ECOSYSTEM MANAGEMENT
and
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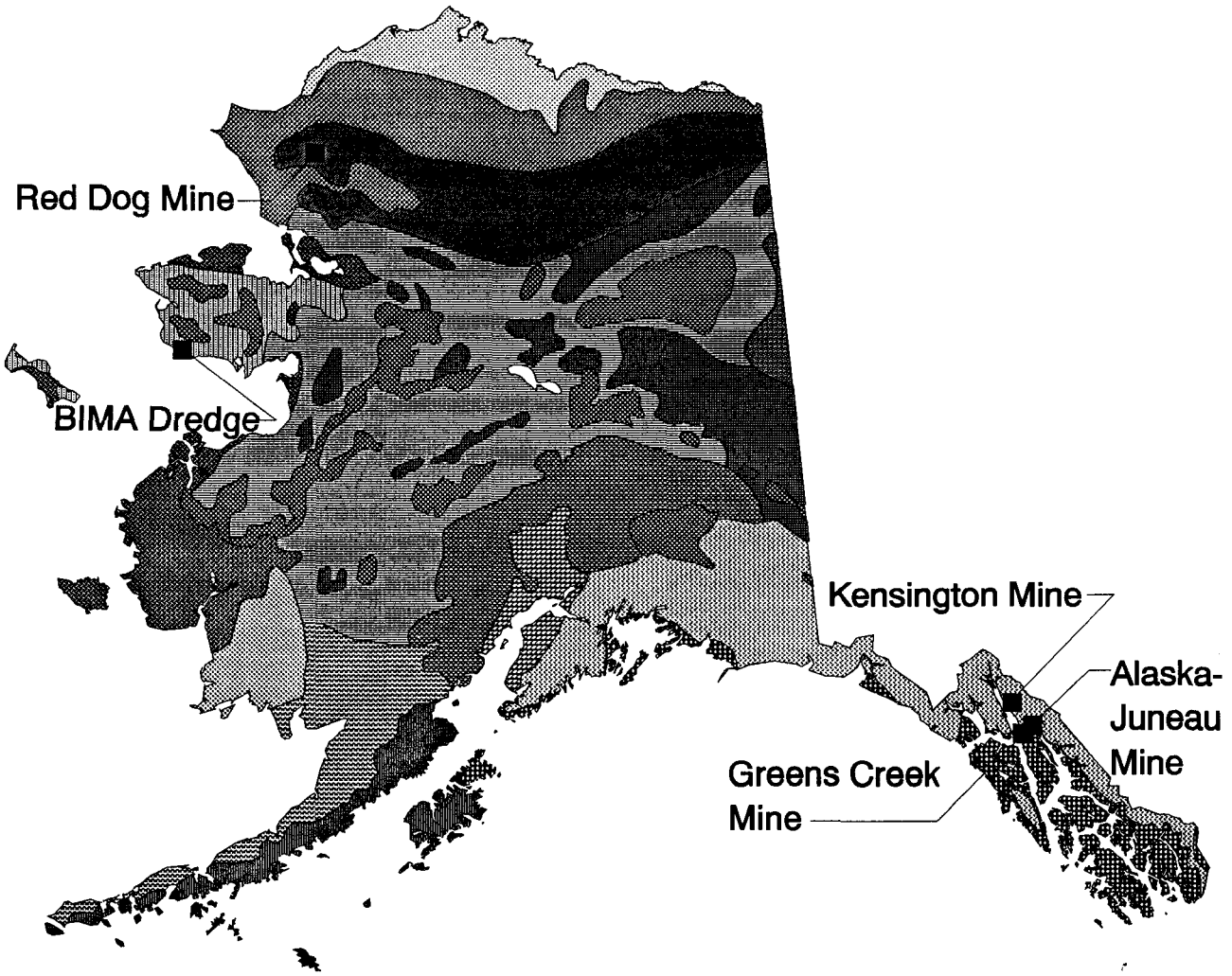

U. S. DEPARTMENT of the INTERIOR
Bruce Babbitt, Secretary

OFR 114-93

Bureau of Mines
Hermann Enzer, Acting Director

ECOSYSTEM MANAGEMENT AND MINE PERMITTING IN ALASKA

By Patrick D. Plumb
and Edward C. Gensler

U.S. Bureau of Mines
Alaska Field Operations Center
P.O. Box 20550
Juneau, Alaska 99802-0550
907-364-2111
Fax 907-364-3622

September 1993

ECOSYSTEM MANAGEMENT AND MINE PERMITTING IN ALASKA

By Patrick D. Plumb[1]
and Edward C. Gensler[2]

ABSTRACT

The Juneau Office of the U.S. Bureau of Mines has undertaken a study of the environmental permitting process for major mines in Alaska to identify the effects ecosystem management has had or could have on the permitting process. To date, ecosystem management affects major mine permitting in Alaska primarily through the NEPA environmental assessment process. In Alaska, only the Forest Service has instituted ecosystem management in an overt and organized manner, while other agencies are doing so less directly.

In recent Bureau of Mines publications, the mine permitting process has been described using case studies of several recently permitted mines in Alaska. The insights into the permitting process and the conclusions of these reports are reviewed and summarized. Several ecosystem management issues were identified in the case studies, including the need for: effective communication between agencies; standardization and coordination of NEPA environmental impact assessment and environmental monitoring programs among agencies; and assessment and selection of alternatives based on risks to ecosystems regardless of jurisdictional boundaries or environmental media-specific regulations. Ecosystem management could be used as a way to systematize, organize, standardize, and coordinate permitting and monitoring requirements and management perspectives among government agencies and project proponents.

[1]Environmental Engineer
[2]Mining Engineer
Engineering and Economic Analysis Section
Alaska Field Operations Center, Juneau, Alaska

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UNIT OF MEASURE ABBREVIATIONS

cu	cubic
ha	hectare
km	kilometer
l	liter
m	meter
mt	metric ton
oz	ounce

INTRODUCTION

An ecosystem can be defined as a system formed by the interaction of a community of organisms with its environment. Ecosystems are composed of the atmosphere, water, minerals, soils, microorganisms, plants, and animals which function together to maintain life and which keep the system viable (25)[1].

Ecosystem management can be defined as the careful and skillful use of ecological, economic, and social principles in managing the environment to produce, restore, or sustain ecosystem integrity over the long-term. It is the integrated use of ecological knowledge at various scales to produce desired resource values, products, services, and conditions. This is done in ways that sustain the diversity and productivity of ecosystems. Ecosystem management recognizes that natural systems must be sustained in order to meet the social and economic needs of future generations (25).

The goals of ecosystem management include managing to protect and preserve the multiple layers of biotic communities which form ecosystems, preserving natural resources associated with these ecosystems, and maintaining environmental functions of ecosystems. Functions of ecosystems include surface and ground hydrologic control, air and water quality control, and toxicant retention and detoxification.

The Bureau of Mines has begun a project to increase understanding of the relationships between ecosystem health and mining activity. The goal is to integrate ecosystem management values and mineral resource development values to produce ecosystem-based policies and regulations for mineral related activity. As a first step, the Bureau's Juneau Office has undertaken a study of the environmental permitting process for major mines in Alaska to identify the effects ecosystem management has had or could have on the permitting process.

If the effects of ecosystem management on this process are not well documented and understood, and ecosystem based land-management policies and regulations are implemented without full knowledge of their impacts, inefficient regulation of the mining industry could be the outcome. Inefficient regulation may result in greater environmental impacts and/or lesser economic benefits than could otherwise be achieved. Other potential consequences of ecosystem management should be explored as well.

For example, one goal of ecosystem management is to ensure the sustainability of complex ecological systems. It is a process that considers the total environment, which may not coincide with administrative or geographic boundaries. Therefore, it will require a higher level of cooperation and shared decision-making among the various public interests, users, land managers, regulators, and scientists who are actively involved in the land management decision-making process. As a result, ecosystem management could be more cost effective than other, more segmented, land-management styles, if information and ideas are shared to reduce duplication and confusion from lack of communication (25).

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[1]Underlined numbers in parentheses refer to citations listed in the "References" section of this report.

On the other hand, ecosystem management could be more costly to the mining industry due to larger bonding requirements or additional taxing of industrial activities aimed at ensuring that increasingly complex environmental monitoring, mitigation, or reclamation is performed. The uncertainty of managing complex ecosystem may increase the need for, and therefore cost of, environmental monitoring programs (15).

In addition to uncertainties such as these, ecosystem management has suffered from a lack of definition, as an ecosystem can be defined at almost any scale, and management perspectives exist on a continuum from the microscopic to the macroscopic. Unlike watersheds, ecosystems generally do not have distinct boundaries, but can be thought of as diminishing rather than ending. Therefore, when and where lines are drawn to define ecosystems must be determined within a particular context and set of priorities, values, and concerns.

Land managers, including the U.S. Forest Service and the Bureau of Land Management, as well as ecologists, economists, politicians, and others will define ecosystems within site specific contexts and sets of concerns. This will be accomplished at varying rates and to varying degrees.

In the mean time, the effect that ecosystem management is having or might have on mine permitting is of interest to the Bureau of Mines. A main purpose of this study is to examine the recently permitted mines in Alaska to see what impact, if any, ecosystem management has had on this process.

In recent Bureau of Mines publications, the permitting process has been described for several mines in Alaska (BIMA Dredge, Red Dog Mine, Greens Creek Mine, Alaska-Juneau Project, and Kensington Project) . The insights into the permitting process and the conclusions of these case studies are reviewed and summarized. Emphasis is placed on successes achieved and difficulties encountered during the permitting process, and the relevance of these to ecosystem management.

A generalized permitting flow chart for major mines in Alaska has been developed to summarize the mine permitting process. This chart is presented with a brief explanation. The flow chart shows the major steps of the permitting process, including the environmental assessment process and the major permits required. Due to the complexity of the process, only the major permits are represented, and these in a very idealized manner.

The status of ecosystem management among federal, state, and local agencies, and the private sector was determined through telephone contacts with agency and company personnel in Alaska. Recommendations are made for improving the permitting process, based on these contacts and on the review of the mine permitting case studies, in light of ecosystem management.

STATUS OF ECOSYSTEM MANAGEMENT IN ALASKA

This section reviews the status of ecosystem management in Alaska among federal, state, and local agencies, and the private sector, as determined through telephone conversations with agency and company personnel. Agency activity in this area includes the U.S. Environmental Protection Agency (EPA) which is funding the definition and delineation of ecoregions of Alaska through Colorado State University and in collaboration with the U.S. Geological Survey (2). The draft ecoregions of Alaska map, which this program has produced, is shown in Figure 1. The final map and report is scheduled for release in late 1993. Other agency and company activity in Alaska related to ecosystem management is reviewed below.

FEDERAL AGENCIES

U.S. Forest Service, Alaska Region

The U.S. Forest Service (USFS) in Alaska is in the midst of the most major policy shift since the adoption of the multiple-use concept in 1964, although the Multiple-Use Sustained Yield Act of 1960 remains the cornerstone of Forest Service management philosophy. The Forest Service has had some requirements for ecosystem management since the passage of this act. However, the intent of the present shift toward ecosystem management is to broaden the dimensions of multiple-use to encompass sustainable yield resource management (9).

Originally called "New Perspectives", ecosystem management in the Forest Service has three complementary goals; environmental sensitivity in resource management, participatory decision-making, and integrated ecosystem science. It has been introduced to all levels of the Forest Service in Alaska, partially through a training workshop held in Petersburg, Alaska, in July of 1990. New concepts introduced at the workshop included biological diversity, consensus problem solving, and adaptive management (29).

According to Forest Service literature, ecosystem management means to "produce desired resource values, uses, products, or services in ways that also sustain the diversity and productivity of ecosystems. This blends the needs of people and environmental values in such a way that National Forests and Grasslands represent diverse, healthy, productive, and sustainable ecosystems" (25).

The National Forest Management Act (NFMA) of 1976 requires the Forest Service to prepare a land management plan for each national forest in the U.S. These land management plans within the Alaska region describe alternatives for managing the resources and uses of national forests, and address the potential environmental effects of implementing those alternatives. The plans are used to direct all land management activities within the national forest. The Tongass Land Management Plan (TLMP) and the Chugach Land Management Plan are two such plans. The Tongass National Forest, the largest of the national forests at 6.9 million hectares (17 million acres), was the first to complete a land management plan under NFMA.

The Act requires that the plans be updated at least every ten to fifteen years. At present, these plans "reflect many ecosystem management principles and guidelines, but further improvements and new research information will provide a stronger basis for an ecological approach to multiple-

ECOREGIONS OF ALASKA

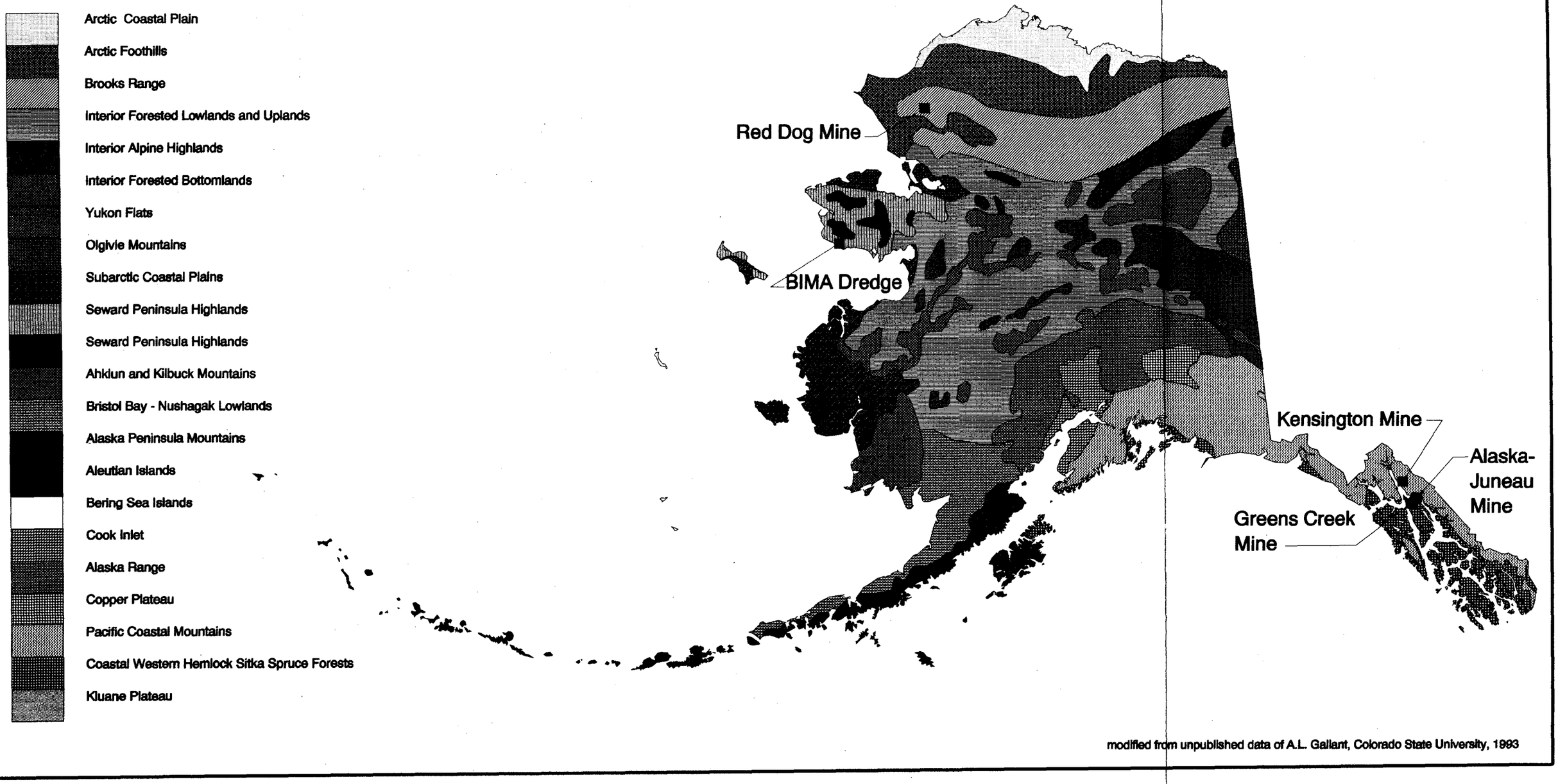

Figure 1. - Draft ecoregions of Alaska map.

use management. Rewriting key plan elements will provide direction for ecosystem management during the implementation of the plans" (26).

Within the Tongass National Forest, little baseline monitoring has been done to identify either natural trends in ecosystem attributes and conditions related to forest health and long-term productivity, or to develop means of tracking social and cultural trends. Several tools and processes have been developed to evaluate the distribution of habitat quality over relatively small areas. These include computer models which estimate effects of land management activities on "management indicator species". These indicator species are used to monitor the overall health of ecosystems.

Changes in habitat capability estimates, based on habitat capability models, are displayed in NEPA documents. Most of the models used by the Forest Service have been verified, but none have been field validated. Current models use the volume and age classes of timber as one indicator of key habitat. It is felt that habitats could be better described using measurable ecosystem attributes based on field studies, so the Forest Service may attempt to do this in the future (26).

The Alaska Region of USFS has been working to develop and implement hierarchical ecosystem classifications. The Region has an extensive data base in a Geographic Information System (GIS) format which can be used to store, analyze, and display ecosystem information, and is utilized for habitat capability modelling of wildlife species.

Actions planned for the Alaska region include (26):

- Develop a process for better analyzing cumulative watershed effects of land-disturbing activities and incorporate it into the regional direction on forest plan implementation.
- Through a public process, analyze current biological, economic, and other information related to the applicability of alternative timber harvest methods within the region.
- Increase knowledge of habitat requirements as well as quality indicators for selected species in terms of measurable ecosystem attributes. Identify what characteristics of the habitat make it suitable for a species or group of species.
- Develop methods to accelerate transfer of new technology to managers.
- Implement effective ways to involve the public early in the decision-making process.
- Develop new, or expand existing, partnerships with other agencies, organizations and individuals focused on ecosystem management.
- Develop an ecosystem management training program for all U.S. Forest Service employees.
- Develop the ability to use computer simulation models for modelling ecological

conditions for various management scenarios.

- Incorporate ecosystem management into the management review process.

These actions are expected to take several years to implement.

Alaska is unique among the states in having a legal requirement to provide for subsistence uses by rural residents, by which wild fish and game may be harvested for personal use. The Forest Service believes ecosystem management will be compatible with the concepts embraced by traditional subsistence cultures in which people are viewed as an integral part of the balance of nature, rather than in control of or apart from it (26).

Another initiative which the Forest Service is undertaking, with the BLM, is the PACFISH strategy aimed at providing habitat conditions that contribute to the conservation and restoration of naturally reproducing stocks of Pacific salmon and anadromous trout on Forest Service and BLM lands in the western states. Its focus is on maintaining and restoring ecological functions and processes, but its application to Alaska has not been determined as of this writing.

U.S. Bureau of Land Management

The Bureau of Land Management (BLM) in Alaska will be moving toward an ecosystem management approach, however movement in this direction is slow at present. Present land management plans utilize a multi-use concept known as "Comprehensive Planning" which has some ecosystem management elements. In the past, however, the BLM has generally not considered impacts from lands outside its jurisdiction. This and other ecosystem management concepts are likely to be incorporated into BLM land-management plans in the future. The BLM in Alaska is expected to receive policy direction from the national level on ecosystem management which will define the direction to be taken (32).

The BLM in Alaska is in the midst of a land selection and conveyance process under the requirements of the Alaska National Interest Lands Conservation Act (ANILCA) and related legislation, involving 42 million hectares (104 million acres) of state land and 18 million hectares (44 million acres) of native corporation land. This process, as well as budget constraints, limits the ability of the BLM in Alaska to engage in the development of new land management plans in the immediate future, but it will follow policy direction from the national level on ecosystem management (14).

At the national level, the BLM, with the Forest Service, is initiating the PACFISH strategy aimed at providing habitat conditions that contribute to the conservation and restoration of naturally reproducing stocks of Pacific salmon and anadromous trout on Forest Service and BLM lands in the western states. Its focus is on maintaining and restoring ecological functions and processes, but, as stated above, its application to Alaska has not been determined as of this writing.

U.S. Army Corps of Engineers

The Alaska District, U.S. Army Corps of Engineers (COE), contacted for this report, did not expect the Forest Service's initiatives in the area of ecosystem management to affect Corps policy in the immediate future. Being a permitting agency, the District is primarily concerned with applying

policies and regulations rather than setting or establishing them. The Corps is responsible for dredge and fill permits under Section 404 of the Clean Water Act and for Section 10 permits of the Rivers and Harbors Act (see Figure 2).

The Corps of Engineers and the U.S. EPA have a memorandum of agreement to "strive to achieve a goal of no overall net loss of values and functions" of wetlands. The Clean Water Act includes requirements for appropriate and practicable mitigation of wetland losses. With each permit decision, the District considers how wetland losses might be compensated, and if such is renewable and practicable, compensation is required to help meet the goal (18).

On the other hand, guidance to the District stresses the exercise of flexibility in permit decisions, especially in areas with abundant wetland resources and a high proportion of land which is wetlands, such as Alaska. Offsite compensatory mitigation is recognized as not being practicable and reasonable for much of Alaska. Therefore, the level of mitigation determined to be appropriate and practicable may lead to individual permit decisions which do not fully meet the goal of no net loss (18).

There has been some effort by various parties to codify a "1% rule" whereby any state which has lost less than one percent of its original wetland would be exempt from the normal regulatory process concerning dredge and fill in wetlands. This would apply only to Alaska, as it is the only state which has not lost more than one percent of its wetlands. To date, however, this has not led to policy or regulatory action.

The District issues General Permits (GP) to cover activities which individually and cumulatively result in no more than minimal environmental impact and/or avoid duplication with other regulatory programs, such as that proposed in the Juneau Wetlands Management Plan which will be discussed later in this chapter. General Permits may allow for greater local and state management of Section 10 and Section 404 permits because evaluation by the Corps is done in advance. In Alaska, the cities of Sitka, Anchorage, Homer, Bethel, Nome, Fairbanks, Deadhorse, Juneau, and the North Slope Borough have requested General Permits. The District is expected to receive guidance concerning General Permits soon, which may change the GP program in the near future (18).

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (FWS) has begun an effort to apply its Habitat Evaluation Procedures (HEP) at the Alaska-Juneau Project near Juneau. The HEP system utilizes Habitat Suitability Index (HSI) models to evaluate effects of land-management decisions on wildlife habitat. These procedures have been under continuous development since the early 1970's, and are taught through the FWS National Ecology Research Center in Fort Collins, Colorado. The Fish and Wildlife Service is expected to make greater use of these evaluation procedures in Alaska in the future (11).

U.S. Environmental Protection Agency

One of the U.S. Environmental Protection Agencies (EPA) Eight Priorities, as articulated by Administrator Carol Browner, is that the "EPA will approach environmental protection with an ecosystem perspective. Natural ecosystems are essential to sustainable long term economic growth and are intrinsically valuable in their own right." The EPA has also proposed management

of some contaminated sites based on assessment of risks to sensitive ecosystems (31). The effects that these or other actions may have on mine permitting in Alaska are not yet known.

STATE AGENCIES

Alaska Division of Governmental Coordination

The federal Coastal Zone Management Act of 1972 established that Coastal Zone Management Plans be used for land planning in coastal areas. The federal act delegates to states, rather than the federal government, the primary management responsibility. The states, in turn, are to require local governments to be the primary managers. The states are to operate an interim management system until local coastal planning can be done (6).

Alaska established its coastal program with legislation in 1977, and obtained federal approval of the plan in 1979. The federal government is to conduct its activities in conformance with the State's coastal policies. When a local coastal program has been approved, state agencies are to conform their activities to the policies of that local program. On the federal level, the plan is administered by the National Oceanic and Atmospheric Administration (NOAA) and applies to all coastal lands regardless of ownership.

Permit applications for projects that would affect natural resources in Alaska's coastal zone are reviewed to ensure that they are consistent with any applicable and approved district coastal management plans. The consistency review process is coordinated by a regional office of the Alaska Division of Governmental Coordination (ADGC).

To date, about 15% of the projects reviewed for consistency with the Alaska Coastal Management Program by the ADGC have involved mining. Projects have included the BIMA Dredge which operated offshore of Nome, the Red Dog Mine north of the Arctic Circle, the Greens Creek Mine near Juneau, the U.S. Borax permit application for the Quartz Hill Mine near Ketchikan, and on-going work on the Kensington and Alaska-Juneau Mines near Juneau. Other management issues addressed through the Alaska Coastal Management Program have included wetlands management, oil and mineral development, forestry, marine waste disposal, and mariculture (22).

Other State Agencies

Other State agencies are involved in mine permitting, including the Alaska Department of Environmental Conservation (ADEC), the Alaska Department of Natural Resources (ADNR), and the Alaska Department of Fish and Game (ADF&G). These agencies primarily serve a regulatory rather than land management function. The ADF&G is responsible in habit permits (see Figure 2), the ADEC is involved in air quality, wastewater and solid waste disposal, and dredge and fill permits, while the ADNR is responsible for land use permits and mine reclamations plans.

LOCAL AGENCIES

City and Borough of Juneau

On the basis of area, Juneau has been touted as the largest "City" in the nation, covering over 800,000 hectares (3,100 square miles or two million acres). Within its boundaries the City and

Borough of Juneau (CBJ) until recently had one active large mine, the Greens Creek Mine (operations were suspended in April, 1993 due to low metal prices), with two others, the Kensington Mine and the Alaska-Juneau Mine under development.

With better knowledge of ecosystems has come the understanding that not all wetlands are of equal value or perform the same functions. Some wetlands are of greater 'natural value' than others. Recognizing this, the City and Borough of Juneau has developed a Wetlands Management Plan (5) to prioritize wetlands according to function. The goal is to classify wetlands into those which are generally suitable for development and those which are generally unsuitable for development.

Six years of effort has gone into the Juneau Wetlands Management Plan, which is expected to be approved by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) in late 1993. It categorizes wetlands according to wetland function and would allow for local administration of dredge and fill permitting on a portion of area wetlands. The plan also proposes a wetlands mitigation bank.

Existing and developing mine sites in the Juneau area do not include wetlands slated for local permitting control, although mining related activities may involve such lands. The Alaska District, Corps of Engineers, plans to issue an Alternative Permit Processing Procedure (APP) in 1993, and, if the local wetland permitting program demonstrates that it is duplicating the Corps' permitting program, then a General Permit may be issued the following year (18).

According to CBJ officials, the Juneau Wetlands Management Plan is designed to provide predictability for property owners, reduce wetlands permit processing time, and provide protection for moderate and high value wetlands while allowing development of some less valuable wetlands. The plan indicates which wetlands contribute most to the natural environment and what functions they serve. Wetlands that were chosen as generally suitable for fill do not fulfill many of the environmental functions associated with wetlands (5).

According to the CBJ, this is the first land use management plan in the nation that has a direct and reproducible linkage between data input and management designations. Paul Adamus, developer of the Wetlands Evaluation Technique (WET), along with researchers from Syracuse University, the State University of New York, and the University of Minnesota, and Juneau habitat biologists, were retained to evaluate area wetlands and conducted a year-long field study (4).

Wetlands were evaluated according to fourteen functions, which compose Adamus's Wetlands Evaluation Technique system. These functions are: groundwater discharge, groundwater recharge, surface hydrologic control, sediment toxicant retention, nutrient export, riparian support, erosion sensitivity, salmonid habitat, disturbance of sensitive wildlife, regional ecological diversity, ecological replacement cost, recreational use potential, recreational use actual, and downslope beneficiary sites. Wetlands were then classified according to how well these functions were met. The plan also calls for a mitigation bank to be established that will allow permit applicants to compensate for damage to wetlands that will result from their development by paying into a fund. Small funds can be combined through the bank to allow larger mitigation projects. The bank can purchase wetlands and make wetland enhancements and improvements.

A permit for the placement of dredged or fill material into waters of the U.S., including wetlands, is mandated by Section 404 of the Clean Water Act. The CBJ General Permit, if approved by the

U.S. Army Corps of Engineers, would allow CBJ officials to administer the 404 program on behalf of the Corps for dredge and fill 404 permits in the less environmentally sensitive wetlands. The Corps would retain its oversight and be able to modify, suspend, or revoke any authorization. This General Permit from the Corps would apply to only about ten percent of the City's wetlands that are located along the Juneau road system and therefore most accessible to development.

The General Permit, if issued, might be challenged in court by environmental groups. These groups, including the Sierra Club Legal Defense Fund, Friends of the Earth, and the National Wildlife Federation, fear that a statewide trend toward greater local control of the 404 program will lead to increased environmental degradation (17).

PRIVATE SECTOR

Coeur d'Alene Mines, Kensington Venture

A representative of the project proponent for the Kensington Mine has encountered ecosystem management in his duties as Manager of Governmental Affairs with Coeur d'Alene Mines. His experiences in this area have primarily been with the U.S. Forest Service, especially related to the Kensington Project which is in the permitting process. This site is located within the City and Borough of Juneau about 65 kilometers (40 miles) north-west of downtown Juneau.

The Kensington Venture's experience with ecosystem management and the Forest Service is that the broader perspective possible when ecosystems are considered as a whole reduces much of the species and media specific baseline studies required. For example, the State of Alaska Department of Fish and Game required a survey to determine the mountain goat population in the vicinity of the proposed mine to assess the potential impacts of the mine on goat populations. The Forest Service, on the other hand, was able to identify the areas of mountain goat habitat which would be affected, regardless of whether there were goats in the area at a particular time. The presence of goat habitat means that although there may not be goats in the area today, the environmental conditions are right and there may be goats in the area in the future. Overall, this approach was less costly and time consuming to the mine proponent.

However, the company representative stated that the wide scope of the ecosystem perspective could not be fully carried through to the Environmental Impact Statement (EIS). Therefore, some specific details required filling in. Also, there were problems associated with dealing with two different management styles (macroscopic vs. microscopic), the Forest Service advocating an ecosystem approach while state agencies requiring a more focussed perspective. The result was that both perspectives were required for the EIS. The company representative felt that the greatest value of ecosystem management may be in providing a standard management perspective for all agencies to use. This unified approach may be more important than the particulars of the perspective used (20).

MINE PERMITTING IN ALASKA

Figure 2 shows the major steps required in permitting a large mine in Alaska, and was modified and updated from a previous Bureau of Mines report (21). As can be seen from the chart, the environmental permitting process is actually a two step process, although in practice the steps may proceed concurrently to some extent.

The first part is the environmental assessment/environmental impact statement (EA/EIS) under the National Environmental Policy Act (NEPA) which promotes consideration of environmental concerns by federal agencies. The second part is the actual application for each of the individual permits required for specific segments of the project activities throughout the exploration, construction, operation and abandonment stages. These two main components of the permitting process will be reviewed briefly here to better define the context of the case studies. Environmental monitoring, which will be required at each phase of mining project development, will also be discussed.

NEPA PROCESS

The National Environmental Policy Act of 1969 requires federal agencies to consider the environmental consequences of federal actions, with the goal of providing a systematic framework to address increasing environmental concerns. The purpose of NEPA is to promote efforts to prevent or eliminate damage to the environment and the biosphere, stimulate human health and welfare, and increase understanding of the ecological systems and natural resources important to the nation (1).

A NEPA review is required whenever a project affects federal land or when discharges to surface waters of the U.S. occurs. Whenever there are federal actions which significantly affect the quality of the human environment an EIS must be written. The specific parts of the EIS which relate to ecosystems are (A) the description of primary and secondary impacts on the environment including the impacts on aquatic and terrestrial ecosystems and (B) a description of probable environmental impacts including impacts on ecological systems such as wildlife and aquatic life. All significant alterations to existing conditions whether they are beneficial or detrimental must be considered and reported by the individuals or organizations proposing the action. There are other requirements of the EIS, but they are less directly related to ecosystem management.

NEPA applies to any federal action and generally requires that an Environmental Assessment (EA) be issued to determine the need for public interest in the proposed activity. The EA presents an evaluation of the probable impacts of the action, including impacts on endangered species, historic properties, water quality, general environmental effects, fish and wildlife values, navigation, safety, mineral needs, and other public interest factors (10).

Under special circumstances, projects which a federal agency determines do not require an EA are categorically excluded from further review under NEPA. If, on the other hand, the agency decides from the beginning of the NEPA process to prepare an EIS then an environmental assessment is not necessary (see Figure 2).

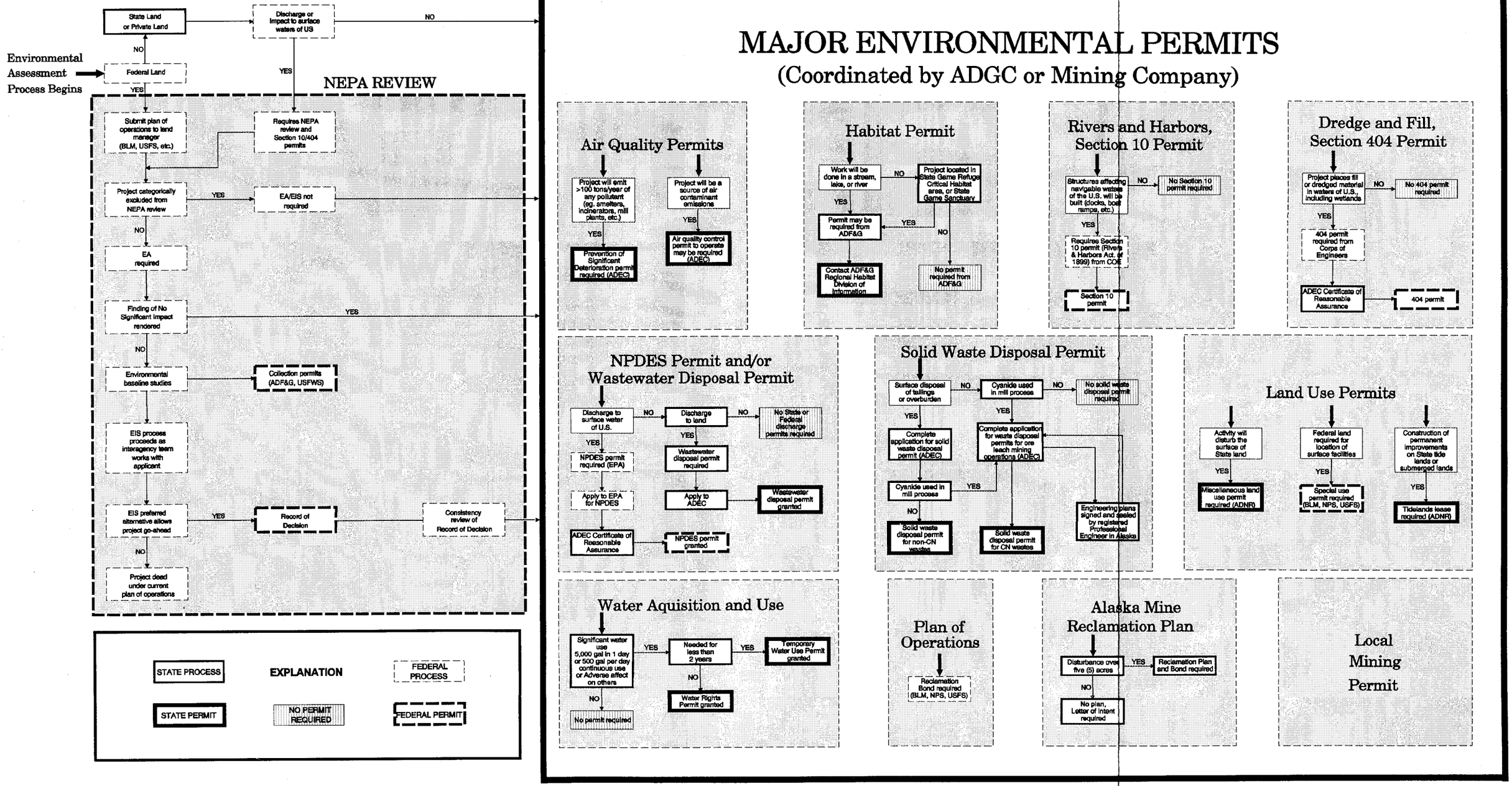

Figure 2. - Environmental assessment, major permits and approvals, for mines in Alaska.

From the EA, the lead federal agency can choose to issue a Finding of No Significant Impact (FONSI), or decide to produce an Environmental Impact Statement (EIS) if a major federal action is proposed which may significantly affect the quality of the human environment (13).

> The "human environment" shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with the environment. This means that economic or social effects are not intended by themselves to require preparation or an environmental impact statement. When an EIS is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment (40 CFR 1508.14).

The EIS review process is designed to minimize impacts to the environment by assuring that a reasonable range of project alternatives are considered along with their impacts. The EIS is examined by specialists with expertise in air and water quality, engineering, biology, land use management, noise abatement, solid waste disposal, toxic substances, economics, and other pertinent fields.

The EIS must include enough detailed information on the existing environmental conditions of the site for the reviewers to adequately assess the potential impacts of the mining operation. This data will also be used as a baseline from which to measure the impacts of the mining operation as they are documented by the monitoring program. The monitoring requirements will be prescribed during the permitting process.

In order to assess the likely effects the project will have on the environment, the EIS must contain detailed information about the existing ecosystems within the potentially affected area. This baseline data must be collected prior to any developmental impacts, therefore it takes place before and/or during the EIS process. Ideally a positive Record of Decision (ROD) is issued prior to proceeding with the second part of the permitting process, obtaining the individual permits, but in practice the two steps may proceed concurrently.

INDIVIDUAL PERMITS

A primary purpose of the EIS is to provide information on the proposed project to aid subsequent permitting decisions. An EIS is an analysis of the environmental effects of a proposed project, but it does not contain an engineering design of the project. Permitting is the regulatory process that is used to approve the detailed design to be used. In this second part of the process, individual permits are issued contingent upon the proposed plan of operations, baseline data, preferred alternative derived from the NEPA review process, and other data submitted during the permitting process. Some of the permits issued will directly or indirectly consider ecosystem impacts, such as the Habitat Permit from the Alaska Department of Fish and Game (ADF&G).

A major mine in Alaska may require fifty or more permits, ten or twelve of which may be considered major. The permitting process is more strictly defined than the NEPA process, although each agency and each permit has its associated process. The processes are generally defined by statute, but are subject to interpretation by the agency responsible for issuing the permit.

Figure 2 shows the major permits required for large mines in Alaska. This permitting flow chart is a greatly simplified and idealized representation of the mine permitting process in Alaska. On this chart the areas where consideration of environmental and ecosystem impacts and mitigation measures would occur can be seen. A brief discussion of each of the major permits is presented in the Appendix to this report.

ENVIRONMENTAL MONITORING

Environmental monitoring will be required at any large mine, to ensure compliance with permit standards and stipulations and to assess the environmental impacts of the operation. The amount of monitoring required can vary greatly, depending on the environmental conditions, the nature of the mining operation, the particular permits involved, local concerns, and other factors.

Environmental monitoring generally consists of four stages which correspond to four stages of project development. These are environmental baseline, development monitoring, operation monitoring, and closure monitoring. During the first stage, the environmental baseline phase, air quality, water quality, plant and wildlife species, and other environmental parameters are characterized. Information gathered during the environmental baseline phase is usually used to prepare the EIS for the project and is also used as a "baseline" from which to assess impacts to the environment during the other three stages.

After the Record of Decision for the NEPA process, the second stage of monitoring, permitting and development monitoring, can begin. During this phase, environmental data collection continues to extend the baseline which will be used to assess environmental impacts during the later stages of the project. Effects on the environment from development activities are also monitored at this stage.

Monitoring continues during the third stage, the operational monitoring, when the project is actually in production. At this stage, effects of project operation on the environment are scrutinized. Data collected here is used to determine compliance with permit stipulations and is compared with baseline data to assess impacts to the environment from project operations.

The fourth stage, closure monitoring, includes monitoring after project reclamation. These monitoring requirements will be specified in the permits, and may cover time periods of several months to several years after completion of actual mining.

REVIEW OF PERMITTING CASE STUDIES

The regulatory processes associated with development of several major mining operations in Alaska were evaluated using case studies. These reports examined the permitting process for five major mining operations in Alaska, two of which are yet to go into production, two are shut down, at least temporarily, and one is presently operating.

Mines evaluated in the case studies included the Red Dog Mine near Kotzebue (7), the Greens Creek Mine near Juneau (1), and the BIMA Dredge which operated off-shore of Nome (10). Only the Red Dog Mine is presently operating.

Also evaluated, in a report on environmental regulation for mines in southeast Alaska (13), were the Alaska-Juneau Mine and the Kensington Mine, both near Juneau and in the process of obtaining permits for operation. A comparison study of regulatory processes in Alaska and British Columbia (8) was also used.

The objective of these case studies was to review metal-mine permitting processes in Alaska. The studies were to provide chronology of the projects' permitting process from both the industry's and the regulator's perspectives. In this report, the case studies are reviewed briefly and ecosystem management issues identified.

Although many concepts inherent to ecosystem management as it is being implemented by land-management agencies entered the permitting process in these cases, they may not have been identified as such during the process itself, or even thought of in terms of ecosystem management by the individuals involved. However, it is important to note for the purposes of this report, where ecosystem management concepts are affecting the mine permitting process.

BIMA Dredge

The BIMA was a large bucket-line gold dredge which operated offshore of Nome, Alaska from 1986 to 1990 (Figure 3). The project involved the dredging of sediments from the seafloor to recover gold from submerged state lands. The sediments were processed onboard the BIMA using physical separation processes only. No chemicals were added during processing. The sediment-water slurry was then discharged into the area that had been dredged.

Permitting activity for the gold-dredging operation offshore at Nome began in August of 1984. Initial permitting was completed in October of 1985 and dredging operations began that month using the barge Kokohead as a platform. The Kokohead had a 7.6 cu m (10 cu yd) clamshell bucket operated by a crane and a sediment processing plant estimated to be able to process 4,900 cu m (1.3 millions gallons) of sediment-water slurry per day (10).

Under NEPA, the U.S. COE and the U.S. EPA were required to prepare an EA for the project. Initially, both agencies determined that the Kokohead operation would not have significant impacts on the environment. A FONSI was issued, therefore no EIS was required.

In 1986, the company decided to change to a bucket ladder operation and purchased the BIMA, which at the time was the world's largest active bucket-line offshore mining vessel. With the BIMA, the scale of the operation changed immensely. The BIMA bucket ladder was 88 m (288

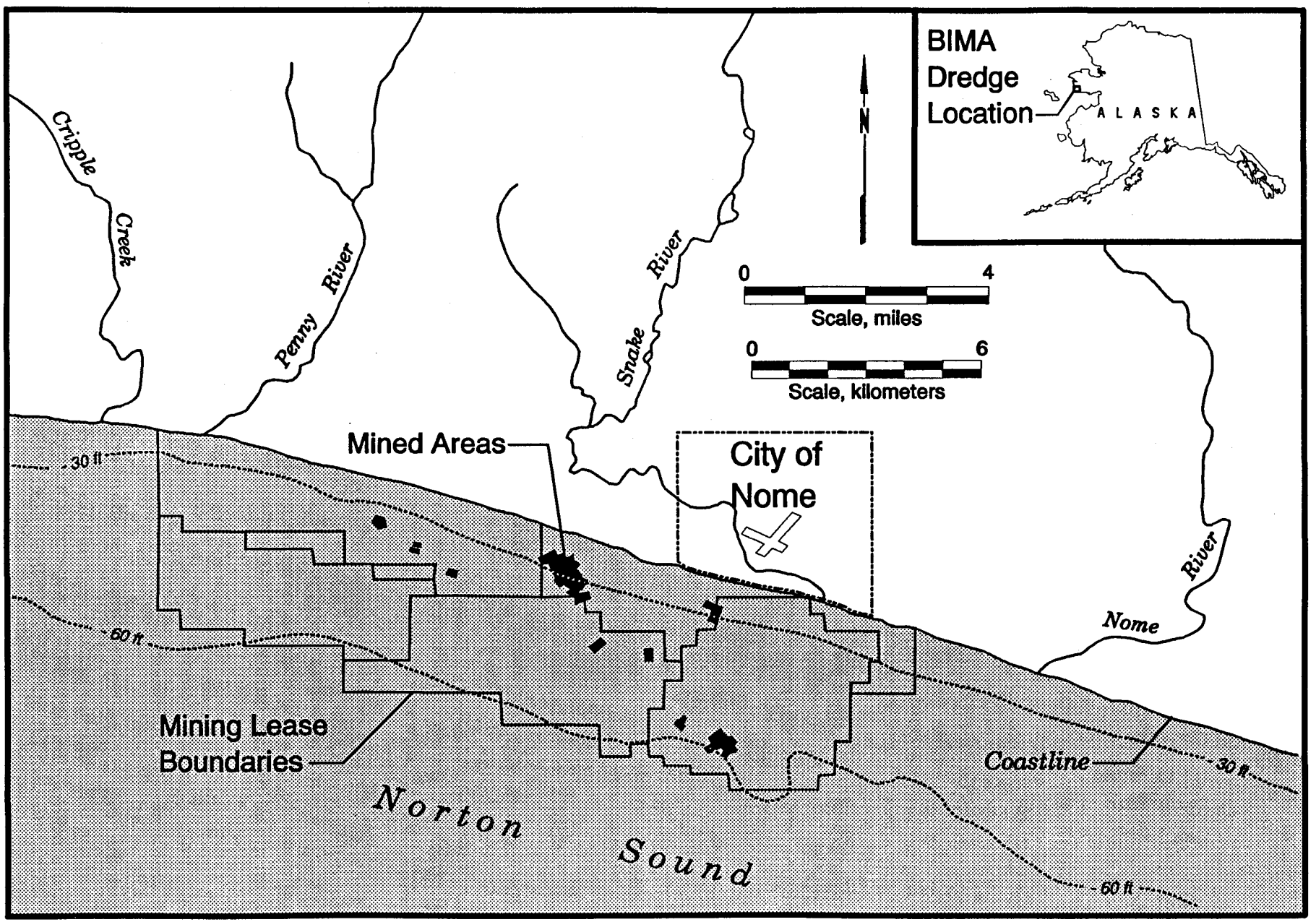

Figure 3. - Location map for the BIMA Dredge showing leased and mined areas.

ft) long, contained 134 buckets, each with a capacity of 0.85 cu m (1.1 cu yd), and could process 220,000 cu m (58 million gallons) of sediment-water slurry per day. Therefore the BIMA's capacity was almost 50 times that of the Kokohead (10).

When an increase in the discharge volume was sought to accommodate the BIMA, the project proponent issued a request for an expedited schedule and expressed a willingness to fund an extensive marine monitoring program concurrent with project operations. Consequently, the EPA determined that a separate EA would not be required, as the permitting action was a modification of an existing permit and not a "new source". Therefore no new EA or EIS was required for the BIMA. Instead, the project proponent and the regulatory agencies adopted a unique "shared risk" approach to the permitting process (10).

Little information existed on potential impacts from a large scale offshore mining operation in the area, so the agencies decided that monitoring actual operational performance would be more valuable than attempting to assess potential impacts with limited data. Since no EIS was prepared for the project, more emphasis was placed on permitting and monitoring of the operation, both of which continued throughout the life of the project.

The NPDES monitoring program for the BIMA became one of the five largest in the U.S. Monitoring information obtained by the project proponent was disclosed to the agencies who used it to formulate and define the next phase of regulation. Concerns related to the environment were addressed and, in many cases, resolved through this iterative process. More details of the monitoring program and permitting process for the BIMA can be found in USBM OFR 88-92 (10).

Much cooperation and communication was required to achieve successful permitting in the case of the BIMA, due to the iterative nature of process. The regulatory agencies had little on which to base predictions of environmental impacts, while the company was required to monitor the operation and its effects much more closely and thoroughly than would otherwise have been required. The result was that, with no EIS to serve as guide, the permitting process was more flexible but less certain than would normally be the case.

A Project Review Committee (PRC) was established to monitor project activities and build community support by addressing issues and concerns. The PRC consisted of personnel from local, state and federal agencies, the company, consultants, native organizations, and special interest groups. All interested parties were invited to attend, but private citizens participated only through organized groups, rather than as individuals, evidently to keep participants to a workable number.

The PRC required a relatively high degree of commitment from all those involved because of the travel costs and time required. It was felt that only a large project could justify this high expense, which was estimated to be about $30,000 and 160 person-hours per meeting for the agencies and project proponent combined. This was based on 30 attendees with 15 requiring travel (10).

The BIMA Dredge case is an example of communication leading to the sharing of environmental data in a timely manner with all concerned parties. This communication was made possible through the use of the PRC, which was established to address regulatory and community concerns. A commitment to open dialogue and the necessary time and expense was maintained by those involved in the permitting processes, leading to innovative and flexible permitting.

Another unique aspect of the BIMA case is that environmental monitoring was used to address uncertainty from the lack of an EIS. This increased the cost of the monitoring program, but decreased the time required to get the BIMA started. The issue of the amount of environmental assessment and/or monitoring needed will be central to ecosystem management.

Red Dog Mine

The Red Dog Mine is a 5,200 metric ton per day open-pit lead, zinc, and silver mine which began production in 1989. The mine is located in northwestern Alaska approximately 130 km (82 miles) north of Kotzebue and 75 km (47 miles) inland from the coast of the Chukchi Sea (Figure 4). The mine site is located on Red Dog Creek in the De Long Mountains of the western Brooks Range, just north of the Arctic Circle. This site is in a remote area with no prior development and no previously published environmental data.

Red Dog Creek runs through the mine deposit, emptying into Ikalukrok Creek which then drains into the Wulik River. Baseline environmental data, collected from 1981 to 1983, indicated that Red Dog Creek was essentially dead for several miles below the orebody. This was due to natural acid generation resulting in low pH and high aluminum, cadmium, copper, manganese, silver, lead, and zinc concentrations in Red Dog Creek.

The orebody contains zinc, lead, and silver sulfides and is being mined using open-pit methods. After the mine began operation, the pit intersected unexpected groundwater seeps which emptied into Red Dog Creek. To avoid additional impacts, a diversion of the creek was constructed which resulted in greatly improved water quality downstream for twenty miles from the orebody to the Wulik River. The mining company also constructed a system to collect and route all surface water runoff and intercepted groundwater to the tailings impoundment (7).

The NEPA process for the Red Dog Mine required about two years to complete. A total of twenty-nine permits were needed. The major permits, including the Section 404 Permit and the Section 10 Permit from the U.S. Army Corps of Engineers, the NPDES Permit from the U.S. EPA, and the Alaska Department of Environmental Conservation 401 Certification, were issued approximately concurrent with the approval of the Final EIS. A complete listing of permits is available in USBM OFR 93-92 (7).

There were three major issues identified during the NEPA and permitting processes. These were:

- Mine Access (the road right-of-way required through the Cape Krusenstern National Monument)
- Water Quality/Hydrology
- Air Quality/Meteorology.

The second two problems, water and air quality resulting from inadequate environmental baseline, could probably have been avoided with a better understanding of the physical environment, and point to the need for establishing a thorough environmental baseline. Ecosystem management could be used to organize, coordinate, or standardize baseline and monitoring requirements, to reduce the potential for problems to occur.

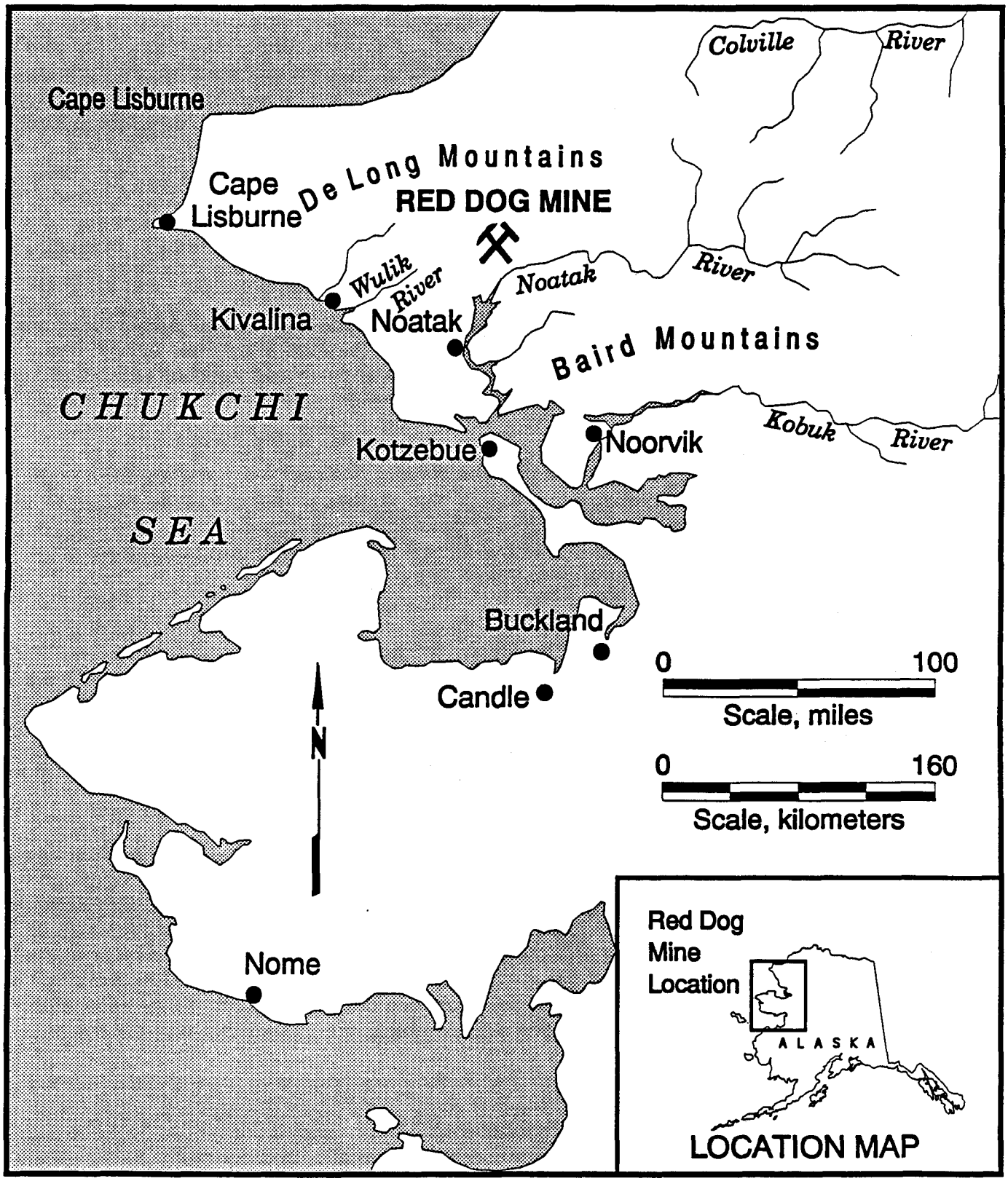

Figure 4. - Location map for the Red Dog Mine.

The first of these issues, mine access through Cape Krusenstern National Monument, also has implications related to ecosystem management. Three alternative road alignments from the port to the mine were considered, one of which crossed through Cape Krusenstern National Monument while the other two skirted it. According to the EIS, the route through the National Monument had the least potential environmental impact, with the other two options having higher potential impacts on waterfowl, fishery, and wetland resources (7).

The road alignment through the National Monument was opposed by the Sierra Club and others who objected to setting a precedence for development of federally preserved lands. On the other hand, the National Audubon Society and others maintained that the alternative with the least impact to the environment should be chosen, regardless of jurisdictional boundaries. In the final decision, the route with the least environmental impacts was selected.

This was ultimately accomplished by a "land swap" in which the road corridor was exchanged for private land. This was possible under provisions of the Alaska National Interest Lands Conservation Act (ANILCA) of 1980, over which the private landowner was concurrently involved in negotiations for land exchanges with the federal government and of which the road corridor became a part.

This can be seen as an ecosystem management approach winning out over other land-use perspectives. The alternative which had the least potential overall impact to area ecosystems was chosen over alternatives which had greater potential overall impacts, but lesser potential impacts to lands with special protected status. No compromise of the purpose and values of the National Monument occurred due to the land exchange.

The analysis of alternatives and identification of the preferred alternative took place during and through the NEPA process. Therefore, ecosystem management issues, including establishing an adequate environmental baseline and assessing overall impacts to ecosystems, affected mine permitting through the NEPA process in this case. However, if a land exchange under the provisions of ANILCA had not been possible, it is questionable whether the alternative with the least environmental impacts would have been selected.

Greens Creek Mine

During its operation from 1989 to 1993, the Greens Creek Mine was a 1000 metric ton per day underground hard rock lead, zinc, silver, and gold operation and was the largest underground producer of silver in North America. The mine is located in the Admiralty National Monument, which is located on Admiralty Island approximately 29 km (18 miles) west of Juneau, Alaska (see Figure 5). The project is adjacent to a designated national wilderness area and most of the island is located within the Tongass National Forest which is under the jurisdiction of the U.S. Forest Service. The ore-body is a small, richly mineralized deposit in historic marine sediments. The deposit contains a complex association of base metals, precious metals, and iron sulfides.

Development of the Greens Creek project dates to 1978 when extensive underground diamond drilling and environmental baseline studies were begun. Largely due to low metals prices on the world market in the early 1980's, project development was postponed until prices began to rise in 1986. Production began in 1989 after eight years of exploration and permitting during which a total of 51 permits were obtained, 26 for construction and 25 for operation. The mine was in production for about 4 years before temporarily suspending operations in April of 1993 due to

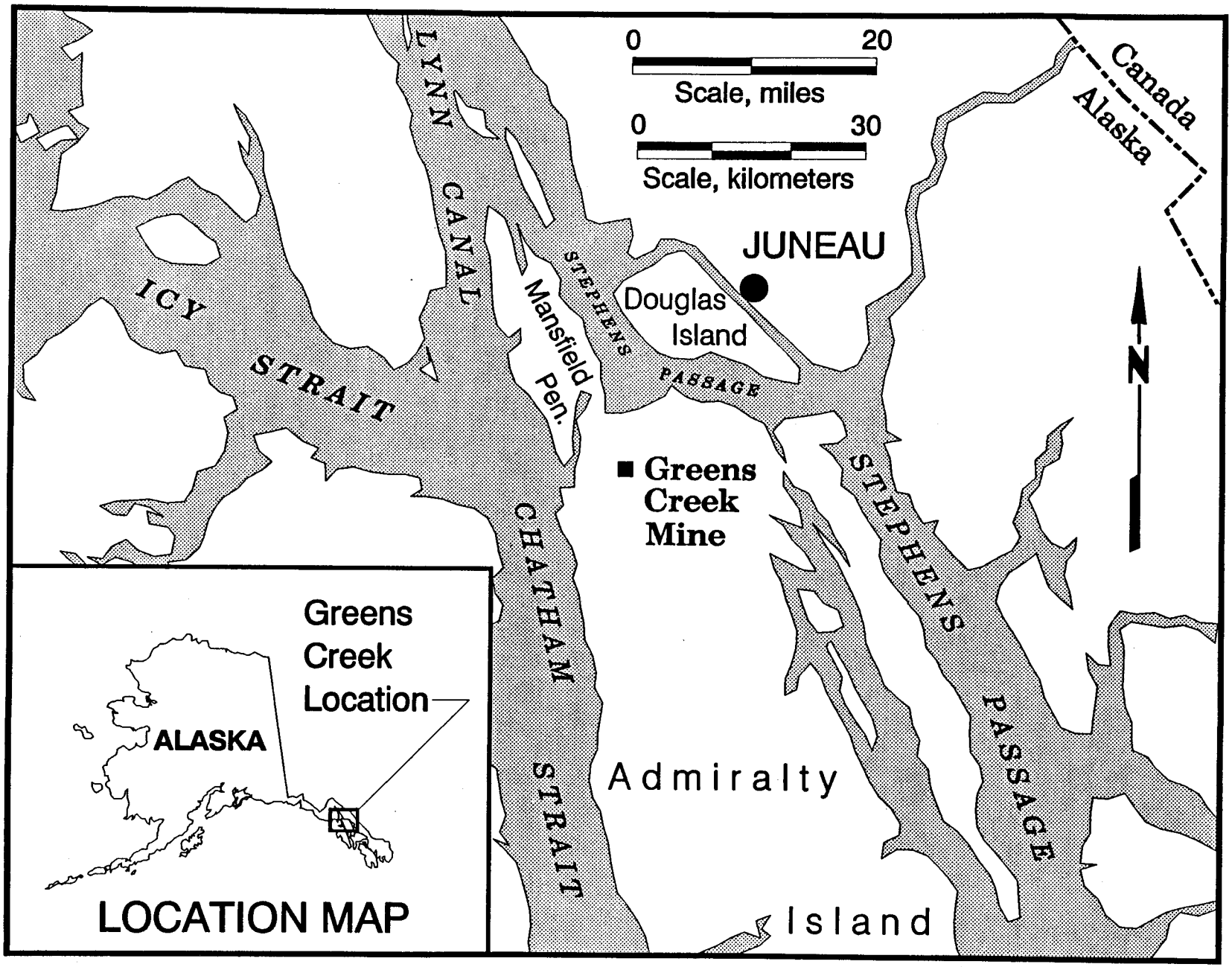

Figure 5. - Location map for the Greens Creek Mine.

low metal prices. Details of the monitoring and permitting process for the Greens Creek Mine can be found in USBM OFR 83-93 (1).

The project proponent filed a Notice of Intent with the Forest Service to conduct initial exploration activities in 1979, and a review of the initial project information indicated the need for an EIS. The USFS filed a Notice of Intent to prepare an EIS, and a scoping document was released in 1980. Environmental baseline studies were conducted for several years, leading to preparation of a Draft Environmental Impact Statement in 1982. The Final EIS and the Record of Decision were approved by the Forest Service in January of 1983. The project proponent prepared a Plan of Operations, as required by the USFS, which was approved in early 1984.

Environmental baseline studies for Greens Creek covered the following broad categories (1):

- Air
- Water
- Land and land use
- Biological environment
- Human aspects
- Economic aspects

Each category was divided into more specific subcategories, for example:

- Water
  - Marine water quality
  - Surface water quality
  - Hydrology and groundwater quality
  - Meteorology and precipitation

Project operation and post-operation monitoring requirements for the Greens Creek project were specifically outlined in the Record of Decision by the lead agency from the EIS process and as conditions to individual permits. However, after the FEIS was completed, the extensive environmental baseline program (more than was required) was continued by the project proponent.

The purpose for continuing the program was twofold: it was necessary to develop a longer baseline for possible future evaluations of environmental impacts, and a longer baseline would illustrate the inherent variability of the environment, thus protecting the mining company from being blamed for natural fluctuations. Although the additional environmental baseline was not required by the agencies, it was viewed as prudent and a valuable asset by the project proponent (1).

Eight years into the project, the environmental monitoring program was reviewed, with the following identified as important issues (1):

- The project proponent felt that many environmental parameters no longer needed to be analyzed and should be discontinued since only a few key ones correlated to project activity. The key parameters included total suspended solids, zinc, nickel, copper, lead, and chromium.

- Some of the monitoring programs were considered redundant by the company who thought that some should be discontinued. For example, effluent impacts from the project were monitored in five ways: effluent toxicity testing on organisms, effluent parameter concentration tests, receiving water quality tests, tests of sediment content in the receiving environment, and tests of body burden content of organisms in the receiving water.

- Guidance from the agencies to the company is needed for data analysis and presentation. Many of the agencies that requested testing and data did not possess an effective method for data review, analysis, storage, or retrieval. The data sets were too complicated and too extensive for visual inspection of data points. The perception exists that data is often submitted and accumulates without review, resulting in a cost without benefit to the project or the environment.

- Monitoring requirements were not standardized or coordinated between agencies and requirements were interpreted differently by different agencies and by the company. Improvements would require general standardization of monitoring requirements and better coordination between agencies and between agencies and the project proponent.

More standardization and/or coordination of monitoring requirements between and among agencies is needed. Movement toward standardization of monitoring requirements among agencies may be a result of implementation of ecosystem management. Inter-agency coordination of monitoring requirements will help achieve the ecosystem management objective of assessing and minimizing impacts to entire ecosystems.

Another issue raised in the Greens Creek case study is that many agencies do not have personnel experienced in some of the technical aspects of mining. This leads to inefficient permitting and may be very time consuming and costly to both the project proponent and the agencies. One solution to this is that in such a case the proponent could request a review of the issues by qualified personnel (e.g. consultants, another agency) experienced in the specific area of question. The project proponent may have to pay for such a review, but in this case it was felt that savings in time and effort would likely justify the additional cost (1).

It may be easier to share technical expertise among agencies under an ecosystem management framework than presently exists, as better communication between agencies and others is inherent to ecosystem management because of the macroscopic perspective it requires. Increased communication between agencies could improve the sharing of technical expertise, making it available to those agencies which presently lack it. Inter-agency coordination in the use of technical expertise will help bring about this aspect of ecosystem management.

One example where communication occurred is in the area of determining mitigation of environmental impacts at the Greens Creek Mine. This process involved communications between the regulatory agencies and the mining company to determine what mitigation was desired and what was feasible, both technically and economically. For example, road access was restricted to mining related activities, thereby mitigating many of the hunting, trapping, and other impacts related to increased road access. This greatly mitigated the potential impacts of the mine on wildlife, and costs almost nothing to implement (24).

On the other hand, mitigation of lost salmon spawning habitat in the tailings disposal area was required by the Forest Service. To accomplish this, a natural barrier to fish migration was removed on Greens Creek, at considerable expense to the mining company. Some involved in the project felt that the money spent on the fish-barrier removal could have been better spent on other mitigation efforts which were more cost-effective. This points to the need for cost-benefit analysis of mitigation efforts.

Protection of "monument values" became an issue with the Greens Creek Mine, because all involved did not have a clear understanding of what these values were. This issue has analogies to the difficulty some have had in identifying "ecosystem management values". Many of those directly involved in ecosystem management have a feeling for what ecosystem management values are, but may have difficulty communicating these values and concepts to others. The Forest Service, the Bureau of Land Management, and other agencies have begun to communicate ecosystem management values (through concept papers, etc.) and continued effort in this area is needed.

Kensington Mine

The Kensington project is a proposed underground hard rock gold mine which is expected to produce about 4000 metric tons of ore per day with a gold production of about 6.2 million grams (200,000 troy oz) per year. Tailings disposal is planned in a conventional tailings impoundment on Sherman Creek.

The Kensington Mine is located on the Kakuhan Range adjacent to Lynn Canal in the Tongass National Forest about 72 km (45 miles) north of downtown Juneau, but is still within the City and Borough boundary (Figure 6). Gold was first discovered at the Kensington site in 1887, however only sporadic production has occurred there totalling about 11,000 metric tons. In 1987, the project proponent submitted a Plan of Operations to the U.S. Forest Service, the lead agency, for development of the mine. A DEIS was completed in June of 1991, with the FEIS released in February of 1992 (13).

The NEPA process for the Kensington Mine took over three years to complete, and the permitting process is expected to take an additional year. Much of this time involved compiling technical information and addressing concerns identified in the public comment period.

The project proponent had originally proposed the use of submarine disposal of tailings, but later abandoned it after discussions with the U.S. EPA determined that this disposal method was not permittable under the New Source Performance Standards of the Clean Water Act (40 CFR 440.104). These regulations recognize that "the elimination of the discharge of pollutants to navigable waters may result in an increase in discharges of some pollutants to other media. The Agency has considered these impacts" (40 CFR 440.104(b)(1)).

In the Final EIS, the U.S. Forest Service states that "submarine disposal of tailings appears to represent the only reasonable alternative method to onshore disposal." However, the EPA "conducted a thorough review of this issue to determine whether or not flexibility exists within the guidelines and underlying statute to allow the subject discharges to marine waters. It was concluded that, without changes in the statutory framework established by the Clean Water Act, these discharges could not be authorized". The EPA further states that "we have noted that it is our opinion that a thorough and meaningful analysis of submarine tailings disposal as a

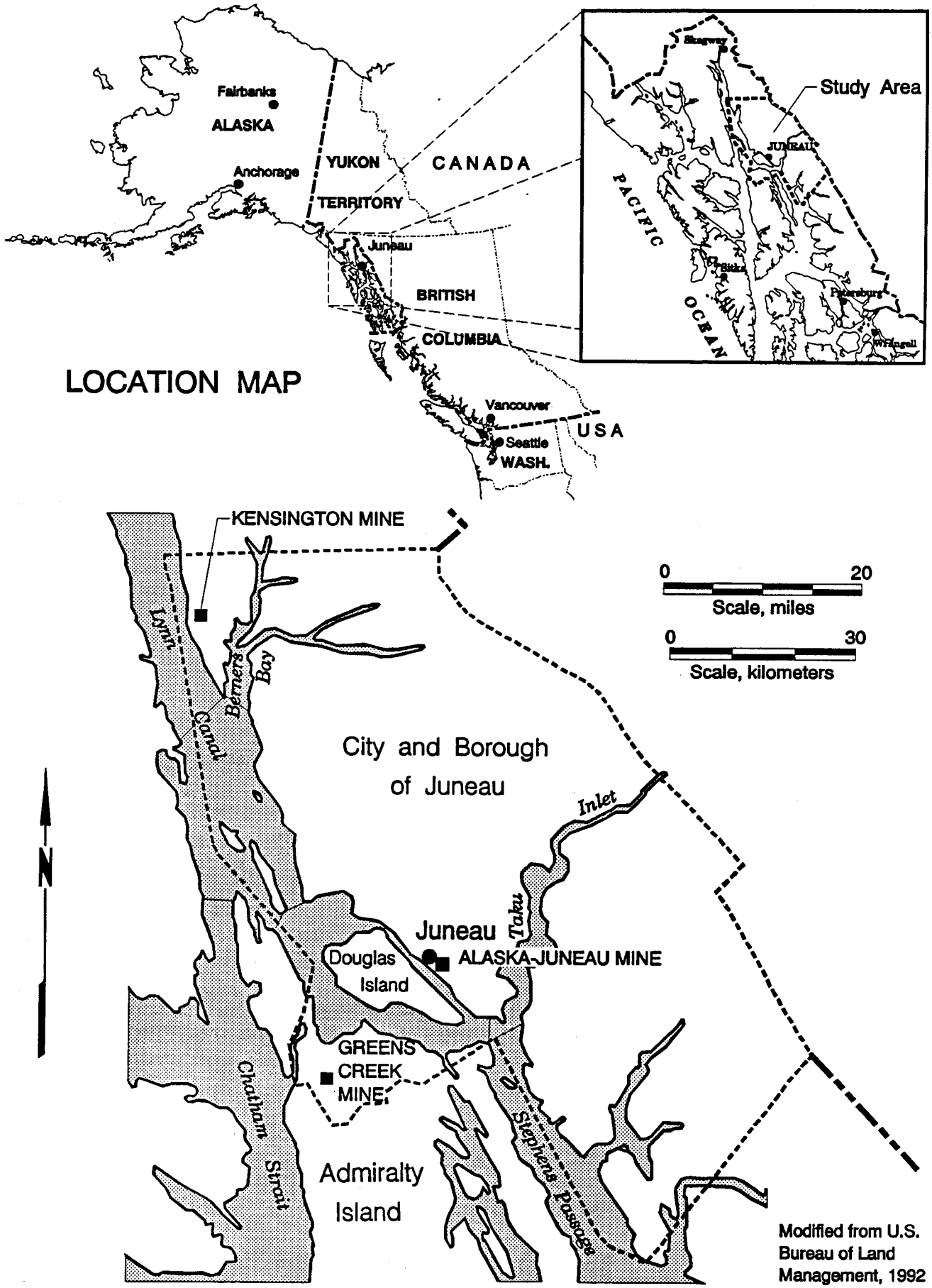

Figure 6. - Mining activities within the City and Borough of Juneau.

'reasonable alternative' cannot be accomplished in the EIS. Although a limited discussion of submarine tailings disposal in the EIS is necessary, a detailed comparison with permittable upland disposal alternatives would not be feasible" (27).

For this reason, submarine disposal of tailings was not considered in detail in the EIS, therefore the environmental impacts of this disposal method were not evaluated. Representatives of the project proponent and others believe that submarine disposal may be the tailings disposal method with the least environmental impacts in this case, however it could not be evaluated in the FEIS for the reasons given above.

Due to the regulatory structure of the Clean Water Act, therefore, an alternative which may have less overall environmental impacts than the one chosen could not be considered. This has implications for ecosystem management which seeks to evaluate impacts to ecosystems regardless of media-specific regulations or jurisdictional boundaries.

On the other hand, the goal of the Clean Water Act is to protect the nation's water resources. Also, while the EPA is concerned with protecting the environment, including marine ecosystems, what is viewed as protective may vary according to the scale considered. Such potentially conflicting goals may present challenges to ecosystem management in some cases.

Alaska-Juneau Mine

The Alaska-Juneau (A-J) project is a proposed underground hard rock gold mine expected to produce about 20,000 metric tons of ore per day with a gold production of about 11 million grams (350,000 troy oz) per year. Tailings disposal is planned in a tailings impoundment on Sheep Creek.

After the closure of other nearby gold mines (the Treadwell Mine in 1916 and the Perseverance Mine in 1920) the Alaska-Juneau Mine became for a time the largest low-grade underground gold mine in the world. The A-J Mine operated for fifty-one years until it shut down in 1944 due to labor shortages associated with World War II. Only recently has there been significant efforts to re-open it.

The location of the Alaska-Juneau Mine, adjacent to downtown Juneau, is shown in Figure 6. The NEPA process for the A-J Mine has taken over four years, and is still not complete. This is partially due to a change in management of much of the land involved from the BLM to the State of Alaska, which has delayed the ROD.

The individual permits are expected to be obtained within about one year after completion of the NEPA process. However, the project proponent has asked the U.S. EPA to postpone consideration of the NPDES permit until after the State of Alaska has completed revision of its water quality standards, which is in progress.

A main concern identified in this case is the length of time necessary for the NEPA process which, for both the Kensington and A-J projects, required much more time and effort than for the other cases studied. This was due primarily to the extensive public comments and concerns that these projects generated among residents of Juneau.

One issue of public concern with the A-J Mine is the method and location of tailings disposal.

The preferred alternative identified in the FEIS is disposal behind a 105 meter (345 ft) roller-compacted concrete dam in Sheep Creek Valley, a locally popular valley which contains a hiking path and historic mill site. The dam and subsequent tailings disposal would form a 180 hectare (440 acres) impoundment, inundating the valley. The U.S. Fish and Wildlife Service has begun an effort to apply its Habitat Evaluation Procedures at the site to evaluate impacts to wildlife habitat.

An alternative method of tailings disposal, submarine disposal of tailings, felt by the project proponent and others as potentially having less environmental impacts than on-land disposal for this site, could not be fully evaluated in the EIS. This was due to the prohibition on marine disposal by New Source Performance Standards of the Clean Water Act, aimed at protecting the nation's water resources, as discussed above for the Kensington Mine.

The FEIS for the A-J Mine Project states that "preliminary analysis by (an environmental consultant) suggested that marine tailings disposal at these locations would cause a lesser degree of anticipated environmental consequences compared to land-based disposal" (30). Therefore, as with the Kensington Mine, a tailings disposal alternative which had potential for less overall environmental impacts could not be considered and fully evaluated due to a medium-specific prohibition on its use, rather than through an assessment of risks to ecosystems. Again, this points to challenges which face implementation of ecosystem management.

IMPACT OF ECOSYSTEM MANAGEMENT ON PERMITTING

Nation-wide, several federal agencies are implementing or are expected to implement policies which require an ecosystem perspective on land-management. In Alaska, however, only the Forest Service has instituted ecosystem management in an overt and organized way. The BLM in Alaska is expected to receive policy direction on ecosystem management in the near future. Other federal agencies are moving toward ecosystem management in an evolutionary manner, but it is likely that most federal agencies will move more directly on this in the future. As an example, the U.S. EPA has proposed management of some contaminated sites based on assessment of risks to sensitive ecosystems.

State of Alaska agencies are instituting ecosystem management only in-so-far as it is becoming a tool for environmental management in general. Eventually, administration of programs such as the State Coastal Zone Management Plan may institute ecosystem management concepts, thereby providing a more comprehensive environmental management framework.

On the local level, the City and Borough of Juneau has taken significant leadership steps with its Wetlands Management Plan. The plan, which categorizes wetlands according to wetland function and value as ecosystems, is an ambitious undertaking for the City. With this plan, a General Permit has been sought for about ten percent of Juneau's accessible wetlands, while the remainder would require individual permits for development.

For the large mine permitting cases considered, the NEPA process required from a few months to over four years to complete. The longer NEPA processes, where an EIS was required, have been associated with the most recent efforts within the City and Borough of Juneau (the Kensington and A-J Projects), while the shortest was for the BIMA in which no EIS was produced. Some preliminary concepts of ecosystem management have come into play in permitting of the Alaska mines considered here, primarily through the NEPA process.

The difference between the more macroscopic perspective generally used with ecosystem management and the more microscopic view required for site specific studies caused tension in at least one case. This tension was evident during the NEPA process of the Kensington Project, where the macroscopic view could not be fully carried through to the Environmental Impact Statement. The issue of scale is also important when reconciling goals such as protection of the nation's water resources, as required by the Clean Water Act, with utilizing technologies with the least environmental impact at a particular site.

The BIMA Dredge study demonstrated that data can be shared with all interested parties, in this case by open communication through the Project Review Committee. However, a high level of commitment was required from all parties to realize benefits because of the relatively large amount of time and travel expenses required. Therefore this method of communicating is considered best for large projects.

The need for communication between regulatory agencies and project proponent was a recurring theme in the case studies. Where a high level of communication was achieved, this was identified as an invaluable asset to the project. Where communication was viewed as insufficient, it was seen as a major hinderance to efficient mine permitting.

The BIMA case was unique in that environmental monitoring was used to address uncertainty from the lack of an EIS. This increased the cost of the monitoring program, but decreased the time required to get the BIMA dredge started.

The Red Dog Mine was a case in which jurisdictional boundaries were transcended to allow the alternative with the least environmental impacts to be chosen. The Red Dog case study demonstrates the ecosystem management theme of assessing impacts to entire ecosystems rather than limiting such assessments because of the jurisdictional boundaries involved. This may not be possible in all cases under the present regulatory regime, but was possible in this case due to special provisions of ANILCA.

The Alaska-Juneau and Kensington case studies, on the other hand, demonstrate that environmental media-specific regulations, while aimed at protecting natural resources, may limit or prematurely exclude a potentially viable and environmentally sound alternative. Such conflict will present a challenge to implementation of ecosystem management which seeks to assess alternatives based on risks to entire ecosystems.

The Greens Creek case study shows that some mitigation efforts can achieve large benefits with little cost, while others may achieve little benefits at large cost. This points to the need for cost-benefit analysis when mitigation measures are considered.

Ecosystem management has begun to have effects on the mine permitting process in Alaska. As can be seen from the case studies cited, ecosystem management concepts are being introduced into the mine permitting process. However, to date in Alaska this has been limited and has come primarily through the NEPA environmental assessment process. More direct influence of ecosystem management through legislation and agency policy is expected in the future.

CONCLUSIONS AND RECOMMENDATIONS

The impact of ecosystem management concepts and issues on the mine permitting process in Alaska has been reviewed. To date, ecosystem management affects major mine permitting in Alaska primarily through the NEPA environmental assessment process. To a certain degree, regional land planning by federal land-management agencies affects mine permits, and it is at this level that ecosystem management is initiated. However, until ecosystem legislation is enacted, and because the NEPA process is site specific while land planning is done on a regional basis, the NEPA process is the main avenue for ecosystem management concepts to affect mine permitting.

For the cases studied in this report, the NEPA process has taken from a few months to over four years to complete. The longer time periods have been associated with the most recent NEPA processes (the Kensington and A-J Projects), although this may be due to site specific considerations and community concerns as much as to increasing complexity of the NEPA process itself.

No recent regulations have been promulgated which require ecosystem management directly, however this is expected to change in the near future. The Forest Service has some requirements for an ecosystem perspective since the passage of the Multiple-Use Sustained Yield Act of 1960. However, the present shift toward ecosystem management has grown out of the understanding that for yield to be truly sustainable, a healthy, fully functioning forest ecosystem must be present and maintained.

Nation-wide, several federal agencies are implementing or are expected to implement policies which require an ecosystem perspective on land-management. In Alaska, however, only the Forest Service has instituted ecosystem management in an overt and organized manner. Other agencies are moving toward ecosystem management in an evolutionary manner, but are expected to move more directly in the future. The effect in Alaska of PACFISH, initiated jointly by the Forest Service and the BLM to manage anadromous fish habitat, is unknown at present.

Several ecosystem management issues were identified in the case studies of large mine permitting in Alaska.

- Effective communication between agencies and between agencies and the project proponent is key to successful and efficient permitting. Effective communication is inherent to ecosystem management because of the macroscopic view it entails.

- Organization, coordination, and/or standardization of NEPA environmental impact assessment and environmental monitoring programs among agencies is needed by both governmental agencies and project proponents.

- In one case, jurisdictional boundaries were transcended to allow selection of the alternative with the least environmental impacts. It is questionable whether this can always be accomplished under the present regulatory regime, however.

- In two cases, a environmental medium-specific prohibition against tailings disposal in marine waters prevented a full assessment of the risks of a tailings disposal alternative to the ecosystem and the environment.

- Some mitigation efforts can achieve large benefits with little cost, while others may achieve little benefits at large cost.

The review of the case studies and the permitting process for large mines in Alaska has identified several areas where the implementation of ecosystem management principles has the potential to improve the permitting process. Several recommendations for improving the permitting process, resulting from these studies and contact with regulatory agency and company personnel, and in light of principles of ecosystem management, are noted below.

- Attempt to build effective communication between regulatory agencies, project proponents, special interest groups, and others involved in the permitting process. This may be done by establishing regular but informal communication processes such as the PRC used in the BIMA case.

- Strive to allow assessment and selection of alternatives based on risks to ecosystems regardless of jurisdictional boundaries or environmental media-specific regulations. It is recognized that conflicting goals and differing scales of perspectives may complicate this effort.

- Develop coordination and standardization of NEPA environmental impact assessment, risk assessment, and environmental monitoring requirements among agencies in light of ecosystem management concepts.

- Perform cost-benefit analyses when mitigation efforts are required.

One positive effect that ecosystem management concepts could have on mine permitting is to simplify the NEPA environmental assessment process by standardizing and consolidating much of the baseline environmental data requirements. Ecosystem management could also be used as a way to systematize and organize permitting and environmental monitoring requirements, to give guidance to land-management agencies, regulatory agencies, and project proponents.

Coordination of efforts and standardization of requirements for the NEPA process itself are also benefits that could be realized through ecosystem management. The NEPA review process could be streamlined if environmental impact assessment was coordinated among both regulatory and land-management agencies and project proponents. Therefore standardization of requirements should be developed for NEPA environmental impact assessment and regulatory environmental monitoring in light of ecosystem management concepts.

A requirement for ecosystem management to be effective is increased communication and cooperation between all concerned parties. Several of the case studies examined in this report identified a lack of communication between agencies as a problem and hinderance to efficient permitting. Ecosystem management has the potential to bring together local, state, and federal agencies, the mining companies, and other interested groups including environmental organizations, to improve communications, consolidate data requirements and requests, and identify concerns. Emphasis should continue to be placed on improving communications between agencies, project proponents, special interest groups, and the general public.

When mitigation efforts are required, cost-benefit analyses should be performed to ensure that as much as possible is being obtained from the available resources. The Juneau Branch of the

Alaska Field Operations Center of the Bureau of Mines is producing a report which considers mitigation of ecosystem impacts and cost-benefit analysis at a mining site in Alaska (16).

The central theme of ecosystem management is that management decisions must consider entire ecosystems. This requires that assessment of impacts be made based on entire ecosystems, rather than be limited to jurisdictionally bounded areas, such as a National Monument, or particular environmental media, such as marine water. When ecosystem management allows, to the greatest extent possible, assessment and selection of alternatives based on risks to entire ecosystems, then ecosystem-based decision-making processes should maximize benefits and minimize impacts to those ecosystems.

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APPENDIX

PERMITTING FLOW CHART

The permitting process is actually a two part process. The first part is the environmental assessment - environmental impact statement (EA - EIS) under the National Environmental Policy Act (NEPA) which promotes consideration of environmental concerns by federal agencies. The second part is the actual application for each of the individual permits required for specific segments of the project activities throughout the exploration, construction, operation and abandonment stages.

The permitting flow chart (Figure 2) is a greatly simplified and idealized representation of the mine permitting process in Alaska. On this chart the areas where consideration of environmental and ecosystem impacts and mitigation measures would occur can be seen.

A NEPA review is required whenever a project affects federal land or when discharges to surface waters of the U.S. occurs. Whenever there are federal actions which significantly affect the quality of the human environment an EIS must be written. The specific parts of the EIS which relate to ecosystems are (A) the description of primary and secondary impacts on the environment including the impacts on aquatic and terrestrial ecosystems and (B) a description of probable environmental impacts including impacts on ecological systems such as wildlife and aquatic life. All significant alterations to existing conditions whether they are beneficial or detrimental must be considered and reported by the individuals or organizations proposing the action. (There are other requirements of the EIS which are less directly related to ecosystem affects).

In order to assess the likely effects the project will have on the environment, the EIS must contain detailed information about the existing ecosystems within the potentially affected area. This baseline data must be collected prior to any developmental impacts, therefore it takes place before and/or during the EIS process. Ideally a positive Record of Decision (ROD) is issued prior to proceeding with the second part of the permitting process.

In the second part of the process individual permits are issued contingent upon the proposed plan of operations, baseline data, and preferred alternative derived from the NEPA review process. Some of the permits issued will directly or indirectly consider ecosystem impacts, such as the Habitat permit from the Alaska Department of Fish and Game (ADF&G).

PERMIT REVIEW COORDINATION

COASTAL ZONE AREAS CONSISTENCY CERTIFICATION, - State Lands - Operations in the Coastal Zone must be conducted in a manner consistent with the approved Alaska Coastal Management Program (ACMP) standards. For projects requiring Federal approvals or a mixture of State and Federal approvals, the applicant must submit a project packet to the Alaska Department of Governmental Coordination (DGC) who will complete the review process. PL 92-583, AS 46.40 and 44.62, 15 CFR 923 and 930, 5 AAC 80 and 85, 6 AAC 50 provide the DGC with the requisite authority.

NON-COASTAL AREAS - Coordination of mining permit applications is normally the responsibility of the mining company itself.

MAJOR ENVIRONMENTAL PERMITS AND APPROVALS

AIR QUALITY PERMITS - State and Federal - The Alaska Department of Environmental Conservation (ADEC) and the EPA regulate airborne emission sources by issuance of permits, approvals, and/or regulatory control and monitoring. These regulatory controls are generally required for stationary sources associated with mining, milling and ultimately with smelting or other refining (crushers, roasters, dryers, power plants, etc.). Regulatory authority is based on New Source Performance Standards, Clean Air Act and Amendments of 1970 and 1977, 18 AAC 50, 40 CFR 60.

HABITAT PERMIT, - The Alaska Department of Fish and Game (ADF&G), Habitat Division regulates on-land habitat altering activities through the issuance of a Special Areas Permit and regulates anthropogenic effects on anadromous fish waterbodies by the issuance of a Fish Habitat Permit. Authority to issue this permit derives from Alaska Statutes Title 16.

RIVERS and HARBORS, Section 10 Permit - The Corps of Engineers (COE) regulates activities affecting navigable waters and wetlands such as construction of any structures in or over navigable waters of the U.S. or the excavation of material in such waters or for any other work affecting the course, location, condition or capacity of such waters (except bridges or causeways) by the issuance of a Section 10 permit. The authority for issuance of this permit derives from the Rivers and Harbors Act of 1899, Section 10.

DREDGE and FILL, Section 404 permit - Under the section 10 permit, allowed activities requiring the discharge of dredged or fill materials into navigable waters requires additional authorization from the COE under the Clean Water Act of 1972 and 1977, Section 404.

NPDES PERMIT, Section 402 Permit, Discharge to Surface Waters of the U.S. - National Pollution Discharge Elimination System (NPDES) - The Environmental Protection Agency regulates discharges of waste water from one or more point sources into waters of the U.S. For new sources a NEPA review is required. The ADEC is allowed a 30 day period for Certification of Reasonable Assurance (401 Certification). The Federal Water Pollution Control Act (FWPCA) Sec.402, 40 CFR 122, 40 CFR 125 and Clean Water Act of 1977, Sec. 401, 18 AAC 15 provides the legal authority for the permit.

WASTE WATER DISPOSAL PERMIT - Discharge to land, surface water, groundwater (when NPDES is not required) - The ADEC can issue a Waste Water Disposal Permit or can accept a combined application form entitled "Application for Plan Review and Waste Disposal Permits for Ore Leach Mining Operations" to be used by mines for solid waste disposal and wastewater discharge permits from heap and vat leach mining operations. The State of Alaska administers this permit under AS 46.03, 18 AAC 70, and 18 AAC 72.010-.100.

SOLID WASTE DISPOSAL PERMIT - Onland, State and Federal - The ADEC regulates disposal of tailings and wasterock with acid rock drainage (ARD) potential and other solid and semisolid wastes by the issuance of a Solid Waste Disposal Permit. This permit would be needed as soon

as landfill disposal of camp wastes becomes desirable and for the remainder of the project. The State of Alaska administers this permit under AS 46.03.100 and 18 AAC 60.

LAND USE PERMITS, - The Alaska Department of Natural Resources (ADNR) regulates most activities involving a permanent improvement on or of State Lands (other than the extraction of natural resources) by the issuance of an Upland Lease or Tideland Lease. Most temporary surface activities will require either the Land Use Permit or the Tideland Permit. Authority for the state to regulate these land uses comes from the Alaska Land Act, AS 38.05. The various federal land management agencies require either permits, leases, or easements for most surface activities, other than casual use. Federal authority derives from the Federal Land Policy and Management Act of Oct. 21, 1976 (FLPMA Sec. 32, 43 CFR 2920).

WATER ACQUISITION AND USE - The Alaska Department of Natural Resources (ADNR), Division of Water regulates the use of significant amounts of water (a significant amount of water is defined as any use of 5,000 or more gallons of water in a single day from a single source, or the regular daily or recurring seasonal use of 500 or more gallons of water per day or more per year from a single source, or any water use that may adversely affect the water rights of other appropriators or the public interest) by issuance of Temporary Water Use Permits or Water Rights Permit/Certificate of Appropriation. Regulatory authority derives from the Alaska Water Use Act and the following codes and statutes: AS 46.15.030 - .185, 11 AAC 93, 11 AAC 05.010.

PLAN OF OPERATIONS, - Federal Lands - On all Federal lands an approved Plan of Operations is required for activities which may result in significant surface resource disturbance. Bonding to cover costs of reclamation will be required in almost all cases prior to start of operations. The following U.S. codes can apply (depending on which land management agency has regulatory authority): 43 CFR 3809, 36 CFR 228 (also USFS public CI/14), 36 CFR 9.9 and 9.10, 43 CFR 36, 25 CFR 216, 42 CFR 3590.

ALASKA MINE RECLAMATION PERMIT - The State of Alaska requires reclamation of all mining operations regardless of size, type of material being mined or the landowner. A minimum reclamation standard has been established and the ADNR administers the program by entering into cooperative agreements with State and Federal agencies and by requiring a reclamation plan and bond for all sites over five acres before any mining activity takes place. This permit regulates the disposal of innocuous overburden and wasterock and requires reclamation of all mining operations to a minimum standard. Authority for this permit derives from AS 27.19 and 11 AAC 97.

LOCAL MINING PERMIT - Some local governments (borough or city level) have enacted or are considering enactment of mining permit requirements. However at this time only the City (and Borough) of Juneau has enacted such a requirement.

ACKNOWLEDGMENTS

The authors wish to thank the following:

Roger L. Baer, U.S. Bureau of Mines, Larry L. Reeder, U.S. Army Corps of Engineers, Kathleen S. Morse, U.S. Forest Service, and Wade E. Martin, Colorado School of Mines, for providing technical review of the manuscript; and Donald R. Johnson, Jr., U.S. Bureau of Mines, for providing cartographic expertise.