Native Allotments Map (DOI 1987b). These allotments are used to maintain traplines, for hunting camps, and for other subsistence activities. In general, their locations indicate areas of importance for local subsistence users today.

Conclusions

Subsistence activities continue in the Beaver Creek drainage, where they remain economically and culturally important to area residents. Traditional patterns of usage, although technologically changed by modern equipment, continue but are shaped today by game management practices and regulations, as well as natural fluctuations in animal populations, water levels, precipitation, climate, and other factors. Presently, mining in the upper reaches of Beaver Creek does not appear to have any significant effect on subsistence uses, users, or resources in downstream areas utilized by Birch Creek villagers and other area inhabitants. As the water resources section states, Beaver Creek has generally good water quality. Consequently, subsistence activities remain viable.

3.10 Recreation

Existing Environment

The WMNRA and Beaver Creek Wild and Scenic Rivers are both covered by approved management plans and management prescriptions for the various areas are already in place. It is assumed that the areas will be managed in strict compliance with those approved plans, which should be referred to by the reader for more detail.

Presently all placer mining takes place within the semi-primitive motorized land use classification area. This portion of the WMNRA is characterized by predominantly natural appearing areas with evidence of other uses. Primitive roads are present along Nome and Champion Creeks. No placer claims exist within the Beaver Creek Wild and Scenic River.

Beaver Creek

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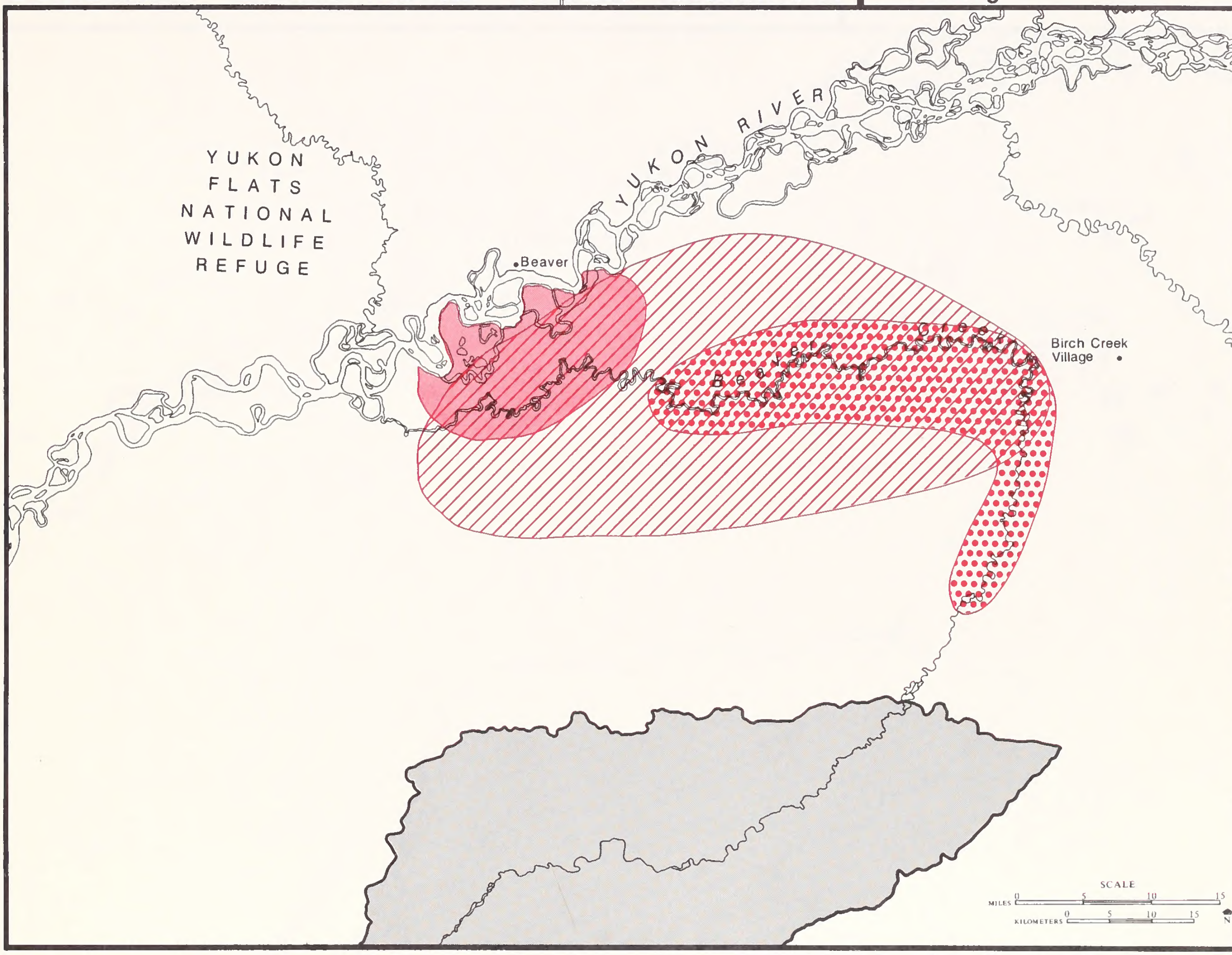
Cumulative Environmental Impact Statement

Subsistence

Subsistence Uses within Beaver Creek Drainage: Waterfowl Hunting Fishing



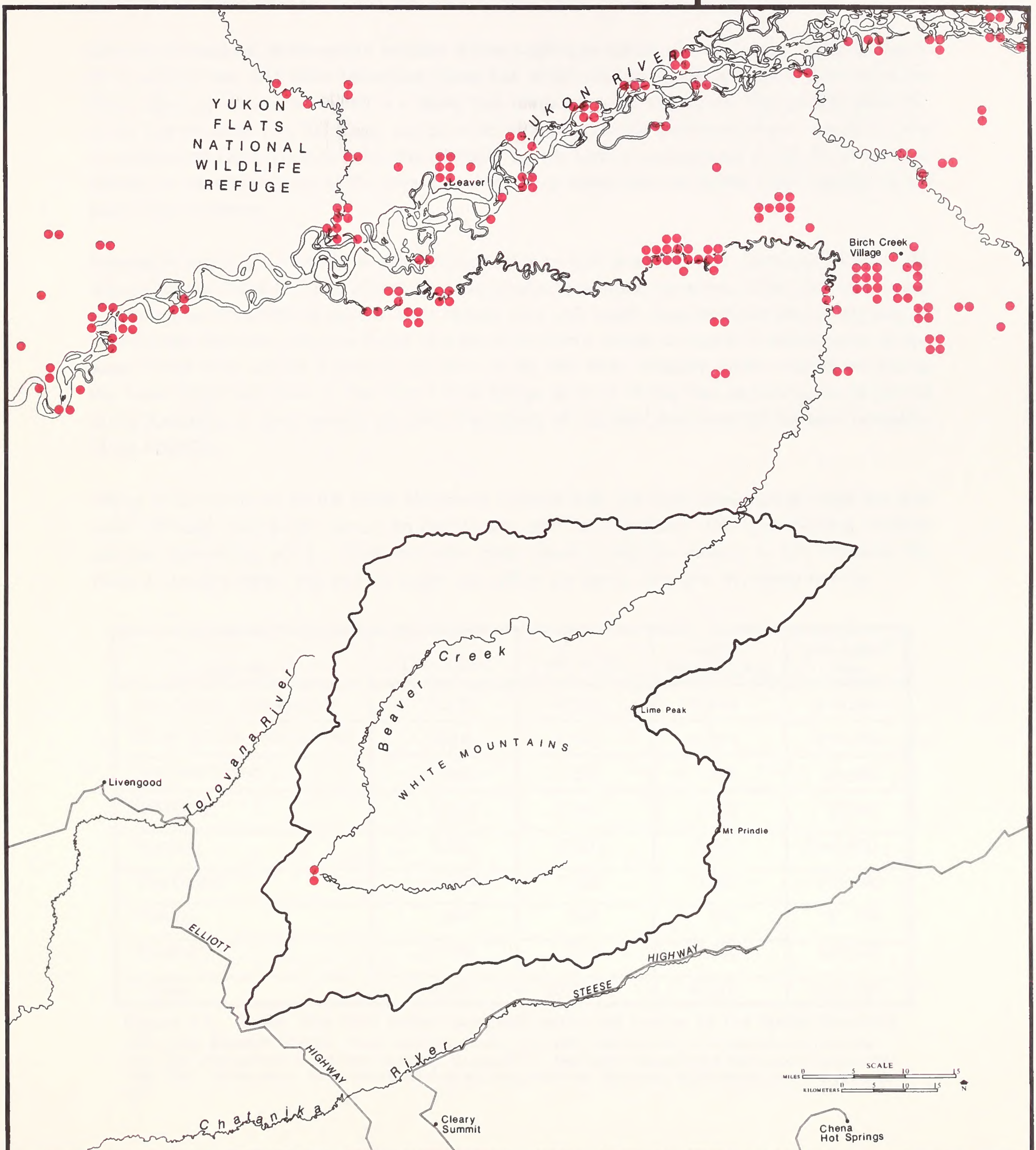
Legend

- Salmon fishing area*
- Other fish species fishing area*
- Waterfowl hunting area*
- Northern area of Beaver Creek watershed

*Data derived from Sumida and Alexander(1985), Caulfield(1983) and Slaughter(n.d.) for villages of Birch Creek and Fort Yukon.

Note: Data for the communities came from the Alaska Department of Fish and Game, Division of Subsistence, which qualifies such maps by stating: 1. subsistence use areas depicted are based on information obtained from a sample of community households; 2. subsistence patterns of household resource use may change from year to year while information is collected for specific periods; 3. therefore, all maps can be considered potentially only a partial representation of areas important to local village residents.

Native Allotments



Sites of Native allotments. Each dot may represent more than one allotment.

BLM recreation management area reports, which include recreation sites adjacent to the WMNRA boundary, indicate that as many as 18,200 visitor days occurred in the WMNRA in 1987. Figure 3-5 identifies the visitor days by activity and the estimated dollar values (Appendix C-2).

Existing recreational development consists of four public use cabins and two trails, the White Mountains summer trail, and White Mountains winter trail, which provide access to Beaver Creek from the Elliott Highway. The summer trail is a hiking trail which generally follows the high ground while the winter trail traverses low, flat areas, and provides winter access via snowmachines or skis. There are no established campgrounds within the WMNRA, but the nearby campground at Cripple Creek contributes to recreational use of the area. Camping along tailing piles on Nome Creek appears to be reasonably common.

Recreation use in the WMNRA is generally light, due to lack of access and developed facilities. Although Beaver Creek National Wild River is the principal recreation attraction of the area, use is also light because of the difficult access. Most visitors drive U.S. Creek Road from the Steese Highway to Nome Creek and then line their boats 12 miles down Nome Creek to Beaver Creek because of low water. There is no surface access to any point on the Wild River. Floaters either travel all the way to the Yukon River and down to the Yukon River bridge (an 8 to 10 day trip) or arrange to be picked up by floatplane or small aircraft, usually in the vicinity of Victoria Creek near the northern boundary of the WMNRA.

Hiking is concentrated on the White Mountains summer trail, but other unmaintained trails are also used. Off-road vehicle use occurs on many trails, often in connection with sport hunting, another popular recreational activity. Most recreation takes place during the summer or fall. However, the White Mountains winter trail and the public use cabins are lightly utilized in the winter months.

Activity	1984 Visits	1987 Visits	1987 Visitor Days	Estimated Value
ORV Travel - snowmobile	5,500	6,750	4,500	$18,000
Winter Sports - skiing/dogs	2,000	3,000	2,000	$20,000
Non-motorized	250	350	500	$2,500
Camping	1,000	1,500	1,300	$7,800
Hunting	5,000	6,500	3,600	$147,600
Site Based	5,000	7,000	3,800	$19,000
Fishing	300	300	100	$1,100
Boating	100	100	2,400	$24,000
Totals	19,150	25,450	18,200	$237,000

Figure 3-5. Visits, and 1987 visitor days with estimated values for the White Mountain NRA and Beaver Creek. These statistics are from Recreation Management Area reports which include recreation sites adjacent to the NRA boundary. Source RMIS - Recreation Management Information System 1984. 1986. 1987 - no reports in 1985. Standard values are computed from Recreation Methodology found in Appendix C-2.

Over the past several years the BLM has spent nearly $300,000 upgrading and constructing new recreation facilities such as remote cabins and new trails.

Development of new roads and trails and a system of public use cabins will encourage additional use, but may have a negative impact on existing primitive and wilderness recreational opportunities for some users. Trail improvements and cabins would be designed to complement the primitive character of this backcountry.

Gold mining does offer interest to the public for its historical value and the potential recreation opportunity to pan for gold. Few recreation activities currently taking place have adverse impact on mining operations, except where a visitor encroaches to pan for gold or observe mining activity. This may interfere and create some conflict with the mining operation; however, it is generally believed that permitting or even encouraging this activity greatly enhances the tourist's experience and understanding of mining. Both miner and recreationist benefit from this experience through better understanding of each other's position and concerns.

3.11 Visual Resource Management

The White Mountains and Beaver Creek are two distinct elements that dominate the WMNRA. There is also a diversity of landscape types existing within the area. All four of the visual dominance elements (form, line, color, and texture) are found in the characteristic landscape in varying degrees. The dark color of the vegetation against the white cliffs is the most dominant element. The undulating and repeated pattern of topography found in the continuous, rugged mountains is second in importance, with texture and line being the least dominant. Texture is found in the patterns of low to moderate-growing discontinuous vegetation, and in the barren rocky slopes of the upper hills, and along river channels. Ridges form line silhouettes as do river channels and meanders. The BLM utilizes a visual resource management system to classify landscapes and visual characteristics. In this classification, I has a higher value than II and III (BLM Handbook).

Beaver Creek is the main drainage, and dramatic views of the sheer white cliffs of the White Mountains can be seen from the Wild River portion of the creek. Detailed examinations of the visual quality are identified in many of the bibliographical selections. The White Mountains RMP included a Visual Resource Management (VRM) Class I designation for Beaver Creek National Wild River. The objective of the class is to preserve the existing character of the landscape so that it appears unaltered by man. The level of change to the landscape should be extremely low.

Most of the headwaters of the drainage and the adjoining lands have been classed as "semi-primitive motorized" and are a VRM Class III area. Most activity in this class can be moderate, but should not attract attention or dominate the view of the casual observer.

The scenic quality of the existing landscape is an important part of the recreational experience in the WMNRA. Maintaining the viewshed along the Beaver Creek corridor and the background view of the White Mountains spine in their natural state is essential to complying with the Wild River designation and the designation of the White Mountains as a National Recreation Area. However, valid existing rights and future rights granted under appropriate federal and State laws will be protected as appropriate.

The current and approved Beaver Creek River Management Plan of December 1983, specifies a management Class I for the areas designated as "Wild." The VRM classification of "special area" applies to all segments of rivers so designated under the WSRA. Past or present activities which have or will alter the characteristic landscape do not meet the Visual Resource Management objectives for Class I management areas. Placer mining, road construction, and other similar activities where the soil, water, or vegetation is altered from the naturally appearing landscape are not compatible with these objectives, but are allowed under valid existing rights.

The objective of the VRM Class II areas (the Primitive and Semi- Primitive Management Units within the critical viewshed of the National Wild River) is to retain the existing character of the landscape. The level of change should be low. Placer mining and associated roads, vegetation removal, and soil disturbances significantly alter the characteristic landscape and are therefore in conflict with the management objectives of VRM Class II areas. Placer mining is taking place within the drainage bottoms where the landscape is visually sensitive, highly noticeable, and of the highest visual interest in the landscape. Observer position, sensitivity levels, and dominance factors all draw the eye to the area disturbed by mining and associated activities.

With VRM Class III (within the Semi-Primitive Management Unit, but outside of the critical viewshed of the National Wild River), modification of the characteristic landscape can occur; however, it should be moderate and should not attract attention or dominate the view of the casual observer. Mining activities in these areas is allowable, but would have to be judged on a case- by-case basis.

3.12 Economics

The Alaska placer mining industry in 1985 contributed $63.4 million in expenditures to the State economy. In 1985, placer mining activities accounted for an estimated 1,668 full- time equivalent jobs statewide. Of these, 50% were directly involved with placer mining operations, and 50% were employed by support industries (Peterson 1986). In 1985, placer mining operations produced approximately 190,000 ounces of gold worth $62 million (Bundtzen 1986).

Direct labor expenditures totaled $18.9 million in 1985. Fairbanks received 23% of these expenditures in 1985 and other locations in Alaska received 35%.

The placer mining industry, when compared to other Alaska industries, ranks 52nd in dollars paid to employees, and accounted for less than one-half percent of total private sector employment and payroll (Todd and Weddleton 1986). Furthermore, of the $18.9 million going toward direct labor expenses, 30% was paid outside of Alaska (Peterson 1986). Placer mining ranks eighth in number of people employed by basic sector industries.

Early Interior Alaska mining family. Photo courtesy of Anchorage Museum of HIstory and Art.

The basic sector of an economy are firms and individuals serving markets outside of the state. The support sector are those firms and individuals which serve markets within Alaska. Changes in basic sector activity result in changes, in the same direction, in the support sector.

Despite the fact that gold prices have decreased through much of the 1980s, statewide gold production, in general, has increased. For the period between 1982 and 1985, it appears that this increase is due mainly to increased production by large and medium-sized mines. Comparing the 1982 census conducted for the Department of Commerce and Economic Development (DCED) to the census done in 1985, statewide there were 46 fewer recreational/assessment mines, 63 fewer small mines and two fewer medium-sized mines in 1985. There were,however, 14 more large placer mines.

Employment

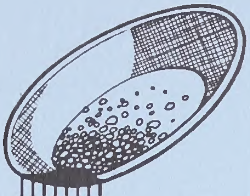
The manner in which employment is traditionally measured does not necessarily reflect employment conditions in rural Alaska communities. Differences in lifestyles, and the manner in which people engage in activities to produce a livelihood, complicates data recording and presentation. The most readily available data on employment do not include self-employed people and are often not available due to disclosure rules.

In Interior Alaska as a whole, government and services are the major employment sectors, while mining, construction, manufacturing, transportation, utilities, wholesale and retail trade, finance, insurance, and real estate combined account for less than one-third of total wage and salary employment (Louis Berger & Associate 1983a).

In the Beaver Creek and Minto Flats drainages combined, employment in placer mining is estimated to have been 57 individuals in 1980 and 63 in 1985. Placer mining employment in the Birch Creek drainage is estimated to have been 470 in 1980 and 209 in 1985. In the Fortymile drainage, employment is estimated to have been 27 in 1980 and 54 in 1985.

An economy of Beaver Creek can hardly be said to exist. Individuals mining in the area must import essentially everything they use. The area is rarely used for subsistence and recreation. The Beaver Creek drainage has no communities and population data from the region are unavailable. The community of Beaver Creek is outside the drainage on the Yukon River near the mouth of Beaver Creek, and has a population of about 80.

Employment data specific to the Beaver Creek drainage are not available.



Chapter IV
Environmental Consequences

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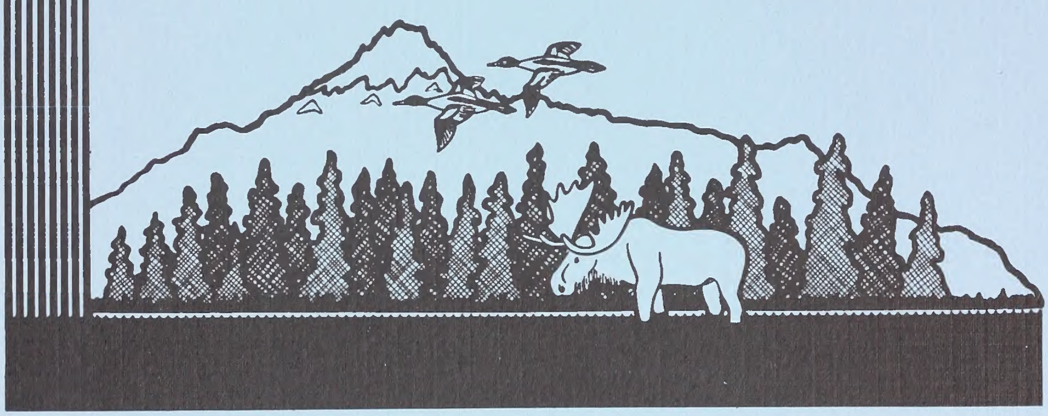


BEAVER CREEK

This chapter discusses the potential consequences or impacts of each of the alternatives described in Chapter Two. The intent of this chapter is to provide the scientific and analytical basis of the comparison of the alternatives (Figure 2-5).

Cumulative Impacts

The evaluation of cumulative impacts requires the integration of time, space, mining/non-mining, and federal/non-federal actions in a complex and dynamic environment. The spatial aspect is covered by considering the impacts of multiple mining operations in the headwaters of Beaver Creek (Placer Mining Operations and Access Roads Map, Chapter One). Time is considered by evaluating the past, present, and reasonably foreseeable actions of placer mining. Past and present impacts are part of the existing environment, discussed in detail in Chapter Three, Affected Environment. The projected number of mines, acreages of disturbance, and miles of roads and trails were calculated using methods outlined in Appendix B-1, and are summarized in Figures 2-2, 2-3, and 2-4. Future impacts are discussed in this chapter, Environmental Consequences. There are only federal mining claims in this watershed, so impacts from non-federal mines are not of concern. Non-mining actions are discussed in Chapters Three and Four as appropriate.

For a summary of the impacts and comparison between alternatives, reference Figure 2-7, which depicts past, 1987, and projected 1998 impacts for the Proposed Action and each alternative.

Projection of Mines

Five mines were selected to represent the projected number of placer mines that would operate in the Beaver Creek drainage over the next 10 years under the Proposed Action. This number of mines was chosen because it corresponds with the number of mining proposals the Steese/White District received for the drainage in 1987, and because five mines represents a reasonable estimation of mining activity within the foreseeable future. This level of mining may be high in estimating future mining activity, since only one mine has operated at any given time over the past six or seven years.

Projecting the number of mines that would operate under Alternatives A, B, and C was based on the compliance costs of these alternatives as compared to the Proposed Action's compliance costs. These costs are listed in Figure 2-6, and a comparison clearly indicates that the estimated water treatment costs for Alternatives A, B, and C are significantly higher than those estimated for the Proposed Action. Due to the significant increase in compliance cost, BLM estimated that only four mines would operate under Alternatives A and B. Similarly, three mines would operate under Alternative C due to increases in water treatment and reclamation costs.

The water treatment costs cited in Figure 2-6 were taken from an EPA report (EPA 1987) that analyzed the economic impact of effluent standards on the placer mining industry. In the EPA report, six water treatment technology options were outlined and their associated costs for Alaska were estimated. BLM reviewed these options and selected the three treatment technologies that came closest to meeting the various water quality standards of the Proposed Action and Alternatives A, B, and C. It is anticipated that a zero discharge system with some water seepage would meet the water quality standards, with EPA variances, for the Proposed Action. Alternatives A and B, with water quality standards of .2 ml/l settleable solids and 5 NTU turbidity, and no EPA variances, would require operating with no seepage of effluent to the stream, or the Option Four water treatment technology listed by EPA. Alternative C, with water quality standards of zero ml/l settleable solids and zero NTU turbidity increase, would require operations comparable to the Option 6c water treatment technology, including zero discharge, 100% recycling of water, and flocculants. The costs in Figure 2-6 represent a mine that processes 150,000 cubic yards per mining season.

A worst-case scenario to describe a level of placer mining more intense than expected was analyzed to predict those possible cumulative environmental impacts. This scenario could occur if unforeseeable circumstances caused this high level of activity, such as the price of gold increasing to $2,000 per ounce. This analysis is presented in Figure 2-8, with methodology in Appendix B-2.

Under any of the alternatives, there are key considerations which are:

- Unavoidable Adverse Impacts
- Short and Long-Term Impacts on Productivity of Resources
- Irreversible and Irretrievable Commitments of Resources.

4.1 Geology and Topography

The scale of surface disturbance attendant to placer mining and related activities is quite small relative to that of natural topographic features as generally perceived. Further, such disturbances would be confined principally to redistribution of unconsolidated/semi-consolidated surficial geologic materials, which should generally be amenable to subsequent reclamation. Appreciable portions of streams and riparian areas are subject to short-term disturbance, frequently rather intensive in character, but long-term impacts are subject to prevention-amelioration via responsible, substantive reclamation efforts.

Each alternative requires some reclamation, which should result in little net modification of the overall topography of areas which have undergone mining activities. There would be some short-term, quite local and small-scale landscape modification impacts during mining activities. These modifications should be subsequently reclaimed, and yield few or no significant long-term impacts. A principal objective of effective reclamation is to return the landscape to a condition similar to that which existed prior to mining activity disturbances. Thus, as reclamation standards become increasingly more stringent, from Alternative A to the Proposed Action and from Alternative B, to C, effects on topography which involve stream channel and riparian disturbances would be increasingly minimized. There should be little likelihood of irreversible or irretrievable commitments of topographic resources, in the sense of appreciable or significant net landscape modification under any of these alternatives. The required reclamation, under any of the alternatives, could also result in reclamation of adjacent older disturbed areas as well (cf. DOI 1988).

4.1.1 Proposed Action

Approximately 115 acres of river benches and bottom grounds will be disturbed and 80 acres will be reclaimed within 10 years, with the remainder reclaimed at the end of the mine life. Therefore, no significant cumulative impacts on topography, given the required reclamation, is expected.

Direct effects may be significant during actual mining due to disturbance and redistribution of gravel, overburden, and related materials. Indirect effects related to this will be due principally to the possibility of increased erosion of these materials during and after such disturbance.

4.1.2 Alternative A

There may be discernible modifications of landscape aspect under this alternative, since the reclamation requirements are directed only to stabilization of disturbed areas; reconfiguration is not required. However, the scale of these alterations in aspect will be relatively small in the overall context of the topographic features in this area of appreciable natural relief. Past disturbances covers approximately 350 acres, projected disturbance over 10 years is 100 acres.

4.1.3 Alternative B

Impacts under Alternative B will be the same as the Proposed Action, except 100 acres will be disturbed.

4.1.4 Alternative C

Impacts under Alternative C will be the same as the Proposed Action, except that 84 acres will be disturbed.

4.1.5 Alternative D

The cumulative impacts under Alternative D will be similar to the Proposed Action, except that no further mining-related disturbance will occur, cessation of mining will end direct effects, and reduce further residual effects to the minimum.

4.1.6 Special Considerations

Unavoidable Adverse Impacts

For all alternatives except A, there would be some minimal alteration of original site aspect, as adequate reclamation does not necessitate attempting to restore the site identically to the original configuration. During mining, the site aspect would be modified to some degree, dependent upon the particular situation; this might be obtrusive in some situations.

For Alternative A, the impacts would in general, be similar to those discussed under the Proposed Action. Reconfiguration, except as necessary to stabilize against erosion, would not be required as part of reclamation, thus readily discernible resultant impacts to landscape aspect might result; these would be small-scale; however, in terms of the overall topography in this region of appreciable relief.

Short-Term Uses vs Long-Term Productivity of Resource

For all alternatives, except A, and D, there would be some short- term modification of site aspect during mining, which would, however, not significantly impact the overall topographic setting of the affected area, since the required reclamation would include reconfiguration and stabilization.

For Alternative A, the situation would, in general, be similar to the discussion under the Proposed Action. However, reclamation would not require reconfiguration, except where necessary to stabilize against erosion, thus some of the more obtrusive short- term disturbances of landscape aspect may persist over a longer term after the cessation of mining.

For Alternative D, the situation would, in general, be similar to the discussion for the Proposed Action. However, cessation of all mining would end further short-term and long-term impingements upon topography.

Irreversible and Irretrievable Commitments of Resources

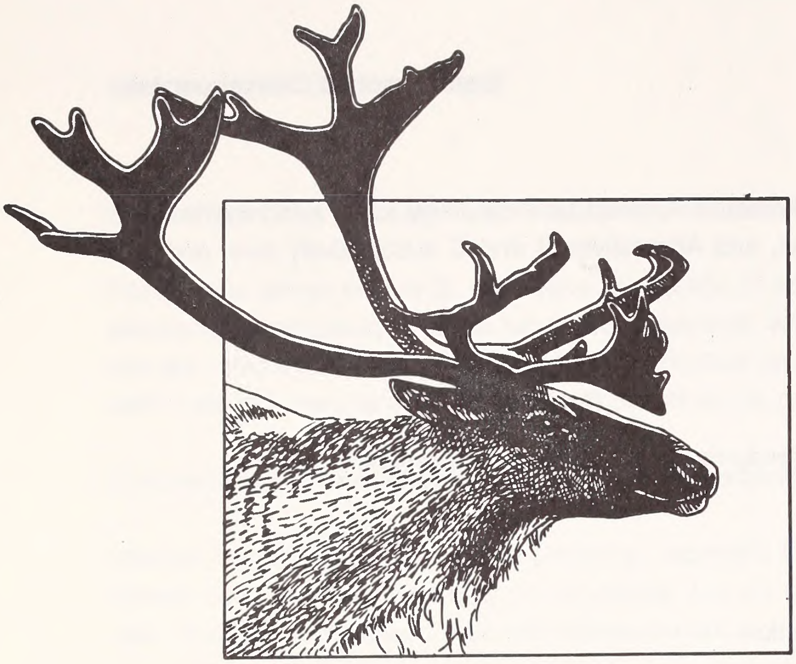
For all alternatives except A and D, there would be no significant irreversible and irretrievable commitments, since the required reclamation would be directed to reconfiguration and stabilization of the disturbed areas.

For Alternative A, the situation would, in general, be similar to the discussion under the Proposed Action. The possible persistence of some landscape modifications might be construed as representing a commitment, in terms of changed site aspect. However, this should be on a relatively small scale, and be relatively unobtrusive, when viewed in the context of the overall topographic relationships within this region of appreciable relief.

For Alternative D, the situation would, in general, be similar to the discussion for the Proposed Action. Cessation of all mining would end any further resource commitments.

4.2 Mineral Resources

BLM roughly estimates that the net present value of placer gold occurring in existing claims in the Beaver Creek drainage is between 1.6 and 44 million dollars (Appendix B-3).



Caribou

The Alternatives become successively somewhat more restrictive to mineral resource development activities, from A to the Proposed Action and B through C, while D precludes mining. Thus, the short-term impacts, successively, are likely to be increased costs and inhibited further development of known mineral deposits because of the severity of such restrictions. For the short-term, most operations likely will try to meet these conditions; their success will vary, and depend on a complex of physical and economic factors, unique to each location, deposit, and operator. In the long term, there could well be a reduction in the number of operations, the size and scale of which will need modification. The White Mountains National Recreation Area Resource Management Plan (DOI 1984) precludes further location (or leasing) of placer mining claims, restricting mining activities to the exercise of valid existing rights existing at the time this Plan was adopted. Thus, Alternatives A,B,C, and the Proposed Action would have no additional effects on expansion of placer mining in the WMNRA.

"Commitment" of resources can be construed in one of two ways, somewhat simplistically, with regard to mineral resources. One view is that resources not developed, remaining in the earth, represent a "savings-account" for possible future use. There is no irreversible-irretrievable commitment of mineral resources from this perspective, they merely remain unused and undiscovered, subject to future events. This view is frequently advocated with the avowed intent of preserving valuable resources for future, presumably more pressing, societal needs, including dire emergencies. However, there is inevitably appreciable time and effort required in order to obtain a product useful to society from even the known deposits (let alone undiscovered resources) of mineral raw materials in the earth, thus this interpretation of preservation for future urgent needs is not totally consistent with physical reality. Further, inhibition of mineral resource development in an area inexorably carries with it the corollary inhibition of exploration for extensions of known deposits and/or new deposits. This, in another sense, consigns "irreversible and irretrievable commitment" of undiscovered resources, via ignorance of their existence, to a limbo of non-use by humanity.

Alternatively, development of mineral resources entails, obviously, physical removal from the earth, and "commitment" to other uses-presumably of benefit to human society, both physically as well as economically. The minerals themselves are thus consigned, irreversibly and irretrievably, to human use, including repeated recycling in many instances.

Thus, as restrictions on development of the mineral resources increase, from Alternative A to the Proposed Action through D, the likelihood of "commitment" of the resources, in the first sense as used above increases; conversely, of course, the likelihood of "commitment" in the second sense as used above decreases, similarly. "Commitment of mineral resources" is used in this EIS in the second sense, (i.e., development), hence Alternative A would be most likely to be accompanied by maximum commitment, the Proposed Action, and Alternatives B and C successively less, and no commitment under Alternative D.

4.2.1 Proposed Action

There are no significant impacts on mineral resource availability for development.

4.2.2 Alternative A

Impacts will be the same as the Proposed Action.

4.2.3 Alternative B

Impacts will be the same as the Proposed Action.

4.2.4 Alternative C

Impacts will be the same as the Proposed Action.

4.2.5 Alternative D

Under Alternative D mining activity resource development and use will end. There would be severe negative impacts on exploration, extension, and development of known and unknown resources in the area and region.

Under Alternative D there will be the direct effect of cessation of mining activities, as well as related exploration and development, plus the indirect negative effect on exploration and development elsewhere in Alaska as well. Known and undiscovered resources which otherwise might have been of value to society will be unused.

4.2.6 Special Considerations

Unavoidable Adverse Impacts

There are no significant impacts under the Proposed Action or Alternatives A, B, and C, and Alternative D calls for a total cessation of mining and related activities.

Short-Term Uses vs Long-Term Productivity of Resource

For all alternatives except D, short-term production of non- renewable resources necessarily implies decreased productivity at some future time. However, without development and use, mineral resources are "resources" only in a somewhat hypothetical sense. In the case of Alternative D, both short-term uses and long-term productivity will effectively be precluded.

Irreversible and Irretrievable Commitment of Resources

Mineral resources developed and produced represent irreversible and irretrievable commitments to human use. The resources may be recyclable, but are ultimately non-renewable, in terms of human use. This will be the case for all alternatives except D.

For Alternative D, such mineral resources as may be present would be consigned, irreversible and irretrievably, to a limbo of no development of known resources and ignorance of existence or presently undiscovered resources. This would be subject, presumably, to possible subsequent changes in law under future circumstances.

4.3 Soils

The initial direct impact to soils from placer mining is the same under all alternatives; the differences are the extent of ground disturbed and measures taken to promote recovery. Generally, placer mining completely destroys soils through the stripping of overburden and processing of gold-bearing gravels. The usual result is that larger tailings and coarse soil material is deposited in one location within the disturbed area and the fine material is collected in holding ponds through settling from the water column. The residual or indirect impact of each alternative would be the rate of recovery of the soils through different reclamation practices. The cumulative impact would be the areal increase in the areas disturbed and the resulting changes in soil stabilization as revegetation occurs. Even under the Proposed Action, the expected disturbance would be less than 0.05% of the watershed area, and this is not expected to cause significant changes to the soil resources. All mining alternatives will result in long term unavoidable impacts to the soils in the areas disturbed by mining.

4.3.1 Proposed Action

It is estimated that approximately 115 additional acres would be disturbed by 1998, with reclamation occurring on 80 acres. The soil profile would be completely altered on all these disturbed areas. Anticipated disturbance of the soil profile and/or compaction of soils would occur on the 33.4 miles of road and 21 miles of trail. All operators would stabilize the site and stream channel. This would result in lower rates of erosion from disturbed areas, but would not promote the general development of a productive soil over the disturbed area. Locations devoid of fine material would redevelop soil structure extremely slowly, if at all, with little or no vegetation being established. Areas rich in fine material would develop a productive vegetative cover more rapidly, but would be subject to high rates of erosion until a successional plant community is established. The disturbed areas would generally end up with reduced slope angles compared to the original contour.

4.3.2 Alternative A

The physical impacts to soils under this alternative would be identical to the Proposed Action. The only difference is in disturbance anticipated; reduction from 115 to 100 acres of disturbance and from 80 to 70 acres of reclamation would not be a significant watershed-wide difference.

4.3.3 Alternative B

The initial physical impacts to soils would be the same as for Alternative A, with 100 acres of disturbance and 70 acres of reclamation, 29.1 miles of road, and 18.3 miles of trail. The different reclamation practices would determine the eventual impact on soils. All operators would stabilize the stream channel, recontour and distribute the fine material, and respread the overburden. This will result in lower rates of erosion from the disturbed area by providing some protection to the inorganic soil material. The redistribution of fine material should reduce the possibility of large quantities of sediment entering the stream system and would provide for a more uniform development of soil stability over the entire disturbed area. Additionally, respreading of any organic overburden would promote the development of vegetative cover by providing micro-relief to trap moisture and seeds. Slope angles would approximate the original contour.

4.3.4 Alternative C

Anticipated impacts would occur on 84 acres of ground, with 58 acres of reclamation occurring by 1998. Approximately 24.4 miles of road and 15.3 miles of trail would be expected. This alternative essentially would provide for restoration of the disturbed area. All operators would reestablish the stream channel in the original floodplain, reshape and distribute the fine material, and enhance regrowth of the vegetative cover. This would result in impacts close to those expected in Alternative B, except the revegetation would probably speed up the process of surface stabilization and would reduce the rate of erosion from the disturbed area. Slope angles would approximate the original contour. These reclamation practices should allow for development of soil stability through revegetation in 25-30 years (Chapter 4.5, Landcover).

4.3.5 Alternative D

All areas disturbed since 1980 would be stabilized and no new areas would be disturbed by placer mining. This would result in impacts similar to the Proposed Action, only to a lesser areal extent. Development and succession of plant communities would generally take a long time and would not be uniform over the disturbed area due to the uneven mixing of fine material in the disturbed areas. Past mining disturbance covers approximately 350 acres.

4.3.6 Special Considerations

Unavoidable Adverse Impacts

The soil profile would be completely altered by mining operations on approximately 115 acres of ground for the Proposed Action, 100 acres for Alternatives A and B, and 84 acres under Alternative C. Soil conditions may be impacted by access roads and trails through disturbance of the soil profile or from compaction. This will not be significant watershed-wide impact on soil resources. Alternative D impacts are discussed in Section 4.3.5.

Irreversible and Irretrievable Commitment of Resources

There would be no significant irreversible or irretrievable commitment of soil resources under the Proposed Action and Alternatives A, B, and C since productive soil stability will eventually develop after 50 years if reclamation practices are followed. Alternative D is discussed under Section 4.3.5.

Fireweed

4.4 Water Resources

To conduct an impact assessment of differing alternatives without having a distinct project to focus on, projections must be made concerning the level of activity anticipated and the success of implementation of the alternative. The projections made for this analysis are found in Figure 2-5. At the same time different alternatives are derived from possible State and Environmental Protection Agency standards. This section, therefore, will evaluate other agency standards.

The primary impact to water quality to be expected from placer mining operations in the basin is an increase in sedimentation. An evaluation of sediment input from various sources, based on a methodology developed by the EPA (1973) is presented in Figure 4- 1. The tonnage figure for forested lands has been used to minimize the contribution from natural sources. This in turn tends to emphasize the contribution from areas affected by surface disturbances. This estimate is verified by comparison with regional analysis of sedimentation presented by Selkregg (1974).

The nature of the basin, its geology, and the relative size of the affected drainages are such that one would not expect a significant <u>change</u> in the chemical components such as heavy metals or ions, or biological constituents such as *Ghiardia* or coliforms. Similarly, the percentage of stream channel and bench disturbance would not lead one to expect a significant <u>change</u> in runoff characteristics such as response to storm events, peak flows, or annual yield.

Hazardous Materials

Considering the types and amounts of hazardous materials used by small placer mining operations, the lack of long-term storage of large quantities, and the lack of any history of significant spills requiring clean-up or mitigation, it is not anticipated that there will be a significant cumulative impact to the environment under any of the alternatives. Implementation of the waste treatment and disposal regulations will make such impact even less likely in the future.

4.4.1 Proposed Action

Under this alternative, the projections are:

1) By 1998, the number of active mines would increase from one to five. Acreage disturbed would increase by 115 acres (in addition to 350 acres of historic disturbance, with reclamation on 80 acres. There would be 33.4 miles of road and 21 miles of trails.

2) Mining would continue to be regulated as in previous years. All operators would be required to meet the State of Alaska and/or EPA standards for discharge or appropriate variances, and responsibility to enforce these standards lies with those agencies. Any suspected violation of water quality standards would be reported to the appropriate agency for enforcement action.

3) BLM's commitment to protect the water quality of Beaver Creek as described in the RMP for the White Mountains National Recreation Area would continue, resulting in all major operators probably operating with a "zero discharge" system as in 1987.

Because placer mining is considered to be a non-consumptive use of water, there would be no significant impact on water quantity under this alternative.

Stream channel morphology would be directly affected in all areas where mining takes place in the active channel. Five operations predicted in the area by 1998 would probably affect 1.25 miles of stream channel. Generally, mining practices tend to reduce the sinuosity of channels and increase channel gradient. This creates an area of channel degradation at the upper end of the disturbance. Water quality is indirectly affected during this process through the introduction of sediment to the water column, which can be a long-term impact.

Some direct effects on water quality can be anticipated during the development stage of an operation due to the construction of settling ponds and stream bypasses, and through rechannelization of the stream, if required. These activities would result in short-term increases in sediment levels and turbidity while equipment operates in the active stream channel. During the production phase of operations, if "zero discharge" was truly attained, there would be no direct impact on water quality. However, it is likely that occasional high water or failure of water control structures would introduce sediments collected by the water treatment system to the stream channel. This would create short-term increases in turbidity and possible localized sedimentation of the stream substrate. The degree of impact would depend on the amount of material released and the streamflow at the time of release. Turbidity would probably be detectable far downstream on Beaver Creek for short periods of time.

Indirect impacts to water quality include accelerated erosion from disturbed areas until fully successful revegetation of the site is achieved. Channel cutting would also occur until the stream reaches equilibrium. These processes would introduce sediment into the stream system, particularly during spring breakup and periods of high water runoff. These impacts would be expected to occur for approximately 30 years or until stabilization is achieved and successful regrowth is established (Landcover, Section 4.5).

For comparative purposes, BLM estimates that under this alternative the soil loss from the Beaver Creek watershed and non-point sources natural erosion would be approximately 343 tons per day based on a 200-day open water season (Figures 3-2 and 4- 1). If the figures from Selkregg (1974) of less than 100 to as much as 500 mg/l sediment concentration in natural waterways are used, along with the assumption that the average summer flow of Beaver Creek in the reach just above Victoria Creek (at the lower end of the Wild River) is approximately 649 cfs, then the expected sediment load in naturally occurring waters in this watershed could be expected to be from less than 175 tons per day to as much as 876 tons per day at the lower reaches of the Wild River. This sediment loading is consistent with the BLM estimate and appears to lie well within estimates of a normal clear- flowing stream.

Projected Annual Tonnage Rates for Sediment in 1998 (tons/year) [1]

Category	Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Forest	40,932	40,932	40,392	40,932	40,932
Abandoned Surface Mines [2]	1,320	1,320	1,320	1,320	1,320
Active Federal Surface Mines [3]	6,000	5,232	5,232	4,320	0
Active State Surface Mines	0	0	0	0	0
Construction [4]	20,910	18,225	18,225	15,270	9,600

[1] Calculated using estimates prepared in Figure 3-2.

[2] Assumes worst case scenario of no regrowth and regeneration for pre-1981 mines.

[3] Assumes disturbances continue past 1998, but there is total reclamation at the end of mine life.

[4] That construction of roads and other disturbances will contribute less sediment in successive years is not taken into account here.

Figure 4-1. Comparison under the alternatives of projected 1998 annual tonnage rates for sediment for various categories in Beaver Creek.

Although the indirect impact of placer mining from non-point sources undoubtedly results in some contribution to the sediment load of the stream system, due to the variables involved in sediment transport theory, the quantity of sediment moved within or through the system by Beaver Creek is not definable with current data. However, this analysis indicates that the downstream effect from non-point sources under this alternative would probably be indistinguishable from expected natural conditions.

Meaningful predictions of the sedimentation of the streambed and associated turbidity for all of the possible impacts discussed above are not possible (Water Resources, Section 3.4). However, if the water quality standards are met, the degree of impact will not be significant due to the naturally-occurring sediment load, the limited impacted area of mining operations, and the large amount of dilution.

The impact on chemical water quality is unknown. However, the AHC (1988) study on heavily mined Birch Creek concludes that, although data are limited, of the parameters tested only those for iron and manganese were found to be in violation of State water quality standards. Both of these constituents are common toxicity metals found in many ground and surface water supplies in Alaska. With the relatively small amount of mining in the Beaver Creek watershed, the impact on chemical water quality would not be expected to be significant.

There would be no expected detectable changes in the channel morphology of Beaver Creek due to increased sedimentation downstream from the mining areas if compliance with water quality standards is attained.

Because roads and trails in the area now and in the future would be expected to be constructed away from the stream channels, the impact on water quality should not be significant. Except for slopes to stream crossings, most of the material eroded from road surfaces would be quickly intercepted and contained by the surrounding vegetation.

4.4.2 Alternative A

Under this alternative, the projections are:

1) By 1998 there would be four federal mining operations in the watershed, resulting in a total disturbance of 100 acres with 70 acres reclaimed. There will be 29.1 miles of road and 18.3 miles of trail. Approximately one mile of stream channel will be directly impacted.

2) All Federal mining operations will meet water quality performance standards of 0.2 ml/l settleable solids and 5 NTU (Section 2.3).

Because mining is considered a non-consumptive use of water, there would be no significant impact on water quantity under this alternative.

Effects and analysis would be the same as for the Proposed Action except that during the production phase of operations there would be detectable increases in the sediment load and turbidity of the mined creeks. If persistent, this increase could become detectable as a "film" on gravel bars immediately downstream from the operations. But it is doubtful it would detectable downstream on Beaver Creek due to dilution. It is also doubtful that the accumulation of sediments from year to year would be detectable due to the large amounts of sediment moved during the spring breakup. The impacts would be expected to occur for approximately 50 years or until successful regrowth was established (Landcover, Section 4.5). The soil loss and sediment analysis in the Proposed Action applies here, except that BLM estimates soil loss from the Beaver Creek watershed from natural erosion and non-point sources would be approximately 325 tons per day based on a 200-day open water season.

The impact of possible changes in the chemical water quality is not known.

There would be no detectable changes in channel morphology due to increased sedimentation downstream from the mined areas. The reduction in the amount of roads and trails in the watershed would reduce the potential impact, but quantification is not possible due to highly variable site conditions.

4.4.3 Alternative B

Under this alternative, the assumptions would be the same as for Alternative A except that reclamation requirements would extend to stabilization of the stream channel, recontouring of disturbed ground, distribution of the retained fine material, and respreading of overburden. There would be no significant impact on water quantity under this alternative.

The impacts and analysis under this alternative would be the same as for Alternative A except that the indirect impacts on water quality of accelerated erosion would be mitigated by reclamation practices which should allow for more rapid reestablishment of vegetation in disturbed areas. This would reduce the period that non-point source introduction of sediment from disturbed areas would occur. The impact of possible changes in the chemical water quality is not known. The impacts would be expected to occur for approximately 30 to 50 years or until successful soil stabilization and vegetation regrowth was established (Landcover 4.5).

4.4.4 Alternative C

Under this alternative, the projections would be the same as for Alternative B except that:

1) All operations would meet performance standards of 0.0 ml/l settleable solids and 0 NTU above background.

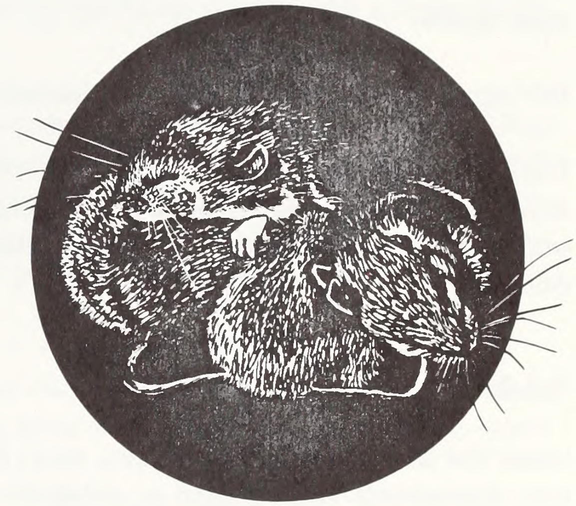
2) Reclamation would consist of channel restoration, recontouring and redistribution of fines and restoration of vegetation on all operations.

3) By 1998 there would be three federal mining operations in the watershed resulting in a total disturbance of 84 acres with 58 acres of reclamation. There will be 24.4 miles of road and 15.3 miles of trail, and approximately 0.75 miles of stream channel would be directly impacted.

There would be no significant impact on water quantity under this alternative.

Channel morphology would be impacted the same as for the Proposed Action and Alternatives A and B except that restoration of the stream channel would reduce impacts to short-term, occurring only as long as the operation is active.

Direct impacts and analysis would be the same as for the Proposed Action. Indirect impacts are the same as for the Proposed Action and Alternative A. With the given reclamation practices, channel stability would be required when operations shut down and the disturbed area should be successfully revegetated in approximately 25 to 30 years (Landcover, Section 4.5). The soil loss and sediment analysis in the Proposed Action applies here, except that BLM estimates soil loss from the Beaver Creek watershed from natural erosion and non-point sources would be approximately 306 tons per day based on a 200-day open water season. The impact on chemical water quality is unknown, but should not be significant.



Field Mice

There would be no detectable changes in channel morphology due to increased sedimentation downstream from the mined areas.

Unavoidable adverse impacts would be possible short-term increases in suspended sediment and turbidity, and accelerated erosion from disturbed areas while the operations are active.

4.4.5 Alternative D

Under this alternative, the assumptions are:

1) No mining operations would be allowed in the area and there would be 7.2 miles of road and 23.3 miles of trail.

2) All areas disturbed by mining operations since 1981 would be required to be stabilized.

Because there would be no use of water in the system, there would be no impact on water quantity under this alternative, other than those due to stabilization effects. Indirect impacts would be the same as for the Proposed Action, and Alternatives A and C. The degree of indirect impacts would not be significant enough to be easily detectable downstream on Beaver Creek at any but the highest flows. The soil loss and sediment analysis in the Proposed Action applies here, except that BLM estimates that soil loss from the Beaver Creek watershed from natural erosion and non-point sources would be approximately 256 tons per day based on a 200-day open water season. The impact on chemical water quality is unknown, but should approximate the natural conditions of the watershed since it is anticipated there would be no placer mining development. There would be no detectable changes in channel morphology due to increased sedimentation downstream from the mined areas.

4.4.6 Special Considerations

Unavoidable Adverse Impacts

For the Proposed Action and Alternatives A and B, unavoidable adverse impacts would be significant short to long-term increases in suspended sediment and turbidity, accelerated erosion from disturbed areas resulting in a possible increase in sediment introduced to the stream system, and changes in channel morphology in the vicinity of the disturbed area.

Under Alternative C unavoidable adverse impacts would be possible short-term increases in suspended sediment and turbidity, and accelerated erosion from disturbed areas while the operations are active.

Under Alternative D erosion from unreclaimed areas may introduce sediment to the stream system, particularly during periods of high water runoff.

Short-Term Uses vs Long-Term Productivity

Under the Proposed Action and Alternatives A, B, and C the short- term use of water resources for placer mining would affect the long-term productivity to the extent that accelerated erosion from disturbed areas and channels may increase the sediment load of the stream until stability and equilibrium are achieved. These impacts are not expected to be significant downstream on Beaver Creek.

Under Alternative D there would be no active placer mining use of the water resource and no effect on long-term productivity.

Irreversible and Irretrievable Commitment

There would be no irreversible or irretrievable commitments of the water resources under the Proposed Action and Alternatives A, B, and C. Water quantity would not be significantly affected, and water quality would return to approximately natural conditions after successful stabilization of disturbed areas. There would be no irreversible or irretrievable commitment of water resources under Alternative D.

4.5 Landcover

Analysis of acreages affected by mining and reclamation is based on projected disturbance for mining and associated claim access roads and trails (Appendix D-1). Estimates of acreages for all alternatives are in Figure 4-2.

The major variation among alternatives which will affect landcover is the relative amount of fine materials remixed in the tailings during reclamation. This fine material content affects both the rate of regrowth and the acreage which will recover to a stable productive vegetative community.

Figure 4-3 illustrates various rates of succession on substrates with different percentages of sub-sand sized fine materials. Analysis of the impacts of the alternatives is therefore largely based on the differing regrowth rates resulting from different reclamation techniques and the mix of fine materials in the tailings.

Figure 4-3 was developed using data from studies and observations of regrowth on tailings (Rutherford & Meyer 1981, Holmes 1981, Halloran 1986, Spencer 1987). The four arrowed lines represent average time frames for succession to various vegetation communities. Most disturbed areas in the Beaver Creek watershed will follow this or a similar pattern of native species regrowth. Cumulative effects become apparent when the disturbed area is large enough to influence seed dispersal into barren ground, or when repeated disturbances such as remining old tailings maintain one of the pioneering communities.

A stable, sustaining productive community is considered to be the open tall shrub community, shown on Figure 4-3. This is generally a tall willow and/or alder community with a canopy cover of at least 50% in vegetated areas, where dying vegetation is replaced by seed or vegetative means. Such a community can sustain moderate pressure from wildlife, especially beaver or browsing moose, and may continue on the site indefinitely, or be successional to a deciduous forest with mixed spruce.

4.5.1 Proposed Action

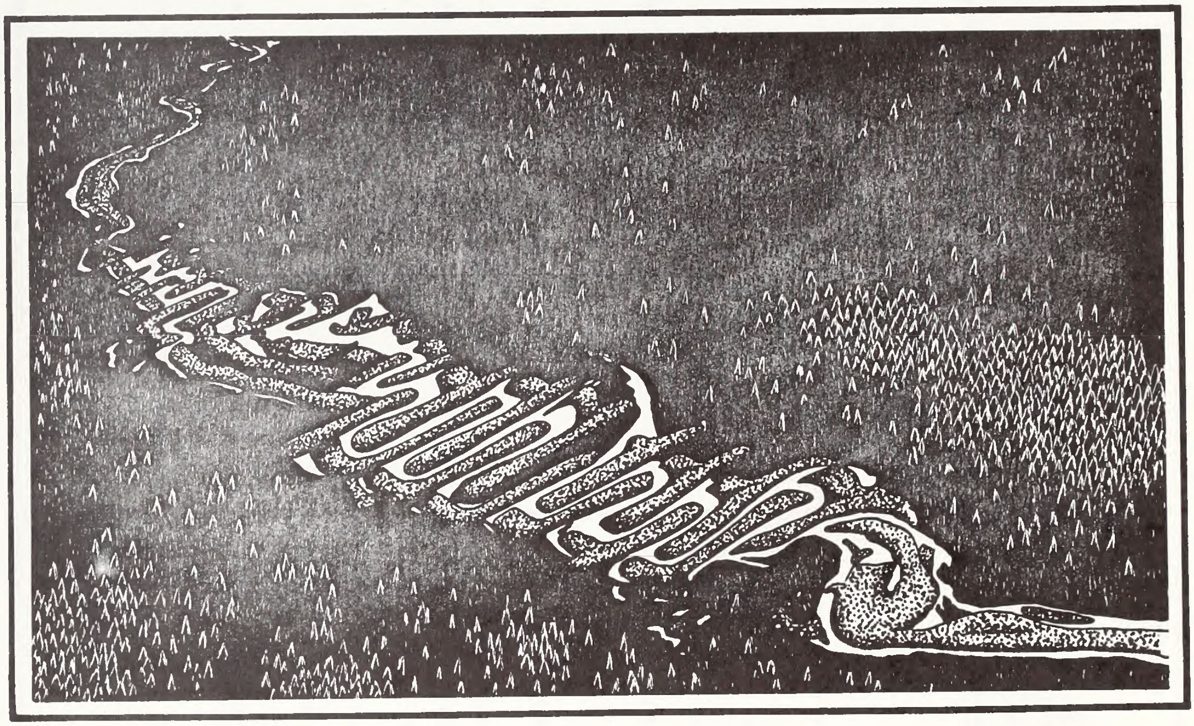
During 1987, three acres of old dredge tailings were sluiced and reclaimed by leveling and there was little to no topsoil and overburden to spread over the reshaped tailings. The lack of fine materials in the reclaimed tailings retards rapid regrowth of vegetation. Regrowth to a stable, sus-

		1987 Season			Proposed Action			Alternative A			Alternative B			Alternative C			Alternative D		
	Pre – 1981 Disturbance	Dredged tailings	Sluiced tailings	Total	Dredged tailings	Sluiced tailings	Total	Dredged tailings	Sluiced tailings	Total	Dredged tailings	Sluiced tailings	Total	Dredged tailings	Sluiced tailings	Total	Dredged tailings	Sluiced tailings	Total
Acres disturbed from mining	352	—	—	3.00	—	—	115.00	—	—	100.00	—	—	100.00	—	—	84.00	—	—	0.00
Acres disturbed from trails	84.70	—	—	84.70	—	—	76.40	—	—	66.60	—	—	66.60	—	—	55.60	—	—	84.70
Acres disturbed from roads	43.60	—	—	43.60	—	—	202.40	—	—	176.40	—	—	176.40	—	—	147.90	—	—	43.60
Acres reclaimed	40.00	—	—	3.00	—	—	80.00	—	—	70.00	—	—	70.00	—	—	58.00	—	—	0.00
% barren after regrowth on reclaimed land	85%	85%	85%	—	85%	40%	—	85%	75%	—	85%	40%	—	50%	40%	—	85%	40%	—
% barren after regrowth on unreclaimed land	85%	85%	75%	—	85%	75%	—	85%	75%	—	85%	75%	—	85%	75%	—	85%	75%	—
Acres barren after regrowth	300	1.28	1.28	2.55	48.88	29.13	78.00	42.50	37.50	80.00	42.50	25.25	67.75	25.55	21.35	46.90	0.00	0.00	0.00
Acres barren from mining and roads	– – –	—	—	346.15	—	—	580.40	—	—	556.40	—	—	544.15	—	—	494.80	—	—	343.60
Acres of successional community on dredged tailings	40.00	0.23	—	40.23	8.63	—	48.63	7.50	—	47.50	7.50	—	47.50	16.45	—	56.45	0.00	0.00	40.00
Acres of successional community on sluiced tailings	– – –	—	—	0.23	—	28.38	28.38	—	12.50	12.50	—	24.75	24.75	—	20.65	20.65	—	0.00	0.00

Figure 4 – 2. Acreage estimates for impacts of mining on landcover. Sluiced tailings are from mining with a washplant on previously unmined ground.

taining, productive community of tall shrubs will take approximately 50 years (Figure 4-3). Prior to that, this area will have low value for big game habitat, especially as winter moose browse (Section 4.6).

As future mining operations disturb (previous unmined) ground, topsoil and overburden may be available for respreading over the tailings. The length of time to grow to a stable, productive shrub community would be approximately 30 years for disturbance on previously unmined ground. Further disturbance on old dredge tailings will take approximately 50 years for regrowth. The difference in regrowth rates is largely attributable to the higher proportion of fine grained materials in tailings from sluicing new ground.



River Tailings

Under the Proposed Action, 115 acres of additional mining disturbance are projected by 1998, and 80 of these acres would be reclaimed. Projected mining activity would probably be concentrated in the upper tributaries of Beaver Creek, especially in Nome, Champion, Bear, and Quartz Creeks. Roads into the area from Nome Creek would result in 202 acres of barren ground, and new trails an additional 76 acres of disturbance to vegetation. Using the calculations discussed in Appendix D-1, 28 acres would regrow to a riparian tall shrub community within 30 years of reclamation, an additional 8.6 acres would revegetate within 50 years on mining disturbance in creek bottoms, and 78 acres of new mining disturbance would remain barren or sparsely vegetated.

The road would remain barren indefinitely, removing 202 acres of upland vegetation. The probable route of this road generally transects stands of mature deciduous forest, sparse black spruce with willow patches, low and dwarf shrub tundra, and sparsely vegetated alpine tundra. New trails in the

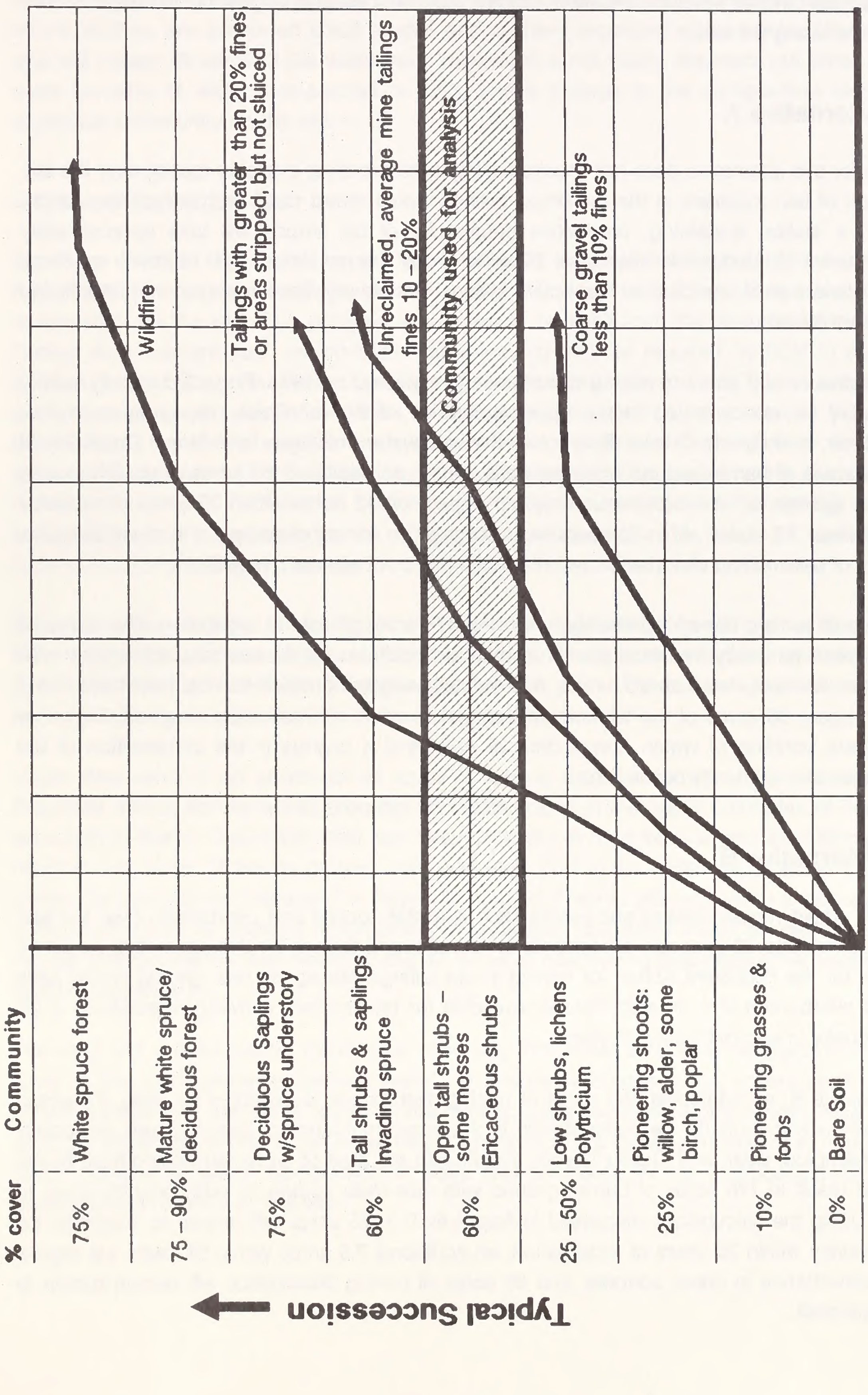


Figure 4 – 3. Comparison of succession rates after various reclamation approaches and natural wildfire.

area will impact 76 acres of the watershed. Vegetation is not totally removed, but other impacts would include ponding of water in low areas, compaction of soils, and vegetational changes in the disturbed areas along the site.

4.5.2 Alternative A

Reclamation for this alternative does not require saving or respreading available topsoil over the tailings. The lack of fine materials in the reclaimed tailings would retard rapid regrowth of vegetation. Regrowth to a stable, sustaining, productive community of tall shrubs will take approximately 50 years (Figure 4-3). Under this alternative 70 acres would be reclaimed, with regrowth on these areas similar to areas of unreclaimed washplant tailings that haven't been respread with stockpiled topsoil and overburden.

Under Alternative A, 100 acres of mining disturbance is expected by 1998. Projected mining activity would probably be concentrated in the upper tributaries of Beaver Creek, especially in Nome, Champion, Bear, and Quartz Creeks. Roads into the headwater drainages from Nome Creek would result in 176 acres of barren ground with new trails adding an additional 66 acres of disturbance to vegetation. A riparian tall shrub community would regrow on 12 acres within 30 years of reclamation, an additional 7.5 acres within 50 years would regrow on mining disturbance in creek bottoms, and 80 acres of new mining disturbance would remain barren or sparsely vegetated.

The roads would remain barren indefinitely, removing 176 acres of upland vegetation. The probable route of this road generally transects stands of mature deciduous forest, sparse black spruce with willow patches, low and dwarf shrub tundra, and sparsely vegetated alpine tundra. New trails in the area would impact 66 acres of the watershed. Vegetation would not be totally removed, but other impacts include ponding of water, compaction of soils, and a change in the composition of the original vegetation community on the site.

4.5.3 Alternative B

Alternative B would require saving and respreading available topsoil and overburden over the tailings. The approximate 50-year rate of regrowth on old dredged tailings for this alternative would be the same as for the Proposed Action for mining in old tailings. Mining on new ground would have fine grained overburden and organic material available for reclamation, allowing regrowth to a tall shrub community in approximately 30 years.

Under Alternative B, an additional 100 acres of mining disturbance is expected by 1998. Projected mining activity would probably be concentrated in the upper tributaries of Beaver Creek, especially in Nome, Champion, Bear, and Quartz Creeks. Roads into the area of projected mining from Nome Creek would result in 176 acres of barren ground with new trails adding an additional 66 acres to vegetation. Using the calculations discussed in Appendix D-1, 25 acres will regrow to a riparian tall shrub community within 30 years of reclamation, an additional 7.5 acres within 50 years will regrow on mining disturbance in creek bottoms, and 68 acres of mining disturbance will remain barren or sparsely vegetated.

The road would remain barren indefinitely, removing 176 acres of upland vegetation. The probable route of this road generally transects stands of mature deciduous forest, sparse black spruce with willow patches, low and dwarf shrub tundra, and sparsely vegetated alpine tundra. New trails in the area will impact 66 acres of the watershed. Vegetation is not totally removed, but other impacts include ponding of water, compaction of soils, and a change in the composition of the original vegetation community on the site.

4.5.4 Alternative C

Alternative C would require that topsoil and overburden be saved and respread over contoured tailings. With the mining in old tailings, another source of fine materials is necessary to facilitate natural revegetation on the site. One possible source would be fines from the abandoned settling ponds. Further enhancement such as fertilization and seeding may be required by BLM in approving individual Plans of Operation. Neiland (1978) and Peterson and Peterson (1977) point out that fertilization and seeding with domestic species tends to encourage non-native species at the expense of establishment by native species. Both suggest a combination of techniques to facilitate quick regrowth of vegetation to reduce erosion, and to enhance eventual establishment of a community of native plants. Mowatt (DOI 1987d) outlines many mitigation techniques for preparing soils, as well as considerations for revegetation of tailings during reclamation. The details of such work would have to be site specific, and specified in the individual Plan of Operation for the mine.

On a site where a variety of techniques are used, including mixing of settling pond fine materials in the tailings, fertilization, seeding, and mulching to enhance regrowth, a stable, sustaining community of tall shrubs will be established in approximately 25-30 years. The percentage of permanent barren and sparsely vegetated land will be reduced to approximately 50%.

Under Alternative C an additional 84 acres of mining disturbance would be expected by 1998. Projected mining activity would probably be concentrated in the upper tributaries of Beaver Creek, especially in Nome, Champion, Bear, and Quartz Creeks. A road into the area from Nome Creek will result in 148 acres of barren ground, with new trails adding an additional 56 acres to vegetation. Using the calculations discussed in Appendix D-1, 20.7 acres will regrow to a riparian tall shrub community within 25 years of reclamation, an additional 16.5 acres within 50 years will regrow on mining disturbance in creek bottoms, and 47 acres of new mining disturbance will remain barren or sparsely vegetated.

The road will remain barren indefinitely, removing 148 acres of upland vegetation. The probable route of this road generally transects stands of mature deciduous forest, sparse black spruce with willow patches, low and dwarf shrub tundra, and sparsely vegetated alpine tundra. New trails in the area will impact 56 acres of the watershed. Vegetation is not totally removed, but other impacts include ponding of water, compaction of soils, and a change in the composition of the original vegetation community on the site.

4.5.5 Alternative D

Under this alternative there would be no further mining on federal claims in the watershed. The rate of regrowth would be very similar to Alternative A, with the existing disturbance becoming revegetated by natural processes. Existing old tailings would not be reclaimed because there would be no further mining in those gravels. There would be no impacts from other mines, because there are no mines on State or private lands in the watershed.

Under Alternative D, no additional acreage of mining disturbance would be expected by 1998, but 300 acres of past dredge tailings will remain barren or sparsely vegetated. The road will remain barren indefinitely, removing 43.6 acres of upland vegetation. Existing trails affect 84.7 acres. Vegetation is not totally removed on trails, but other impacts include ponding of water, compaction of soils, and a change in the composition of the original vegetation community on the site.

4.5.6 Special Considerations

Unavoidable Adverse Impacts

During mining operations, the vegetation cover is destroyed in the areas of the mine and roads. A short-term unavoidable loss of productivity under the Proposed Action and Alternatives A and B would be unavoidable. There would be a long-term cumulative avoidable loss of 580 acres of the vegetation cover in this area under the Proposed Action. Under Alternative A, 556 acres would be lost. Under Alternative B. there would be a loss of 544 acres of the vegetation cover in this area. There would be a loss of the original riparian community, which would be replaced by an earlier successional community, and soils, including permafrost, for 100-200 years. Alternative C would be similar to the above except that production would be lost or reduced for a short period and the lost acreage would total 495. during past mining operations, the vegetation cover was destroyed on mine sites and roads, resulting in a short-term unavoidable loss of productivity. Alternative D would be similar to Alternative C except that 344 acres would be lost.

Short-Term Uses vs Long-Term Productivity of Resources

Immediately following mining, the disturbed area will have almost no productivity for vegetation biomass. During the early stages of succession (sparse cover of grasses, forbs, and small shrubs), productivity gradually increases. The community of open tall shrubs of willow, birch, and balsam poplar, will have the same or higher productivity than that of the original riparian community on the site. Natural revegetation will take approximately 25- 50 years after mining disturbance, with time frames dependent on the environmental factors of the sites (Figure 4-3). As succession proceeds toward mature deciduous or white spruce forest, productivity gradually declines. Short-term use vs long- term productivity of vegetation resources would be the same for all alternatives because the successional patterns would be similar even though the rates of successional change may vary.

Irreversible and Irretrievable Commitment of Resources

One irretrievable loss would be the original riparian vegetation community with its associated organic soils and permafrost regime. This would be particularly true for areas along edges of the valleys or old terraces. These areas often support black spruce and shrub vegetation with moss ground cover prior to mining. Time frames for reestablishment of these soils and corresponding vegetation types range from 100 over 200 years. The irretrievable loss of the original riparian community with the organic soils and permafrost regime would be similar for all mining alternatives, because the mining actions which destroy the original soil structure and vegetation communities are the same for all mining alternatives.

Not all areas revegetate, and some may remain barren or sparsely vegetated for over 90 years after mining and reclamation are complete. The amount of ground remaining barren depends on the proportion of fine grained materials in the reclaimed tails, and other site-specific factors. Under the Proposed Action, a total of 580 acres would be left barren. The barren area includes 300 acres of tailings from past dredging, 78 acres from new mining, and 202 acres from all roads. This barren acreage would be an irretrievable and irreversible loss of vegetation resources. Alternative A would be the same except that 556 acres would be left barren, including 80 acres of new mining and 176 acres from all roads. Alternative B would be the same as Alternative A except that 544 acres would be left barren, including 68 acres from new mining. Alternative C differs from the Proposed Action only in that 495 acres would be left barren, including 47 acres from new mining and 148 acres from all roads. Alternative D would be the same as the Proposed Action except that a total of 344 acres would be left barren, including tailings from past dredging, and all roads.

4.5.7 Threatened and Endangered Plants

Within the Beaver Creek drainage study area there are currently no "listed or candidate" threatened or endangered plant species. There are plant species considered endemic by BLM. Endemic plant species are those being considered by the Fish and Wildlife Service for listing as threatened and endangered (Section 3.5.4). The existing surface management regulations, 43 CFR 3809.2-2(d), apply. Assessments of proposed development sites, which are required under all alternatives causing disturbance, help to eliminate impact upon threatened, endangered or endemic plants and their habitats. Therefore the cumulative effects upon any endemic plant species would be similar for all alternatives.

BLM policy is to protect, conserve, and manage federally and State-listed T/E plant species and candidate plants, and to use existing BLM authority to further the purpose of the Endangered Species Act and similar state laws. The BLM will ensure that actions authorized, funded, or carried out will not jeopardize the continued existence of such species or result in the destruction or adverse modification of their critical habitats. Specifically, BLM will: 1. Evaluate information to determine the distribution, abundance, reasons for current status, and habitat needs for candidate species on BLM lands, and the significance of BLM lands and actions in maintaining those species. 2. Evaluate all information to determine whether it is adequate to make informed management decisions (BLM Manual Section 6840). Priority is given to species for which significant adverse impacts are anticipated or for which there is a high risk in not knowing population trends. The effectiveness of the initial habitat assessment for the Proposed Action is vital to the survival and conservation of these species. These mitigation measures apply to all alternatives.

Unavoidable Adverse Impacts

Any disturbance or impact upon endemic species constitutes undue degradation. However, at this time the potential unavoidable loss of endemic plant habitat due to mining in Beaver Creek watershed is unknown. It is beyond BLM's present capabilities to clear all proposed development sites of possible disturbance to endemic species because of incomplete site-specific studies.

Short-Term Uses vs Long-Term Productivity of Resources

It is difficult to evaluate Threatened, Endangered, or Endemic plant species for short or long-term productivity because once a species is disturbed it may well lead to extinction in that particular area. Because of the pre-action assessments there should be no short of long-term threats on the Beaver Creek watershed. Overall, the best management practice in this case is avoidance of the resource.

Irreversible and Irretrievable Commitment of Resources

There are no irretrievable or irreversible conditions threatening the species involved.

4.6 Wildlife

The degree of impact to wildlife habitat and populations resulting from mining-related activities depends on the location, timing, and frequency or extent of the activity. The format adopted to analyze and discuss the impacts of the Proposed Action and alternatives includes those factors common to all alternatives and those specific to the Proposed Action and each alternative.

Analysis Approach

For the purpose of this analysis, mineral development activities were broken down and categorized into components. The major action components used to assess the environmental consequences of the Proposed Action and Alternatives on wildlife resources were access, facilities, and operations (Figure 4-4).

Analysis of the effects of access considered the type of vehicle(s) involved, material(s) being transported, location and length of access route, and how often the route would be used in the present and future. Subcomponents considered under facilities include the number and size of structures; the size of pad(s); the timing, frequency, and duration of human activity; the type and amount of waste produced; and the frequency of waste disposal. Distinct aspects of the operation component included the type and number of equipment used, timing and overall duration of equipment use, size of the area to be stripped, size of the area to be mined, size of various stockpiles, number and size of settling basins, and the size of any other surface disturbances.

ACCESS	FACILITIES	OPERATIONS
Type(s) of vehicle(s)	Number & size of structures	Type/amount of equipment
Materials transported	Size of pad(s)	Timing & duration of equipment operation
Location & length of route	Number of people & time of year & length of their duration	Size of area stripped
Frequency of current route use	Type & amount of waste produced	Size of area mined
Frequency of future route use	How often waste is disposed of	Size of various stockpiles
		Settling basin number & size
		Size of other surface disturbance

Figure 4-4. The three major components and subcomponents of mineral development used to assess impact on wildlife by the Proposed Action and the alternatives.

General Impacts

The general potential impacts from the access, facilities, and operation components on the wildlife resource were identified in Figure 4-5. The levels of impact for the Proposed Action and Alternatives were subsequently determined and are presented in detail in Sections 4.6.1 - 4.6.5.

Potential impacts resulting from access include removal of wildlife habitat due to roads and trails, disturbance and/or disruption of wildlife movements and seasonal use areas due to vehicular traffic, increased hunting/trapping pressure and other recreation use, and habitat destruction because of new or improved access into remote areas.

The potential impacts resulting from the facilities component are elimination of wildlife habitat due to the construction of gravel pads for structures; disturbance or disruption to wildlife due to human activity associated with the facility; and the removal of grizzly bear, black bear or other animals attracted to solid waste.

ACCESS	FACILITIES	OPERATIONS
Direct (long term) habitat loss	Direct (long term) habitat loss	Direct (long term) habitat loss
Disturbance (short term)/ disruption	Disturbance (short term)/ disruption	Disturbance (short term)/ disruption
Increased (long term) hunting pressure	Removal (long term) of nuisance animals	Hazardous (long term) material spill
Potential (long term) increased habitat loss		

Figure 4-5. Potential impacts to wildlife from mineral development.

Impacts from the operations component would result in loss of wildlife habitat due to removal or covering of vegetation by stripping, making mine cuts, stockpiling and for settling basins. Disturbance or disruption of wildlife would occur in the vicinity of the operation due to noise from machinery and other activities. There is the unpredictable possibility of spilling diesel fuel, a hazardous material, which would result in contamination and loss of vegetation.

The type of mitigation or management control necessary to alleviate impacts to wildlife resources depends on the type, extent, and overall magnitude of the impact. Measures to avoid, minimize or rectify, and replace wildlife resources that may be impacted by mineral development are presented in Section 4.13, Appendix D-2, and Figure 4-8 of this document.

4.6.1 Proposed Action

Construction of approximately 33.4 miles of permanent gravel roads in the Beaver Creek watershed would result in the permanent loss of 202 acres of wildlife habitat in the Nome and Bear Creek drainages. The establishment and use of 21 miles of primitive roads and trails, in addition to permanent roads, could result in 35,820 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The anticipated level of vehicular use of roads and trails would be low to moderate, and minimal alteration of wildlife movement routes or disturbance/disruption of seasonal use areas is anticipated.

Improvement and expansion of access trails into Quartz Creek, Bear Creek, and other areas of Beaver Creek would indirectly result in increased harvest pressure on moose, caribou, Dall sheep, grizzly bear, black bear and other species. Improving access or establishing new access for mining, recreation, and other activities into the area would indirectly facilitate more wildlife habitat loss and disturbance in wildlife use areas over the long term by enhancing the feasibility of mining and other human activities in more and larger areas.

The increased presence of five mining camp facilities and structures associated with mining activities in Beaver Creek would result in the long-term loss of five acres of winter range for moose in the Nome, Bear, and Quartz Creek drainages. Similarly, 90 acres of riparian habitat used by moose and other species would be unavailable for the short-term due to frequent human disturbance near the facilities during May through October. The removal of grizzly or black bears as nuisance animals due to their attraction to refuse or other solid waste in the vicinity of mining facilities could occur.

Activities directly associated with stripping, mine cuts, stockpiles, and settling basins would result in physical alteration of about 110 additional acres of moose winter range in the Nome, Bear, and Quartz Creek valleys. Reclamation of the 110 acres would occur through spreading of tailings and natural succession (as described in Section 2.3). Revegetation in previously undisturbed areas would take 30 to 50 years and revegetation in old tailings areas would take at least 50 years (Figure 4-3) to reach a stage suitable for moose browse. Short- term avoidance during the summer mining season of 2,420 acres of riparian and upland habitat in the Nome, Bear, and Quartz Creek areas may occur due to noise from machinery and other mining activities. The possibility of hazardous material spills such as diesel fuel exists, and may result in contamination or loss of wildlife habitat.

Conclusion

The effects of the Proposed Action are summarized in Figure 4-6. Approximately 676 total acres of wildlife habitat (primarily moose winter range) would be physically altered due to mining- related activities (including roads and facilities) in the Nome, Bear, and Quartz Creek areas of Beaver Creek. Periodic disturbances to wildlife due to use of roads and trails, operation of vehicles and machinery, and human habitation in the Beaver Creek watershed totaling 38,420 acres could result in a low to moderate level of short-term cumulative effects in localized areas, particularly during May through October. Minimum harvest of wildlife directly resulting from mining activities is anticipated in Beaver Creek. The principle long term adverse effect of mining in Beaver Creek would be the unavoidable loss (even with reclamation) of approximately 115 acres of the moose winter range in the Nome, Bear, and Quartz Creek watersheds for up to a 30 to 50 year period. In addition, approximately 78 acres of the area would remain permanently barren or support only sparse vegetation after 50 years. The long-term cumulative loss of habitat to mining activities in these areas of Beaver Creek and adjacent State lands would probably contribute to a low-level reduction in moose population potential.

The potential exists for long term cumulative adverse effects to moose, caribou, Dall sheep, raptors, and other species if human use of the area increases greatly in crucial wildlife habitats. Additionally, the potential exists for a greater long-term loss of wildlife habitat from removal of vegetation due to a potential increase of mining activity in crucial wildlife habitats. The long-term cumulative effects of potential future disturbance/disruption and loss of habitat in crucial use areas could be significant depending on the specific location, amount, and duration of the actions.

Moose

4.6.2 Alternative A

Construction of approximately 29.1 miles of permanent gravel roads in the Beaver Creek watershed would result in the permanent loss of 176 acres of wildlife habitat in the Nome and Bear Creek drainages. The establishment and use of 18.3 miles of primitive roads and trails, in addition to permanent roads, could result in 31,340 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The anticipated level of vehicular use on roads and trails would be low to moderate, and minimal alteration of wildlife movement routes or disturbance and disruption of seasonal use areas is anticipated.

Improvement and expansion of access trails into Quartz Creek, Bear Creek, and other areas of Beaver Creek would indirectly result in increased harvest pressure on moose, caribou, Dall sheep, grizzly bear, black bear, and other species. Improving access or establishing new access for mining, recreation, and other activities into the area will indirectly facilitate more wildlife habitat loss and disturbance in wildlife use areas over the long term by enhancing the feasibility of mining and other human activities in more and larger areas.

The increased presence of four facilities associated with mining activities in Beaver Creek would result in the long-term loss of four acres of winter range for moose in the Nome, Bear, and Quartz Creek drainages due to the installation of mining camp facilities/structures. Similarly, 72 acres of riparian habitat used by moose and other species would be unavailable for the short term due to frequent human disturbance near the facilities during May through October. The removal of grizzly or black bears as nuisance animals due to their attraction to refuse or other solid waste in the vicinity of mining facilities could occur.

Activities directly associated with stripping, mine cuts, stockpiles, and settling basins would result in physical alteration of approximately 96 additional acres of moose winter range in the Nome, Bear, and Quartz Creek valleys. Reclamation of the 96 acres would occur through stabilizing to prevent erosion and natural succession (as described in Section 2.3). Revegetation in previously undisturbed areas would take 30 years and revegetation in old tailings areas would take at least 50 years (Figure 4-3) to reach a stage suitable for moose browse. Short-term avoidance during the summer mining season of 2,000 acres of riparian habitat in the Nome, Bear, and Quartz Creek areas may occur due to noise from machinery and other mining operation activities. The possibility of hazardous material spills (diesel fuel) exists, and may result in contamination and loss of wildlife habitat.

Conclusion

The effects of Alternative A are summarized in Figure 4-6. Approximately 634 total acres of wildlife habitat (primarily moose winter range) would be physically altered due to mining related activities including roads and facilities in the Nome, Bear, and Quartz Creek areas of Beaver Creek. Periodic disturbances to wildlife due to use of roads and trails, operation of vehicles and machinery, and human activities in the Beaver Creek watershed totaling 33,348 acres would result in a low to moderate level of short-term cumulative adverse effects in localized areas, particularly during May through October. Minimum harvest of wildlife as a direct result of mining activities is anticipated in Beaver Creek. The principle long-term adverse effect of mining in Beaver Creek would be the unavoidable loss (even with reclamation) of approximately 100 acres of the moose winter range in the Nome, Bear, and Quartz Creek watersheds for a 30 to 50 year period. In addition, approximately 80 acres of the area would remain permanently barren or support only sparse vegetation after 50 years. The long term cumulative loss of habitat to mining activities in these areas of Beaver Creek and adjacent State lands would probably contribute to a low-level reduction in moose population potential.

The potential exists for long-term cumulative adverse effects to moose, caribou, Dall sheep, raptors and other species if human use of the area increases greatly in crucial wildlife habitats. Additionally, the potential exists for a greater long-term loss of wildlife habitat (removal of vegetation) due to a potential increase of mining activity in crucial wildlife habitats. The long-term cumulative effects of potential future disturbance/disruption and loss of habitat in crucial use areas could be significant depending on the specific location, amount, and duration of the actions.

4.6.3 Alternative B

Construction of approximately 29.1 miles of permanent gravel roads in the Beaver Creek watershed would result in the permanent loss of 176 acres of wildlife habitat in the Nome and Bear Creek drainages. The establishment and use of 18.3 miles of primitive roads and trails, in addition to permanent roads, could result in 31,340 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The anticipated level of vehicular use on roads and trails would be low to moderate and minimal alteration of wildlife movement routes or disturbance and disruption of seasonal use areas is anticipated.

Improvement and expansion of access trails into Quartz Creek, Bear Creek, and other areas of Beaver Creek would indirectly result in increased harvest pressure on moose, caribou, Dall sheep, grizzly bear, black bear, and other species. Improving access or establishing new access for mining, recreation, and other activities into the area will indirectly facilitate more wildlife habitat loss and disturbance in wildlife use areas over the long term by enhancing the feasibility of mining and other human activities in more and larger areas.

The increased presence of four facilities associated with mining activities in Beaver Creek would result in the long-term loss of four acres of winter range for moose in the Nome, Bear, and Quartz Creek drainages due to the installation of mining camp facilities/structures. Similarly, 72 acres of riparian habitat used by moose and other species would be unavailable for the short term due to frequent human disturbance near the facilities during May through October. The removal of grizzly or black bears as nuisance animals due to their attraction to refuse or other solid waste in the vicinity of mining facilities could occur.

Activities directly associated with stripping, mine cuts, stockpiles, and settling basins would result in physical alteration of approximately 96 additional acres of moose winter range in the Nome, Bear, and Quartz Creek valleys. Reclamation of 96 acres would occur through the spreading of tailings, fines, topsoil, and natural succession (as described in Section 2.3). Revegetation in previously undisturbed areas would take 30 to 50 years and revegetation in old tailings areas would take at least

50 years (Figure 4-3) to reach a stage suitable for moose browse. Short-term avoidance during the summer mining season of 2,000 acres of riparian and upland habitat in the Nome, Bear, and Quartz Creek areas will occur due to noise from machinery and other mining operation activities. The possibility of hazardous material spills (diesel fuel) exists and may result in contamination and loss of wildlife habitat.

Conclusion

The effects of Alternative B are summarized in Figure 4-6. Approximately 634 total acres of wildlife habitat (primarily moose winter range) would be physically altered due to mining related activities including roads and facilities in the Nome, Bear, and Quartz Creek areas of Beaver Creek. Periodic disturbances to wildlife due to use of roads and trails, operation of vehicles and machinery, and human habitation in the Beaver Creek watershed totaling 33,348 acres could result in a low to moderate level of short-term adverse effects in localized areas, particularly during May through October. Minimum harvest of wildlife as a direct result of mining activities is anticipated in Beaver Creek. The principle long-term adverse effect of mining in Beaver Creek would be the unavoidable loss (even with reclamation) of approximately 100 acres of the moose winter range in the Nome, Bear, and Quartz Creek watersheds for a 30-50 year period. In addition, approximately 68 acres of the area would remain permanently barren or support only sparse vegetation after 50 years. The long-term cumulative loss of habitat to mining activities in these areas of Beaver Creek and adjacent State lands would probably contribute to a low-level reduction in moose population potential.

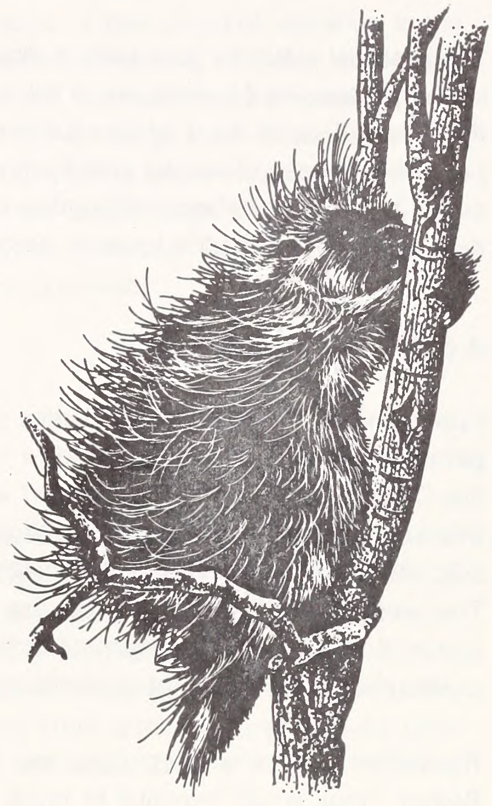
The potential exists for long-term cumulative adverse effects to moose, caribou, Dall sheep, raptors and other species if human use of the area increases greatly in crucial wildlife habitats. Additionally, the potential exists for a greater long-term loss of wildlife habitat (removal of vegetation) due to a potential increase of mining activity in crucial wildlife habitats. The long-term cumulative effects of potential future disturbance/disruption and loss of habitat in crucial use areas could be significant depending on the specific location, amount and duration of the actions.

4.6.4 Alternative C

Construction of approximately 24.4 miles of permanent gravel roads in the Beaver Creek watershed would result in the permanent loss of 148 acres of wildlife habitat in the Nome and Bear Creek drainages. The establishment and use of 15.3 miles of primitive roads and trails, in addition to permanent roads, could result in 26,412 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The anticipated level of vehicular use of roads and trails would be low to moderate and minimal alteration of wildlife movement routes or disturbance and disruption of seasonal use areas is anticipated.

Improvement and expansion of access trails into Quartz Creek, Bear Creek, and other areas of Beaver Creek would indirectly result in increased harvest pressure on moose, caribou, Dall sheep, grizzly bear, black bear, and other species. Improving access or establishing new access for mining, recreation, and other activities into the area will indirectly facilitate more wildlife habitat loss and disturbance in wildlife use areas over the long term by enhancing the feasibility of mining and other human activities in more and larger areas.

The increased presence of four facilities associated with mining activities in Beaver Creek would result in the long-term loss of three acres of winter range for moose in the Nome, Bear, and Quartz Creek drainages due to the installation of mining camp facilities/structures. Similarly, 54 acres of riparian habitat used by moose and other species would be unavailable for the short term due to frequent human disturbance near the facilities during May through October. The removal of grizzly or black bears as nuisance animals due to their attraction to refuse or other solid waste in the vicinity of mining facilities could occur.



Porcupine

Activities directly associated with stripping, mine cuts, stockpiles, and settling basins would result in physical alteration of approximately 80 additional acres of moose winter range in the Nome, Bear, and Quartz Creek valleys. Reclamation of the 80 acres would occur through the spreading of tailings, fines, topsoil, and fertilizing and reseeding with native species (as described in Section 2.3). Revegetation in previously undisturbed areas would take 25 to 30 years and revegetation in old tailings areas would take at least 50 years (Figure 4-3) to reach a stage suitable for moose browse. Short-term avoidance during the summer mining season of 1,500 acres of riparian and upland habitat in the Nome, Bear, and Quartz Creek areas will occur due to noise from machinery and other mining operation activities. The possibility of hazardous material spills (diesel fuel) exists and may result in contamination and loss of wildlife habitat.

Conclusion

The effects of Alternative C are summarized in Figure 4-6. Approximately 589 total acres of wildlife habitat (primarily moose winter range) would be physically altered due to mining related activities including roads and facilities in the Nome, Bear, and Quartz Creek areas of Beaver Creek. Periodic disturbances to wildlife due to use of roads and trails, operation of vehicles and machinery, and human habitation in the Beaver Creek watershed totaling 27,972 acres could result in a low to moderate level of short-term adverse effects in localized areas, particularly during May through October. Minimum harvest of wildlife as a direct result of mining activities is anticipated in Beaver Creek. The principle long-term adverse effect of mining in Beaver Creek would be the unavoidable loss (even with reclamation) of approximately 100 acres of the moose winter range in the Nome, Bear, and Quartz Creek watersheds for a 25-50 year period. In addition, approximately 47 acres of the area would remain permanently barren or support only sparse vegetation after 50 years. The long-term cumulative loss of habitat to mining activities in these areas of Beaver Creek and adjacent State lands would probably contribute to a low-level reduction in moose population potential.

The potential exists for long-term cumulative adverse effects to moose, caribou, Dall sheep, raptors and other species if human use of the area increases greatly in crucial wildlife habitats. Additionally, the potential exists for a greater long-term loss of wildlife habitat (removal of vegetation) due to a potential increase of mining activity in crucial wildlife habitats. The long-term cumulative effects of potential future disturbance/disruption and loss of habitat in crucial use areas could be significant depending on the specific location, amount and duration of the actions.

4.6.5 Alternative D

Approximately 7.2 miles of permanent gravel roads in the Beaver Creek watershed and associated permanent loss of 44 acres of wildlife habitat in the Nome Creek drainage would remain if Alternative D is implemented. The continued use of 23.3 miles of primitive roads and trails, in addition to existing permanent roads, may result in 20,524 acres of wildlife habitat subject to short-term periodic disturbance by vehicular traffic when wildlife such as moose, caribou, and others are present. The present low level of vehicular use of roads and trails would probably increase over time because of non-mineral development activities (recreation). No alteration of wildlife movement routes, or disturbance/disruption of seasonal use areas directly attributable to mining access would occur.

Recreation and other secondary use of the access trails into Quartz Creek and other areas of Beaver Creek would continue to result in increased harvest of moose, caribou, Dall sheep, grizzly bear, black bear, and other species. Improving access or establishing new access for mining activities would not occur.

Mining facilities that have resulted in the long-term loss of two acres of winter range for moose in the Nome Creek drainage would be removed. Similarly, riparian habitat used by moose and other species would <u>not</u> be subject to mining facility-related human disturbance from May through October. The removal of grizzly or black bears as nuisance animals due to their attraction to refuse or other solid waste in the vicinity of mining facilities would not occur.

Past activities directly associated with stripping, mine cuts, stockpiles, and settling basins have resulted in physical alteration of approximately 352 acres of moose late winter range in the Nome Creek valley. Approximately 310 acres of this previously-mined habitat that has recovered over the last 40- 60 years now provides approximately 30-50 acres of usable browse for moose. This area would remain undisturbed. Approximately 40 acres of the previously-mined area which has been mined since 1984 has been reclaimed through the spreading of tailings and natural succession (as discussed in Section 2.3). Revegetation in this old tailing area will require at least 50 years (Figure 4-3) to reach a stage to become suitable as moose browse. Avoidance by animals of riparian habitat during the summer mining season in the Nome Creek area due to noise from machinery and other mining activities would <u>not</u> occur. Similarly, the possibility of hazardous material spills would <u>not</u> exist.

Conclusion

The effects of Alternative D are summarized in Figure 4-6. Approximately 300-320 acres of riparian habitat (primarily moose winter range) would remain lost because of past physical alteration in the Nome Creek area of Beaver Creek. Past disturbances to wildlife from mining vehicles, machinery, and human habitation in the Beaver Creek watershed would cease. Recreation use of existing roads and trails would continue to facilitate increased harvest of wildlife. Although there would be no further mining, unreclaimed areas disturbed by past mining will continue to result in the long-term unavoidable loss of 32- 34% of the previously disturbed moose late winter range in the Nome Creek watershed. The long term loss of habitat to mining in this portion of Beaver Creek will continue to contribute to a slight to low level reduction in moose population potential.

4.6.6 Special Considerations

Unavoidable Adverse Impacts

Unavoidable short-term impacts occur from mineral development. Species that are sensitive to noise, odors, movement, and the presence of human activity are most affected by mining activities and will avoid areas where these actions occur. Construction and use of facilities, operation of mining equipment, and increased vehicular traffic for access result in an unavoidable adverse effect to wildlife. Mining roads and trails are generally not removed or closed to present or future public use. This situation facilitates an increase in human use of wildlife and other resources over the long term. Over the long term; the extent, frequency, and duration of the activities determine the degree of disturbance or disruption.

Natural recovery of wildlife habitat is slow in areas that have been disturbed by mineral development. Reclamation practices can facilitate or enhance the recovery of wildlife habitat in disturbed areas; nevertheless, the affected habitat may be lost for 25 to 50 years. The principal habitats that are unavoidably lost over the long-term, for these periods of time, are the riparian habitats that are especially important to moose as winter range. Furthermore, previously-mined areas that are subjected to additional, new mining are the principle source of permanent habitat loss because fines and other basic soil components are not available for use in reclamation. It is possible for localized extirpation or reduction beyond minimum viable population levels to occur if the overall extent of habitat loss is large and the duration is long-term.

The potential for an overall increase in the level of cumulative impacts on wildlife and habitat exists. This could occur because of the accumulation of small, apparently insignificant, residual impacts to wildlife resources over time. This unavoidable impact could become substantial over the long-term if conflicts between wildlife values, mineral development, increased visitor use, and a greater demand for human use of the wildlife resource are not adequately mitigated.

Action Component/ Potential Impact		Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Permanent roads result in habitat loss	Extent	33.4 miles/202 acres	29.1 miles/ 176 acres	29.1 miles/176 acres	24.4 miles/148 acres	7.2 miles/44 acres
	Duration	Mine life & beyond	Mine life & beyond	Mine life & beyond	Mine life & beyond	Present, & beyond
	Frequency	Annually	Annually	Annually	Annually	Annually
Use of roads/trails can disrupt normal wildlife use patterns	Extent	54.4 miles/35,820 acres	47.4 miles/31,340 acres	47.4 miles/31,340 acres	39.7 miles/26,512 acres	30.5 miles/20,524 acres[1]
	Duration	6 months (May – Oct) All months for recreation	6 months (May – Oct) All months for recreation	6 months (May – Oct) All months for recreation	6 months (May – Oct) All months for recreation	All months for recreation
	Frequency	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent
Use of roads/trails increases harvest	Extent	54.4 miles/35,820 acres	47.4 miles/31,340 acres	47.4 miles/31,340 acres	39.7 miles/26,512 acres	30.5 miles/20,524 acres[1]
	Duration	Mine life & beyond	Mine life & beyond	Mine life & beyond	Mine life & beyond	Present, & beyond
	Frequency	Annually	Annually	Annually	Annually	Annually
Potential upgrading of roads/ trails & more roads/ trails can increase habitat loss, disturbance & harvest	Extent	Unpredictable, but greater	Unpredictable, but greater	Unpredictable, but greater	Unpredictable, but greater	NO EFFECT
	Duration	Mine life & beyond All months for recreation	Mine life & beyond	Mine life & beyond	Mine life & beyond	
	Frequency	Annually	Annually	Annually	Annually	
Gravel pads etc. remove/ cover habitat	Extent	5 acres	4 acres	4 acres	3 acres	2 acres
	Duration	Mine life	Mine life	Mine life	Mine life	50 years[2]
	Frequency	Annually	Annually	Annually	Annually	Annually
Human habitation can cause disturbance/ disruption	Extent	90 acres	72 acres	72 acres	54 acres	NO EFFECT
	Duration	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	
	Frequency	Annually	Annually	Annually	Annually	
Improper solid waste disposal may attract nuisance animals	Extent	1 – 3 bears	1 – 3 bears	1 – 3 bears	1 – 3 bears	NO EFFECT
	Duration	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	
	Frequency	Annually	Annually	Annually	Annually	

[1]Due to recreation or other uses, not directly attributable to mineral development

[2]Reclamation will be conducted on areas previously disturbed with minimum fines available

CONTINUATION

Action Component/ Potential Impact		Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D
Stripping, mine cuts, stockpiles & roads remove/ cover habitat	Extent	115 acres	100 acres	100 acres	84 acres	40 acres
	Duration	50 years	50 years	30 – 50 years	25 – 35 years	50 years [2]
	Frequency	Annually	Annually	Annually	Annually	Annually
Operation of machinery can disrupt natural wildlife use patterns	Extent	2,510 acres	2,008 acres	2,008 acres	1,506 acres	NO EFFECT
	Duration	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	6 months (May – Oct)	
	Frequency	Annually	Annually	Annually	Annually	
Hazardous material spills result in habitat loss	Extent	Unpredictable	Unpredictable	Unpredictable	Unpredictable	NO EFFECT
	Duration	50 years	50 years	30 – 50 years	25 – 35 years	
	Frequency	Unpredictable	Unpredictable	Unpredictable	Unpredictable	

[1] Due to recreation or other uses, not directly attributable to mineral development.

[2] Reclamation will be conducted on areas previously disturbed with minimum fines available

Figure 4 – 6. Summary and comparison of probable effects on wildlife resources in relation to the Proposed Action and alternatives.

Short-Term Uses vs Long-Term Productivity

The long-term productivity of wildlife habitat subject to mineral development activities would depend on 1) the extent and timing of mineral development activities, 2) the success of mitigative measures or management controls to minimize the alteration and disturbance of normal wildlife use patterns, and 3) the successful reclamation of habitat that has been physically altered, removed, or lost.

Even the successful implementation of management controls to avoid, minimize, or replace lost habitat cannot prevent the possibility of a reduction in the long-term opportunity for increasing the potential moose population in the area. Specifically, the area has supported a larger population of moose in the past and the existing habitat has the potential to support a larger population (the present moose population is not at carrying capacity). The loss of existing moose habitat, especially late winter range, due to mineral development activities would reduce carrying capacity and could compromise the ADF&G management goal to increase the moose population over the long term. The potential for optimal numbers of moose would be lowered because the habitat carrying capacity will have been lost or reduced due to mineral development. The degree of impact to the moose population potential in the region due to mineral development would depend on the overall extent and duration of the habitat loss.

Irreversible and Irretrievable Commitments of Resources

Wildlife and habitat are renewable resources over the long term. If the mitigative measures designed to avoid, minimize, and monitor the adverse effects and to replace habitat physically altered by mineral development were fully and successfully employed, there would be little irreversible or irretrievable commitment or permanent loss of wildlife habitat over the long term. Previously-mined areas that are subjected to additional, new mining are the principle source of permanent habitat loss because fines and other basic soil components are not available for use in reclamation.

4.6.7 Threatened or Endangered Animals

Impacts Common to All Alternatives

The Proposed Action and alternatives are anticipated to have no effect on the endangered peregrine falcon. Each operator is required to take such action as may be needed to prevent adverse impacts to threatened or endangered species, 43 CFR 3809.2-2(d).

Protective Measures

Each proposal to conduct mining activities is evaluated by BLM on a case-by-case basis for potential conflicts with the peregrine falcon. As a result, the recommended protective measures of the Peregrine Falcon Recovery Plan (USFWS 1982), informal consultation with the USFWS, or formal consultation with the USFWS may be employed by BLM, if necessary. The standard mitigation or protective measures recommended by the USFWS are:

Within one mile of nest sites:

1. Require aircraft to maintain minimum altitudes of 1500 feet above nest level from April 15 through August 31.

2. Prohibit all ground level activity from April 15 through August 31, except on existing thoroughfares.

3. Prohibit habitat alterations or the construction of permanent facilities.

Within two miles of nest sites:

1. Prohibit activities having high noise levels from April 15 through August 31.

2. Prohibit permanent facilities having high noise levels or sustained human activity, or the altering of limited, high quality habitat (e.g., ponds, lakes, wetlands, and riparian habitats).

Within 15 miles of nest sites:

1. Prohibit alteration of limited, high quality habitat which could detrimentally and significantly reduce prey availability. Of particular concern are ponds, lakes, wetlands, and riparian habitats.

2. Prohibit use of pesticides; the only exception may be limited non-aerial application of approved non-persistent insecticides at supply bases.

Unavoidable Adverse Impacts

No unavoidable adverse impacts are anticipated to result from implementation of the Proposed Action or the alternatives.

Short-Term Uses vs Long-Term Productivity

No adverse impact to the long-term productivity of the peregrine falcon is anticipated to result from implementation of the Proposed Action or the alternatives.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitment or permanent loss of Peregrine falcon habitat is anticipated to result from implementation of the Proposed Action or the alternatives.

4.7 Fisheries

Placer mining may adversely affect aquatic systems directly through habitat disruption or physical alteration, and indirectly through point and non-point discharges of waste waters (Figure 4-7). Direct impacts to the aquatic community include the destruction of instream habitat, disruption of riparian zones, and creation of migration barriers. Indirect impacts to the aquatic community result from increased levels of trace metal contaminants, increased turbidity and suspended sediment, increased levels of settleable solids, increased imbeddedness of stream substrates, decreased food supply for fish, long-term changes in channel configuration, and long-term disruption of riparian habitats. The overall severity of these effects on aquatic communities depends on their magnitude, frequency, and duration.

	DIRECT EFFECTS	INDIRECT EFFECTS
Actions which physically alter the Aquatic Habitat	Loss of Instream Habitat	Straight\monotypic stream channel Increased water velocity Decreased pools
	Loss of Streamside (Riparian) Habitat	Unstable banks Decreased temperature control Decreased detrital nutrient input Decreased debris recruitment
	Creation of Migration Barriers	Decrease in suitable habitat
Discharge of Wastewater	Increased Suspended Sediment/Turbidity	Increase trace metals Decreased light penetration, which leads to decreased primary production Decreased incubation and rearing suitability for fish Decreased incubation and rearing suitability for aquatic insects Interference with fish migration, which leads to decreased available habitat Decreased opportunity for recreational fishing
	Increased Settleable Solids/Sediment	Decreased aquatic insect density, biomass, diversity which leads to decreased fish food supply Increased stream substrate imbeddedness Increased smothering of incubating eggs

Figure 4-7. Direct and indirect effects of physically altering the aquatic habitat and the discharging wastewater.

Effects on Aquatic Habitats

Numerous studies have addressed the effects of placer mining on chemical water quality of affected streams. Many of these studies have identified alterations in chemical components. In some cases, levels of trace metals like arsenic, cadmium, copper, lead, mercury, and zinc exceeded drinking water and aquatic life protection standards. Dames and Moore et al (1986) provide a summary discussion of these data. The general conclusion by all studies is that concentrations of certain trace metals were increased below mining activity. The increased total concentrations of trace metals below mining activity may pose a threat to aquatic animals if a significant portion of the total recoverable metals dissolve and are biologically available. There is a positive relationship between total recoverable and dissolved fractions of the metals. Therefore, it follows that reductions in sediment inputs from mining could substantially reduce metals concentrations in the affected streams (Dames and Moore et al 1986, LaPerrier et al 1985).

The biological significance of this conclusion is complicated by several factors. The sensitivities of arctic grayling and other organisms are not well known, the speciation of some of the metals is not known, the degree of tolerance of the local organisms is unquantified, and the proportion of metals that is biologically available versus that which is totally recoverable is unknown. All of these uncertainties contribute to the difficulty of assessing the biological significance of these data.

Increases in total suspended sediment (TSS) levels in streams with placer mining and in receiving waters downstream are the most significant impacts of mining activity (Bjerklie and LaPerrier 1985, Dames & Moore 1976, Dames & Moore et al. 1986. LaPerrier et al. 1985, Mack et al. 1987, Mathers et al 1981, Simmons 1984, Van Nieuwenhuyse and LaPerriere 1986. Wagener and LaPerriere 1985, Weber and Post 1985). Many studies document increases in suspended sediment concentrations of several orders of magnitude over background levels as a result of placer mining. The degree or magnitude of increase is highly variable and depends on regional geology, type of mining operation, and effectiveness of waste water treatment.

Placer mining affects the physical habitat in a stream through destruction of the channel, and removal of the organic overburden of the banks and riparian zone adjacent to the stream. The post-mining stream channel is usually straight and the streams usually flow along bedrock with no pools, velocity barriers, or other migratory blocks (e.g., settling pond dams).

The disruption of riparian habitat along the stream is a major impact from placer mining. This riparian habitat is important for bank stabilization, detrital nutrient input, temperature control, and debris recruitment. Weber and Post (1985) reported mined areas over 60 years old where riparian vegetation covered only 25% of the banks. As with reestablishment of the channel morphology, the regeneration of the riparian vegetation requires long periods in the subarctic environment. These processes can be expected to take in excess of 100 years on unreclaimed streams. These unavoidable impacts of placer mining on the aquatic system are typically long-term, and may remain even with reclamation measures.

Effects on Aquatic Populations

Light penetration is crucial to primary production in aquatic ecosystems. Turbid conditions that reduce light penetration will reduce primary productivity. In turn, the effects of reductions in primary productivity are transmitted up the food chain and can ultimately result in reduced populations of fish and their prey organisms.

The general lack of streamside forest or canopy cover over some subarctic streams suggests that these streams may be highly dependent on instream productivity to support the higher lifeforms present in them. Reductions in primary productivity could lead to reductions in biomass of aquatic invertebrates and ultimately to reductions in fish biomass, at least in the higher elevation headwater areas. Destruction of the riparian vegetation along forested streams also reduces carbon inputs from leaf litter.

Sediment and/or turbidity adversely effects aquatic invertebrate density, biomass, and diversity (EIFAC 1965, Mathers et al. 1981, Lloyd 1985, Wagener and LaPerrier 1985, Weber and Post 1985, Chapman and McLeod 1987). Studies demonstrate that increasing suspended and deposited sediment can lead to smothering and reduced respiratory efficiency of aquatic insects, abrasion, interference with filter feeders and net spinners, reduced food resources for grazers, cementing or increases in imbeddedness, and filling of crevices among larger cobbles. All of these actions result in habitat alterations that make the stream unsuitable for many species of aquatic organisms.

Weber and Post (1985) made comparisons of invertebrate populations above and below mining activity and compared unmined versus previously mined streams. In all cases, average densities of invertebrates decreased at sites below mining activity when compared to upstream controls. In many cases, whole families and one entire order (*Trichoptera*, caddis flies) disappeared below mining. In streams which had experienced previous mining activity, invertebrate densities were about 37% lower than unmined streams. In streams below active mining, invertebrate densities were reduced by nearly 90% compared with control stream segments.

The effects of reduced food supply and therefore reduced fat storage on overwinter survival and long-term fitness may be an important effect of placer mining on fish populations. It is possible that even if grayling were able to survive the summer in water heavily loaded with suspended sediments that they would be unable to store the same fat reserves accumulated by fish in clearwater areas. Therefore, they could be adversely affected in their overwinter survival, hampered in their upstream migration to spawning areas in the spring, and/or may be less able to produce viable gametes for successful reproduction. Overall, this could lead to a lower reproductive fitness of these fish populations and could lead to their possible elimination over time.

Numerous studies have been conducted to assess the effects of fine sediments on fish populations. Direct effects of suspended sediments on fish begin to be observed somewhere in the range of 50 to 100 mg/l (Herbert and Merkens 1961, EIFAC 1965, Noggle 1978, Berg 1982, McLeay et al 1983, 1984, Simmons 1984, Lloyd 1985, Chapman and McLeod 1987, McLeay et al 1987). EIFAC (1965) determined that no adverse effects of suspended sediments were demonstrated on fish at or below 25 mg/l. They further concluded that good to moderate fisheries could be expected with suspended sediment concentrations between 20 and 80 mg/l. At concentrations above 80 mg/l it was considered unlikely that good fisheries could be maintained, and about 400 mg/l, only poor fisheries were to be expected.

McLeay et al (1983, 1984, 1987) conducted an extensive series of experiments concerning the effects of sediments from placer mining on Arctic grayling. They found lethal and sublethal effects from acute exposure at concentrations of 50,000 to 250,000 mg/l and chronic exposure up to 1,000 mg/l. Chronic exposures for six weeks to concentrations greater than 100 mg/l impaired feeding, caused reductions in growth rates, showed changes in coloration, and caused downstream displacement of experimental fish. Stress, as measured by changes in blood chemistry, was reported in fish exposed for short periods to sediment concentrations as low as 50 mg/l. It was noted that downstream displacement and the resultant decrease in suitable habitat were of particular concern in maintaining healthy fish populations in streams exposed to placer mining.

Investigations have been conducted to determine the effects of placer mining on grayling distribution (Mathers et al 1981, Weber and Post 1985, Dames and Moore et al 1986). In two of these studies (Weber and Post 1985, Dames and Moore et al 1986), fish were found in clear water tributaries of mined streams and in unmined streams but none were found in streams affected by mining. Mathers et al (1981) found adult grayling in almost all streams they sampled but no juvenile fish were found in three streams heavily affected by mining. Mathers et al found adult grayling in suspended sediment concentrations as high as 4,453 mg/l. However, they were unable to determine if these fish were residing in these conditions or were moving downstream to escape the high sediment loads. In one stream with suspended sediment concentrations over 7,000 mg/l no grayling were found.

Sediment impacts to incubating eggs may have been the cause for the absence of grayling fry in three streams sampled by Mathers et al (1981). Grayling broadcast their eggs over gravel or other substrates making no effort to produce a redd as is common with trout and salmon (Reed 1964). Eggs exposed on the surface of the substrate are susceptible to smothering by sediment deposition from mining activities. This effect may have contributed to the apparent lack of spawning success noted by Mathers et al.

Physical disturbance of stream channels may be another factor that affected grayling distribution (Dames and Moore et al 1986). Data suggests that long reaches of disturbed channels with potential passage barriers restricts migration into some clearwater tributaries and therefore affects access to available habitat in some river basins. This could adversely effect the ability of a basin affected by mining to support a grayling population.

4.7.1 Proposed Action

Concentrations of arsenic, copper, lead, mercury, or other trace metals will increase in areas below mining activities. The biological significance of the increased metals concentrations is unknown. The magnitude of the increase will be a function of geology at mine sites, type of mining operation and effectiveness of wastewater treatment.

Mining operations will increase the total suspended sediment downstream from affected areas. The magnitude of impacts from increased suspended sediment and increased turbidity will be a function of geology at the mine sites and effectiveness of wastewater treatment.

Bjerklie and LaPerrier (1985) documented reduced hydraulic connection between surface and subsurface waters as an indirect effect of sediment on groundwater. The result of increased sediment in these circumstances is a lowering of the groundwater below the stream and a significant reduction in dissolved oxygen in mined streams. This condition could result in a reduction in overall quantity and quality of overwintering habitat and has been known to be directly harmful to fish eggs and aquatic insect larvae that are present in the substrate materials.

The direct effects of mining operations will be habitat degradation due to physical alteration and possible blockage of fish migration. Streams in excavated areas develop new channels through the tailings and over exposed bedrock. These channels are usually shallow with few pools, have little instream cover, are unstable during breakup, and are generally poor habitat for fish and aquatic insects. These areas may also contain barriers to fish migration resulting in the reduction of available habitat in upstream areas. The physical alteration at the mines will also result in the loss of riparian vegetation which, under normal conditions, provides bank stability, instream cover, temperature control, and detrital nutrient input.

Mining activities will reduce primary productivity in areas affected by increased suspended sediment and turbidity. The magnitude of reduction of primary productivity will be a function of geology at the mine sites and effectiveness of wastewater treatment.

The average density (abundance) and diversity of aquatic insects will be decreased below mining activities. The magnitude of the impact on aquatic insects will be a function of total suspended sediment concentrations. These concentrations are, in turn, a function of geology at the mine sites and the effectiveness of wastewater treatment.

Stream segments directly affected by mining operations are not expected to support arctic grayling or other species. However, clearwater tributaries and other areas in the basin will continue to support all age classes and sizes, including fry, of grayling and other species. The overall magnitude of adverse affect to fish populations is not possible to determine. The combined effect of the mining operation will at least partially eliminate grayling from the mined reaches of the stream. The magnitude of the impacts to fish populations will probably be a function of the extent of migration blockages due to physical barriers and/or sediment concentrations, and the extent of rearing habitat lost. Habitat suitability in the streams affected by mining will be poor due to increased toxic metals concentrations, reduced food supply, reduced cover and refuge habitat, and reduced visibility for feeding. Spawning habitat in unaffected streams is expected to provide some recruitment for the affected areas if they remain accessible to fish, and if the habitat is suitable for rearing.

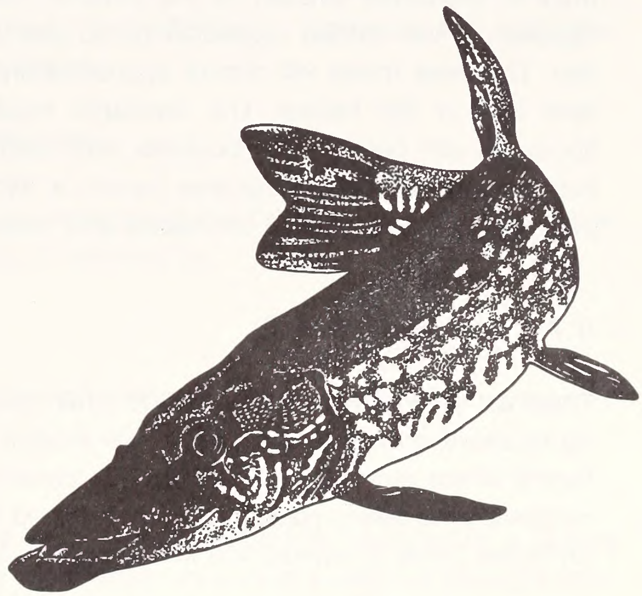
Conclusions

Physical alteration and increases in suspended sediment from multiple mines in the basin constitute a cumulative effect on the aquatic resources. Approximately one and one quarter miles of physical disturbance will occur in the upper basin of Beaver Creek. If the streams are blocked to access for fish by the physical disturbances, the total affected area will increase because of their exclusion from clearwater areas upstream of mining activity. Some of the projected mining activity will probably be in areas previously dredged. Reclamation and stabilization of the bypass may improve previously disturbed fish habitat over the long term. The overall cumulative effect of total suspended sediment increases in Beaver Creek cannot be determined. These effects will be a function of geology at individual mine sites and effectiveness of wastewater treatment.

The duration or persistence of effects on aquatic resources will be a function of magnitude of habitat disruptions, the recovery of physical habitat and recolonization by fish and aquatic insects. Aquatic invertebrate populations exhibit rapid recolonization because most of these organisms use an aerial adult stage (fly) for dispersion and propagation if there is suitable instream and streamside habitat present. Restoration of the river/stream channel to approximate natural conditions is the situation most suitable for recovery and recolonization of aquatic resources.

4.7.2 Alternative A

Effects on the fish habitat from water quality changes are about the same as for the Proposed Action. Impacts could be less because there are no EPA variances as are allowed under the Proposed Action. Some detectable increase in the sediment load and turbidity of the mined streams would result during the production phase of the operations; however, this increase and accumulation of sediment could not be detectable in the fish habitat downstream because of the amount of dilution and large amounts of sediment transported during spring breakup. Trace metal concentrations would probably be less than under the Proposed Action with the magnitude of impact dependent on geology of mine site, type of operation, and effectiveness of wastewater treatment.



Northern Pike

Cumulative impacts are similar as outlined for the Proposed Action. The degree of impact depends on the assumption that all federal mining operations will meet water quality performance standards as described in Chapter Two. There would be no significant impact on the Beaver Creek fishery under Alternative A if mining continues as in 1987 and standards are strictly adhered to.

There would be four placer mines, with disturbance along one mile total of stream, scattered in Nome, Quartz, Bear and/or Champion Creeks. Some areas may be remined, and reclamation requiring stabilization of the stream bypass may enhance previously disturbed fish habitat. In areas of mining in previously unmined streambed, the stream would be channeled into a bypass. This would reduce fish habitat as bypasses are generally straight, with no pools, and a faster velocity than the original stream channel.

4.7.3 Alternative B

Impacts from Alternative B would be very similar to those listed under Alternative A. The four mines will also impact approximately one mile of stream. The enhanced reclamation standards for Alternative B will probably increase the rate and amount of revegetation along the riparian zone. This will decrease the sedimentation from non-point erosion, and increase the bank stability, instream cover, temperature control, and detrital nutrient impact.

4.7.4 Alternative C

Three mining operations are projected to operate with the performance standards outlined for Alternative C. Operations that meet the water quality standards will result in minimal contribution of sediment or increased turbidity to the streams. The reclamation standards will result in more rapid regrowth of the riparian vegetation (25-30 years), and reduce the amount of non-point sedimentation. The three mines will disturb approximately .75 mile of stream channels, resulting in a short-term loss of fish habitat. The standards require rebuilding the stream channel in the original floodplain with pools, riffles, boulders, and approximately the original gradient. This replacement of habitat will minimize the long-term impacts to fish habitat. Areas that are remined in old dredged tailings will result in enhanced fish habitat after reclamation of the current bypass.

4.7.5 Alternative D

There will be no further impact on the fishery resources because there would be no additional mining to cause surface disturbance. Some erosion and turbidity could occur from past mining disturbance where reclamation has not been conducted. Also, increased turbidity would occur where reclamation is taking place on areas disturbed from mining since 1981. Fish habitat enhancement on Nome Creek, in conjunction with recreation, is an opportunity in this alternative.

4.7.6 Special Considerations

Unavoidable Adverse Impacts

Placer mining unavoidably results in a short to long-term loss of instream habitat, fish, and other aquatic insects in areas of active mining. Effects on the downstream habitat from sediment increases on the channel and stream bed can be detrimental to fish populations. Also sport fish opportunities would be reduced because of increased turbidity in those stream sections below mining. These sport fish opportunities will become available once the mining operation closes down and the site is successfully rehabilitated.

New mining in the headwater streams of Beaver Creek would increase land disturbances and increase turbidity from seasonal runoff. These new operations could produce increased sediment downstream from mining operations along with any ongoing mining activities. Channel changes which destroy desirable fish habitat in the vicinity of the disturbed areas could preclude fish uses.

Short-Term Uses vs Long-Term Productivity

The long-term productivity of fish habitat would depend on the extent and timing of the mining development, adherence to performance standards, success of reclamation efforts where the habitat has been physically altered, and mitigation used.

Some short-term use that affects the long-term productivity are losses of desirable habitat and degradation of water quality from channel changes, increased channel gradients, degradation at the upper end of the mine disturbance, and sedimentation of stream substrate.

Occasionally, failure of water control structures, and runoff from access road construction creates sediment discharge into the fish habitat. Introduction of sediment into the stream environment will occur during spring breakup and floods. Adherence to performance standards and mitigation measures would help alleviate these short-term problems.

Irreversible and Irretrievable Commitment of Resource

There would be no irreversible or irretrievable commitments of the fishery resources if mitigation measures are followed and performance standards are adhered to.

4.8 Cultural Resources

4.8.1 Proposed Action

Under the Proposed Action all federal Notice and Plan operations would be reviewed by a cultural resources specialist. A Class I Inventory would be done, which consists of a check of literature sources and the Alaska Heritage Resources Survey (AHRS) files maintained by the Alaska State Historic Preservation Officer's (SHPO) office. This constitutes an "appropriate level inventory" under 43 CFR 3809. At the end of the season, a compilation of all inventories on actions would be submitted to the SHPO's office as part of a Memorandum of Understanding between BLM-Alaska and the SHPO. A paragraph describing the operator's responsibility for cultural resources would be included in both Notice and Plan letters mailed to the operators. Information on known prehistoric, paleontological, or historic resources in the area and/or cultural resources potential would be included in the case file. Most cabins and/or old mining structures and equipment are privately owned, part of the surface estate, or are not significant cultural resources. These would be generally noted or documented during on-site compliance inspections, along with references to identified paleontological or prehistoric materials.

Direct impacts would be the actual destruction of sites, structures, or materials. Indirect impacts would result from the increased accessibility of the area to people and the potential for damage to sites, structures, and materials from ORV's, hikers, and collectors.

To date, no previously undiscovered cultural resources requiring preservation or mitigation have been found in this drainage; therefore, the potential conflict between 36 CFR 800 and 43 CFR 3809 would not raised (Section 3.8.5).

4.8.2 Alternative A

Assessment and examination for cultural resources would be conducted the same as for the Proposed Action. It is unlikely that any change in impacts to cultural resources will result. As procedures are the same for cultural resources under the different alternatives, the difference in impacts are addressed in site-specific environmental analyses and in frequency of monitoring. This is compatible with the RMP goals of the Beaver Creek National Wild River Management Plan and the White Mountains National Recreation Area Record of Decision.

4.8.3 Alternative B

Assessment and examination for cultural resources would be conducted the same as for the Proposed Action. It is unlikely that this alternative would cause any change in impacts to cultural resources. As procedures are the same for cultural resources under the alternatives, the differences in impacts are addressed in site-specific environmental analyses. This is compatible with the RMP goals of the Beaver Creek National Wild River Management Plan and the White Mountains National Recreation Area Record of Decision.

4.8.4 Alternative C

Assessment and examination for cultural resources would be conducted the same as for the Proposed Action. It is unlikely this alternative would cause any change in impacts to cultural resources. As procedures are the same for cultural resources under all the alternatives, the difference in impacts would be addressed in site-specific environmental analyses and in frequency of monitoring.

4.8.5 Alternative D

There would probably be little further impact to cultural resources as a result of the no mining alternative. Previously undisturbed prehistoric sites and paleontological resources would remain unexposed, undamaged, and undiscovered. Historic mining sites,which are generally not protected by federal legislation, would remain largely intact although many old cabins, which are seasonally used and maintained by the miners, would be abandoned and subject to more rapid decay. Continuous natural erosion of drainages may damage and expose cultural and paleontological resources.

4.8.6 Special Considerations

Unavoidable Adverse Impacts

Since no testing and little survey would be done prior to most surface disturbing activity on mining operations, there is a possibility that cultural or paleontological resources would be impacted or destroyed without the operators' knowledge. Even if extensive testing and surveying took place, the potential for missing such resources is great due to heavy vegetation, the large areas involved, and the depth of burial for most sites. Heavy equipment can and does destroy such resources without the operator being aware of the damage. Historic mining resources, which are not generally protected by federal legislation, can and have been destroyed.

Short-Term Uses versus Long-Term Productivity

Cultural and paleontological resources would be preserved to a greater extent if no mining took place, but the knowledge gleaned from these discoveries would not exist. However, it does not seem likely that continued operation with heavy equipment would result in much further discovery due to the destructive nature of such techniques. Constant monitoring of such operations may result in better discovery and recovery, but it could also slow mining operations. The occasional new find resulting from such an effort does not seem worthwhile in view of the scarcity of resources found to date.

Unavoidable and Irreversible Commitments of Resources

Prehistoric and historic cultural resources and paleontological resources are finite and non-renewable for any particular time period. Regardless of standards set for differing alternatives, it would be the initial surface-disturbing activity that primarily impacts such resources. Such resources, once damaged, would be irretrievably lost. Not only would the material possibly be lost, but so would the scientific knowledge to be potentially gained from an undisturbed site. These resources may include structures, soil stratigraphy, bones and other fossils, pollen, and ash. The process of assessing and monitoring site-specific mining operations is the most important form of protection for these resources.

4.9 Subsistence

Subsistence uses and needs may be affected to varying degrees by a variety of causes. In general, any action which disturbs the land, its vegetative cover, the quality or quantity of water resources, wildlife or fish populations, or human or animal access routes may have an impact on subsistence uses and needs.

Such potentially impacting actions may occur all at once or gradually, so that the cumulative impact may build over time to increasingly affect subsistence. Further, cumulative impacts to subsistence uses and needs may occur strictly from human-caused events, or from naturally caused effects, or a combination of the two. When the latter is the case, it often becomes very difficult to quantify exactly how much of the cumulative impact is human- caused versus how much is caused by nature. Moreover, agreement on exact percentage of human versus nature-caused impacts may be difficult to achieve due the the differing viewpoints or assumptions of people viewing the impacts. Also of potential dispute is how much of impacts seen today are the result of recent or ongoing events versus how much were caused by past events which, in some cases, could still be causing effects.

Placer mining is one human-caused impact in the Beaver Creek drainage. In general, placer mining has the potential to impact subsistence uses and needs in the following ways:

1. Through a reduction in the potable water quality of a stream used as a source of drinking water.

2. Through disturbance or destruction of fisheries, animal populations, or habitats which support subsistence fishing, hunting, or trapping.

3. Through sedimentation of waterways which then impede human access to subsistence resources.

4. Through resulting increased harvest pressure due to the creation of more or better access routes into an area.

Other examples of human-caused potential impacts in the Beaver Creek drainage include changes in hunting/trapping/fishing technology, changes in the numbers of people involved, or changes in the amount of harvest.

In the latter examples, the federal government, including BLM, may or may not have full or even any control over the impact. Also, fires may be human-caused, but their effects may be just as unpredictable as natural fires for destroying or improving wildlife habitat, populations, or causing sedimentation of streams. Further, developments may occur on private or State lands, besides federal lands, and lead to new subsistence patterns or pressures. And the type or amount of subsistence resource harvest can vary due to decisions by the State of Alaska in regulating fish and game.

Other potential human-caused impacts to the Beaver Creek drainage relate to the amount of enforcement of environmental laws by responsible State or federal agencies besides the BLM (see further discussion in Chapter Two).

Finally, examples of potential nature-caused impacts to subsistence uses and needs in the Beaver Creek drainage include: natural stream changes, erosion, and sedimentation; and natural permafrost degradation, also resulting in sedimentation.

As noted in the subsistence section in Chapter Three, present village-based subsistence usage of Beaver Creek is downstream from mining activity on BLM lands in the headwaters and is done predominately by residents of Birch Creek village. Farther downstream, toward the confluence of Beaver Creek with the Yukon River, some additional subsistence usage is documented for residents of Fort Yukon and Beaver village. As shown on the subsistence use area maps, overall subsistence usage of the Beaver Creek drainage extends approximately 30 miles upstream from Birch Creek village. This approximate maximum extent is downstream also about 30 miles from the closest mining claims on federal land. Thus, the past, current, or potential impacts to subsistence users and resources from mining are indirect, and would involve events upstream from where village-based subsistence users usually go for harvesting resources at the present time.

ANILCA 810(a) Evaluation and Finding -- General Consideration

One of the purposes of an ANILCA 810 evaluation is to identify whether subsistence uses are being significantly restricted. Under the BLM definition of a "significant restriction to subsistence use" (see glossary), this level of restriction appears not to have happened in the past, nor to be happening now from mining activities or other causes (see Chapter Three). However, certain long-term gradual decreases or changes in fish and wildlife populations may have occurred in the past or are occurring now. If not mitigated, these could cause more pronounced future impacts to those resources

Water is important to the subsistence lifestyle of rural Alaskans. Photo courtesy of BLM Public Affairs.

and associated subsistence usage, such that a significant restriction might occur (Section 4.7, Fisheries). To follow, the focus of each respective ANILCA 810 evaluation and finding for each alternative will be on how much, if any, new or increased contributions it would make in causing the downstream effects of:

1. Decreased fish or wildlife populations, including through increased access.

2. Decreased terrestrial or aquatic habitat.

3. Decreased access to subsistence resources.

4. Any other water-related impacts, such as turbidity or deterioration of potential drinking water.

ANILCA Section 810 (a): Consideration of the Availability of Other Lands and Other Alternatives.

At the end of this environmental analysis process, BLM will have analyzed all and only the lands relevant to the purposes of this study, namely the lands involved in the Beaver Creek watershed. Thus, this document is considering all relevant lands so that there are no "other lands" which could be considered. The Proposed Action and the four alternatives constitute the "other alternatives" required for consideration by ANILCA Section 810.

4.9.1 Proposed Action

As noted under the description in Chapter Two, the Proposed Action would continue management of mining for claims on Federal land as it was conducted during the summer of 1987.

Past and Projected Future Cumulative Impacts

There have been no significant cumulative past impacts from mining to subsistence uses or needs. This is because only one mine operated in 1987, and it was designed for zero discharge of water so that no sediment from it would directly enter Beaver Creek. Its overall success meant that there were no nearby or downstream significant negative effects from this single mine. And as a result, downstream fish and animal populations, habitat, drinking water, and human access routes received no impacts.

While only one mine operated in 1987, as noted.three questions could be asked regarding potential subsistence impacts under the Proposed Action:

1) What if all five mining operations proposed in 1987 had operated?

2) What if even more than five mining operations had occurred?

3) What if future mining were to occur in new areas on federal claims in the Beaver Creek drainage?

The answer to all three is virtually the same; namely, it is projected that notable impacts related to subsistence uses and needs could be avoided so that the level of potential future restriction to subsistence, if any, would not be significant. The reason is that while additional surface disturbances undoubtedly would occur in the upper reaches of Beaver Creek, where the only mining claims are located, those impacts would be duly regulated and mitigated there on the spot, with the prime objective being to avoid downstream impacts.

In the future, regardless of the number of mining operations, water quality standards would be applied to all of them, meaning that the water quality of Beaver Creek would not be allowed to deteriorate below set standards of acceptability. And again, like what actually occurred in 1987, the result would be no notable downstream impacts on fish and animal populations, habitat, drinking water, or human access.

Potential future cumulative sedimentation, particularly from non- point sources, like erosion of mining areas during high runoff, may affect fish spawning areas nearest the active mining (Section 4.7, Fisheries). Yet, in the future, if such sedimentation were to occur, it would have the effect of decreasing upstream spawning areas so that spawning might be pushed farther downstream. If this were to happen, subsistence fishing, which occurs downstream anyway, should not be notably affected as fish would still be present.

Finally, as to the cumulative affects of increased access being created due to increased mining, additional recreationists and others likely would enter the upper Beaver Creek drainage. This would mean, at worst, potential resulting decreases in local animal and fish populations by increased harvest pressures, or by certain species avoiding the presence of humans. Yet, however true these theoretical effects would be in reality in upper Beaver Creek, this area is relatively remote from general village-based subsistence use areas. Consequently, such potential impacts are judged unlikely to be felt in those villages to any significant extent. Related to this, it is necessary to remember that the moose population of upper Beaver Creek is not the same as the one harvested in the downstream subsistence use areas. Further, if new fishing pressures were to develop in upper Beaver Creek, the State of Alaska has regulatory authority and responsibility to adjust harvest levels so that stocks are not significantly reduced and that subsistence usage be given a priority over sports usage. The same is true for major animal species, like moose.

Compliance with Section 810 (a) of ANILCA; Evaluation and Finding

1. Uses and Needs. As discussed above and elsewhere, the Proposed Action is to have mining result in no notable impacts to water quality of Beaver Creek. As a consequence, mining would have no significant impacts on subsistence uses or needs as downstream fish and animal populations, habitat, and human access to subsistence resources would not be impacted in any way. The cumulative effect would be that any new mining under the Proposed Action would not add in any notable degree to any prior accumulation of impacts that might have resulted from past mining or any other human-caused events.

2. Section 810 (a) Finding for the Proposed Action. The Proposed Action would not result in a significant restriction to subsistence uses. The direct reasons for this finding are given in the preceding sections with supporting information found in other sections analyzing the impacts to fish, wildlife, water, and soils for this alternative.

4.9.2 Alternative A

Alternative A would be similar to the Proposed Action. The main difference is that performance standards under Alternative A for reclamation of fish and wildlife habitats, and soil and vegetation stabilization would be less restrictive than under the Proposed Action. Yet, the overall likely downstream effects on subsistence resources and users essentially would be unchanged because water quality standards would remain the same as under the Proposed Action. Thus, the net effect of impacts to subsistence uses, users, and resources would be the same as under the Proposed Action, namely none at all. Accordingly, the impact analysis statements concerning subsistence for the Proposed Action apply to Alternative A, and should be read for further information.

Compliance with Section 810 (a) of ANILCA: Evaluation and Finding

1. Uses and Needs. The statements made under this heading for the Proposed Action completely apply to Alternative A because the finding of no net effect on subsistence uses and needs is the same.

2. Section 810 (a) Finding for Alternative A. Alternative A would not result in a significant restriction to subsistence uses. The direct reasons for this finding are given in the preceding sections with supporting information found in other sections analyzing the impacts to fish and wildlife, water, and soils for this alternative.

4.9.3 Alternative B

Alternative B would be similar to the Proposed Action and Alternative A. Performance standards for water quality would remain the same, leading to the same lack of potential downstream impacts to subsistence uses, users, and resources. Reclamation standards, however, would be like the Proposed Action. As a result, the likely downstream effects of Alternative B would be particularly similar to the Proposed Action, namely none at all. Accordingly, the impact analysis statements concerning subsistence for the Proposed Action apply to Alternative B and should be read for further information.

Compliance with Section 810 (a) of ANILCA: Evaluation and Finding

1. Uses and Needs. The statements under this heading for the Proposed Action completely apply to Alternative B because the finding of no net effect on subsistence uses and needs is the same.

2. **Section 810 (a) Finding for Alternative B:** Alternative B would not result in a significant restriction to subsistence uses. The direct reasons for this finding are given in preceding sections with supporting information found in other sections analyzing the impacts to fish and wildlife, water, and soils for this alternative.

4.9.4 Alternative C

Alternative C would be similar to the Proposed Action and Alternatives A and B. The main differences, as they might relate to subsistence, are that water quality performance standards are more stringent and that restoration would be enhanced (although actual reclamation standards remain similar to those under the other alternatives). The likely downstream effects on subsistence uses, users, and resources again would not be different than under the Proposed Action or Alternatives A or B, namely none at all. Thus, once more the impact analysis statements concerning subsistence for the Proposed Action apply to Alternative C and should be read for further information.

Compliance with Section 810 (a) of ANILCA: Evaluation and Finding

1. **Uses and Needs.** The statements made under this heading for the Proposed Action completely apply to Alternative C because the finding of no net effect on subsistence uses and needs is the same.

2. **Section 810 (a) Finding for Alternative C.** Alternative C would not result in a significant restriction to subsistence uses. The direct reasons for this finding are given in the preceding sections with supporting information found in other sections analyzing the impacts to fish and wildlife, water, and soils for this alternative.

4.9.5 Alternative D

As indicated under the description of this alternative, no mining would occur on federal mining claims although stabilization of surface disturbances that have occurred since 1980 would be required. Further restoration of mined areas would proceed by natural processes. The net result of this for subsistence uses, users, and resources would be in the range of minimal to no impact.

As for the possibility of any impacts occurring, conceivably natural erosion during spring runoff or at other times of high water could cause some turbidity in Beaver Creek from areas where further restoration would not take place. Still, as discussed in the water and aquatic fauna impacts assessment sections for this alternative, the resulting downstream effects, even if this were to happen, are predicted to be negligible and temporary. They would not contribute appreciably to the accumulation of past events that may have caused some degree of impact to subsistence resources or activities in or around Beaver Creek. Otherwise, the likely downstream effects on subsistence resources and users would be no different than under the Proposed Action or any alternative. And in terms of access, potential impacts might even be less. This is because without further mining in the future, fewer access roads would be built and presumably fewer people would enter the area to potentially impact fish and wildlife or their habitats. Overall, the level of impacts would be similar to those otherwise stated for the Proposed Action. Thus, information stated there applies to Alternative D and should be read.

Compliance with Section 810 (a) of ANILCA: Evaluation and Finding

1. Uses and Needs. The statements made under this heading for the Proposed Action essentially apply to Alternative D because the net effect is similar on subsistence uses and needs. As noted in the preceding section, the impact to subsistence uses, users, and resources would be in the range of minimal to none, with the overall effect still negligible even under a "minimal impact" situation where natural erosion might cause turbidity in Beaver Creek on a temporary basis.

2. Section 810 (a) Finding for Alternative D. Alternative D would not result in a significant restriction to subsistence uses. The direct reasons for this finding are given in the preceding sections with supporting information found in other sections analyzing the impacts to fish and wildlife, water, and soils for this alternative.

Summary of ANILCA Section 810 (a) Findings

The findings for all alternatives, including the Proposed Action, were the same; namely, none would result in a significant restriction to subsistence uses. This is because the predicted impacts to subsistence uses, users, and resources under all alternatives were evaluated to be negligible or nonexistent. This conclusion was reached for each alternative because only negligible-to-no effects were predicted from any of the alternatives on animal populations, habitat, human access, or general water quality particularly in the downstream region of Beaver Creek where direct subsistence usage does occur by Birch Creek Village residents and others.

Finally, it should be noted that in arriving at these evaluations and findings, potential immediate, future, and cumulative impacts were considered, with the reader referred back to the respective impact analysis sections for details on each alternative.

4.9.6 Special Considerations

Unavoidable Adverse Impacts

No cumulative unavoidable impacts are likely to occur under the Proposed Action and all alternatives to downstream areas utilized for subsistence purposes by residents of Birch Creek village or other villages. See preceding sections supporting this conclusion.

Short-Term Uses vs Long-Term Productivity

The Proposed Action and all alternatives should have no notable impacts either to cause long-term or short-term productivity changes in the availability of wild, renewable resources used for subsistence purposes by downstream residents of the region. Again, see preceding sections supporting this conclusion.

Irreversible and Irretrievable Impacts

Also, no irreversible and irretrievable impacts are likely to occur under the Proposed Action and all alternatives to downstream areas important to village-based subsistence users, for reasons again given in preceding sections.

4.10 Recreation

4.10.1 Proposed Action

The BLM has been upgrading the WMNRA facilities and building new facilities. By 1988 more than $300,000 had been spent and we expect to see increased and improved recreation facilities. The additional access roads allowed under this alternative could create impacts to primitive recreation resources. Increased road access could facilitate additional recreational use on the river in the Beaver Creek basin. This would bring more people to the area and possibly increase recreational use of the Beaver Creek NWR. Such an increase would probably require additional facilities and use supervision, decreasing the primitive nature of these areas while increasing management costs. Increased access would reduce the opportunity for a primitive recreation experience in the river corridor and in adjacent lands to the primitive areas, but it would also spread out use.

Long-term impacts on the recreation resource will continue under this alternative until vegetative cover and water quality are returned to the natural conditions that existed before mining occurred. Wildlife viewing is an important recreation activity dependent upon wildlife in the area. Long-term impacts to the wildlife habitat will also impact hunting, fishing, and wildlife viewing activities accordingly.

4.10.2 Alternative A

The impacts of Alternative A are similar to the Proposed Action although less development will take place. The impacts on recreation and recreation-related resources will be somewhat less because of less activity.

4.10.3 Alternative B

The impacts of Alternative B are similar to the Proposed Action although less development will take place. The impacts on recreation and recreation-related resources will be somewhat less because of less activity.

4.10.4 Alternative C

The impacts of Alternative C are even less due to the reduced level of mining activity, although less development will take place. The impacts on recreation and recreation-related resources will be somewhat less because of less activity.

4.10.5 Alternative D

Under this alternative no mining would take place and any possible conflicts identified about would be ameliorated.

4.10.6 Special Considerations

Unavoidable Adverse Impacts

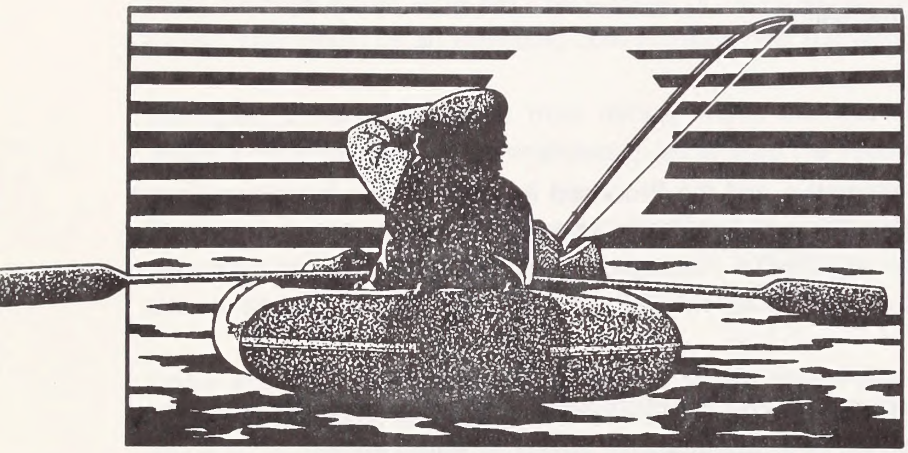
Under the Proposed Action and all alternatives there might be some unavoidable adverse impacts on recreationists if when expecting a "pure" wilderness experience they encounter mined lands. Since the BLM knows where these areas are it would be suggested that other areas of the WMNRA be utilized to protect the "pure" experience. Under Alternative D no mining would take place and any possible conflicts identified above would be ameliorated.

Short-Term Uses vs Long-Term Productivity of Resources

Under the Proposed Action and all alternatives, although specific habitat and vegetative losses will occur, the increase in access will allow more people to recreate in the WMNRA and to increase the value of recreation to the local economy, although the magnitude of this increase is not known. There might be a slight reduction in the number of hunter opportunities in the upper watershed, but overall this is expected to be insignificant. Under Alternative D no mining would take place and any possible conflicts identified above would be ameliorated.

4.11 Visual Resource Management

Placer gold mining activities throughout the Beaver Creek watershed are for the most part located in the bottom of the drainages. From the roads, which are generally constructed on the sidehills and provide the access routes for visitors to the area, the view looks down onto the mining activity. Other viewing positions are from Beaver Creek itself (where recreationists use the river) which is in an normal observer position and from aircraft (superior observer position). Aircraft use is perhaps one of the major modes of transportation throughout much of Alaska. The superior observer position is the most critical position as it allows a viewer to see more of the whole landscape from an unrestricted view. Activities which alter the characteristic landscape are readily discernible. In the normal observer position the viewer is within the same general elevation or level as the landscape being viewed. The view can often be limited or restricted, although it does give the viewer a frame of reference of scale of the landscape. In the inferior observer position the viewer is looking up at the viewshed (i.e., standing in the bottom of a drainage looking up at the hill sides). In this position much of the view is more restricted, with disturbances and other landscape features often masked by topography, vegetation, and similar elements found in the natural landscape. It is the least critical from the observer position standpoint.



Fishing

Mining, being a discordant element to the natural environment, greatly influences how the landscape is perceived by the viewer. Within the characteristic landscape, visual modifications created by access roads and placer mines are not readily absorbed due to the high contrast of darker colored vegetation and lightly colored soils. Linear developments such as roads and utility lines are highly visible as few line features exist in the natural landscape.

Placer mining activities have altered certain landscape within the drainage bottoms. The high visual contrast of lightly colored soils (where placer mining has or is taking place) and the darker green vegetation is readily apparent. Linear developments such as access roads, ridge lines and drainage bottoms also draw the eye towards the axis or terminus. Discordant elements at these points become more evident to the observer. Access roads generally go through or terminate at the mines in the drainage bottom, pulling the eye towards those disturbed areas more readily.

The more visually evident something is to the observer the greater the impact. Discharges of sediments from mining activities which change the color of the normally clear free- flowing condition of the rivers and streams also create a greater perceived impact on the characteristic landscape by the observer.

The cumulative visual impact created by mining or mining activities will be greatest when viewed from the superior observer position (from aircraft or high vantage points), with a lesser impact when viewed from the normal observer position. From the normal observer position it is more likely that a viewer will see the impact more closely and in greater detail.

4.11.1 Proposed Action

The areas of current and projected placer mining are in a Visual Resource Class III (VRM) area. Within VRM Class III areas, individual mines could meet the standards of being "moderate" and "should not attract attention or dominate the view of the casual observer," if they are well designed and executed. However, several mines within the general area may not meet the standards due to cumulative impacts. Individual placer mines are not as evident as those grouped together. Modifications created by mining and associated activities visually dominate the characteristic landscape, especially where several mining operations occur in close proximity to each other. Placer mining creates unavoidable adverse impacts on the visual resources; however, the impacts are not irreversible or irretrievable. Impacts are considered long term due to the removal of vegetation and time needed to return the characteristic landscape to a natural condition. Recommended mitigation is the same as in the preceding section on recreation.

4.11.2 Alternative A

Little difference exists between this alternative and the Proposed Action because the management strategy exists within the RMP to protect the values as stated above.

4.11.3 Alternative B

Little difference exists between this alternative and the Proposed Action and Alternative A because the management strategy exists within the RMP to protect the values as stated above.

4.11.4 Alternative C

With water and reclamation restrictions more severe than those identified in the RMP, the results of this alternative would be to lessen the minimal impacts to VRM Classes. Individual placer mines would need to modify operations to increase rehabilitation and restoration, and linear developments and access roads would need to be carefully screened.

4.11.5 Alternative D

Under this alternative, no federal mining would be allowed. Since all mines are federal, no further impacts would be created on visual resources. No additional cumulative or long-term impacts would be expected.

4.12 Economics

The description of economic impacts does not include indirect impacts to employment, income, and population because data are not available.

4.12.1 Proposed Action

A continuation of present management would allow the projected total number of mines to increase from one to five within the Beaver Creek drainage over the next decade.

If so, estimated total direct employment from mining would increase from about two work months per year to about 40. (This assumes an average of eight person months per mine.) It is anticipated that most of the employees would reside in or around Fairbanks.

Direct income generated by the additional mining would also increase, by about $45,000 per year.

A continuation of present management within Beaver Creek, Birch Creek, Minto Flats, and Fortymile River drainage would allow the total number of mines within the four drainages to increase from 135 to 162. This would be an estimated 20% increase over the next decade.

Estimated direct employment from mining within the four watershed would increase by about 200 FTE (Full-time equivalent employees) (20%) from the 1985 estimated level of about 1000 FTE.

Employment changes would be most significant in communities near the watershed. Although increased mining would also cause employment of Fairbanks residents to increase by about 90 FTE, this would be less than half of one percent change in total Fairbanks employment.

Direct income generated by the additional mining would also increase from $2.3 million to an estimated $2.7 million (about 20). This too would be most significant to the local communities. Annual direct income to Fairbanks residents would increase by less than one tenth of one percent of the 1985 yearly payroll.

Since population increases in Fairbanks would be less than half of one percent, no significant new demand for additional public services would be expected in Fairbanks. However, the increased demand for these services in some of the communities near the drainages would be more significant and related to increases in population.

4.12.2 Alternative A

Implementation of this alternative would allow the total number of mines to increase from one to four within the Beaver Creek drainage over the next decade.

If so, estimated total direct employment from mining would increase from two work months per year to about 32.

Annual direct income generated by the additional mining would also increase by about $34,000.

Implementation of this alternative would allow an estimated four percent increase in the total number of mines within the four drainages over the next decade, i.e., the total number of mines would increase from 135 to 141.

Estimated direct employment from mining within the four watersheds would increase by about 40 FTE (4%) from the 1985 estimated level of about 1000 FTE. Employment changes would be most significant in communities within and near the watersheds.

These increases would be less significant than would occur with continued present management. Employment increases among Fairbanks residents would be less than 20 FTE per year and would also be less significant than with continued present management.

Direct income generated by the additional mining would also increase by about $90,000 (about 4%). This too would be most apparent within local communities. Here too total direct personal income in Fairbanks would increase by less than one- tenth of one percent.

Population increases in Fairbanks would be less than half of one percent and no significant new demand for public services would be expected.

4.12.3 Alternative B

This alternative would be identical to Alternative A.

4.12.4 Alternative C

Implementation of Alternative C would allow the number of mines to increase from one to three mines within the Beaver Creek drainage over the next decade.

Estimated total direct employment from mining would increase from two work months per year to about 24.

Direct annual income generated by the additional mining would also increase by about $25,000.

Implementation of Alternative C would cause a 10% decrease in the total number of mines within the four drainages over the next decade, i.e., the estimated number of mines would decrease from 135 to 122.

Estimated annual direct employment from mining within the four watersheds would also decrease by about 10% (100 FTE) from the 1985 estimated level of about 1000 FTE. Employment changes would be most significant in communities within and near the watersheds. Employment declines among Fairbanks residents would be about 46 FTE per year. This would be less than a .2% decline from the 1985 level.

Annual direct income generated by mining would also decline by about $228,000.

The Fairbanks population would decline by about 140 people (assuming an average of a three-person family per unemployed miner). This population change would amount to less than half of one percent.

The change in demand for public services in Fairbanks would be insignificant.

4.12.5 Alternative D

Implementation of Alternative D would cause the only mine within the Beaver Creek to shut down.

Estimated total direct employment from mining would decrease from two work months per year to 0.

Annual mining-related income (wages) would decline to 0.

It is anticipated that implementation of Alternative D would cause the total number of mines within the four drainages to decrease from 135 to 76 over the next decade.

Estimated annual direct employment from mining within the four watersheds would also decrease by about 440 FTE (44%) from the 1985 estimated level of about 1000 FTE. Employment changes would be most significant in communities within and near the watersheds. Employment declines among Fairbanks residents would be about 210 FTE. This would be less than a one percent decline from the 1986 total employment.

Annual direct income generated by mining would also decline by about $1 million. This would amount to about $640,000 in Fairbanks. The Fairbanks population would decline by about 630 people (assuming an average of a three person family per unemployed miner). This population change would amount to nearly one percent of the Fairbanks area population.

The change in demand for public service in Fairbanks may be noticeable.

4.12.6 Special Considerations

Unavoidable Adverse Impacts

None for the Proposed Action and Alternatives A, B, and C. Under Alternative D there would be a decrease in mining-related employment and income and population in the communities near the Beaver Creek watershed.

Short-Term Uses vs Long-Term Productivity

None for the Proposed Action or any of the alternatives.

Irreversible and Irretrievable Commitment of Resources

None for the Proposed Action or any of the alternatives.

4.13 Mitigation

Mitigation measures are generalized prescribed of actions which can be taken to reduce or eliminate the impact of placer mining on various resources in the Beaver Creek watershed.

Guidelines for development of measures to mitigate impacts to resources included prioritization of the types of mitigation. The highest priority is to avoid the impact, a lesser priority is to minimize or rectify the impacts, and the last priority was to replace the impacted resource. On-site or in-basin mitigation within the stream or drainage where the impact occurred is favored, as was "in-kind" mitigation, where the impacted resources would be replaced, thereby reducing both potential disruptions to the system's ecology and management problems. Some impacts cannot be mitigated and are an irreversible or irretrievable impact to the resource.

When specific mineral development actions are proposed in the area, a site-specific analysis of effects will be developed through the environmental assessment process for each Plan of Operations, as required by the NEPA and 43 CFR 3809. As a result of this process, stipulations which alter or restrict timing, location, and extent of a mineral development activity may be required to avoid or minimize adverse effects and to avoid unnecessary or undue degradation. Various mitigation measures are discussed extensively by Mowatt in "Surface Disturbing Activities in Alaska: A Guide to the Technical Aspects of Mitigation and Reclamation (DOI 1987a).

The alternatives are a gradient of mitigation measures, with emphasis in water quality and reclamation standards (Section 2.3). Performance standards are more stringent from the Proposed Action, Alternatives A through C, and there is a corresponding trend for reducing the magnitude of impacts on the natural environment. The effectiveness of the mitigation measures will vary considerably with the site conditions of each mining operation.

The varying degrees and effectiveness of the reclamation efforts required by the Proposed Action and each alternative have been incorporated into the analysis and are discussed in their respective sections.

Quantitative estimates for changes in impacts for specific alternatives and locations cannot be made due to the variation of other site-specific environmental conditions. However, the trends of the mitigation will be to decrease each identified impact.

In order to provide an appropriate level of mitigation for any impact, the extent and magnitude of the impact effects on the resource must be known. In some cases, impacts cannot be precisely estimated due to their complexity, the lack of information, or the low probability of their occurrence.

Additional information is then required to develop suitable mitigation. In those instances, the potential impacts must be measured through an impact monitoring program designed to detect changes in biological and/or physical parameters.

The timing and location of unpredictable impacts, such as a hazardous material spill, are unknown, so a monitoring program is not feasible. However, implementation of a pre-determined mitigation response plan to contain, neutralize, and clean up the impacted area is possible. A follow-up assessment of biological impact, reclamation, and replacement could then be implemented.

Resource component	Impact	Mitigation under the alternatives	Further mitigation not covered under the alternatives	Irreversible and irretrievable commitments of resources
Topography	Localized modification of landscape	Reshape and stabilize during reclamation		
Mineral resources	Increased costs of compliance and less development	Lower water quality and reclamation standards		
Soils	Destruction of soil structure			X
	Loss of fine-grained soils through erosion	–Reshape to reduce slope angles –Revegetate to reduce rate of water runoff		
	Compaction in areas of roads and trails		Access allowed only during winter when ground is frozen and adequate snow cover exists	
Water resources	Greater stream channel gradient and reduced sinuosity	–Resestablish stream in original floodplain –Rebuild channel to approximate original channel		
	Increased sediment levels and turbidity during operations in stream	Use mining techniques to meet water quality standards for sediment and turbidity, including settling ponds, recycling and stream bypasses		
	Accelerated erosion from non-point sources	Revegetate and reshape		
	Erosion from roads		Careful design and construction will alleviate some	Some
Landcover	Reduced productivity shortly after mining	Reseeding and fertilization	Scarify, mulch	Some
	Loss of original riparian vegetation with organic soils			X
	Loss of fine-grained material in soils	–Reshape topsoil and overburden –Respread tailings and pond fines		
	Change of vegetation species, pattern and structure		–Leave strips of orginal vegetation as seed source –Redistribute topsoil in patchy pattern	Some
	Areas will remain barren or sparsely vegetated		–Replant with willow shoots	Some
	Loss of vegetation from roads Change of vegetation type from trails		Winter travel in non–forested areas, especially wetlands	Some

Figure 4-8. Mitigation for impacts from placer mining.

Resource component	Impact	Mitigation under the alternatives	Further mitigation not covered under the alternatives	Irreversible and irretrievable commitments of resources
Wildlife	General habitat loss	Reseeding and fertilizing	Reclaim lost habitat—see Landcover	Some
	Crucial habitat loss		Locate development to avoid crucial habitats	
	Disturbance/ disruption of wildlife use pattern		Restrict or alter timing of operations, location, and extent of activities	Some
	Increased hunting pressure due to roads and trails		—Regulation by other agencies —Restrict access	Some
	Hazardous material spills		Plan to contain, neutralize,and clean up. Locate fuel operations and storage away from streams, storage areas diked and lined with impermeable material	
	Removal of nuisance animals		Dispose garbage and other waste so as to not attract animals	
Aquatic fauna	Loss of fish habitat Decreased populations	Restore creek channel in floodplain with original gradient, contours, pools, riffles, etc.		
	Short-term loss of productivity			X
	Restriction of fish passage through channel		Construct culverts to ensure passage	
	Increased flow rate Low water especially in winter Loss of pools Silt and sedimentation from erosion	—Stabilize and reconfigure —Regrowth of vegetation		
	Loss of food and light penetration from siltation	Water quality standards		
	Loss of riparian cover		—Buffers of at least 100 feet around streams where physical alterations are permitted, except on mining claims —Replant with willow shoots	In some areas of mining claims
Cultural resources	Possible harm to undiscovered artifacts	Review cultural information, site inspection if cultural resource located during mining operations		
Subsistence	Impacts to natural system	See Other Resources		
	Changes in human technology and use patterns			Yes, unless regulations established

Figure 4-8 continued.

Resource component	Impact	Mitigation under the alternatives	Further mitigation not covered under the alternatives	Irreversible and irretrievable commitments of resources
Recreation	Decrease primitive experience Increased access creating pressure, especially in primitive areas	Follow RMP for access development, i.e. no construction of roads in primitive areas	Remove or clean up old camps and facilities	
	Reduced wildlife viewing and hunting		See Wildlife	Some
Visual	Reduced visual quality and visual modifications from development and its effects	–Water quality requirements –Reconfigure tailings to approximate surrounding contours –Revegetation	Remove garbage, use natural appearing materials for buildings, etc.	Some
Economics	Reduced employment in mining and secondary industries resulting from increased compliance costs	–Gradient of water quality and reclamation standards		Some

Figure 4-8 continued.

Chapter V
Public Participation

5.1 Introduction

This chapter consists of three parts: **Part One** describes the consultation and coordination process.

Part Two contains the names and qualifications of the persons responsible for preparing these EISs.

Part Three is a list of persons, organizations, and agencies reviewing the EISs.

This chapter is being prepared in the same manner for each of the EISs for the four watersheds of concern (Section 1.2). Public interest was focused on all the drainages, with some limited, specific references to each particular drainage. In some cases, data were collected on an area-wide basis. The preparers worked on all four of the documents, some to different extents.

5.2 Scoping and Issue Identification

5.2.1 Introduction

The BLM conducted a broad public and interagency consultation program throughout the development of this project, and this input has been incorporated into this document. Specific public and agency involvement is described below.

5.2.2 Scoping

The scoping process conducted by the BLM provided an opportunity for members of the public, special interest groups, the mining industry, and other agencies to assist in defining significant environmental issues. The main objectives of the scoping meetings were:

- To present an overview of this EIS.
- To identify the major environmental issues to be addressed in this EIS.
- To receive comments and questions regarding environmental impact concerns.
- To incorporate those comments and questions into the EIS planning process.

Initially more than 450 letters were sent to the public requesting comments, issues, and concerns to help in setting the parameters of the study, and developing a mailing list.

The scoping process was initiated for this EIS with the publication of a Notice of Intent to prepare an EIS in the Federal Register of August 18, 1987. The scoping meetings were also announced in local papers and on radio throughout the Fairbanks area, in remote communities, and in Anchorage. These announcements resulted in formal meetings in the following locations, which were attended by various publics and agencies.

The scoping meetings and the approximate number of persons in attendance were as follows:

Date	Location	Attendance
Sept. 9, 1987	Central	44
Sept. 10, 1987	Livengood	34
Sept. 15, 1987	Chicken	33
Sept. 16, 1987	Fairbanks	51
Sept. 17, 1987	Anchorage	20
Oct. 5, 1987	Minto	31
Oct. 6, 1987	Birch Creek Village	10

Additionally, a total of 32 written comments were received. These and the oral comments taken at the meetings were summarized and reviewed by EIS team members. This review was to respond to the issues and concerns, and to provide a systematic procedure for EIS preparation. The issues and concerns were organized into general areas of concern for further evaluations.

Copies of these comments, as well as tapes of scoping meetings for review are available in the BLM State Office in Anchorage. The general areas of concern cited in public response letters are subsistence, NEPA, reclamation, recreation, water quality, sedimentation, fish and wildlife, habitat, economics, legal considerations, research, and engineering. All concerns identified during the scoping process were carefully considered during the development of this EIS.

The National Park Service (NPS) is conducting a cumulative EIS similar to the BLM effort. Several meetings were held to exchange information and ideas. The NPS and the BLM approached the issues of a cumulative EIS in a somewhat different manner due to their different management responsibilities.

The Corps of Engineers (COE) is cooperating with the BLM in these EISs. There has been useful exchange of information between the two organizations.

The U.S. Fish and Wildlife Service was solicited for information regarding any listed and proposed threatened and endangered species that may be present in the Beaver Creek drainage. Informal consultation determined that no candidate endangered, or threatened species would be effected.

Meetings were held with the EPA during the scoping and data collection process. In particular, EPA was concerned that this EIS not become involved with the present reevaluation of proposed placer mining regulations. Several meetings were held to deal with technical aspects of water quality; these produced information to refine the water quality efforts and this led to several contracts with State agencies to assist BLM in data acquisition and analysis.

Meetings and briefings were conducted with the State of Alaska, including the Departments of Fish and Game, Environmental Conservation, Natural Resources, and Office of Management and Budget.

In addition to numerous meetings to gather data on resources and programs, the State of Alaska collected data and provided interpretation in several contractual reports. These reports included the topics of water quality, aquatic habitat and fisheries, biologic information, and a review of other consultant reports.

Meetings were conducted with the U.S. Bureau of Mines, State of Alaska Department of Natural Resources, and the U.S. Geological Survey to update the BLM on mineral resources and geology in the study area.

5.3 Names and Qualifications of Preparers

Carol Belenski, Visual Information Specialist for seven years. Mapping specialist and printing coordinator for numerous plans.

Kent F. Biddulph, Landscape Architect/Environmental Planning, Bachelor of Arts, 1964, Utah State University, 21 years in Landscape Architecture - Visual Resource Management and Recreation Planning.

Frank Bruno, Writer/Editor, Bachelor of Arts - Journalism, 1974, San Jose State University. Five years with BLM.

Louis Carufel, District Fisheries Biologist, Bachelor of Science - Biology, 1948, St. John's University - Minnesota; Master of Science - Fish and Wildlife Management, 1960, Montana State University. Twenty years of Federal service.

Lee Douthit, Subsistence Coordinator, Bachelor of Arts - History, 1967, Texas Woman's University; Master of Arts - Anthropology, 1976, University of Texas at Austin; Ph.D. - Anthropology, 1978, University of Texas at Austin. Seven years with BLM as a Research Archaeologist, cultural resource manager, and subsistence coordinator.

Linda Du Lac, Land Law Examiner, Bachelor of Science - Resource and Recreation Management, 1974, Oregon State University. Nine years with the Forest Service and four years with BLM.

Bruce Durtsche, District Wildlife Biologist, Bachelor of Science - Wildlife Biology, 1978, Arizona State University. Twelve years with BLM. Three years with the State of Arizona.

Richard F. Dworsky, Project Manager, Bachelor of Science - Forestry, 1965, University of Michigan; Masters in Science - Recreation, 1972, Colorado State University; Ph.D. - Forestry, 1986, University of Massachusetts. 20 years in natural resources planning and management. Former Chief of Forestry in Puerto Rico.

KJ Ferencak, Land Law Examiner, Associate Degree - Mining Engineering, 1981, Penn State. Five years with BLM.

William S. Hauser, Mining Engineer, Bachelor of Science - Mining Engineering, 1977, Virginia Polytechnic Institute and State University. 10 years Federal service.

Ronald G. Huntsinger, Physical Scientist, Bachelor of Arts - Biology, 1972, Humboldt State University; Graduate studies - Hydraulic Engineering and Watershed Management, Humboldt State University. Fifteen years experience hydrology, watershed management, aquatic sciences, and undergraduate instruction in biology and physics.

Robert E. King, Anthropologist, Bachelor of Arts - History, 1970, Washington State University; Bachelor of Arts - Anthropology/Archaeology, 1970, Washington State University; Master of Arts - Anthropology/Historical Archaeology, 1973, University of Pennsylvania; Ph.D. - Anthropology/Ethnohistory, 1978, University of Pennsylvania. Six years with BLM. One year Anthropology contract work. Two years author, historian.

Paula V. Krebs, Geographic Information Systems Coordinator, Bachelor of Arts - Zoology, 1965, University of Colorado; Ph.D. - Plant Ecology, 1972, University of Colorado. 22 years experience in landcover/vegetation data production, applied plant ecology projects, ecological analysis and vegetative mapping, and graduate/undergraduate instruction in Botany and Resource Management.

Howard Levine, Land Law Examiner, Bachelor of Arts - Geography, 1981, San Diego State University. Seven years with BLM.

Thomas C. Mowatt, Geologist, Bachelor of Arts, 1959, Rutgers University; Ph.D., 1965, University of Montana. Twenty-five years professional experience in geology, geochemistry, chemistry, and environmental sciences. Includes private sector research and energy/mineral resources exploration-development-production, university teaching-research, state and federal government work. Active professionally in Alaska since 1970.

Kim Pearce, Illustrator, Bachelor of Science, major - Illustration, minor - Biology, 1986. Nazareth College of Rochester, New York. One year with BLM.

Jacob Schlapfer, Land Use Planner, Bachelor of Science - Biology, 1987, Western Oregon State College. One year with the U.S. Forest Service. Two years with the U.S. Fish and Wildlife Service.

Page Spencer, Technical Coordinator, Bachelor of Science - Biology, 1972, University of Alaska - Fairbanks; Masters of Arts - Ecology, 1975, University of Colorado; Ph.D. - Plant Ecology, 1981, University of Alaska, Fairbanks. Seven years with BLM.

John Thompson, Environmental Coordinator, Bachelor of Science - Economics and Political Science, 1975, Dakota State University; Master of Science - Agricultural Economics, 1977, Purdue University. Employed by BLM 1977 to present.

Dave Vogler, Hydrologist, Bachelor of Science - Watershed Science (Hydrology), 1978, Colorado State University. Ten years subsequent professional experience in hydrology.

Susan M. Will, Archaeologist, Steese-White Mountains District, Bachelor of Arts, 1975, University of Alaska at Fairbanks. Nine years with Bureau of Land Management.

Support Personnel

Mike Clark, Cartograhic Technician

Debbie Llacuna, Clerk/Typist

Linda Mowatt, Miscellaneous Documents Clerk

Betty Ostby, Land Law Assistant

Aaron Ritchins, Cartographic Technician

Paul Schlepler, Clerk/Typist

5.4 List of Persons, Organizations, and Agencies Reviewing the EISs.

Alaska Congressional Delegation

Don Young
Frank Murkowski
Ted Stevens

Alaska State Government

Alaska Dept. of Commerce and Economic Development
Alaska Dept. of Environmental Conservation
Alaska Dept. of Law
Alaska Dept. of Natural Resources

- Alaska Governor's Office
- Alaska Dept. of Policy Development and Planning
- Governor, State of Alaska
- Honorable John B. Coghill
- University of Alaska - Anchorage Library
- University of Alaska

U.S. Government

- National Park Service
- U.S. Bureau of Land Management
- U.S. Corps of Engineers
- U.S. Environmental Protection Agency
- U.S. Fish & Wildlife Service

Organizations

- Alaska Center for the Environment
- Alaska Federation of Natives
- Alaska Miners Association
- Alaska Women in Mining
- Birch Creek Council
- Circle District Historical
- Citizen's Adv. Commission on Federal Areas
- Denali Citizens Council
- Klondike Placer Miners Association
- Northern Alaska Environmental Center
- Sierra Club
- The Wilderness Society
- Trustees for Alaska

Businesses

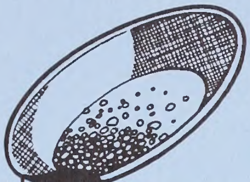
- Alaska Gold Company
- Alloy Welding & Machine
- Alyeska Oil & Exploration
- Anchorage District Recording Office
- Apocalypse Design, Inc.
- Bean Ridge Corporation
- Beaver Kwit'chin Corporation
- Clem's Backpacking Sports
- Danzhit Hanlaii Corporation
- Dinyee
- Dot Lake Native Corporation
- Doyon, Limited

Environlab
Fairbanks District Recording Office
Fairbanks Exploration
Fraley Equipment, Inc.
George Miller Construction, Inc.
Hungwitchin Corporation
Kachemak Mining Company
Little Squaw Gold Mining Company
Nerco Minerals Company
Ray Wolf Mining
Rife & McMillan
Robertson Mining Company
Russell/Norton/Drovin
Seth-de-ya-ha Corporation
T.C.C.
Tanacross, Inc.
Tihteet'Aii, Inc.
Tozitna, Limited
Usibelli Coal Mine, Inc.
Yukon Quest International, Ltd.

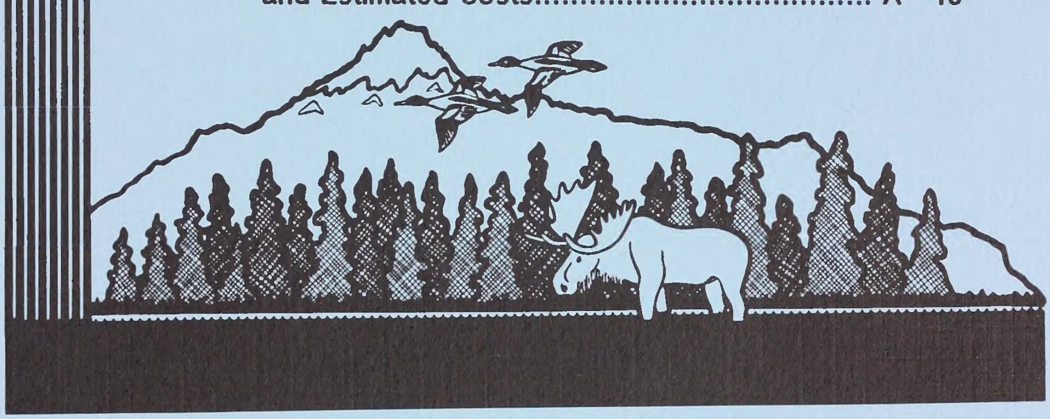
Libraries & Newspapers

Noel Wien Library
Alaska Resources Library
Z.J. Loussac Public Library

375 Individuals



Appendices



BEAVER CREEK

Appendices

Appendix A-1, Summary of Contractor Reports

1. Alaska Division of Geological and Geophysical Surveys (DGGS)

A cooperative agreement was entered into between the Bureau of Land Management (BLM) and the Alaska Division of Geological and Geophysical Surveys. The agreement provided additional funds and logistical support to DGGS for it to collect and analyze stream discharge, water quality, biologic information, and synthesis work during 1987. The agreement called for DGGS to attempt to evaluate the cumulative environmental effects of placer mining in the Birch Creek, Beaver Creek, and Fortymile River drainages. In addition, DGGS would also attempt to assess the cumulative impacts of mining on subsistence activities in the Birch Creek and Minto Flats watersheds.

Two reports were produced by DGGS, "Water quality and discharge data from selected sites in the Fortymile and Tolovana Drainages, Summer 1987," written by Stephen F. Mack, Mary A. Moorman, and Linda Harris, and "Compilation of Stream macroinvertebrate data for the Birch Creek, Beaver Creek, Fortymile, and Minto Flats drainages, Alaska," written by Mary A. Maurer. Additional data was supplied to the BLM on computer diskettes for stream discharge in the Tolovana and Fortymile drainages by Steve Mack and John Bauer, the latter from the Alaska Department of Environmental Conservation. BLM receipt of these products is considered to constitute completion of the project.

2. Alaska Department of Fish and Game (ADF&G)

The Alaska Department of Fish and Game Habitat Division was contracted to prepare a report for the BLM on the aquatic habitat for all watersheds addressed in Sierra Club v. Penfold. The contract also called for ADF&G to provide the BLM with extant data on computer disks in the Lotus 123 format regarding hydrogeology, water quality, and geochemistry in the four watersheds of concern.

A final report entitled "Aquatic habitat and fisheries for seven drainages affected by placer mining: Chatanika River, Tolovana River, Goldstream Creek, Birch Creek, Fortymile River, Beaver Creek, Minto Flats," was filed with the BLM in December, 1987.

3. Hagler, Bailly, and Company

Hagler, Bailly, and Company of Washington, D.C. was contracted to prepare an analysis of the economic and historical relationship of placer mining in Interior Alaska. The Hagler, Bailly study addressed the history of placer mining in the four watersheds, current status of the industry and its socio-economic impacts, and a projection of levels of future mining activity based on the results of research, synthesis, and interpretations of extant information. Hagler, Bailly, and Company subcontracted substantial portions of the study to L.A. Peterson and Associates of Fairbanks, Alaska. This work was facilitated, administered, and funded by BLM-Washington Office (680).

A draft report was sent to the BLM in December, 1987.

4. Environmental Services, Ltd. (ESL)

Environmental Services, Ltd. provided a "Model Environmental Assessment (EA)" upon which the BLM could base the preparation of EAs for each placer mining operation starting in 1988 as directed by order of the District Court in the Sierra Club lawsuit. A draft report was submitted to the BLM in December, 1987.

A second contract was entered into with ESL to provide BLM with data on wildlife for all four drainages. This report was provided to the BLM in January, 1988.

5. Arctic Hydrologic Consultants (AHC)

AHC was contracted by BLM to assess differences in water parameters between mined and unmined areas of Beaver Creek, Birch Creek, Fortymile River, and the drainages into Minto Flats (Chatanika River, Tolovana River, and Goldstream Creek.) AHC was also to provide a comparison of water quality values in mined areas with State and federal water quality regulations, as they apply to receiving water. In addition, AHC was to evaluate the state of the technology available for controlling wastewater quality at placer mining operations.

A final report dealing with Birch and Beaver Creeks and the Tolovana River was delivered to the BLM on February 29, 1988.

6. Peter E. K. Shepherd

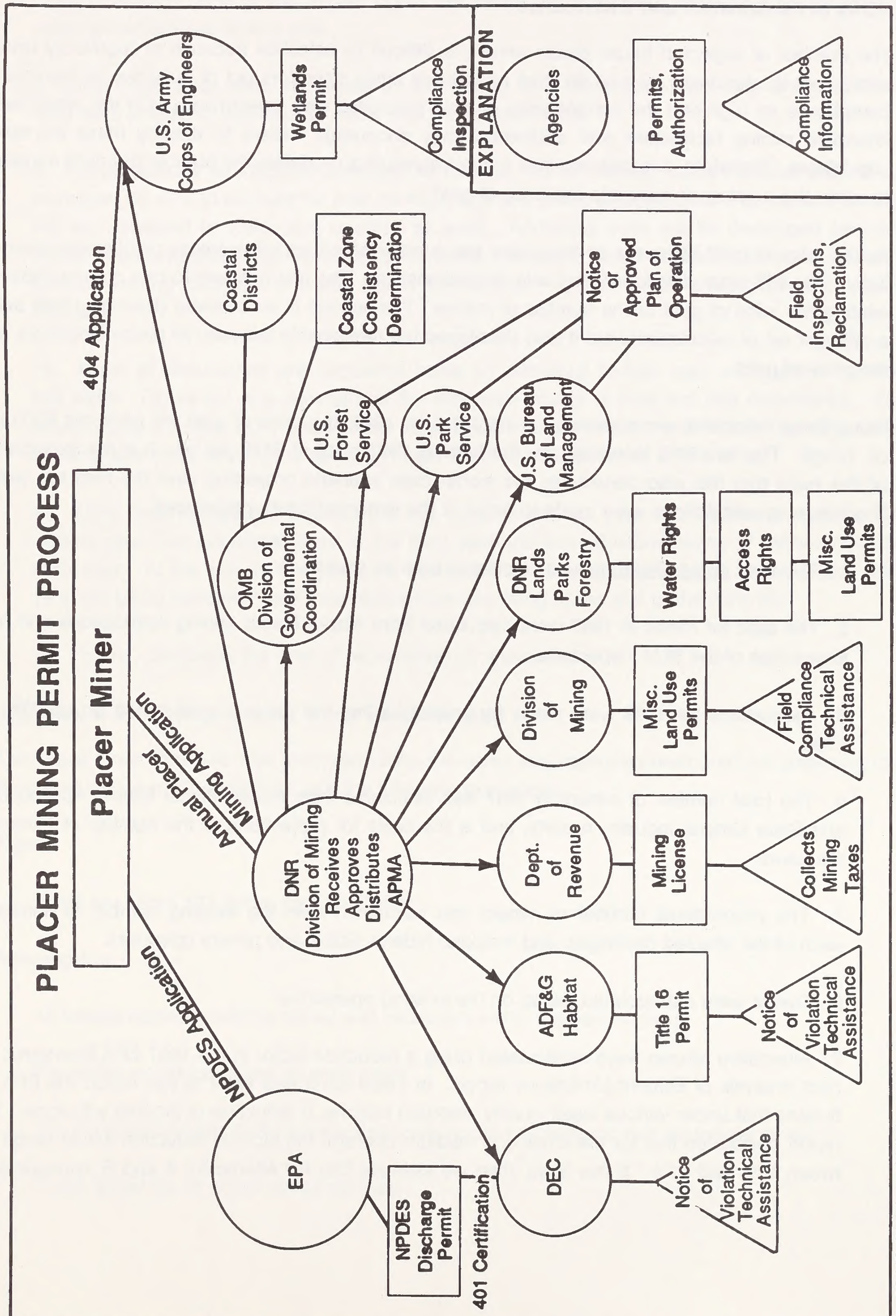
Mr. Shepherd prepared a report entitled "Impacts of Environmental Change on Minto Flats Subsistence Resources." The report examined the effects of placer mining on environmental habitats within the four watersheds and the relationship of those effects to subsistence uses and needs.

A final report was submitted to the BLM in January, 1988.

7. Dames and Moore

Dames and Moore was contracted to supply a report assessing the cumulative impacts of placer mining on the aquatic communities of the four watersheds. Additionally, Dames and Moore was to provide an assessment of the impact of placer mining within each stream basin on the aquatic communities of the receiving waters. A draft report was sent to BLM in February, 1988.

Appendix A-2, Placer Mining Permit Process



ADNR Division of Mining 3-8-88

Appendix B-1, Methodology for Forecasting the Future Number of Mines and Roads, and Acres of Reclamation and Disturbance

The number of expected future placer miners is difficult to calculate because of regulatory uncertainty; that is, standards may be so strict as to force many operators out of business, or the cost of compliance so high that the current price of gold precludes new investments. On the other hand, improved mining techniques and equipment may encourage miners to employ these increased capabilities. Therefore, it is believed that a good measure to estimate the number of future miners is to relate the number of miners to the price of gold.

As the price of gold increases or decreases the number of miners will increase or decrease accordingly. The EIS team developed two sets of relationships. The first is a one-to-one correspondence relating the price of gold to the number of miners. The second is an estimate (Bennett 1988) using a different set of calculations; but it also developed the relationship between all placer operators and the price of gold.

Using these estimates, we reasonably expect that by 1998, the price of gold will be in the $600 per oz. range. This is a 23% increase over the highest 1987 price of $475 per oz. It is the expectation of this team that this also constitutes the worst- case scenario projecting over the next ten years. The following calculations were made to arrive at the expected future projections.

1. The 1981 acres disturbed was calculated from air photos.

2. The data for mines in 1987 were calculated from Alaska Placer Mining Applications and field knowledge of the BLM inspectors.

3. Estimations for 1998 were made by projecting that the price of gold would go up 23% by 1998.

4. The total number of miners in 1987 was calculated from Alaska Placer Mining Applications, and State Mineral Industry reports, and is the basis for projections of the number of miners in the future.

5. The proportional number of miners was calculated from the existing number of miners in each of the affected drainages, and included federal, State, and private operators.

6. Trends were extrapolated based on the existing operations.

7. Alternative futures were recalculated using a reduction factor in the 1987 EPA Economic Impact Analysis of Effluent Limitations report. In Table VIII-3 and VIII-4 of this report the EPA estimates that under various water quality standard options, a reduction of income will occur. This report concluded that for the small and medium operator the income reduction would range between 13% and 27%. If this is so, then we estimate that for Alternative A and B approximately

13% of the miners would not be able to afford the added cost of compliance, and for Alternative C approximately 27% of the miners could not afford the cost. For Alternative D, no federal miner would operate at any cost.

8. Roads and trails were calculated by air photos, field inspections, and map analysis. The 1987 data is divided into federal, State, and joint components.

9. The projections for 1998 are estimated as follows: Current federal roads will exist and will be increased by 40% to account for new mining roads and reuse of existing mining roads. All trails will be converted to roads and counted as such. Additional trails will be developed for new mines. Roads and trails are reduced by the same 13% and 27% as discussed above to account for less mining because of water quality restrictions. Special notes are indicated for each drainage.

10. Acres of disturbance are calculated using an estimated 50-foot road width and a 30-foot trail width. Figure B-1 is a summary of the estimated effects of road and trail disturbance. Estimated disturbances from major State roads such as the Steese and Elliott highways, and housing and other developments along major rivers is not calculated in this table.

11. Mine disturbances are estimated at five acres in the first year, two additional acres in the second year, two additional areas in the third year and two additional acres of reclamation the third year. At the end of ten years we estimate that 23 acres of land will be disturbed, with 14 acres being reclaimed and total reclamation occurring at the end of the mine life.

12. Figure - discusses the cost of reclamation by alternative.

Appendix B-2, Assumptions for Worst Case Scenario

The Worst Case Scenario was analyzed using the same assumptions considered for analyzing the Proposed Action in Chapter Four with the following exceptions:

Fact

There are about 131 active Federal Claims

Assumption

All federal claims would be mined and reclaimed within the next 10 years

Ten acres would be mined on each claim

The Proposed Action performance standards would be used and met on federal claims

There would be 26 active mines per year

There would be five acres mined per mine

There would be 130 acres mined per year

There would be five acres reclaimed per federal mine annually beginning in the second year (130 acres reclaimed in years two through nine and 260 acres at the end of year 10

Approximately 1300 acres would be disturbed directly by mining activity during the 10 year period

Roads and trails would be built to all active claims

Appendix B-3, Methodology for Estimating the Administrative Cost of BLM's Surface Management Program and the Cost for Implementing Alternative D

The Steese/White District processed over 100 placer mining applications and inspected about 75 active mines during fiscal year 1987. For administrative cost estimation purposes, the cost of this program for fiscal year 1987 (approximately $175,000) has been divided into two parts, processing mining applications and field compliance, and has been used as the predictive model of the EISs. Considering the number of placer mining plans and notices processed, the amount of monitoring trips, and the compliance inspections completed, it was estimated that placer mining applications cost about $1,000 to receive, review, and process and about $800 to inspect each active mine. The $1,000 estimate includes the cost of conferring with applicants, onsite inspections, and preparing Environmental Assessments when necessary. The inspection costs include transportation, two monitoring visits, two inspection trips to the mine site, and preparation time for the compliance report. Both costs include between 10 and 15% overhead for management direction and training.

Administration of the Surface Management program under the Proposed Action would be a continuation of the program as administrated by the Steese/White District in Fiscal Year 1987. The estimated costs for processing a placer mining application and completing compliance inspections under the Proposed Action would be $1,000 and $800, respectively, for a total of $1,800 per mine.

Alternative A would place less emphasis on reclamation standards than does the Proposed Action, so it was assumed that the lower reclamation standards would require fewer mine site inspections to ensure compliance and would result in an estimated 50% reduction in cost of compliance. Therefore, the costs for processing a placer mining application and completing compliance inspections under Alternative A would be $1,000 and $400, respectively, for a total of $1,400 per mine.

Alternative B would place greater emphasis on reclamation standards than Alternative A and proposes a greater level of compliance inspection than in the Proposed Action to ensure compliance with customary and proficient mining practices and reclamation performance standards; therefore, a 50% increase in inspection costs was estimated. The greater level of compliance inspection could include increased inspector training or move frequent inspections. The costs for processing a placer mining application and completing compliance inspections under Alternative B would be $1,000 and $1,200, respectively, for a total of $2,200 per mine.

Alternative C would require more stringent performance standards than the other alternatives, so a 100% increase in the compliance cost of the Proposed Action was estimated to be necessary to ensure compliance with these strict standards. An increase in BLM compliance cost would be attributed to additional inspector training, a greater number of compliance inspections, and some additional costs attributed to the COE for the enforcement of reclamation standards. The costs for processing a placer mining application and completing compliance inspections under Alternative C would be $1,000 and $1,600, respectively, for a total of $2,600 per mine.

Validity exams would be conducted on all properly filed mining claims (roughly 131 claims in the Beaver Creek drainage) and appraisals would be completed on all valid claims (all claims were assumed to be valid) in Alternative D. Conducting and completing validity exams and appraisals were estimated to cost about $2,000 per claim, or approximately $262,000 for evaluating all of the claims in the Beaver Creek drainage. The $2,000 claim evaluation cost was based on actual expenditures for similar evaluations conducted in the Nome Creek drainage during the summer of 1987.

The net present value (NPV) of each claim was estimated by discounting minimum and maximum claim values over a 10-year period, using a 10% discount rate. The minimum and maximum claim values were estimated by making the following assumptions:

Minimum Claim Value

- Net pay gravel thickness was three feet.
- Ten acres of each claim contained gold-bearing gravel.
- Minimum pay gravel value was $4 per cubic yard.
- Claim was mined out sometime within next ten years.
- A 10% profit for the mining operation was realized.

Maximum Claim Value

- Net pay gravel thickness was nine feet.
- Ten acres of each claim contained gold-bearing gravel.
- Maximum pay gravel value was $15 per cubic yard.
- Claim was mined out sometime within next ten years.
- A 25% profit for the mining operation was realized.

Using these minimum and maximum claim value assumptions, the gross values of gold mined would be approximately $194,000 and $2,178,000 respectively. Since the timing of the mining activity was unknown, the profit from the mining operation was spread equally over a 10-year period. This cash flow was then discounted at an annual rate of 10% to determine the NPV. The NPV for the minimum claim values would be about $12,000 and the maximum claim value would be about $335,000. The minimum and maximum NPVs for all 131 claims in the Beaver Creek drainage are $1,572,000 and $44,000,000, respectively. This simplistic approach to determining NPV values was developed to present the magnitude of values that could be expected if the BLM selected Alternative D. The estimated claim values may not include the extreme minimum and maximum values that could exist on some claims.

Appendix C-1, Geologic Time Scale

GEOLOGIC TIME SCALE			
Era	System or Time Period	Series (rocks) or Epoch (time)	Approximate Age in millions of years (beginning of unit)
Cenozoic		Holocene	0.01
	Quaternary	Pleistocene	1.7 to 2.0
		Pliocene	5 to 6
		Miocene	25 to 27
	Tertiary	Oligocene	37 to 39
		Eocene	53 to 54
		Paleocene	63
Mesozoic	Cretaceous		136 to 138
	Jurassic		190 to 195
	Triassic		225
Paleozoic	Permian		270 to 280
	Carboniferous		345 to 350
	Pennsylvanian		
	Mississippian		
	Devonian		395 to 420
	Silurian		440 to 450
	Ordovician		ca. 500
	Cambrian		ca. 570
Precambrian			

Source: from Principles of Geology. 1975; Gilluly, James [and others]; San Francisco, CA; W.H. Freeman and Company; page 77.

Appendix C-2, Recreation Methodology

The concept of the value of river recreation use is based on the economics of consumer demand. A detailed examination can be found in "Wild and Scenic River Economics: Recreation Use and Preservation Values" by the American Wilderness Alliance. They indicate that three methods recommended by an interagency committee of the U.S. Government provide acceptable economic measures of the value of recreation (Water Resource Council 1979, 1983). The three methods were travel cost, contingent valuation, and unit day. In the above report, the unit day value was found most satisfactory.

In this method the U.S. Water Resources Council (WRC 1982) recommended a range of values from $6.10-$17.90 per day of specialized recreation. They included as criteria for rating specialized recreation: 1) quality of the recreation experience as affected by congestion, 2) availability of substitute areas within (x) hours of travel, 3) carrying capacity as determined by levels of activity development, 4) accessibility as affected by roads and parking conditions and, 5) environmental quality, including forest, air, water, pests, climate, adjacent areas,and scenery.

The WRC values are comparable to the calculations of outdoor recreation unit day values recommended by the Forest Service, Rocky Mountain Region, 1985. BLM recreation visitor use data (Alaska State Office) are used to estimate the total visitor values. Although specific Alaska recreation costs may be higher, the present valuation is an adequate tool for computing computing expected values.

The data is calculated basin-wide and needs to be viewed in that context when estimating the value of water-based recreation on the Wild and Scenic Rivers. The following is background information for recreation statistics:

1. Visitor use statistics are collected and reported by Districts for specific Special Recreation Management Areas (SRMS).

The four EIS's areas fall into the following areas:

AK08001	White Mountains/Beaver Creek	1,000,000 acres
AK08002	Fortymile River	243,000 acres
AK08004	Steese NCA/Birch Creek	1,220,000 acres
AK08005	Yukon Extensive Areas	5,000,000 acres

Minto Flats and the acreage surrounding the Fortymile fall into the Yukon Extensive Management areas, but little or no data are collected by BLM. Any further breakdown or interpretation of the RMIS data will have to be done by the District staff.

2. Visitor use statistics supplied for RMIS for these areas generally have a reliability factor of "three", or low validity based on "best guess." Some statistics have a "two", or medium validity, which is based partially on primary or secondary sources and on reliable observations..

3. This methodology is only "best guess of reported visitor use."

4. Growth of the visitor use will not change based on a yearly rate, but site-specific growth will be created by other management actions:

On Beaver Creek, any improvement of the Nome Creek Road, or other access routes associated with mining will increase that use significantly. In the White Mountains, expansion of the cabin system will increase visitor use by expanding winter visitation opportunities.

On Birch Creek, improvement of the turbidity of the water will increase visitor use.

On Fortymile, Birch Creek, and Beaver Creek, increased visitor information, such as brochures, news articles, etc. will increase awareness and visitor use.

Use will increase without these actions, but each management action which improves access, provides facilities, or promotes use through visitor information, will increase use over and above any straight percentage figure.

5. Other Recreation Value. In addition to the recreation values indicated above, it is commonly accepted that "nonuse preservation values" of river values should be added to the total economic benefits of rivers to society. Studies such as "W&S River Economics, Colorado" determined that the general population may be willing to pay for the preservation of unique natural environments, and that their option, existence, and bequest values should be added to the unit day value, which is being estimated.

In this EIS, it is impossible to determine these nonuse values, since analysis is an involved process evaluating the river values and characteristics in a regional approach by State and Federal river managers.

D-1 Landcover Methodology

Analysis of acreages affected by mining and reclamation were based on projected disturbance from mining and associated mining access roads and trails (Figure 4-1).

1. Acreages for pre-1981 disturbance were interpreted from NASA high-altitude aerial photos taken from 1978 through 1981. The acreages correspond with figures for tailings given in Wolff and Thomas (1982) for Livengood and Crooked Creek. The aerial extent of disturbance interpreted from the photos probably underestimates total disturbance since the acreages were calculated from areas that still show evidence of tailings piles and barren ground.

2. Figures taken from 1987 APMAs show that approximately 50% of mining disturbance on federal claims in the Birch Creek watershed was on old dredge tailings, and 50% on new, previously unworked ground. This proportion was extended to Beaver Creek to calculate the acreage of mining which would be on "new" ground and "old" tailings.

3. Old dredge tailings in Nome Creek are 80-90% barren or sparsely vegetated after 40 years of natural regrowth. A figure of 85% was used to estimate barren acreage for mining activity on old dredge tailings, and 15% for revegetation on old tailings. Dredge tailings are "clean," with a very small percentage of fine materials remaining in the gravel tailings.

4. Mining disturbance on new ground is estimated to result in a 60% vegetation cover after reclamation and regrowth, with 40% remaining barren.

5. Mining disturbance on new ground which is not reclaimed is estimated to result in 75% barren, with a 25% vegetated cover after approximately 40 years. Washplant tailings have a greater proportion of fine-grained materials than dredge tailings.

6. Disturbed areas on dredge tailings would be extensively reclaimed with Alternative C. The addition of fine materials, fertilizer, and possible seeding would increase vegetative cover after regrowth. This level of reclamation is estimated to result in 50% vegetative cover, with 50% remaining barren.

7. Roads are assumed to remain barren, while trails are considered to be changed in vegetative cover and composition, but not rendered barren.

8. Total acreages for each alternative were calculated by adding historic disturbance, projected disturbance with associated regrowth for each alternative, and the contribution from roads or trails. Estimates for acreages for all alternatives are in Figure 4-1.

Appendix D-2, Recommended Mitigation Measures for Wildlife

Guidelines for development of measures to mitigate impacts to wildlife resources included prioritization of the types of mitigation. The highest priority was to avoid the impact, a lesser priority was to minimize or rectify the impacts, and last priority was to replace the impacted resource. On-site or in-basin mitigation within the stream or drainage where the impact occurred was favored, as was "In-kind" mitigation, where the impacted species would be replaced by the same species thereby reducing potential disruptions to the system's ecology and harvest management problems.

The type of management control or mitigation required for any impact depends on the type and extent of the impact, and the magnitude of the effects. Therefore, each impact needs to be well defined before specific mitigation measures can be identified. Based on identification of the impacts, expected short-term (5- 10 years), continuous or long-term (up to 20 years or beyond), and unpredictable impacts are the types that will require mitigation. Potential measures suitable for mitigating short-term and continuous or long-term impacts resulting from the distinct components of the Proposed Action and alternatives are presented in the figure in this appendix. The potential mitigating measures listed for each mining action component are technically feasible and are considered appropriate for the anticipated magnitude of impact.

In order to provide an appropriate level of mitigation for any impact, the extent and magnitude of the impact effects on the wildlife resource must be known. The figure in this appendix summarizes expected impacts and provides an estimate of effects on the wildlife resources. In some cases, impacts cannot be precisely estimated due to their complexity, lack of information, or the low probability of their occurrence. Additional information is then required to develop suitable mitigation. In those instances, the potential impacts will need to be measured through an impact monitoring program designed to detect changes in biological and/or physical parameters. Changes that exceed some maximum acceptable level or threshold (as determined by the regulatory agency or agencies) would trigger a mitigation response plan. This plan can be developed for expected short-term impacts, continuous or long-term impacts, as well as potential impacts. A monitoring program could be implemented to 1) more accurately determine the impacts to the present and potential future population of a species, 2) determine timing, extent and duration of habitat(s) lost, 3) evaluate the effectiveness of habitat replacement or reclamation, and 4) determine the need for possible modification of previous management decisions. This long-term wildlife/mining impact monitoring

Mineral development action component	Habitat impact	Potential effect	Potential mitigating measure	Effectiveness
ACCESS				
Construction of permanent gravel roads	Habitat loss	Reduction in numbers	– Locate crucial use areas – Plan road alignments to avoid crucial areas	Would avoid or minimize loss of crucial habitat
Use of roads/trails	Disturbance/ disruption	– Alter habitat use – Increased harvest	– Locate crucial use areas – Plan trail alignments to avoid crucial areas – Restrict or alter timing, location & extent of activity – Monitor use of roads/trails – Monitor human use conflicts in crucial habitats – Monitor human use of wildlife resources – Coordinate with ADF&G	– Would avoid or minimize disturbance/disruption of wildlife use areas – Would provide information about effects, effectiveness of mitigation & accuracy of impact predictions – Would keep ADF&G informed
Potential upgrading & more roads/trails	Increase in habitat loss, disturbance/ disruption	Increase in above potential effects	– Locate crucial use areas – Plan trail alignments to avoid crucial areas – Restrict or alter timing, location & extent of activity – Monitor use of roads/trails – Monitor human use conflicts in crucial habitats – Monitor human use of wildlife resources – Coordinate with ADF&G	– Would avoid or minimize disturbance/disruption of wildlife use areas – Would provide information about effects, effectiveness of mitigation & accuracy of impact predictions – Would keep ADF&G informed
FACILITIES				
Construction of gravel pads, etc.	Habitat loss	Reduction in numbers	– Locate crucial use areas – Plan facility locations to avoid crucial habitats – Reclaim/replace lost habitat (see below)	– Would avoid or minimize loss of most crucial habitat – Would replace wildlife habitat in 5 – 50 years (see below)
Human habitation of facilities	Disturbance/ disruption	Alter habitat use	– Restrict or alter timing, location & extent of activity – Monitor human use conflicts in crucial habitats	– Would avoid or minimize disruption in crucial habitats
Solid waste disposal	Remove nuisance animals	Reduction in numbers	– Dispose of garbage & other waste in a manner to not attract wildlife – Comply with ADEC solid waste disposal regulations	Would avoid or minimize attraction of bears & other wildlife
OPERATIONS				
Stripping, mine cuts, stockpiles, settling basins	Habitat loss	Reduction in numbers	– Locate crucial habitats – Plan operations actions to avoid crucial habitats – Monitor overall habitat losses – Monitor reclamation effectiveness	– Would avoid or minimize loss of some crucial habitats – Would provide information about effectiveness of mitigation & accuracy of impact predictions

CONTINUATION

Mineral development action component	Habitat impact	Potential effect	Potential mitigating measure	Effectiveness
OPERATIONS cont'd				
Stripping, mine cuts, stockpiles, settling basins	Habitat loss	Reduction in numbers	– Reclaim by recontouring, respreading fines & topsoil, fertilize &/or reseed &/or replant willows[1] – Reclaim by recontouring, respreading available topsoil, natural succession[2] – Reclaim by stabilizing to prevent erosion, natural succession[3] – Reclaim by recontouring, respreading fines & topsoil, natural succession[4] – Reclaim by recontouring, respreading fines, fertilize &/or reseed with native plants (no shrubs)[5]	– Would replace habitat in 5 – 25 years[1] – Would replace habitat in 50 years – Would replace habitat in 50 years – Would replace habitat in 30 – 50 years – Would replace habitat in 25 – 35 years
Operation of machinery	Disturbance/ disruption	Alter habitat use	– Restrict or alter timing, location & extent of activity – Monitor operations disturbance/disruption in crucial habitats	– Would avoid or minimize disturbance/disruption in crucial habitats
Fuel spills Hazardous materials	Habitat loss	Reduction in numbers	– Response plan to contain, neutralize & clean up – Comply with ADEC hazardous materials regulations	– Would avoid or minimize size, extent & duration of habitat loss

[1] Source: Sisk, unpublished data
[2] Specified in Proposed Action and Alternative D
[3] Specified in Alternative A
[4] Specified in Alternative B
[5] Specified in Alternative C

General effects of mineral development actions and their potential mitigation measures.

program would be conducted cooperatively by BLM and ADF&G to provide information regarding the effects of mineral development activities, adequacy of mitigative measures (i.e. reclamation) and accuracy of impact predictions.

The timing and location of unpredictable impacts, such as a hazardous material spill, are unknown, so a monitoring program is not feasible. However, implementation of a pre-determined mitigation response plan to contain, neutralize, and clean up the impacted area is possible. A follow-up assessment of biological impact, reclamation, and replacement could then be implemented. The Alaska Department of Environmental Conservation has prepared a hazardous material spill contingency plan.

When specific mineral development actions are proposed in the area, a site-specific analysis of effects will be developed through the environmental assessment process, as required by the National Environmental Policy Act and the Surface Management Regulations (43 CFR 3809). As a result of this process, restriction or alteration of timing, location and extent of a mineral development activity may be required to avoid or minimize adverse effects and/or to avoid unnecessary or undue degradation. Possible crucial habitats, and timeframes, that surface or aerial use restrictions may be required by BLM, are listed in Table 9-1 and 9-2 of the Record of Decision for the Resource Management Plan for the White Mountains National Recreation Area (DOI 1986).

Mitigative measures to replace/reclaim habitat that has been altered, removed, or lost as a result of mineral development activities are an inherent part of the Proposed Action and each Alternative (Section 2.5). Measures can be incorporated into the restoration techniques required in order to enhance the recovery process of wildlife habitat. For example, materials can be sorted as part of the mining operation, with larger materials deposited in the lower reaches of tailings and smaller materials above. This is especially important in previously mined tailings where there is no layer of overburden and top soil. Durst (1984) found that revegetation will be enhanced if the recontouring effectively reduces the slope of tailings, and reduces the height of tailing above the water table. In addition, plants will colonize more readily if recontouring leaves a "patchy" landscape that includes low wet spots with gentle slopes and hummocks. In cases where topsoil and/or fines are very limited, better results may generally be obtained by spreading these materials in a patchy manner than by evenly spreading them over only part of the area to be reclaimed. The varying degrees and effectiveness of the reclamation efforts required by the Proposed Action and each alternative have been incorporated into the analysis and are discussed in their respective sections (see Sections 4.6.1- 4.6.5). The success of reclamation varies from site to site and depends on elevation, aspect, slope, soil, water, and many other factors.

Appendix E-1, Methodology for Sediment

In 1973, the EPA estimated the various erosion rates from various land uses. While this data is based on nationwide rates and does not specifically represent Alaska, it does provide a set of parameters that can be used as a comparison. This comparison focuses on the relative contribution of ongoing and historic placer operations; proposed future contributions may thereby be placed in perspective.

One of the reasons to use this type of methodology is the issue of data. In theory, it is possible to calculate the sediment that can be put into a stream and predict the amount that will pass by a point downstream. In practice, such a task is difficult, requiring a considerable amount of sediment, hydraulic, and hydrologic data. More specifically, the types of soils, ground cover, slope and aspect, nature of the operation, microclimate precipitation, and a host of other variables suggest that an overall approach be developed for comparative purposes. This data is not available for the enjoined watersheds, except for some limited data on Birch Creek (Dames and Moore 1986). The EIS team developed their own approach using the EPA data, then compared it to the Birch Creek data:

1) EPA (1973) estimated the representative rates of erosion from various land uses in annual tons per square mile to be:

Forest	24
Abandoned surface mines	2,400
Harvested forest	12,000
Active surface mines	48,000
Construction	48,000

2) EPA methodology does not identify the relative contributions to water courses or normal sediment traps.

3) Acreage figures were used from ongoing and projected disturbances and converted to a square mile ratio.

4) Representative rates and areas were multiplied to get suggested comparative rates.

5) Some specific assumptions were made, which in the final analysis means that our projections probably overstate the actual magnitude of the problem. The assumptions include:

a. Forest lands are estimated to be 90% of the basin, and forest cover is defined as all covered ground.

b. No regrowth and regeneration occur on previously disturbed lands.

c. Disturbances continue past 1998 but reclamation will occur at the end of the mining operation.

d. Construction of roads and other development will contribute less sediment on successive years, but this is not calculated here.

6. Figure 3-2 is a summary of this evaluation.

7. When compared to Birch Creek (Dames and Moore 1986) the following generalizations can be made:

a. The average estimated sediment load for two undisturbed basins (Boulder Creek - 30.47 square miles and Bedrock Creek - 10.35 square miles) was 0.0010 and 0.0038 tons per square mile, respectively. If these rates are projected to the entire Birch Creek drainage, and figured on a 24-hour day and a 200-day season, the projected sediment rates are 11,234.6 and 42,774.1 tons per day season. This is compared to our idealized sediment from forests of 46,224 tons per year.

b. The average estimated sediment load for Birch Creek at the Steese Highway (which includes all mined areas) was 0.014 tons per hour per square mile during the 1985 field season. For projection purposes, all things being equal, using the Dames and Moore (1986) study, the BLM would estimate that, based on a 200-day season, about 143,800 tons of sediment would find its way past the bridge monitoring station. The idealized sediment rates were calculated to be 202,820 tons per year. So the BLM estimates, in a very general qualitative way, are within about 30% of the calculated values of the Dames and Moore study.

8. Tons of sediment per year and tons of sediment for an Alaska 200-day season are converted to tons per day.

Appendix E-2, Staking and Operating a Federal Mining Claim

The following paragraphs tell how to locate a Federal mining claim and what the BLM's requirements are for operation on a claim.

A certain degree of background research is necessary to identify what general area a prospective miner may be interested in. The interested party must identify where, by legal land description, he/she intends to conduct activities. Examination of a 1:150,000 (E series) map will aid in the proper identification of BLM lands and, when used in conjunction with the master title (MT) plats found in the public room, will help identify lands open to mineral entry. Proper identification and marking of the prospect on a topographic map to more clearly define the area of interest will aid the proponent in finding the lands of interest in the field.

After determining where the desired location is, the proponent must travel to the actual site and determine if any location markers exist. If not, the claim must be "located" by establishing clearly visible location posts or markers and then recording the claim with the proper authorities, i.e., the State of Alaska's Recording Office and the BLM (of course, a prospective miner can take a chance and not go through the process of claim location, but he/she then runs the risk of having someone else staking (locating and recording) the claim and being legally able to force them off the claim.) Once a claim is properly located and recorded, $100,000 worth of assessment work must be performed on the claim every year with proof of the work performed filed by December 30th annually with the BLM. If this is not accomplished and the claimant desires to keep his/her claim, he/she must file with the BLM by December 30th annually a Notice of Intent to Hold.

While it is to the advantage of any prospective miner to legally locate and file his/her claim there is no requirement that a miner must do so prior to conducting mining activities.

The filing of a Notice, as per 43 CFR 3809.1-3, is required of any operator (other than casual use operators or recreational miners as described in 43 CFR 3809.1.2) whose facilities disturb 5 or less acres. A Notice filing must include the name and mailing address of the mining claimant and operator, if other than the claimant; when applicable, the name of the mining claim(s); a statement describing the activities proposed and their location in sufficient detail to locate the activities on the ground; the approximate date of the onset of the activities; a description of the access routes to be constructed; a description of the equipment to be used; a statement that all reclamation of disturbed areas will be accomplished in accordance with 43 CFR 3809.1-3(d); and a statement that reasonable measures will be taken to prevent unnecessary or undue degradation of the Federal lands. No recommended format for the Notice exists. (This portion may be under judicial review by the District Court).

The filing and approval of a Plan of Operations, as per 43 CFR 3908.1-4, is required of any operator whose facilities disturb more than 5 acres. A Plan filing must include the above listed information as well as a map, preferably topographic, showing existing or proposed routes of access, aircraft landing areas, or other means of access, and size of each area where surface disturbance will occur; and measures to be taken during extended periods of non-operation to maintain the area in a clean and safe manner and to reclaim the land to avoid erosion and other adverse impacts.

BLM may do the following things to ensure compliance with the reclamation of mining sites: [see other agency permits (Chapter One)

- Conduct field compliance inspections/monitoring
- Develop reclamation plans with the operator/claimant
- Develop mitigative measures/site specific stipulations
- Require mandatory bonding
- Seek court intervention
- a. Temporary restraining order
- b. Injunction from further activity
- Institute fines or civil penalties
- Perform reclamation ourselves and go to court to recover costs from the operator/claimant

Appendix E-3, Comparison of Reclamation Requirements and Estimated Costs

Reclamation Requirements				
Proposed Action	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Grade tails, stabilize soils, stabilize streams, bypass	Grade tails, stabilize soils, stabilize streams,	Grade tails, spread soils, overcontour tails stabilize stream bypass	Reseed and fertilize, reestablish stream channel	No mining, post-1981 unreclaimed, ground to follow Alt. A standards
Cost Per Acre in 1987 Dollars				
Proposed Action	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
$500-tailings $500-soils	$500-tailings	$500-tailings $500-soils	$500-tailings $500-soils $250-fertilizer $100-seed $350-stream	$500-tailings
$1,000 total	$500 total	$1,000 total	$1,700 total	$500 total

Comparison of reclamation requirements and estimated costs. Sources: Reclamation Research Plans for Alaska National Park System Units. 1986: Alaska Department of Natural Resources. Division of Mining: Bureau of Land Management estimates.

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Glossary

Active Mining Claim: A current BLM mining claim in which all assessment and other requirements have been met, although no active mining may be taking place.

Alevius: A newly hatched salmon with yolk sac still attached.

Allochthonous: Formed elsewhere and transported from a distance.

Alluvial fan: A low, outspread mass of loose rock material shaped like an open fan deposited by a stream at the place where it issues.

Alluvium: Deposits laid down by modern rivers and streams.

Anadromous: Aquatic organism migrating from marine waters to freshwater to spawn.

Alteration Zone: An area being modified or changed in any noticeable way.

Aquifer: A body of rock that is sufficiently permeable to convey ground water and to yield economically significant quantities of water to wells and springs.

Areal: A multi-leveled or spatial relationship between two or more resources.

Aspect: A particular status or phase in which something appears or may be regarded.

Association: In an abstract sense, a group of communities or stands that are classified together because they meet certain standards of similarity.

Aufesis: An ice feature formed by water overflowing onto a surface, such as river ice or gravel deposits, and freezing.

Batholith: A large plutonic mass that has more than 40 square miles of surface exposure and no known floor.

Benthic: Relating to or occurring at the bottom of a water body.

Biomass: Amount of living matter as in a unit area or volume of matter.

Biotite: A general term to designate all iron and magnesium- bearing micas.

Braided Stream: A stream flowing in several dividing and reuniting channels resembling the strands of a braid. Typically within a wide floodplain.

Bryophytes: Non-flowering plants comprising of the mosses and liverworts.

Burin: A steel tool with an oblique point and rounded handle for carving stone, or a prehistoric chisel-like flint tool.

Candidate Species: Those species (plant or animal) included in the Federal Register "Notice of Review" listing that are being considered by the FWS for listing as threatened or endangered species.

Chaining: Cultivating implement used to spread and distribute debris; usually devised of link chains.

Channelize: A non-natural rerouting of a stream course.

Cirque: A deep, steep-walled, half-bowl-like recess situated high on the side of a mountain and commonly at the head of a glacial valley and produced by the erosive activity of a mountain glacier.

Classification: Separation of materials by size.

Clay: Sediment particles between 0.002 and 0.004 mm in equivalent spherical diameter.

Climax: A more or less stable biotic community which is in equilibrium with existing environmental conditions and which represents the terminal stage of an ecological succession.

Coagulation: A chemical process that reduces turbidity in a water body.

Code of Federal Regulations (CFR): Regulations promulgated and enforced by federal agencies which have the full force of law.

Coliforms: Relating to, resembling, or being a bacilli that resides in vertebrate intestines.

Colluvial: Soil material, rock fragments, or both, which have been deposited at the base of a steep slope by creep, slide, or local wash.

Comminute: To reduce to minute particles or pulverize.

Community: Any group of organisms belonging to a number of different species that co-occur in the same habitat or area and interact through trophic and spatial relationships, typically characterized by reference to one or more dominant species.

Critical Viewsheds: A unit within a National Wild River that has special considerations.

Crown Fire: A fire that burns mainly the top foliage of trees or shrubs.

Crustose: Having a thin thallus, adhering closely to a substratum of rock, bark, or soils.

Cryofibrist: An organic soil material (peat) formed under cold conditions.

Cryogenic: A soil formed under cold conditions, literally "cold genesis."

Cumulative Effects or Impacts: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

D2: Refers to Section 17(d)2 of the Alaska Native Claims Settlement Act.

Deciduous: To fall off or shed annually, seasonally, or at a certain stage in the life cycle.

Dendritic: A stream pattern characterized by irregular branching in all directions.

Detritus: Material released by weathering processes and subsequently transported and deposited as sediments.

Dike: A tabular igneous intrusion that ducts across the structure of the surrounding rock.

Disclimax: An ecological succession maintained below climax by climatic instability, fire, grazing, or by the activities of man.

Ecosystem: The Community including all the component organisms together with the abiotic environment, forming an interacting system, e.g., a marsh.

Ecotone: The boundary or transitional zone between adjacent communities or biomes.

Endemic: Native to or restrictive towards a particular type of habitat, locality, or region.

Environmental Assessment: This document is prepared for actions not exempt from NEPA, not categorically excluded, not adequately covered in an existing RMP/EIS or other environmental analysis, and not normally or obviously requiring an EIS.

Ericaceous: Refers to the heath family of plants. Heaths are dwarf woody shrubs, including such species as blueberries, cranberries, mossberries, etc.

Federal Land Policy and Management Act (FLPMA): BLM's "organic act" which serves as the basic law providing direction for lands and minerals management under its jurisdiction.

Federal Register: A publication system used to inform the public of Federal regulations, proposed regulations, and to provide for the publication of agency statements of organization, procedural rules, and general policy.

Felsic: An igneous rock containing light minerals such as quartz, feldspars, feldspathoids and muscovite.

Fingerling: A fish up to one year of age; between the fry and smolt stage.

Fines: The smaller-grained particles of soil or gravel, usually consisting of fine sand, silt, and clay.

Flaggy: A soil characterized by coarse rock fragments that are flat, thin, and angular, with dimensions of six to 15 inches.

Flocculation: A chemical process that causes clay particles to stick together, making them settle out faster and reduce turbidity.

Fluvial: Produced by river or other stream action.

Foliose Lichens: Lichens having a flat, thin, and usually lobed thallos attached to a foundation.

Forb: Any herbaceous plant which is not a grass or sedge.

43 CFR 3809: Regulations which set forth policies and procedures providing for mineral entry, exploration, location, operations and purchase pursuant to the mining laws in a manner that will not unduly hinder such activities, but will assure that these activities are conducted in a manner that will prevent unnecessary or undue degradation and provide protection of non- mineral resources of the Federal lands.

404 Permit: The 404 guidelines are the substantive criteria used in evaluating discharge of dredged or fill material under Section 404 of the Clean Water Act.

Freshet: A great rise or overflowing of a stream due to heavy rains or melting snow.

Frost Boil: A small area of upward movement of soil or inorganic material caused by the freezing and thawing of free water in the soil.

Fruiticose: More or less shrub-like.

Fry: A recently hatched fish that has used up the yolk cas, and has emerged from gravel and is ready to feed.

Gel Long: A chemical treatment that settles out suspended solids from effluent water before releasing it into a stream.

General Mining Law of 1872: Provides for exploration, development, production, and purchase of mineral resources of the public lands, as well as the implied right of statutory access to mining claims.

Giardia: Infestation or disease caused by a flagellate protozoan.

Graminoid: Refers to an herb with long, narrow leaves, i.e., grasses and sedges.

Gravimetric: Analysis which pertains to a measurement by weight.

Harrow: A cultivating implement with spikes, spring teeth, or discs, and used primarily for smoothing and distributing soil.

Herb: A plant with one or more stems that die back to the ground each year; grasses and Forbs as distinct from shrubs and trees.

Hydrology: The study of the origin, distribution, and properties of water on or near the surface of the earth.

Hydrostatic Pressure: Pressure exerted or transmitted by fluids at rest.

Ice wedge: Wedge-shaped ground ice produced in permafrost, occurring as a sheet, dike, or vein tapering downward. It originates as the growth of frost or by the freezing of water in a narrow crack or fissure.

Invasion: The Migration and Establishment of an organism in a new location.

Karsting: An irregular limestone region with sinks, underground streams, and caverns.

Lacustrine: Pertaining to, produced by, or formed in a lake or lakes.

Legume: A plant belonging to the pea family (Leguminosae).

Listed Threatened and Endangered Species: A species (plant or animal) that is officially recognized by FWS as being threatened or endangered.

Lithic: A medium-grained sedimentary rock containing abundant fragments of previously formed rocks; also said of such fragments.

Loam: Soil material that is seven to 27% clay particles, 26 to 50% percent silt particles and less than 52% percent sand particles.

Lode: A vein containing important quantities of metallic ore and filling a well-defined fissure in the rock.

Mafic: Igneous rock composed chiefly of one or more dark iron and magnesium-bearing minerals.

Management Framework Plan: A planning decision document prepared before the effective date of regulations implementing land use planning provisions of FLPMA which provides interim management until replaced by the RMP.

Massif: A principal mountain mass.

Management Goal: Goals that have been developed through the planning processes of BLM and other agencies for the watersheds being considered.

Master Title Plats: Maps displaying lands status of lands managed by the federal government.

Megafauna: Living or fossil animals large enough to be seen with the naked eye.

Metasedimentary: Sediment or sedimentary rock that shows evidence of being subjected to physical and chemical conditions below the earth's surface.

Mineral Soil: Soil composed mainly of inorganic materials and with only a relatively low amount of organic material.

Mining Technique: Methods used by miners to operate their mine. This includes activities such as exploration, access, development, mineral extraction, and reclamation.

Moraine: 1. Solidified volcanic debris carried on the surface of a lava flow. 2. A mound, ridge or other distinct accumulation of glacial drift deposited chiefly by direct action of glacial ice.

Morphology: A branch of biology or paleontology that deals with the form and structure of animals and plants, or their fossil remains.

National Environmental Policy Act (NEPA): This Act establishes a national policy for the protection and enhancement of the environment. Federal agencies are directed to develop methods and procedures that ensure the unquantified environmental values are given appropriate consideration in decisionmaking as are economic and technical considerations.

National Recreation Area: A federally managed area which involves the protection, regulated use, and development of public lands for recreational enjoyment.

Native: Indigenous; living naturally within a given area; used of a plant species that occurs at least partly in natural habitats and is consistently associated with certain other species in these habitats.

Non-Point Source: All turbidity, suspended sediment. and sedimentation resulting from soil erosion caused by human activity and emanating from a widespread area.

Notice: A Notice must be filed by all mining operators whose operations, including access across federal lands to their claim, cause a cumulative surface disturbance of five acres or less during any calendar year.

Notice of Intent: A public notice stating that an environmental impact statement will be prepared and considered.

Orographic: Relating to mountains, ie., precipitation caused by uplift of an air mass over a mountain range.

Oxbow Lakes: Remaining lakes that were once a part of a river channel, but are now isolated from the main stream. Most resemble a bent or U-type configuration.

Peltic: 1. Pertaining to or characteristic of pelite, a sedimentary rock composed of clay and minute particles of quartz 2. A metamorphic rock derived from a pelite.

Physiography: Relating to the form of the earth or its surface features, e.g. topography.

Peraluminous: A type of igneous rock in which the molecular proportion of alumina exceeds that of soda, potash, and lime combined.

Performance Standards: A measurable quantity used to define the limits of allowable environmental impacts resulting from mining and related activities.

pH: The hydrogen-ion activity of a solution, which is an indication of the solution's acidity or basicity.

Physiography: Relating to the form of the earth or its surface features, e.g., topography.

Plan of Operations: This plan is required for mining operations disturbing five surface acres or more, and any operation except casual use in areas designated for potential addition to, or an actual part of the Wild and Scenic Rivers System, and designated areas of Critical Environment Concern, the National Wilderness Preservation System administered by BLM, and areas closed to off-road vehicle use.

Pluton: An igneous intrusion or rock mass formed within surrounding rock of another type.

Primary Succession: Succession beginning on a bare area, not previously occupied by plants or animals.

Propagule: Any part of an organism, produced sexually or asexually, that is capable of giving rise to a new individual.

Proposed Action: Any resource use or development or management action proposed by the Bureau, or to the Bureau by a member of the public, or by another agency through any appropriately developed procedures including, in the case of non-Bureau proposals, nominations, petitions, and applications.

Record of Decision: A brief statement which completes the associated EIS and, among other things, indicates which alternative, or combination of alternatives has been approved.

Recorded: The filing of paperwork with the State and BLM to make a mining claim properly of record.

Resource Management Plan: A land use plan as prescribed by the Federal Land Policy and Management Act which establishes: 1) the level and intensity of land use, 2) allowable resource uses and related levels of production or use, 3) resource condition goals and objectives, 4) program constraints and general management practices needed to achieve the above, 5) the need for an area to be covered by more detailed and specific plans, 6) support action to achieve the above, 7) general implementation sequences, and 8) intervals and standards for monitoring and evaluating the plan. It is not a final implementation decision on actions which require further specific plans, process steps, or decisions under specific provisions of law and regulations.

Riparian: Refers to land bordering a stream, lake, or tidewater.

Scarify: See harrow or chaining.

Scoping: The act of holding organized meetings to address significant issues that are of particular concern to individuals or groups.

Section 810: Section within ANILCA mandating that subsistence uses and needs are to be considered in federal land use decisions.

Sedge: A rush-like or grass-like plant that grows in wet places.

Sere: The series of stages that follow one another in an ecologic succession.

Serotinous: Refers to late opening, such as cones of black spruce trees which remain on the trees for several years without opening. Allows cones to survive fires, and provide seed source after fire.

Settling Pond: A pond, usually artificially constructed of tailings, designed to remove sediment from water by simple settling.

Settleable Solids: The volume of matter in water that will settle in one hour under quiescent conditions in an Imhoff cone.

Sierra Club Lawsuit: The series of orders and injunctions arising from the Sierra Club's action that resulted in this EIS.

Significance: A high degree of importance as indicated by either quantitative measurements or qualitative judgments. Significant issues and impacts require explicit consideration in preparing a plan. Significance may be determined by evaluating characteristics pertaining to location, extent, consequences, and duration. As used in the National Environmental Policy Act, "significance" requires consideration of both context and intensity. (see 40 CFR 1508.17)

Significant Restriction to Subsistence Uses and Needs: BLM policy states that a "significant restriction to subsistence uses and needs" could occur if there is: 1) a reduction in harvestable resources used for subsistence purposes, 2) there is a reduction in the availability of resources caused by an alteration in their distribution, migration, or location, or 3) a limitation on the access of subsistence users to harvestable resources. Generally, only the prediction of large or substantial effects as opposed to slight effects in one or more of these three categories would result in a section 810 evaluation of significant restriction to subsistence uses and needs.

Sill: A tabular igneous intrusion that parallels the structure of the surrounding rock.

Silt: Sediment particles between 0.004 and 0.0625 mm in equivalent spherical diameter; coarse mud.

Skarn: An old Swedish mining term for silicate waste rock with certain iron-ore and sulfide deposits.

Sluice: To mine or wash with water. Also used synonomously with sluicebox.

Sluicebox: The rectangular shaped launder, containing riffles, that is used as a gold recovery system in placer mining.

Solifluction Lobe: A mass of soil material which, because of water saturation, has formed a small terrace through the slow, mass movement of the soil blanket downslope.

Special Area: Those geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important or easily disrupted ecological values.

Stocks: An igneous intrusion that is smaller than a batholith and more or less circular in shape.

Stone Stripe: A form of patterned ground consisting of a line of rocks or other inorganic material parallel to the slope of the ground, caused by the freeze - thaw cycle and the effects of gravity.

Stratigraphy: The science or arrangement of rock strata.

Stream Bypass: A channel constructed to divert an active stream channel around a mining operation, so to avoid direct stream contact.

Strike-slip fault: A fault on which the movement parallel to the fault's strike.

Subsistence Uses: Section 803 of ANILCA defines the term "subsistence uses" to mean "...the customary and traditional uses by rural Alaskan residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade." For the purposes of this definition, 1) "family" means all persons related by blood, marriage, or adoption, or any person living within the household on a permanent basis; and 2) "barter" means the exchange of fish or wildlife or their parts, taken for subsistence uses - (a) for other fish or game or their parts; or (b) for other food or for nonedible items other than money if the exchange is of a limited and noncommercial nature.

Succession: The replacement of one kind of community by another kind; the progressive changes in vegetation and in animal life which may culminate in the climax.

Sucker: In many plants, a shoot arising from the lower parts of the stem or from the root.

Suite: A collection of rock specimens from a single area, generally representing related igneous rocks.

Taiga: A swampy area of coniferous forest.

Tailings: Waste material processed through a placer operation usually consisting of coarse sand and larger particles.

Taxonomic: The study of the general principles of orderly scientific classification, usually according to their presumed natural characteristics.

Terrane: A rock or group of rocks and the area in which they crop out.

Thrust fault: A fault with a dip of 45° or less over much of its extent, on which the hanging wall appears to have moved upward relative to the footwall. Horizontal compression rather than vertical displacement is its characteristic feature.

Tiering: An interrelationship in which reference to a more general NEPA document such as an EIS can be made by a more specific one, thus avoiding duplication. Designed to focus on the actual issues ripe for decision at each level of environmental review.

Topsoil: The upper soil layer or layers containing some organic matter.

Tailrace: A channel in which mine tailings are carried away.

Tundra: The treeless land in arctic and alpine regions, varying from bare area to various types of vegetation consisting of grasses, sedges, forbs, dwarf shrubs, mosses, and lichens.

Turbidity: The condition of a body of water that contains suspended material such as clay or silt particles, dead organisms or their parts, or small living plants and animals.

Tussock: A dense, heavy tuft or matted growth of grass or sedge which forms a small hillock.

Type: A kind of vegetation, e.g., community-type, forest type, birch type.

Unnecessary or Undue Degradation: This is surface disturbance greater than what would normally result under a prudent operator in usual, customary, and proficient operations of similar character. Effects of operations on other resources and land uses, including resources and uses outside the area of operations are also considered.

Vegetation Type: A kind of vegetation or the kind of community of any size, rank, or stage of succession.

Vegetative Reproduction: Reproduction by asexual processes.

Visual Resource Management (VRM): Utilized to classify landscapes and visual characteristics. Classification I has a higher value than II and III.

Volatile Organics: Carbon-based line matter that is highly vulnerable to disruption.

Watershed: A region or area bounded peripherally by water, parting and draining ultimately to a particular watercourse or body of water.

Wetland: An area of low-lying land, submerged or inundated periodically by fresh or saline water.

Wild River: Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive, and waters unpolluted.

Windlass: A device for hauling or hoisting.

Zero Discharge: A condition where there is no effluent discharge from a mining operation.

Acronyms

ACEC........Area of Critical Environmental Concern

ADGGS.....Alaska Department of Geological and Geophysical Surveys

ADFG........Alaska Department of Fish and Game

ADNR........Alaska Department of Natural Resources

AHC...........Arctic Hydrologic Consultants

AHRS........Alaska Heritage Resources Survey

ANILCA....Alaska National Interest Lands Conservation Act

BLM..........Bureau of Land Management

CEQ..........Council on Environmental Quality

CFR...........Code of Federal Regulations

CFS...........Cubic Feet per Second

COE..........Corps of Engineers

DEC..........Department of Environmental Conservation (Alaska)

DOA..........Department of Agriculture

DOI...........Department of Interior

EIS.............Environmental Impact Statement

EPA...........Environmental Protection Agency

FLPMA.....Federal Land Policy and Management Act

ml/l............Milliliters per liter

NEPA........National Environmental Policy Act

NOI...........Notice of Intent

NPDES.......National Pollutant Discharge Elimination System

NTU............Nephelometric Turbidity Units

RMIS..........Recreation Management Information System

RMP...........Resource Management Plan

ROD...........Record of Decision

SHPO.........State Historic Preservation Officer

SNCA.........Steese National Conservation Area

SRMS.........Special Recreation Management Area

TSS............Total Suspended Solids

U.S.C..........United States Code

USGS..........United States Geological Survey

VRM............Visual Resource Management

WMNRA.....White Mountains National Recreation Area

WRC...........Water Resources Council

WRM..........Wild River Mile

WSRA........Wild Scenic River Act

Index

An index will be included in the final Beaver Creek EIS.