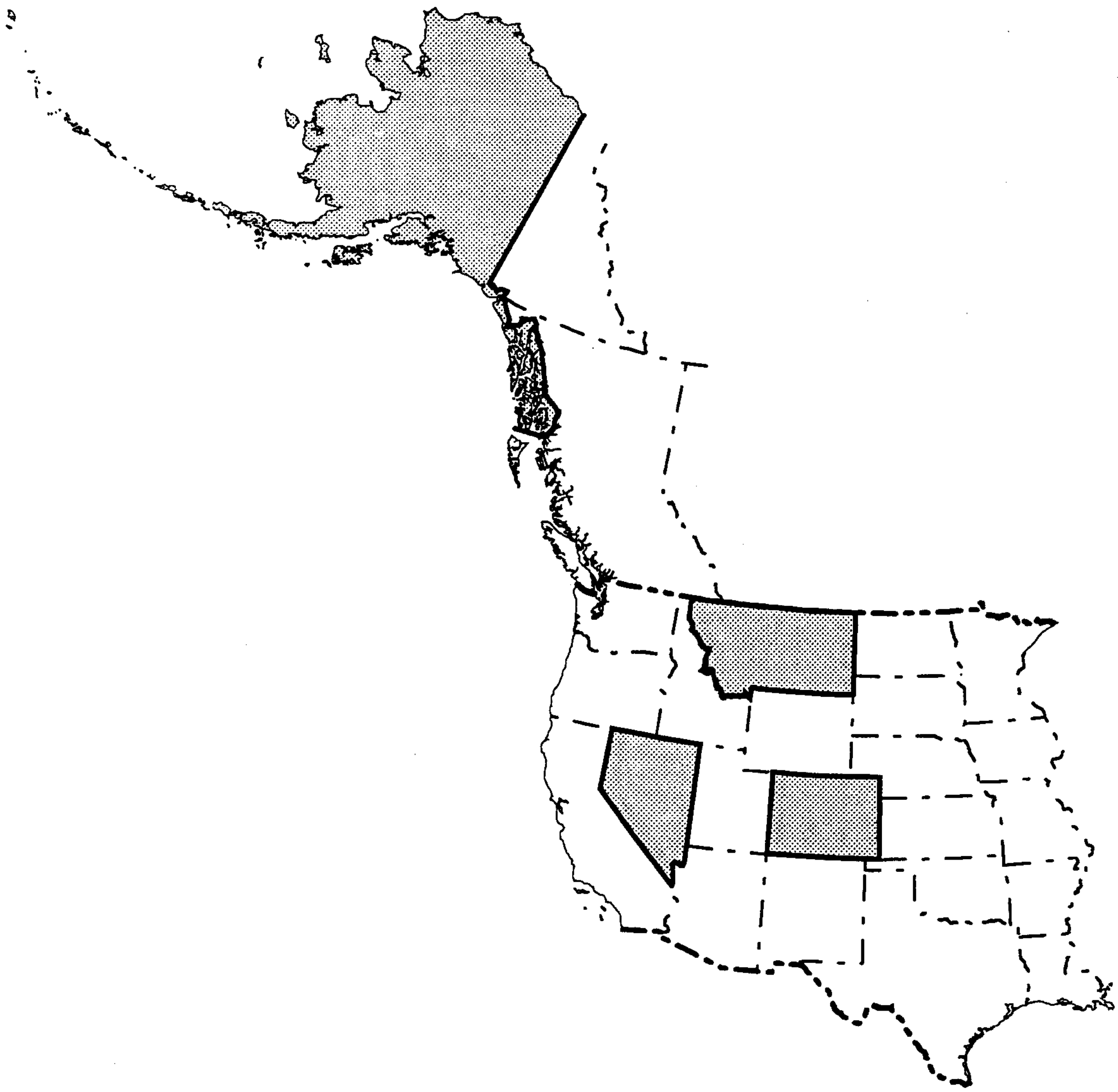
ENVIRONMENTAL COMPLIANCE IN THE MINE PERMITTING PROCESS: CASE STUDIES FROM ALASKA, COLORADO, MONTANA AND NEVADA



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ENVIRONMENTAL COMPLIANCE IN THE MINE PERMITTING PROCESS: CASE STUDIES FROM ALASKA, COLORADO, MONTANA AND NEVADA

prepared for:

U.S. Bureau of Mines
Alaska Field Operations Center
P.O. Box 20550
Juneau, Alaska 99802-0550

prepared by:

Wade E. Martin & Lisa A. McDonald
Environmental Policy Center
Mineral Economics Department
Colorado School of Mines
Golden, Colorado 80401-1887

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EXECUTIVE SUMMARY

Case studies from four western states are used to illustrate the impact of the environmental compliance process on the mining industry. The case studies were not chosen as a statistically significant sample of all mining operations in the western United States but were chosen as representative of operations on both public and private lands and in locations that exhibited varying degrees of involvement by governmental units, non-governmental organizations and the general public. Basically, each case study was chosen because some aspect of their environmental compliance process helped to illustrate an interesting point in the regulatory process.

The criteria used to select the case studies were: mines located in different jurisdictional areas; mines located in varying geological areas; mines located in areas having different historical relationships with mining; and operations that are in production as well as those seeking an operating permit. The variety of such projects should provide the necessary foundation to evaluate the impacts of the environmental compliance process in each location.

The four states considered are: Alaska; Colorado; Montana; and Nevada. Ten case studies were selected from these four states. Three gold mines - the Alaska-Juneau Mine, Fort Knox, and Kensington - where selected in Alaska. Two mines were selected in Colorado - the Mt. Emmons molybdenum mine and the San Luis gold mine. A gold mine - Jardine - and a copper/silver mine -Montanore - were selected in Montana. Finally, three gold mines - Big Springs, Lone Tree and Sleeper - were selected in Nevada. Although the majority of the case studies are gold mines, the environmental compliance process is similar for all minerals.

The use of the phrase environmental compliance process is meant to reflect the activities of the participants prior to the construction and operation of a mining project. The focus is on the regulatory compliance structure in obtaining the necessary operating and discharge permits and not in complying with the requirements of these permits once operation begins.

Each of the case studies addresses the impacts of the environmental compliance or permitting process in two areas: design modifications and timeline impacts. The impacts vary considerably from location to location. The regulatory structure of each state is shown to have a significant impact on both design and timeline impacts. It is also shown that within a state the impacts can vary depending on the role of the local government in the compliance process. Both the interstate and intrastate differences are addressed but a judgement regarding what system is most efficient or equitable is not made. The objective of this report is to point out the differences between cases and not make a judgement as to which is "better".

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1.0 INTRODUCTION

The primary objective of this study is to examine the impact of the environmental compliance process on the choice of production technology and the timing of mine development. A number of case studies are used to identify what is actually occurring in the industry. The case studies are located in four western states which have significant mining activity within their borders. The four states are: Alaska, Colorado, Nevada and Montana.

Environmental compliance has taken on a number of different meanings in the literature. Generally, most interpretations can be categorized by two different views. One defines environmental compliance as the requirements necessary to satisfy permit standards *during* operations. A second definition considers environmental compliance to include all requirements needed *prior* to an operational stage. This generally includes all NEPA and permit requirements needed before operations can commence. This research will use the second definition for environmental compliance and thus the focus will be on requirements that must be satisfied before operations begin.

The case studies were chosen with the purpose of identifying trends in information requirements, project timing, production technology changes, and firm level approaches to achieve compliance. Interesting aspects include:

- case studies in different jurisdictional areas;
- examples of mining projects located in or near wilderness areas as well as areas of relatively barren terrains;
- projects in areas which have supported mining activities as well as areas experiencing mining for the first time; and
- case studies which are still in the permitting stages as well as those which are in production.

The majority of the ten cases chosen are gold mines but also include examples of copper, silver and molybdenum mines. The cases examined in this study are not meant to represent the full spectrum of permitting issues but to document possible effects of the compliance process on mine development. A summary of the mines and the selection criteria is provided in table 1.1.

The purpose of choosing such a diverse number of projects is to determine the specific as well as general impacts of the environmental compliance process on mining activities in the Western states. Sections 2 through 5 will discuss each of the cases in some detail.

Table 1.1 Mine Selection Criteria

LOCATION/SITE		LAND OWNERSHIP				ENVIRONMENTAL ASSETS		OTHER	
STATE	MINE (Mineral)	FEDERAL		STATE	PRIVATE	WILDERNESS	NON - WILDERNESS	PREVIOUSLY MINED[B]	PROD
		USFS	USBLM						
ALASKA	A-J (Au)		√	√				√	
	Ft. Knox (Au)			√	√		√	√	
	Kensington (Au)	√			√		√	√	
COLORADO	Mt. Emmons (Mo)	√			√		√		
	San Luis (Au)				√		√	√	√
MONTANA	Jardine (Au)	√			√	√		√	
	Montanore (Cu, Ag)	√			√	√			
NEVADA	Big Springs (Au)	√	√		√		√		√
	Lone Tree (Au)				√		√	√	√
	Sleeper (Au)		√				√		√

A Wilderness in this context refers to areas defined as "wilderness" by the 1960 Wilderness Act. The mines marked as wilderness are those which are in or located very near a designated wilderness area.

B. These are areas which have experienced historically mining activities.

2.0 ALASKA

Three proposed mines in Alaska have been selected as case studies. These are the Alaska-Juneau (A-J) and Kensington projects, located in southeast Alaska and the Ft. Knox project near Fairbanks (see figure 2.1). All three projects are still in the proposal stage and have yet to complete all environmental compliance requirements. The A-J and Kensington projects are interesting case studies because of the unique regulatory framework the firms face. The structure of environmental regulations gives local agencies the opportunity to participate in the permitting process and the City and Borough of Juneau (CBJ) has exercised this option. Both A-J and Kensington are located within CBJ's jurisdiction and are subject to these regulations. This situation appears to have further complicated the compliance process for mining projects and thus makes for interesting case studies.

The Fort Knox project, which is presently owned by AMAX Gold, Inc. is seeking approval for operations in central Alaska. The project is interesting as a case study because it is located in an area which has supported nearly a century of mining activities. This has had a positive influence on the way mining is perceived in the area. The analysis thus provides some insight into how public perception can influence the permitting of a project. The case is also interesting as a comparison with the other two cases located in southeast Alaska. This is due to the very different approaches the two local governing agencies have chosen to use in dealing with proposed mining projects. These aspects will be discussed in detail below.

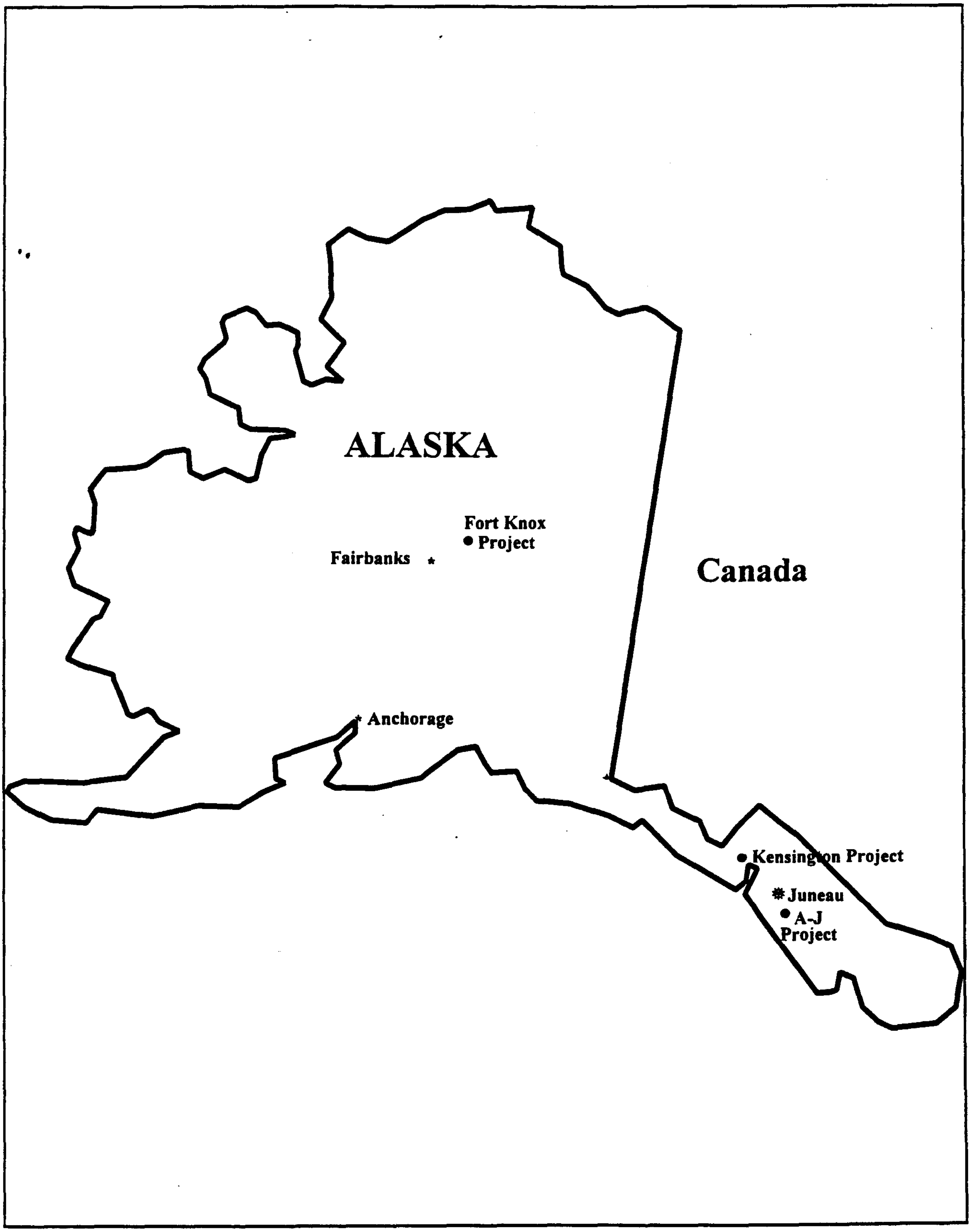
2.1 Alaska-Juneau Mine Case Study

A study of the Alaska-Juneau Mine (A-J) provides insight into the effects of the mine permitting process on project development in southeast Alaska. The important issues highlighted by the permitting of the A-J mine are: its location adjacent to Juneau (see Figure 2.1); a long history of operation (first opened prior to 1900); permitting requirements under a local ordinance as well as the more common federal and state permitting regulations; major design changes from the original plan; socioeconomic impacts of the project; and a change in the ownership of the public lands from the federal to the state government. Each of these issues provides information of interest and importance for other mining projects.

Mine History

Gold was discovered in placer deposits in the Juneau area in the early 1880's. After further prospecting, the A-J Mining Company filed for thirteen patented lode claims in the Silver Bow Basin in 1897 (Echo Bay Exploration, 1990). The A-J Mining Company began production at the A-J mine using a 30-stamp mill soon after the patents were filed. The mine reached peak production of 13,000 tons per day in the 1920's after a number of improvements and the addition of a new ball mill (Echo Bay Exploration, 1990). The Perseverance mine was originally operated by the Alaska Gastineau Gold Mining Company from 1912 to 1920. This property was purchased by the A-J Mining Company in 1934 and was mined as part of the A-J operation which continued until 1944 when it was closed due to labor shortages and increasing production

Figure 2.1 Alaska Case Studies



costs associated with the war effort (Echo Bay Exploration, Inc., 1989).

The A-J mine was one of the largest underground gold mines in the world at one time (Engineering & Mining Journal, 1991). Production from the A-J and Perseverance mines approached 100 million tons of ore with an average gold grade of 0.043 ounces per ton and eventually produced 3.52 million ounces of gold (Echo Bay Exploration, 1990). All properties and facilities associated with the mine were purchased by Alaska Electric Light and Power Company (AEL&P) and the City and Borough of Juneau (CBJ) in 1972. AEL&P and CBJ reached a unitization agreement in 1980 in which they agreed to handle all future negotiations with any company concerning the mining property as a single unit.

The essential elements of the proposal submitted by Echo Bay Alaska (EBA) states that the mine project has 46 million standard tons of proven and probable gold reserves at a grade of approximately .05 ounces/ton. The mine is scheduled to produce 22,500 short tons of ore per day with the life of the mine estimated to be 13 years (USBLM, 1992). The proposed A-J project involves building a surface facility on a thirty acre site located at Thane, southeast of Juneau for processing and refining of crushed ore. The Bradley Adit, a 2.7 mile tunnel, will be constructed connecting the surface facility with an underground crushing facility located next to the ore body (see figure 2.2).

EBA will use the stoping under rock fill (SURF) mining method (USBLM, 1992). This bulk mining method was chosen due to the low grade of the deposit. Ore will be mined from predetermined blocks[1] in two steps. First, twenty-five percent of the ore will be removed to make room for the remaining broken ore. Next, the remaining ore will be extracted by mechanical scoops after a sequenced mass blast. The broken gold-bearing ore will then be transported to an underground crushing mill where it is crushed and gravity separated. The remaining fine grain material is transported to the surface facility for further refining using a cyanide leaching process. It is proposed that the cyanide treated tailings be thickened into a slurry and pumped back through the Bradley adit to a tailings impoundment dam located in Sheep Creek valley. Excess wasterock will also be transported to a permanent disposal site in Sheep Creek valley.

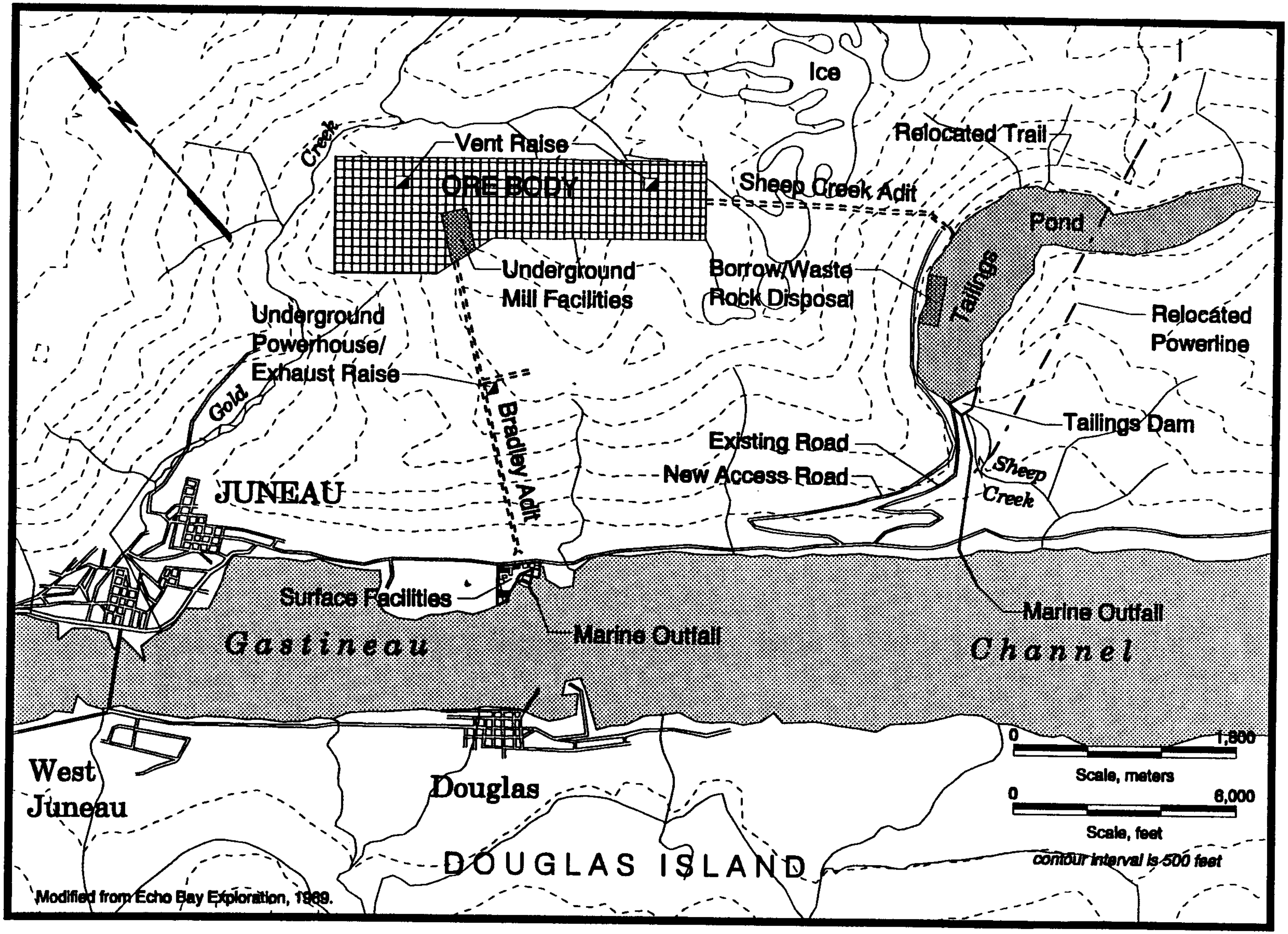
Impacts of Compliance Process

The permitting process for the A-J mine began in 1989 and has continued through 1993 and as of now there is still no record of decision. During this process not only did the various governmental agencies[2] involved have significant input but there were over 100 public meetings regarding the proposed project (see table 2.1). The results of this environmental compliance process relevant to the A-J project were a number of design modifications and time delays. This case highlights the potential impacts of the process on mine development. Over the course of

[1]The predetermined blocks (unit stopes) are 160 feet along the direction of the ore body, 380 feet high and range from 40 to 550 feet in width (USBLM, 1992).

[2]Federal, state and local agencies have all been actively involved in the permitting of the A-J mine.

Figure 2.2 A-J Mine Plan



permitting the A-J mine EBA has been faced with a variety of unusual events. Four issues that either affect or are affected by the permitting process are considered. These include: reopening of the mine; development within city boundaries; socioeconomic impacts; and land ownership issues.

As stated above, the A-J mine had previously operated for approximately thirty years and if it should reopen, it will have been at least fifty years since it last operated. Over this time dramatic changes have occurred, particularly regarding the attitudes of environmental impacts of a mining activity. It appears that the area, which has traditionally been dominated by supporters of extractive industries, has now also attracted a strong anti-development component. CBJ is populated by a significant number of individuals that were attracted to the area as part of the state government and would like to see development in the extractive industries halted, particularly within sight of the city. This bimodal distribution of attitudes has resulted in the proposed re-opening of the mine to dominate the local political debate, thus delaying the permitting process.

Table 2.1 Permits and Approvals for A-J Mine

Level of Government	Agency	Permit or Requirement
Federal	USBLM	POO, NEPA
	USF&W	Biological Clearance
	COE	CWA (404 Permit)
	EPA	NPDES, SPCC
State of Alaska	ADEC	Cert. of Reas. Assurance, Oil Contingency plan, Air Quality Permit, Solid Waste Permit, Oil Facilities Approval of Fin. Resp.
	ADGC	Coastal Project Questionnaire, Coastal Management Program
	ADNR	Water Right, Tidelands Lease, Dam Permit, ROW permit
	ADF&G	Fish Passage Permit, Fish Habitat, Approval of Coastal Zone Management
Local	CBJ	Mining Ordinance

Another important issue which has affected the permitting of the A-J mine is the development of the site within CBJ. CBJ was the first local government in southeast Alaska to expand their influence in the environmental compliance process to include actual legal requirements designed to address environmental impacts prior to allowing development of a mine.[3] CBJ amended an ordinance which affects all exploration and mining activities within CBJ's jurisdiction on October 6, 1989 (CBJ Ordinance 89-47am, 1989). This ordinance is relevant to a number of mining operations and communities because the area within CBJ's jurisdiction is very large.[4] These amendments require mining and exploration activities within CBJ's boundary to obtain large mine permits from CBJ.

CBJ requires operators of large[5] mining projects to submit an application for a mining permit in the form of a report. The report contains specific information regarding mining operations which officials can use to determine if the operation complies with federal, state and local environmental requirements. Information which must be included in the application consist of (CBJ Ordinance 89-47am, 1989):

- Description of the mine site and affected surface area including all roads, buildings and processing facilities;
- Time table of the proposed mining operation;
- Description of all reclamation operations;
- Description of methods used to control, treat and transport hazardous substances, sewage and solid waste; and
- Description of other potential environmental, health, safety and general welfare effects.[6]

CBJ also requires operators to conduct a socioeconomic impact assessment. This assessment includes all beneficial and adverse impacts of a large mining operation on local conditions. The study must include the direct and indirect effects on facilities and services such as sewer and water, public safety and fire protection, education, and traffic and transportation. A number of socio-economic impacts of the A-J mine have been identified and have become a focus of the public debate. The concerns are centered around impacts on area housing, schools, services such as chemical dependency, mental health and child care, police and fire protection and negative impacts on recreation facilities.

The issues have been raised because most of the areas mentioned are reaching threshold

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[3]State and local governments are allowed to set criteria which are more stringent than federal regulations as long as a right which has been granted by federal legislation is not rendered impossible to exercise by such laws (Laitos, 1985).

[4]The City and Borough of Juneau is comparable in size to the state of Rhode Island.

[5]Large mine projects are ones which will disturb 20 or more acres, employ 75 or more or where there is a full DEIS/FEIS involved (CBJ Ordinance 89-47am, 1989).

[6]An additional requirement for a mining permit from CBJ is a financial warranty. The amount of the financial warranty will be determined by city officials using the advice of the engineering department and consideration of all financial warranties given to other agencies.

levels and would not be able to absorb a significant increase in the population like those which could occur with a large mining project. While a mining project like A-J can have such affects on a community it is important to realize that CBJ would have to face these issues regardless of the type of economic activity which would stimulate population growth in the area.

Another important issue affecting the permitting of the A-J mine is the change in land ownership from the federal to state government. When EBA first proposed re-opening the A-J mine they approached the Bureau of Land Management (USBLM) to begin the permitting process. However, by the time the Final Environmental Impact Statement (FEIS) was released in 1992 the USBLM no longer had any authority over the project. This has resulted in uncertainty regarding who would issue the Record of Decision (ROD) associated with the project proposal. The efficiency of the process designed by CEQ may no longer hold since the USBLM will not write the ROD.

The reason that the role of USBLM, which was the lead agency throughout the NEPA process, ended prior to the end of the process dates back to the Alaska Statehood Act of 1959. When Alaska was admitted to the union the statehood act specified that the new state would be permitted to select 100 million acres for the state. Once the state began selecting land, controversy surfaced regarding claims by Alaskan natives. This controversy was resolved by passage of the Alaska Native Claims Settlement Act (ANCSA) in 1971.

Under ANCSA Alaskan Natives and Native Corporations were allotted approximately 44 million acres, 80 million acres were set aside for the federal government and the state selection process was permitted to continue.[7] As part of the state land selection process the state has selected land surrounding the A-J mine that was previously managed by the USBLM. Since the USBLM is no longer directly involved in the land management of the area, they have adopted the position that they no longer have standing to issue a ROD and have basically resigned from the process. At this time it is unclear which agency will issue a ROD or if multiple agencies will issue RODs.

Design Modifications. An impact of the environmental permitting process on the A-J project are a number of design changes which were proposed by EBA. The majority of these changes can be attributed to the high degree of public scrutiny the project has experienced. This is mainly due to the close proximity of the project to Juneau and Douglas. Major design changes include: moving milling operations to an underground site; moving the surface facilities from the Rock Dump site four miles south to Thane; and using liquified petroleum gas (LPG) instead of diesel for power generation.[8]

[7]Other issues associated with land transfers in Alaska were addressed by Congress in the Alaska National Interest Lands Act of 1980. This act will not be addressed since it has little impact on the land ownership issues affecting the A-J mine.

[8]There were also a number of minor design changes which were initiated by the NEPA process which are not discussed here. The details of these changes are discussed in the Draft EIS (USBLM, 1991).

The decision was made to move milling operations to an underground location because of land availability, noise reduction and reduced surface effects. Problems associated with leasing[9] and the physical nature of the area along Gastineau Channel, reduced the number of sites available for a milling facility. Concerns were also raised regarding the noise accompanying milling. The close proximity of Juneau and Douglas reduced the feasibility of placing a milling facility on the surface due to noise generation during operation. EBA also has decreased surface effects by moving the milling facility below ground which will reduce intertidal and subtidal fill requirements (USBLM, 1991).

EBA has also proposed moving the surface facility four miles south from the Rock Dump site at the Thane location (see figures 2.2 and 2.3). A number of issues were raised regarding the location of surface facilities at the Rock Dump site which included (Echo Bay Exploration, 1990):

- Exposure to snow avalanche;
- Heavy truck haulage of waste rock on Thane Road;
- Lighting and noise as observed from Douglas Island and West Juneau;
- Increased tug and barge traffic nearing Douglas and Juneau;
- Extent of fill into marine waters;
- Flushing action of Gastineau Channel near Douglas and Juneau; and
- Potential for diesel fuel spills.

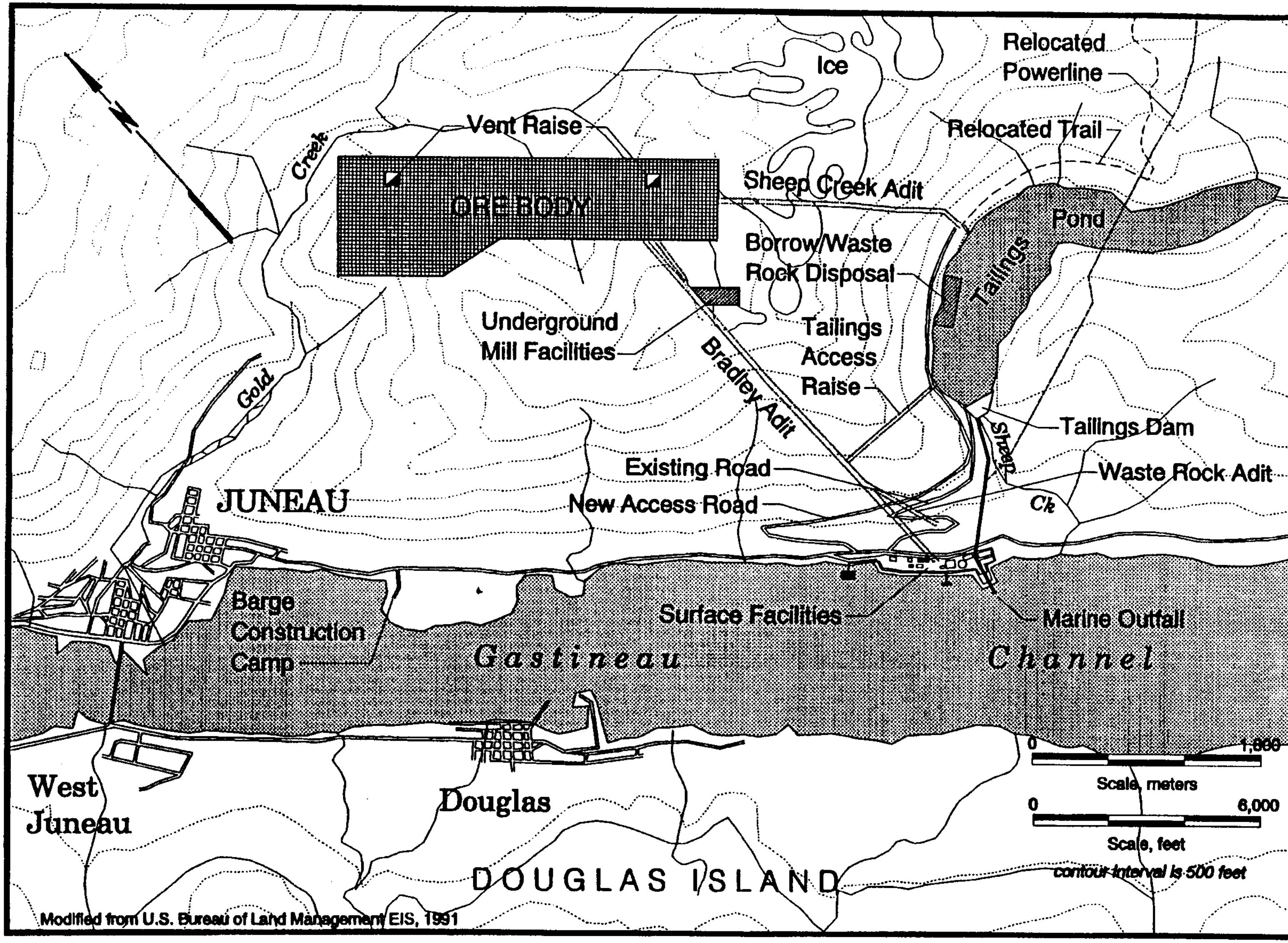
Concerns have also been raised regarding the air emissions caused by an underground energy generation process using diesel fuel. EBA has since proposed that energy generation at the underground facility use LPG instead of diesel fuel. This will reduce the air emissions of the facility.

Time Line Impacts. Also of importance to company officials are the necessary time requirements needed to bring the A-J project into operation. EBA, after several years of exploration and environmental baseline studies, filed the necessary documents with the USBLM to begin the permitting process in 1989. EBA also filed a number of appropriate permit applications with federal, state and local agencies. A preliminary DEIS was completed in October, 1989 and the DEIS for general comment was released in January, 1991. The initial permits were amended and evaluated with the FEIS which was released in May, 1992.

Company officials are assuming that NEPA review and authorization of the project will be completed in early 1994. This estimation may be optimistic since the land transfer between the USBLM and the state of Alaska has not been finalized. Even though the FEIS has been released
no ROD has been issued. At this time it is believed that either the EPA or COE will write the

[9]The location of any surface facilities at the North Rock Dump Site were eliminated from further consideration because of the ongoing litigation surrounding land ownership (Bank of California v. Hayes, IJU-82-2048 Civil Superior Court, First Judicial District at Juneau) (USBLM, 1989).

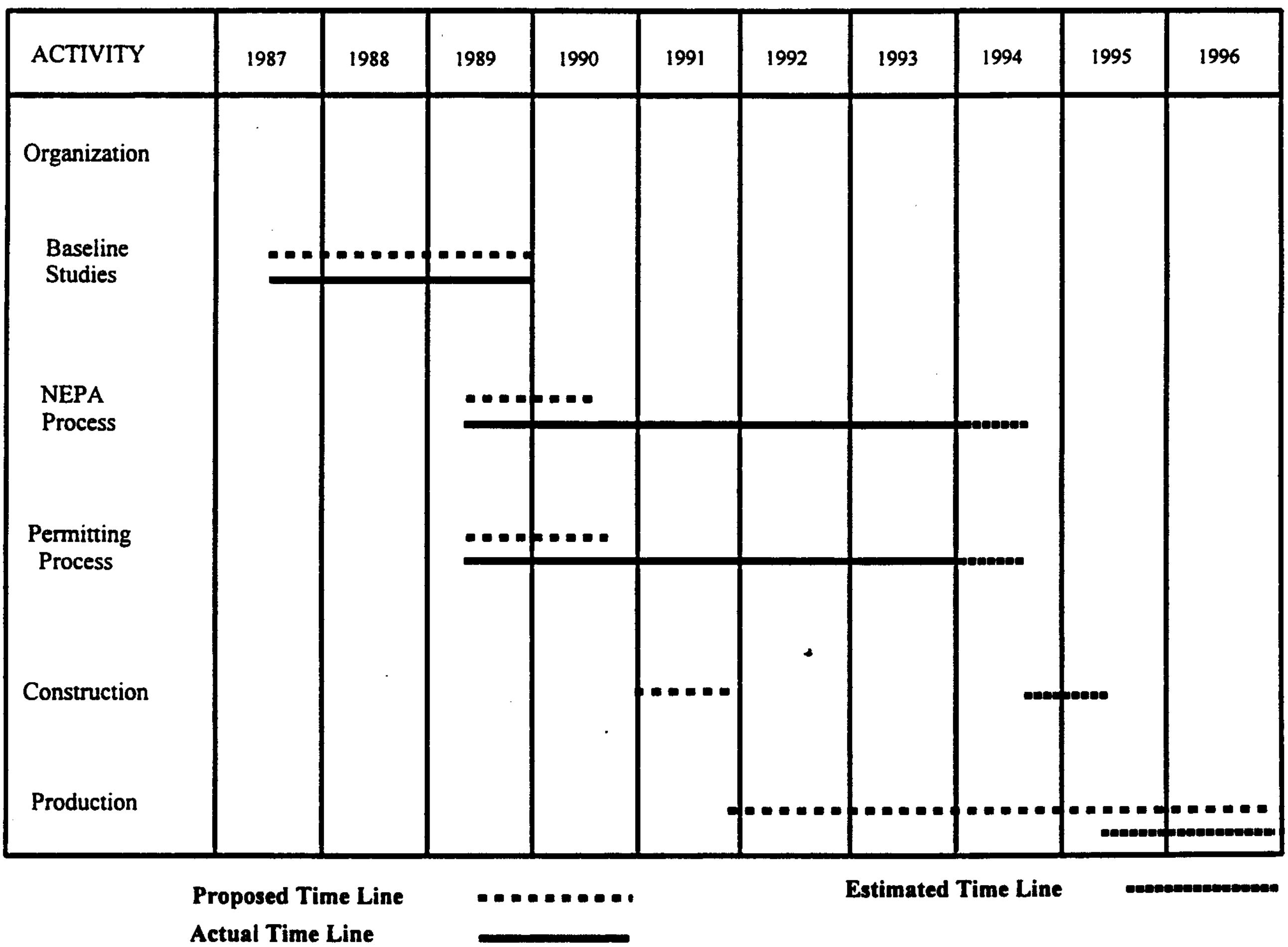
Figure 2.3 A-J Mine Design, 1988



ROD, assuming they agree on the form it should take.[10] Construction of the project is expected to take thirty months to complete which would allow gold production to commence sometime in 1996. This scenario would indicate a delay in development of the mine of over four years. This is quite dramatic compared with successful permitting in other areas. The estimated, actual and proposed project timeline are presented in figure 2.4.

Delays in the permitting of the A-J project can be attributed to a number of unique circumstances. First, the mine is being developed close to the center of Juneau. This not only

Figure 2.4 Timeline for Alaska-Juneau Mine



subjects the developers to a number of city requirements for mining projects but also makes the minea subject of local debate. This has influenced a number of design changes as well as delayed

[10]If the COE and EPA disagree as to the form it is conceivable that *both* would issue RODs.

the permitting process. Additionally, the developers have had to deal with a change in land ownership from the federal to state government. This has affected the lead agency designation in the NEPA process and has lead to some confusion as to who is responsible for the issuance of the ROD on the project.

Another major delay of the A-J project has been in the issuance of the water discharge permit, or the National Pollution Discharge Elimination System (NPDES) permit. Currently the NPDES permit is being delayed because of the uncertainty regarding the exact standards set by the state of Alaska. Alaska is revising their water quality standards which must then be approved by the Environmental Protection Agency under the Clean Water Act. The revision of state water quality standards is required every three years by amendments made to the Clean Water Act. This revision process has delayed the issuing of the NPDES permit for A-J and several other projects. It appears that much of the delay has been caused by an extended public comment period. This highlights one of the potential major problems concerning the public nature of the environmental compliance process.

2.2 Kensington Mine Case Study

The Kensington case study provides insight into the actual and potential effects of the mine permitting process on project development. The case is interesting when compared with the A-J project because both face similar permitting requirements but have had somewhat contrasting results. The Kensington project, which is located in a remote area in southeast Alaska, has not experienced the level of public scrutiny that the A-J project has received. The result of this is the Kensington project has not gone through as many design modifications as of February of 1992 when the ROD was released.

Mine History

The proposed project will disturb 277 acres in the construction and operation phase. The acreage is both on private and USFS lands. Production is expected to be approximately 4000 tons of ore per day with expected gold production to reach 200,000 ounces per year (Kensington Venture, 1990). The expected life of the mine is 12 years but may be extended with further exploration. Employment at the mine is expected to reach 340 workers once in full production. The operation will consist of an underground crushing facility in addition to refining and processing operations located at the surface. Surface operations will employ a conventional flotation and tank cyanidation process for gold recovery. The presently proposed project will use a wet tailings disposal method to dispose of the tailings in Sherman Creek.

Impacts of the Compliance Process

The impacts of the compliance process for the Kensington project are interesting, especially when compared with those of the A-J project. The projects are both located within CBJ so both are required to comply with federal, state and local regulations (see table 2.2). Despite the similar compliance requirements for both projects the two sites have experienced somewhat different impacts. The analysis of the two projects highlights some of the uncertainties associated with mine permitting.

Design Modifications. The Kensington Mine recently completed the NEPA process and has experienced some changes in project design. While changes in design have occurred partially as a result of close evaluation throughout the NEPA process they are not nearly as extensive as those for A-J. The Kensington Mine has not been as closely scrutinized as the A-J project mainly because of its remote location. This is highlighted by the number of comments which have been received on the DEIS for the two projects. The USFS received a total of 121 written comments regarding the Kensington project (USFS, 1992) while the USBLM received over 3,000 comments for the A-J project (USBLM, 1992). While many of the comments were repetitive for the A-J project they still represent a burden to the regulator because each must be reviewed and considered.[11]

Table 2.2 Permits and Approvals for Kensington Project

Level of Government	Agency	Permit or Requirement
Federal	USFS	POO, NEPA
	USF&W	Biological Clearance
	COE	CWA (404 Permit)
	EPA	NPDES, SPCC
State of Alaska	ADEC	Cert. of Reas. Assurance, Oil Contingency Plan, Air Quality Permit, Solid Waste Permit, Oil Facilities Approval of Fin. Resp.
	ADGC	Coastal Project Questionnaire, Coastal Management Program
	ADNR	Water Right, Tidelands Lease, Dam Permit, ROW permit
	ADF&G	Fish Passage Permit, Fish Habitat, Approval of Coastal Zone Management
Local	CBJ	Mining Ordinance

[11]Regulators assigned to evaluate the Kensington project made a number of revisions to studies concerned with impacts of the project on the environment. Additional studies were performed on salmon at Comet Beach near the mine discharge, as well as mountain goat herds and noise impacts (Stange, 1992).

One aspect of the project design which was eliminated from further consideration early in the scoping process was submarine tailings disposal. The operator performed exhaustive technical and environmental feasibility studies on the method and determined that this was the environmentally preferred approach for the Kensington project. These studies were undertaken because of a perceived high probability that the method would be approved based upon the apparent successful permitting of a much larger project also located in southeast Alaska. The EPA ruled on April 19, 1989, that submarine tailings disposal violated the zero discharge limitation of Subpart J of the Ore Mining Regulation and could not be permitted under the NPDES section 402 permit (USFS, 1990). The developers frustration with the decision was expressed as: "Submarine tailings disposal method has thus been eliminated from further consideration despite favorable support from the USFS, several federal and state agencies and environmental groups" (Richens, 1992).

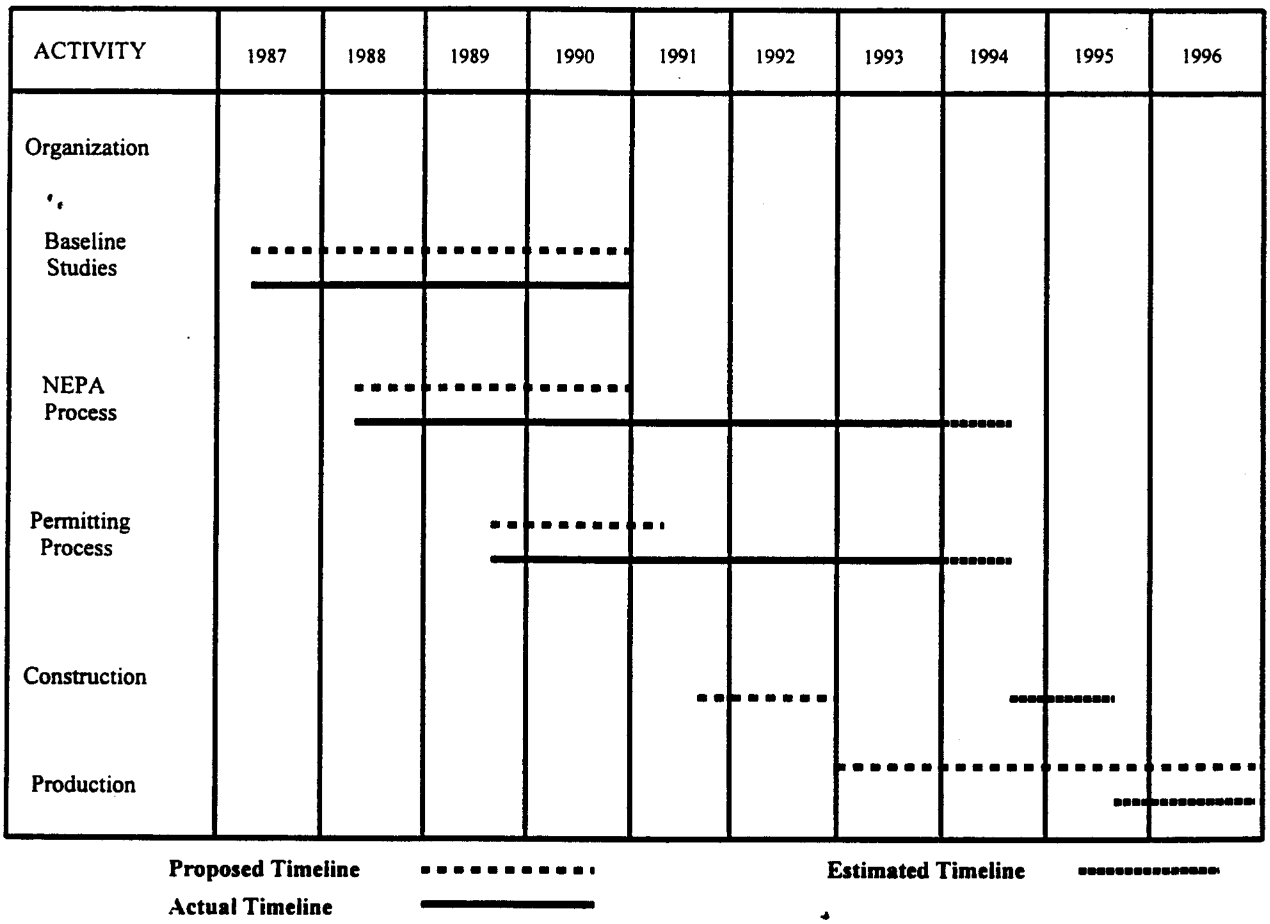
Other design changes for the project include: reduction in disturbed acreage from 300 to 277; no breakwater at the marine facility; treatment of wastewater from the tailings facility; and moving the grinding facility above ground. The reduction in acreage at the site was mainly accomplished by removing an air strip and a proposed quarry. The operator also proposed at one time to build a breakwater at a marine facility to add protection to boat and barge traffic from intense winter storms. This idea was abandoned due to concerns that the breakwater would restrict the migration of fish along the Lynn Canal which is an important commercial fishing area (Kensington Venture, 1990).

Late within the NEPA process the government decision maker for the project made the decision that the firm would be required to treat wastewater by dechlorination and enhanced pond settling to substantially reduce the discharge of total suspended solids and heavy metals into the Lynn Canal (USFS, 1992). While the decision to require treatment of wastewater will decrease the amount of water pollution at the site, the movement of the grinding facility will increase the amount of air pollution. This may be a rational decision by the regulator when taking into account the benefits and costs of the two processes.

The differences in design changes between the two projects can mainly be explained by the difference in location of the two mines. The Kensington project is located 35 air miles from the nearest town and must be reached either by aircraft or boat. The A-J project, however, is located very near to the center of Juneau. Thus, the Kensington venture has not experienced the level of public debate as the A-J project. Another reason for the differences in public scrutiny may be the difference in size of the two projects. The Kensington project is approximately one-fourth of the size of the A-J project. Consequently, it may be expected that the A-J project would have to deal with a larger number of stakeholders interested in how the project is developed.

Timeline Impacts. Agency scoping for the Kensington process began in October, 1989 (see figure 2.5). This led to the development of draft scoping documents by the USFS and the applicant which were released in April, 1990. A DEIS was released for the project on June 1, 1991 and the FEIS with a ROD was released in January, 1992. Although a ROD has been released the project has been further delayed due to litigation initiated by an environmental group.

Figure 2.5 Timeline for Kensington Mine



Early company estimates indicate that the permitting process was expected to be complete in early 1991 with construction to be completed by late 1992 when production would commence. Delays from these early estimates will be approximately three years if construction begins in early 1994.

One of the more interesting aspects of the Kensington project is the significant time delays the developer has experienced. The delays are very similar to those of the A-J project. This is despite the limited amount of public debate over the project early in the NEPA process. Part of the delays can be attributed to the reevaluation of the water quality standards by the state of Alaska.[12] This has delayed several projects, including A-J and Kensington. Another influence

[12]See the A-J case for a more detailed discussion.

which has significantly delayed the project is the appeal of the EIS for the project by environmental groups, fisherman and native groups (Stange, 1992). The issue of importance to the case involves the degradation of water quality in the area which is very important to the local fishing industry.[13] The appeal which has delayed the project approximately a year has yet to be resolved.

2.3 Fort Knox Mine Case Study

The Fort Knox project is an interesting case study due to the ease with which the mine is expected to be permitted compared to the cases in southeast Alaska. It appears that the large open pit gold mine, which is located in central Alaska (see figure 2.1) will meet NEPA requirements by completing an Environmental Assessment. This is very similar to mines located in Nevada. The main reason the mine has had little opposition is the area has historically supported numerous mine operations. The case provides an example of how public attitude can play a significant role in the environmental compliance process. Also, the mine may be considered a remediation action for the location.

Mine History

The area around Fairbanks, including the Fort Knox site has an extensive mining history dating back to the beginning of this century. Gold was first discovered in the "Fairbanks Mining District" in the summer of 1902. The district became one the major gold producing areas in Alaska and established Fairbanks as a major mining center. The area was a major gold producing region from 1904 to 1930 with gold production from placer activities totaling an estimated four million ounces. Large scale dredging operations which commenced in 1928 continued in the area until 1968 (Fairbanks Gold, Ltd. 1990).

Mining activity increased in the area in the mid 1980's after the price of gold increased. The latest activities centered on a number of active lode claims. This led to the development of two mines near Fairbanks. The Grant Mine, an underground operation was opened in 1985 and the Ryan Lode, an open-pit operation, began operations the following year. Besides the estimated 2,500 lode claims which are active the area also supports a number of small placer mine operations.

The discovery of gold at the Fort Knox location was made in 1987 by a geologist who noted the visible gold in a sample of granite. This observation initiated an extensive exploration program which began later that year. Approximately 300 holes were drilled during the exploration phase of the project which continued until 1991. Environmental baseline studies, which included hydrology, fisheries, wildlife, archaeology, and socio-economic were imitated in 1991 and continued for over two years.

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[13]The issue being examined is whether a proposed mixing zone in Lynn Canal will harm local commercial fishing activities. The mixing zone is an area within Lynn Canal where wastewater containing heavy metals and toxics are diluted to legal limits.

Fairbanks Gold, Ltd of Vancouver, British Columbia[14] has proposed the development of a large scale, open pit mining and milling operation. The site is located approximately 18 miles northeast of Fairbanks, Alaska. The proven and probably gold reserves have been estimated to be six million ounces at a grade of .0125. The mine will have an estimated ore extraction rate of between 12 million tons per year (tpy) and 18 million tpy depending on the final economic analysis for the project (Fairbanks Gold, Ltd, 1991). This would make the project one of the largest new gold mine projects in the world in terms of reserves and in yearly production (Fairbanks Gold, Ltd., 1990). The Fort Knox development is attractive given its economies of scale, favorable infrastructure and simple recovery system. These combine to make the mine a relatively low cost gold producer.

The proposed project would include the development of an open pit, mill, tailings impoundment, waste rock disposal areas, a plant site, ancillary facilities and the construction of approximately 45 miles of electric transmission lines. The area of disturbance is estimated to be 1,700 acres which would consist of an open pit (290 acres); tailings dam (40 acres); tailings pond (780 acres); diversion ditches (125 acres); service roads (125 acres); waste disposal area (320 acres); and various facilities (40 acres) (Fairbanks Gold, Ltd, 1991). Construction of the mine is expected to last two years and operations are predicted to extend for at least 12 years.

The relatively simple metallurgical nature of the ore body at the Fort Knox site will allow the operator to utilize a pebble reject process technology. This process involves rejecting an estimated 30% of the ore which contain pebbles of a certain size and a grade less than .01 ounces/ton. The rejected ore is fed through a secondary grinding and leaching circuit which results in an upgrading of at least 30%. Utilization of the pebble reject method allows for the feed rate of the primary grinding circuit to be increased. The base case scenario for the mine indicates that the leach capacity will be 25,000 tons per day (tpd) which will yield approximately 300,000 ounces of gold per year.

The proposed tailings facility is to be located in Fish Creek approximately three miles from the process facility (Fairbanks Gold, Ltd, 1991) . This tailings site is being proposed because it meets all primary objectives and has experienced extensive placer mine activity.[15] The dam will be initially constructed at a height of 160 feet and extended to 270 feet over the life of the mine. The "zero discharge" design will allow 154 million tons of tailings to be disposed over the 12 year life of the operation. Tailings will be transported from the mill facility to the tailings pond through a pipeline as a slurry of which 42% is in solid form.

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[14]Fairbanks Gold is a subsidiary of AMAX Gold, Inc.

[15]The five primary objectives for an optimal site include: 1) meet all environmental guidelines; 2) divert clean runoff around disturbed areas; 3) minimize changes to the natural flow of creeks and streams; 4) provide an adequate supply of recycled water for project operations; and 5) provide a volume capable of holding mill tailings (Fairbanks Gold, Ltd., 1991).

The permitting process for the Fort Knox case is somewhat unique from the other case studies in southeast Alaska due mainly to land ownership. The site is located predominately on state lands so the number of federal agencies involved has been reduced. Additionally, the local government, Fairbanks North Star Borough (NSB), has taken a very different approach to mining operations than CBJ. NSB differs from CBJ because the local government actively supports mining development within their jurisdiction. The local government support as well as a favorable public perception of the project seems to have influenced the compliance process relevant to this case. A complete list of agencies involved is listed in table 2.3.

Table 2.3 Permits and Approvals for Fort Knox Project

Level of Government	Agency	Permit or Requirement
Federal	COE	NEPA, CWA (404 permit),
	USBLM	ROW
	USEPA	SPCC
State of Alaska	ADEC	Air Permit, Cert. of Reasonable Assur. (404 Permit), Ore Leach Permit, Solid Waste and Wastewater Permit
	ADNR	Water Rights, Land Use Permit, POO, ROW,
	ADFG	Fish Habitat Permits
Local	Fairbanks North Star Borough	Air Quality, Solid Waste, Flood Control, Construction and Maintenance of Roads

The unique land ownership situation of the Fort Knox site has had some interesting implications for the project. Most of the site (91%) is located on state owned lands. The remaining area is owned by Fairbanks Gold Inc. and other private holdings. The area is thus governed by state mining claim laws. One federal agency, COE will be involved in the development of the project. COE is required to review the project because the operation will require a 404 dredge and fill permit for the tailings facility.[16] The approval of this major permit will initiate the NEPA process with the COE acting as the lead agency. It appears that COE, which generally does not act as a lead agency on most mining projects, will require the applicant to complete only an EA. This is dependent on the number of comments which are received on the proposed 404 permit. This could dramatically reduce the amount of time needed to approve

[16]The EPA, which is responsible for the issuance of NPDES permits, will not be actively involved with the NEPA process because the operation is being designed as a "zero discharge" facility. The agency does, however, have veto power of the 404 permit.

the project.

Another influence of the permitting of the Fort Knox project is the public perception of the project. The project thus far has received very limited public opposition. This is largely attributed to the importance of mining in the area and the limited amount of conflicting uses.[17] The area has been an important mining district since gold was discovered around the turn of the century. Consequently, the area has been designated a "High Mineral Potential Land" by NSB.[18] The designation gives mining a preference over other land uses. The importance of mining in the area and the land use preference has given the project a very favorable public standing.

Impacts of the Permitting Process

The Fort Knox project is interesting as a permitting case study because of the relative ease with which the applicants have proceed through the environmental compliance process. This appears to be the result of the limited number of agencies involved, the lack of public opposition, the land use designation and the support of the state and local governments. While the project has moved smoothly through the compliance process relative to the projects located in southeast Alaska, developers have still experienced some delays in activities. This appears to be typical of many mining projects in Alaska.

Design Modification. Design modifications resulting from the environmental compliance process for the Fort Knox project have been minimal. This observation may change given the project has yet to gain final approval. However, it appears that the operator will not have significant requirements placed on the project. This is mainly the result of the operation being well accepted by the community (Fairbanks) and the fact that the area has experienced a tremendous amount of mining activity prior to the proposed operation. Also, many feel that the operation can be considered a mitigation measure for the area which has been disturbed by numerous placer mining activities (Seaborne, 1992).

While the project has not been required to make significant changes in design as a result of the compliance process a number of decisions on specifics have been influenced by environmental concerns. These include the decision not to use heap leaching in the processing of ore; the use of the pebble reject method; and the location of the tailings facility. The developer made the decision not to use heap leaching in the processing of ore because of the limited flat land in the area and the local perception of heap leach operations. The flat lands

[17]Analysis has indicated that there are no unique habitats or threatened or endangered species in the area. Additionally, the area is used for recreational activities on a limited basis due to the industrial scale placer mining which is prevalent in the area.

[18]The Fort Knox site has been designated either Mineral Lands (ML) or General Use-1 (GU-1). The Fairbanks North Star Borough Ordinance 89-099 states "the ML designation is intended to protect mineralized areas from the intrusions of incompatible land uses, to allow active exploration for and development of mineral resources, and to allow development necessary to carry out the recovery of mineral resources". The general use designation considers all uses as compatible including mining (Fairbanks Gold, Inc. 1991).

suitable for a heap leach facility are limited to hill tops which are observable by the public and in wetland areas. This combined with recent local heap leaching problems influenced the developer to abandon the technique for the project.

The decision to use the pebble reject method over other methods which would grind and leach ore was influenced by the reduction in environmental impacts. The chosen method will reduce the amount of reagents needed in processing;[19] reduce the amount of material placed in the tailings facility; and reduce energy requirements (Fairbanks Gold, Ltd., 1991). The developer has proposed using a tailings facility site partially for environmental reasons. The location of the facility at the Fish Creek site is advantageous because the location has been previously disturbed by numerous placer mining operations.

Two issues which are likely to be addressed in the NEPA process which may also affect project design are whether to require a lined or unlined tailings pond and the impact of changing state water quality standards. The proposed development calls for an unlined facility so this could be a major design change if ADEC requires a liner be used.[20] Additionally, changing state water quality standards may affect project design because current regulations require all discharges from tailings facilities to meet state standards. The increased standards may require additional treatment to water from processing of discharges from the tailings facility.

Time Line Impacts. Though the process has had minimal impacts on the project design the developer has still encountered delays (see figure 2.6). Early estimates indicate that the compliance process was expected to be completed by the fall of 1993 which would allow construction to begin soon after. The project is still moving through the NEPA process with relevant documents still being prepared. It appears at this time that the developer will only be required to prepare an EA for the project since comments received on the draft 404 permit were very minimal.[21] However, the analysis indicates that delays in project development will be one and a half to two years in length. Given that the review of the project is still ongoing it is difficult to determine what the extent of the delays will be. This result is consistent with other cases from Alaska which have encountered delays up to four years in length.

2.4 Summary

The analysis of the three case studies demonstrates the complicated nature of the Alaska compliance process and the sometimes dramatic affects it can have on mine development. The

[19]This includes reagents used in processing as well as those used for pH neutralization and cyanide destruction.

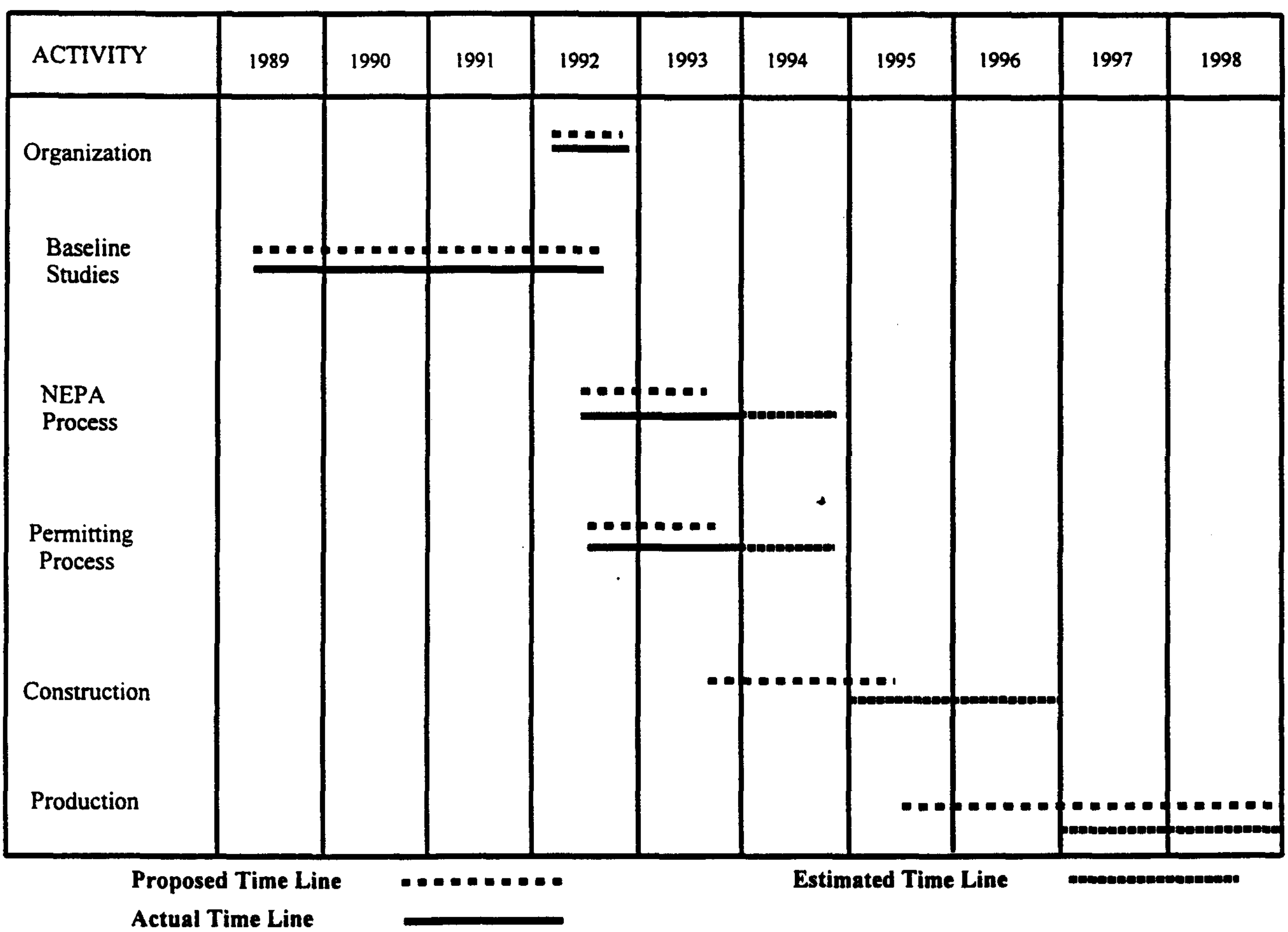
[20]There are four other operating or proposed mines which are similar in size to the Fort Knox project. (Red Dog, Kensington, A-J and Greens Creek). The Reg Dog Mine is the only one of these sites which has or proposed a lined tailings facility.

[21]This indicates how the amount of public opposition can influence the length and scope of the NEPA process relevant to specific projects.

most apparent impact of this particular process is the lengthy time requirements needed to obtain approval of a project. This was consistent with all three projects which have been delayed by at least two years and up to as long as four years. The lengthy delays can be largely attributed to the evolving nature of the compliance process within the state. State and local governments are presently refining mining regulations which have delayed several mine development activities including those discussed above.

The evaluation also indicated that design modifications are likely when gaining approval of mining projects in Alaska. This is highlighted by the A-J mine which experienced a great deal of design changes as the project moved through the NEPA process. The degree of modifications,

Figure 2.6 Timeline for Fort Knox Project



however, which are encountered by developers is uncertain. This is demonstrated with the

Kensington case which had far fewer changes in design despite having similar regulatory requirements as A-J. Similarly, the Fort Knox developer thus far has made very few design changes while completing the environmental process.

3.0 COLORADO

Two mines from Colorado were selected to be analyzed. These include the Mount Emmons project which is owned by AMAX and the San Luis mine which is being operated by Battle Mountain Gold. The Mount Emmons project is a proposed molybdenum mining and milling operation in Gunnison County near the town of Crested Butte (see figure 3.1). The project was permitted in the early 1980's and has yet to be developed. This case was chosen because of its location on public lands and the relevant environmental compliance for the project occurred in the late 1970's and early 1980's. Thus, the analysis is important from a comparison standpoint with the San Luis mine which is located primarily on private lands and was permitted in the late 1980's. The analysis can provide some insight to the different degrees of regulation required for operations located on public and private lands and whether changing requirements during the last decade have had significant impacts on mine development within the state.

The San Luis mine is an open pit gold operation which is located in Costilla county in southern Colorado (see figure 3.1). This project was chosen because of its location on private lands which is in contrast to the Mount Emmons project. This is important to the analysis of the Colorado system because the majority of mines are located on private land holdings and are not subject to many federal regulations.[22]

3.1 Mount Emmons Case Study

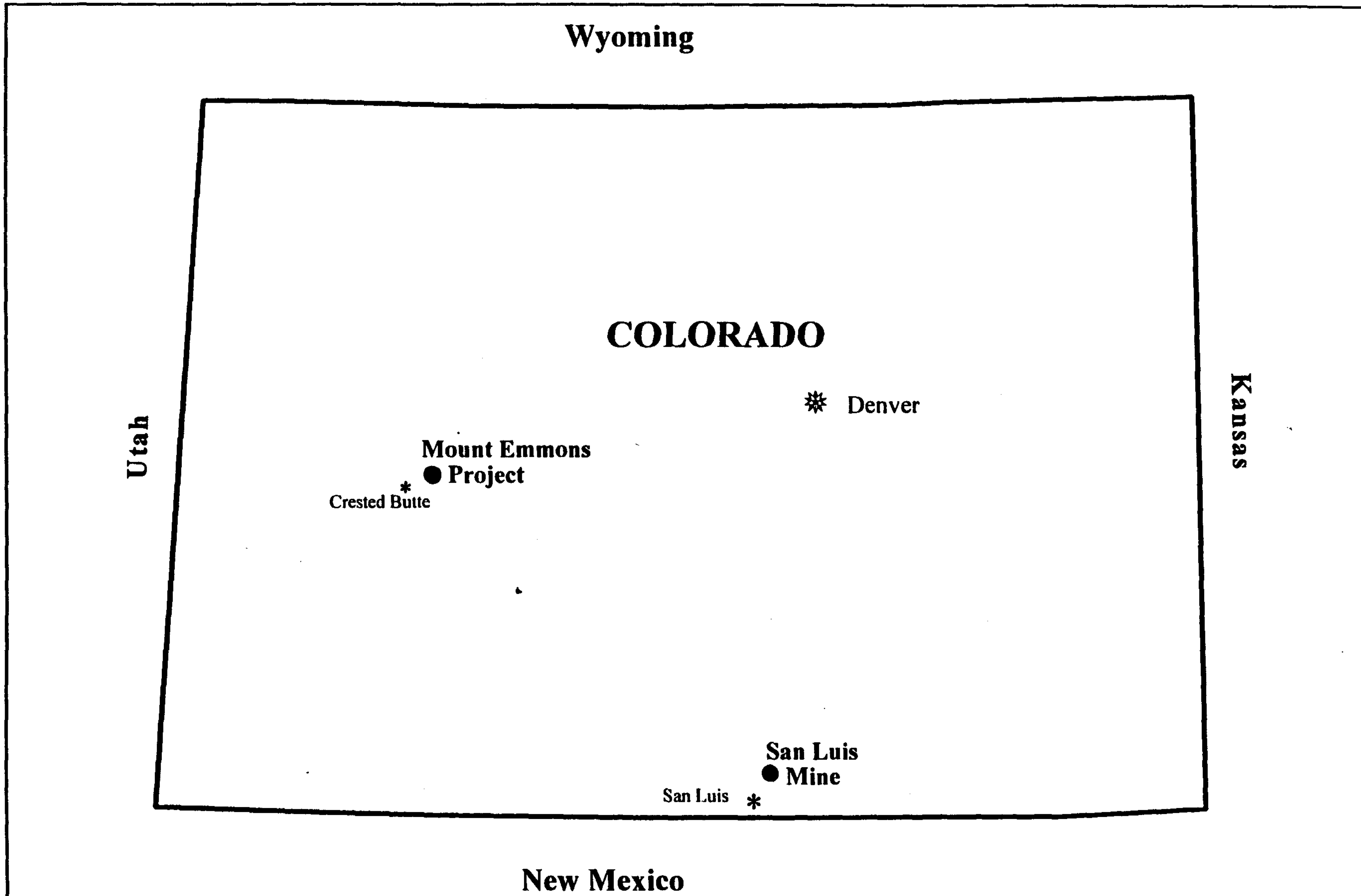
The Mount Emmons project was chosen as a case study due to the complicated nature of the environmental compliance process relevant to the project and the interesting approaches used by the mining company and the agencies involved to complete the environmental requirements. One of the interesting aspects of the case was the development of a joint review committee which included government regulators from a number of agencies. The committee coordinated permitting requirements and provided an open public forum to discuss issues related to the development. Also, the project was proposed in the early 1980's and may provide insight as to how the environmental compliance process has evolved over the last decade.

Mine History

AMAX began exploring for molybdenum in the Gunnison County area in the early 1970's. This led to a discovery of a large molybdenum disulfide deposit in the Colorado Mineral Belt in 1976. Further drilling helped to define the ore body and in 1977 AMAX announced the

[22] The case is also interesting when compared with the Lone Tree Mine in Nevada which is also located on private holdings. This provides an interesting comparison to determine the impacts of the different state environmental requirements

Figure 3.1 Colorado Case Studies



discovery of approximately 155 million tons of molybdenite (MoS_2) with an average grade of .43%. AMAX then began extensive mine planing studies in 1977. The analysis focused on tailings disposal, mill siting, mine development, project feasibility, environmental data collection, and government and public involvement (AMAX, Inc., 1981a).

The proposed development at the Mount Emmons site was a large molybdenum mine in Gunnison County Colorado near the town of Crested Butte. The proposal was developed by AMAX Inc. in the late 1970's and early 1980's. The proposal called for the mining of 155 million tons of ore using a panel caving method at a production rate of 20,000 tons per day. This would result in approximately 63 million pounds of molybdenum disulfide over a mine life of thirty years (USFS, 1982a). AMAX proposed an underground mine site at Coal Creek and the mill at Alkali Creek. Ore would be transported to the mill with a single track electric rail system along Carbon Creek. Waste rock would be placed as fill along Coal Creek. A number of tailings facility sites were examined which involved placing the tailings behind an impermeable earth-fill dam.

The Mount Emmons case is interesting from a permitting standpoint due to the complicated nature of the project which involved a large number of agencies from all three levels of government. An indication of the size and complexity surrounding the development was the 40,000 pages of information which was generated *before* the DEIS was written. The large scope and complicated nature of the project required over twenty agencies from all three levels of government. This included the issuance of permits as well as approval of activities. A list of the major requirements needed for the project are presented in table 3.1.

An interesting approach used by the agencies involved with the environmental review of Mount Emmons and AMAX was the organization of a joint review committee. The Colorado Joint Review Process (CJRP) was organized in June, 1978 and included representatives from the USFS, Colorado Department of Natural Resources and Gunnison County.[23] The committee was developed for the purpose of coordinating the complex permitting requirements for the project and to provide a forum for the exchange, discussion, and dissemination of project related information (USFS, 1982).

CJRP was able to focus the analysis of the project by organizing monthly meetings which involved AMAX, several government entities and environmental groups.[24] These meetings were held very early in the scoping process which allowed issues and concerns to be identified before decisions on the project were made. The increased public awareness led to a number of suggestions and additional information which aided in project revisions made by AMAX. CJRP

[23]A "Statement of Responsibilities" was signed by all the parties involved in the CJRP which defined all statutory, regulatory and administrative responsibilities of those involved.

[24]Citizen and environmental groups which participated in the CJRP included: Conservation Foundation; County Sector Planning Committees; Ducks Unlimited; Foresight; High County Citizens Alliance; League of Women Voters; Trout Unlimited; and Western State College (AMAX, 1981).

Table 3.1 Major Permits and Approvals for Mount Emmons Project

Level of Government	Agency	Permit or Requirement
Federal[25]	USFS	POO, ROW, NEPA
	USBLM	ROW, Land Exchange
	USACE	CWA (404 Permit)
	USEPA	Air Permit (PSD), RCRA Permit,
	USBR	Approval of water appropriations
State of Colorado[26]	CMLRB	Reclamation Permit
	CDH (WQCC)	NPDES, Sewage Treatment
	CDH (AQCC)	Air Permits (Cons., Oper.)
	CDNR(WR)	Tailings facility, well and pump permits, approve dam and reservoir plans
	CDHPA	Archaeologic Clearance
Local[27]	Gunnison County	Approval of Mine Waste Plan, Land Use Resolution

was also successful in identifying and resolving interagency jurisdictional conflicts. The creation of CJRP allowed for these conflicts to be lessened by developing a mutual understanding between all parties involved. The open public forum used by the agencies and the applicant early in the project enabled a number of key issues to be identified. Forty-seven specific issues were identified and thus addressed throughout the NEPA process. The majority of the issues involved concerns over: air and water quality; siting of the tailings facility; reclamation methods; and socio-economic impacts.

Another interesting aspect of the development of the Mount Emmons project was a proposal by AMAX to the USFS involving the exchange of land affected by the mining operation. The exchange involved 7,587 acres under the jurisdiction of the USFS. The area was

[25]Additional federal agencies which participated in the review process include: U.S. Bureau of Mines, National Park Service and U.S. Geological Survey.

[26]The Colorado Department of Local Affairs was also involved in the review of Mount Emmons.

[27]Other local agencies involved in the review process included: City of Gunnison Planning Commission; City of Gunnison Staff; Crested Butte Fire Protection District; Crested Butte South Metropolitan District; Crested Butte Staff; Crested Butte Town Council; Crested Butte Water and Sanitation District; Gunnison City Council; Gunnison County Board of County Commissioners; Gunnison County Planning Commission; Gunnison County Staff; Gunnison Watershed School District RE-IJ; Human Services Council; Mt. Crested Butte Staff; and Mt. Crested Butte Town Council (AMAX, 1981a).

to be used for the majority of the mine site development.[28] AMAX proposed exchanging area to be affected by mining activities with other national forest inholdings in Colorado which AMAX had obtained (see table 3.2). The exchange consisted of AMAX offering 9,807 acres in other areas for the 7,587 acres of the affected area.

Table 3.2 Land Exchange Acreage

County	Acres	% of Total
Boulder	142	1
Conejos	595	6
Douglas	70	1
Eagle	160	2
Garfield	800	8
Gunnison	3441	35
Larimer	999	10
Rio Grande	240	2
Routt	920	10
Saguache	2416	25
San Juan	24	.2
Total	9807	100

Source: USFS, 1982

Impacts of Permitting Process

The complicated nature of the environmental compliance process relevant to the Mount Emmons project had a number of impacts on the project. These included both design changes and timeline impacts. The impacts of the design changes appears to have been minimized since AMAX was able to adjust for the changes early in the development of the mine. However, it appears that AMAX was required to analyze an extensive number of alternatives compared to other mining projects which increased time requirements needed to gain project approval. The following will discuss these impacts.

Design Modification. A number of design changes for the Mount Emmons project were proposed by AMAX as the project was reviewed. Many of these modifications were initiated by suggestions or additional information resulting from the activities of CJRP. It appears, however, that AMAX was able to employ changes to the design early in the development stages before any decisions on the project were made. This reduced the costly nature of changing a mine design late in the development stage. Though the open nature of this process allowed for design changes to be made early, it appears that AMAX was required to evaluate an extensive list of

[28]This included the areas affected by the mine site, subsidence zone, mill and tailings site, Carbon Creek potable water reservoir, the north portal of Red Mountain tunnel, and both portals of the Mt. Axtell tunnel (USFS, 1982b).

alternatives. This appears to be partly the result of governing bodies being involved early in the development stage. Thus, while AMAX was able to eliminate costly design changes late in the development stage they were required to evaluate more alternatives than is normally required.

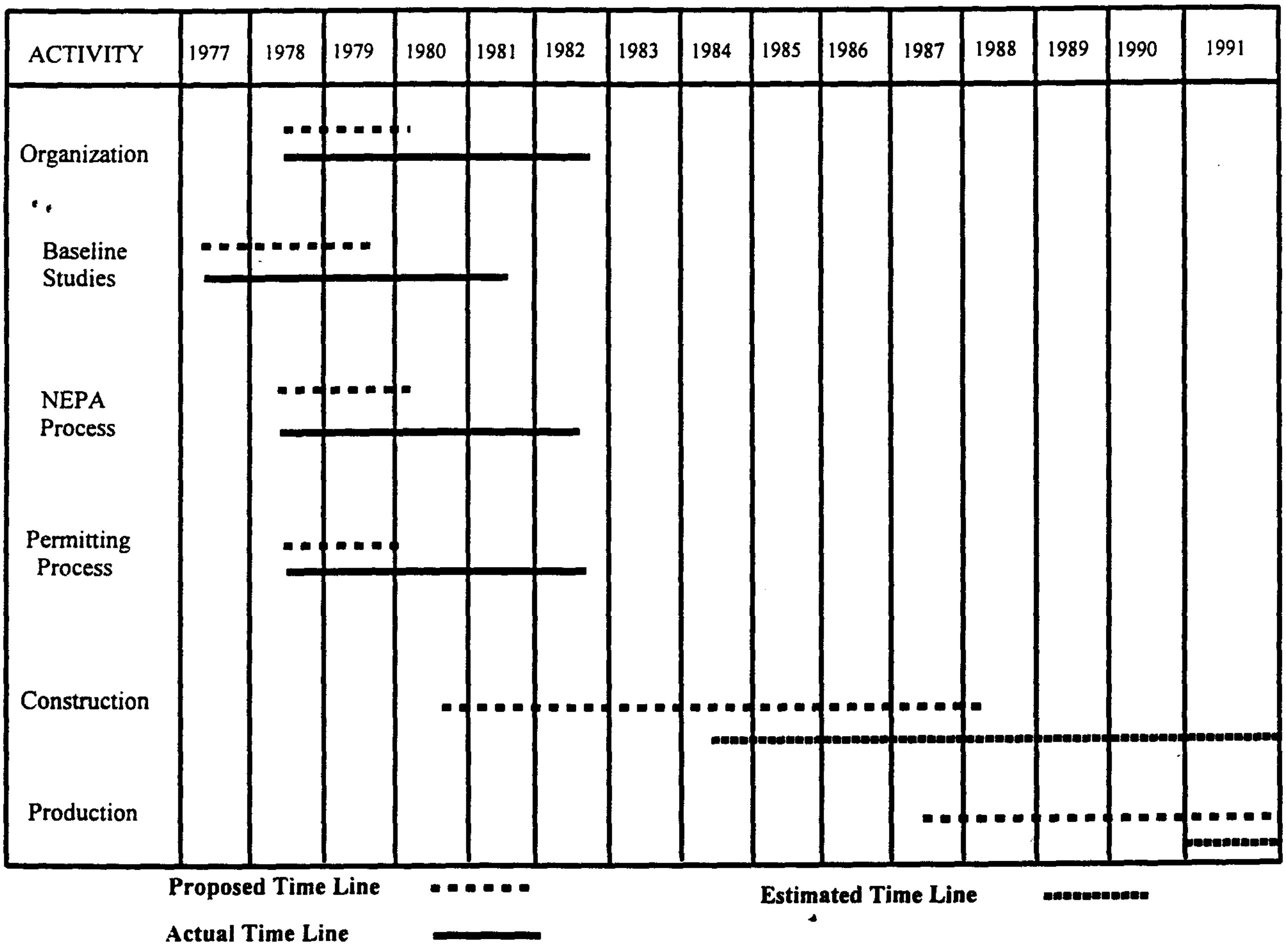
The major focus of many of the baseline and feasibility studies for the Mount Emmons project focused on the analysis of the 63 potential mill and tailings disposal sites (AMAX, 1981a). Sixty of these sites were evaluated for a potential tailings facility while the other three were evaluated for possible mill sites. The analysis was able to eliminate 44 of the initial tailings sites early in the evaluation and the remaining 16 were studied in detail which was completed in 1977.[29] The analysis indicated that three of the sites be further evaluated. Other sites were added to those which were to be studied in more detail after consulting with the USFS. This resulted in ten sites being studied in detail. This extensive analysis was completed in three years and concluded that three mill/tailings sites remained to be studied in even more detail and included: Alkali Basin; Upper Carbon/Ohio Creek; and Chance Gulch. These three sites were then evaluated in an Environmental Report, completed by AMAX in 1981 and were the focus of the DEIS and FEIS.

Timeline Impacts. Though the Mount Emmons project has yet to be developed,[30] review of the literature indicates that the project would have experienced significant delays if development would have proceeded after approval (see figure 3.2). An original schedule for the project was published in the Plan of Operations (POO) filed with the USFS in 1979. The timeline indicated that AMAX planned to begin surveying the site and mine site preparation in 1980 and full scale construction in 1981. A revised timeline which was included in the DEIS in early 1982 indicated these activities would be delayed until 1984. Complete construction of the mine was estimated to take nine years which delayed production until the early 1990's. It appears the delays for the project would have been approximately three years if development would have commenced sometime in 1984. This indicates that significant delays are not solely the result of increasing environmental regulations related to mining projects.

[29]This analysis was conducted by the applicant prior to the review by regulators.

[30]The decision not to develop the mine was made after the price of molybdenum dropped in 1982.

Figure 3.2 Timeline for Mount Emmons Project



3.2 San Luis Mine Case Study

The San Luis Mine was chosen as a case study for Colorado because the mine is located primarily on private land holdings and thus federal agencies had minimal involvement with the environmental compliance process for the project.[31] The mine is representative of operations in Colorado because most are *not* located within the public domain. Thus, the case represents what a typical operation may have to endure to achieve compliance in Colorado.

[31]Colorado has federally approved permitting programs for the CAA and CWA giving the state jurisdiction in these areas. Review of mining projects on private lands will thus predominately be the responsibility of state and local agencies.

Mine History

The San Luis Gold Mine is owned and operated by Battle Mountain Resources, Inc. The mine is located approximately five miles northeast of the town of San Luis in Costilla County. The site is on the western slope of the Sangre de Cristo Mountains at an elevation ranging from approximately 8300 to 9600 feet. The project is located on 2,200 acres which are owned and /or controlled by Battle Mountain. The primary land uses prior to mining were rangeland and wildlife habitat. Additionally, the area has experienced previous mining activities during the 1970's.

The approved development involves mining and milling of approximately 12.2 million tons of ore over a seven to ten year life. Company estimates indicate that original proven and probable reserves were 12.15 million standard tons at a grade of .04 ounces/standard ton (Engineering and Mining Journal, 1990). Ore is extracted from two open pits at a rate of approximately 4,680 tons per day. Beneficiation of the ore is done with a conventional carbon in leach circuit. Approximately 25 million tons of waste rock will be removed over the life of the project and will be disposed of in six different areas. The processing will produce roughly 12.2 million tons of tailings which will be disposed of in a lined tailings facility located southwest of the mill.

The mill facility consists of a crushing and grinding circuit, a cyanidation circuit, a gold recovery circuit and a tailings treatment circuit. The facility was designed with the capability of processing 5,000 tons per day of ore or produce approximately 60,000 ounces per year (Engineering and Mining Journal, 1990). The mill was designed as a closed circuit operation with no potential cyanide solutions being discharged to the environment. Ore is delivered to the mill where it is stockpiled and sorted for beneficiation. The ore is crushed and then mixed with water. The slurry is fed through a ball mill until the proper size is achieved. An inert flocculent is added to the slurry and thickened and then placed in a leach tank. Gold is dissolved in the leach tanks using a dilute cyanide solution. Gold is then recovered from the solution by absorption onto activated carbon.

The tailings produced during the processing phase are disposed of at the tailings facility in a slurry form. The disposal system has been designed as a zero discharge facility so solid and liquid portions of the tailings will remain in the facility. The tailings are placed on the disposal area utilizing a thin layering technique. This type of application allows dewatering and consolidation of tailings before additional layers are placed on top. The dewatered tailings serve two favorable purposes. First, the thin layers form a relatively impermeable layer. Second, the method promotes higher tailings density which utilizes the disposal area capacity and reduces the amount of the residual water trapped in the tailings.

The requirements needed for the approval of the San Luis Mine were somewhat limited relative to the other cases being considered. This is mainly the result of the majority of the regulations being handled by one state agency. Since the operation is located primarily on private land holdings federal agencies had minimal involvement with the process.[32] Thus, the operation was not required to prepare any NEPA documents. The main requirements for the project were the reclamation permit, air permits, an archaeologic clearance, and land use approval from the county. A complete list of the requirements and regulating agencies are in table 3.3.

Table 3.3 Permits and Approvals for San Luis Project

Level of Government	Agency	Permit or Requirement
State of Colorado	CMLRB	Reclamation Permit
	CDH (AQCC)	Air Permits (Cons., Oper.)
	CDHPA	Archaeologic Clearance
Local	Costilla, County	Special Use Permit

The most demanding requirement for the approval of this mine was the securing of necessary water rights, not any environmental permit. Battle Mountain had acquired the water rights by a prior appropriations system which is administered by a "water court" within the state. The company was able to obtain the rights by buying a local ranch and converting the water use from irrigation to an industrial use.[33] An interesting result of the water court decision was the requirement that the company administer additional monitoring around the site to insure that drinking supplies for the city of San Luis were not harmed. This is unusual for a water court to consider since the main focus is on water quantity not water quality.

Impacts of Permitting Process

The impacts on the environmental compliance process for the San Luis Mine are minimal in comparisons to other case studies. This appears to be the result of the limited review and a small number of agencies involved. This case, like the Lone Tree Mine, had limited timeline impacts and design modifications. This strengthens the argument that mines located on private lands will have a considerable advantage over those on public lands because of the limited environmental review requirements. The following reviews some of the effects of the process for this case.

[32] COE was the only federal agency to play a role in the permitting of the San Luis Mine. The involvement of the COE entailed reviewing the project to determine if the mine would comply with section 404 of the CWA. The mine was excluded from having to obtain a 404 individual permit because dredge and fill into waters of the U.S. were minimal and fell below the regulatory cutoff at the time the mine was permitted. Thus, the mine was included in a nationwide permit for 404 compliance.

[33] Approval of the change in water use required Battle Mountain to convert the use back when operations at the mine are complete (Baldrige, 1993).

Design Modification. The design modifications resulting from the environmental compliance process are minimal for this case. The only significant design modification to the mine plan was strictly a company decision. The major modification involved the elimination of a heap leach facility which required all ore to be processed in the mill. The decision eliminated the plans for a leach pad which would have utilize a double liner system to extract gold from low-grade ore. This reduced the disturbance area for the leach pad and waste rock disposal.

A minor modification of the project as a result of the compliance process was additional monitoring. This involved the monitoring of groundwater for water rights approval and post-closure monitoring. The state of Colorado has the ability to determine monitoring requirements for the reclamation permit on a site specific basis. Originally, the State indicated that monitoring at San Luis will be continued for a period of 15 years after the mine has ceased operations. The State has since changed their position and will require monitoring until such a time that Battle Mountain can demonstrate that there has not been or will be any future impacts to groundwater resources (Baldrige, 1994). This is somewhat of a different requirement than at other mines which are required to continue monitoring for five years after operations have been completed. The company was also required to make changes in their proposed reclamation plan for the site. The modification required Battle Mountain to partially backfill the west pit to create a rock buttress instead of a straight wall. The company has since completely backfilled the east pit with waste rock after mining was completed and has determined that the west pit can be concurrently backfilled while mining is underway. This will allow surface runoff and eliminate a hole at the west pit (Baldrige, 1993).

Timeline Impacts. Battle Mountain was able to gain approval from all agencies for the San Luis Mine in a relatively short amount of time (see figure 3.3). The developer was able to complete all environmental compliance requirements in approximately a year and a half. The only major delay occurred when the applicant made the decision to eliminate a heap leach facility which required that an amendment for a reclamation permit be filed. This delayed the project approximately one year. This indicates that the operator was able to obtain a reclamation permit for the original mine plan in six months. This is not a surprising result given the strict time requirements which were promulgated in the Colorado regulations. These rules restrict the amount of time which can be required for application review.

The permitting process is evolving in the state, however, and it appears that applicants will not be able to achieve compliance in such a swift manner. The changes in the Colorado Mined Land Reclamation Act may add significant time requirements to the permitting process in the state. Additional requirements for an "environmental plan" for large operations and a possible increase in baseline data from one year to two years may soon be in effect. This could significantly increase time requirements needed to achieve compliance.[34]

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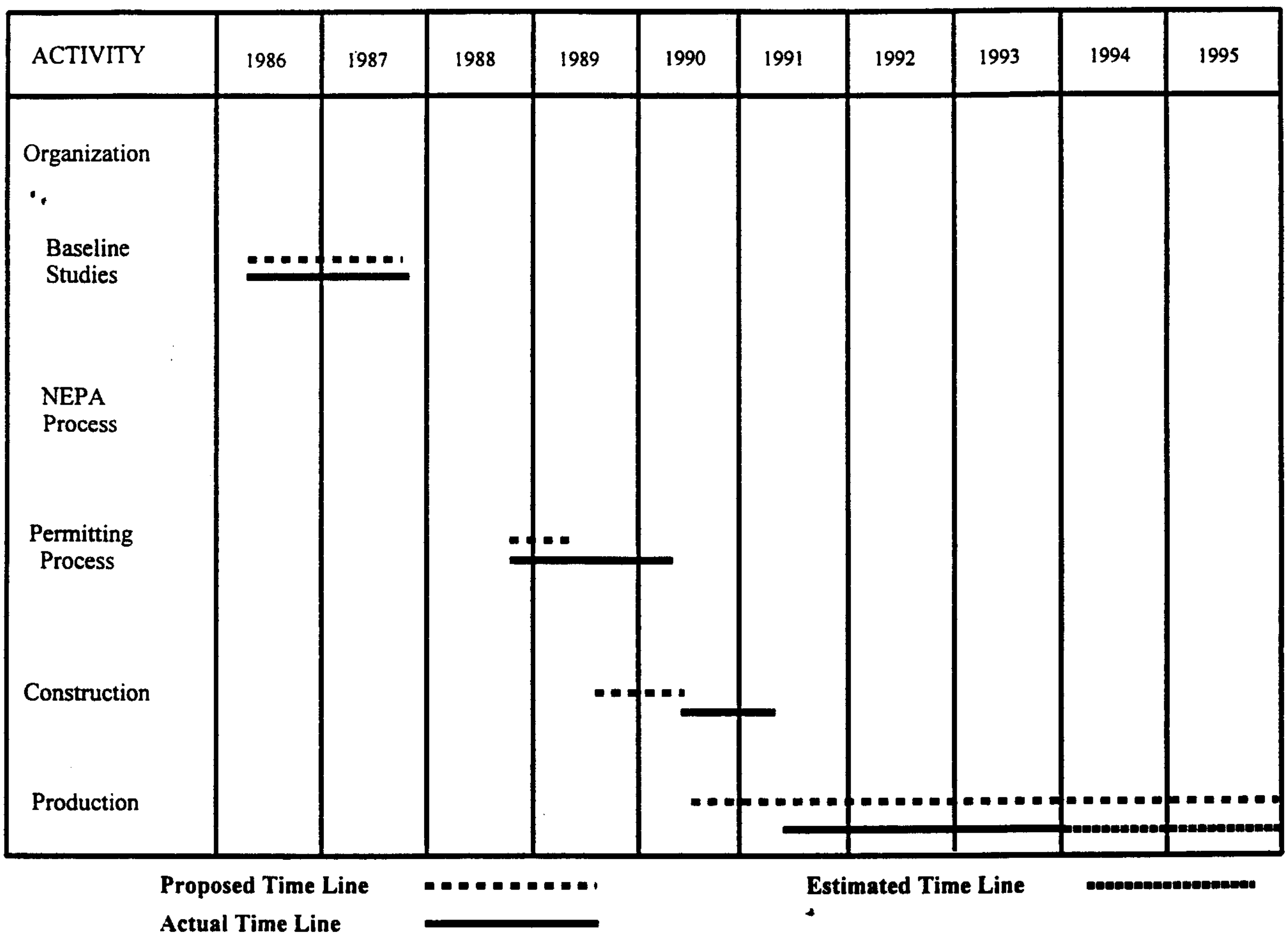
[34]Operators will also have to comply with newly enacted ground water regulations under the jurisdiction of the CMLRB and storm water regulations under the CDH.

Figure 3.3 Timeline for San Luis Mine



3.3 Summary

The analysis of these two cases indicates a dramatic difference in the compliance process relevant for the two projects. This was influenced by a number of factors including the location of the sites. The Mt. Emmons project was located on federal lands and was thus subjected to the federal review process. The San Luis project, which is located primarily on private holdings, was only required to complete a less time consuming state review process. Another important factor influential in the permitting of the two projects was local government involvement. The local government entities were much more involved in the environmental compliance process for Mt. Emmons than San Luis which further complicated permitting activities. This is very similar to the City and Borough of Juneau which has played an active role in the permitting of the A-J and Kensington projects.

4.0 MONTANA

The two case studies selected for Montana are the Montanore project which is being developed by Noranda and the Jardine mine operated by TVX Gold and Homestake, Gold (see figure 4.1). Both of these mines are in environmentally sensitive areas which make them interesting case studies.[35] The large Montanore copper-silver project is located under the Cabinet Mountains Wilderness Area within the Kootenai National Forest (see figure 4.2). The Jardine mine is located adjacent to Yellowstone National Park within the Gallatin National Forest. These two mines have been chosen because of the innovative ways the developers have tried to deal with the problems of operating in environmentally sensitive areas.

Noranda and Montana Reserves Co. recently received an operating permit for the Montanore project. The Montanore mine is particularly challenging from an environmental standpoint because the wilderness area is the site of grizzly bear habitat and the surface waters are considered pristine. One of the interesting aspects of this operation is that the operators intend to reach the ore body through an adit that originates on private lands outside the wilderness area.

The Jardine mine is a project which was successfully permitted despite the mine location being sensitive both environmentally and politically. The area is visible from Yellowstone National Park, is a grizzly bear habitat, a bald eagle nesting area, an elk migration route and is located adjacent to Yellowstone River (Pincock *et al.*, 1990). Operators also had to deal with a number of historically sensitive issues at the site. The success of this project has been attributed to an inter-agency task force that worked on the project throughout the compliance process.

4.1 Montanore Mine Case Study

One reason the Montanore project makes for an interesting case study is because the proposed development would be one of the largest silver mines in the world. This is combined with the fact that the mine is located in an environmentally sensitive area. The result is the environmental compliance process encountered by the developer has been very comprehensive in nature. An interesting aspect of the development is that the developer chose to evaluate possible reserves under a wilderness area from an adit accessed by tunnels on private lands.

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[35]These mines were not selected to be representative of all mine permitting cases in Montana.

Figure 4.1 Montana Case Studies

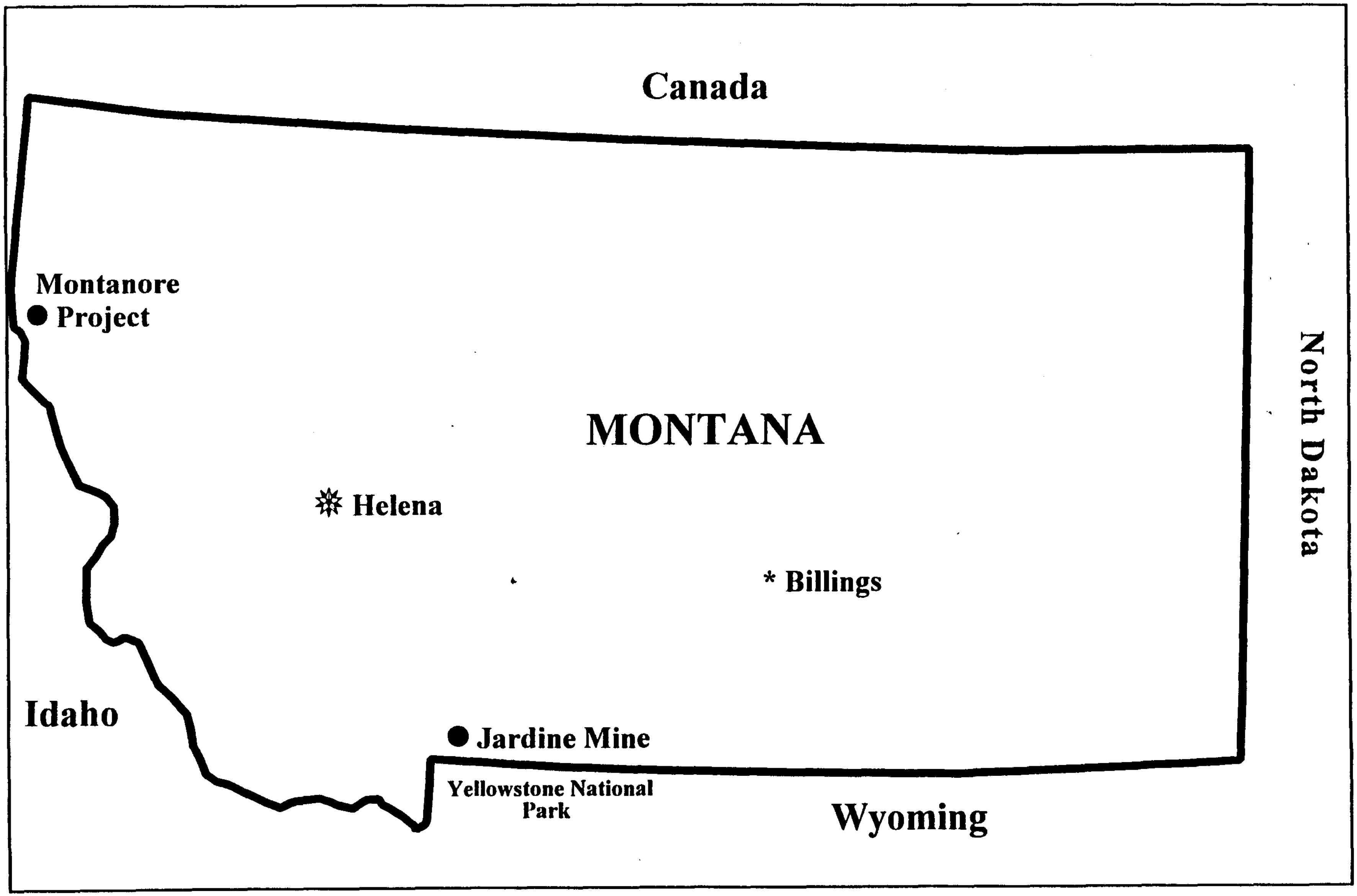
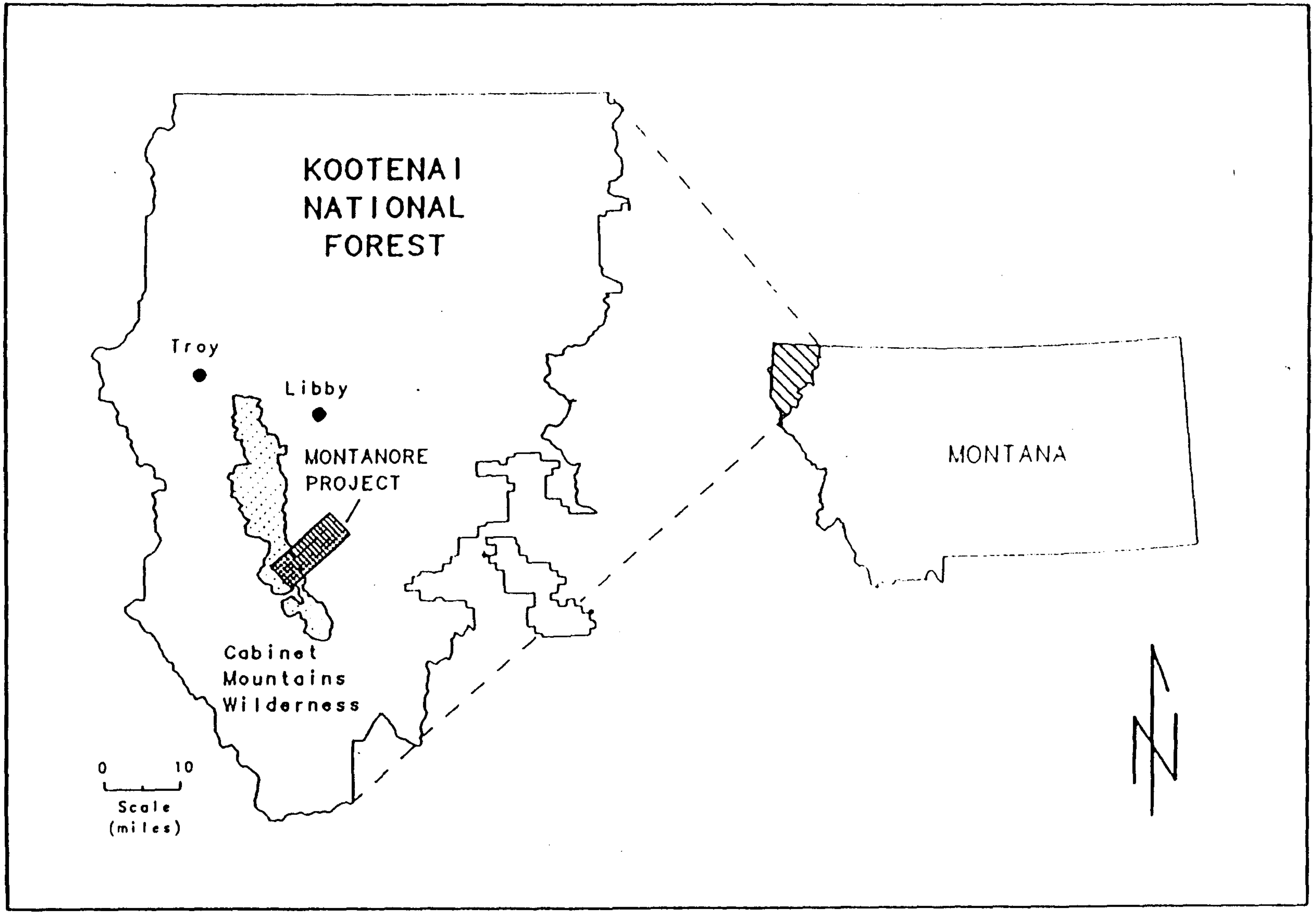


Figure 4.2 Montanore Mine Location



Mine History

The development of the Montanore ore body was initiated by a subsidiary of the U.S. Borax Chemical Corporation (Borax) in 1982 and 1983 with the location of 202 individual lode claims within the Cabinet Mountain Wilderness area (see figure 4.2)(MDSL & USFS, 1992). Results based on drilling, surface sampling, geologic mapping and other data, indicated that a large apex of stratabound copper-silver deposit had been located. The location of the claims within a wilderness area required that the USFS verify that Borax had established existing rights to the claims prior to the withdrawal of the wilderness area.[36] The USFS validated four of the claims on February 28, 1985, which allowed the agency to begin processing an application for further exploration activities.

The location of the claims within a wilderness area allowed the USFS to place a number of additional stipulations on the applicant for exploration activities. This included the submission of a POO and an EA (Pincock, *et al.*, 1990). Additional requirements included drill pads which could only be accessed by helicopter, wastes that had to be removed aerially, and exploration that had to be completed by the end of 1987. The expensive nature of surface exploration necessitated moving future exploration activities underground. Noranda and Montana Reserves purchased the mineral rights in 1988 and continued exploration activities by constructing the Libby adit from private land holdings. An 18,000 foot exploration adit was approved following the completion of all environmental analysis by MDSL.

The applicant proposed the development of an underground copper and silver mine in northwest Montana. The major components of the development include the construction of an underground mine, a mill, two adits and portals, a tailings impoundment, access roads and a 16.7 mile electric transmission line. An adit was built from private land holdings in Lincoln County to access mineral rights within the Cabinet Mountain Wilderness in Sanders County. Ore would then be processed at a site outside the wilderness area. The estimated reserves of the project are 142 million standard tons of ore at an average grade of .78% copper and 2.1 ounces/standard ton silver (Engineering and Mining Journal, 1990). Production would average 20,000 tons per day (7.0 million tons per year) and result in 20 million ounces silver and 1.5 billion pounds of copper.[37] The estimated life of the mine is 15 years.

Development includes the construction of the Ramsey Creek Adits which runs from the mill site approximately 13,000 feet to an underground primary crushing facility. Approximately 4,000 feet of the Libby Adit, which was started in 1989 for exploration purposes would also be

[36]The Wilderness Act of 1964 provided that wilderness lands be withdrawn from the hardrock mining and mineral leasing laws on January 1, 1984 (Coggins & Wilkinson, 1987).

[37]These production rates would make the mine the largest silver producer in the world and one of the largest copper producers in North America (Engineering and Mining Journal, 1990).

completed and used mainly for ventilation.[38] Conventional room-and-pillar mining method would be employed at the site for ore extraction. Ore would then be hauled to the primary crusher using 39-ton electric trucks. Crushed ore would then be transported through the Ramsey Adit for further crushing, grinding and processing.

The mill facility would be constructed near the Ramsey Creek Adit and would include: a mill concentrator; a tailings thickener; drainage sumps; attendant pumps; slurry and water lines; an office and parking lot; and a shop warehouse (MDSL & USFS, 1992). The mill will operate seven days a week, 350 days a year, allowing for the processing of seven million tons of ore. Ore delivered to the mill would be subjected to crushing, grinding and a froth flotation process resulting in a single concentrate which contains both copper and silver. The tailings would then be disposed of at the tailings facility. Reagents used in processing would either stay in the concentrates or be disposed of at the tailings facility.

Approximately 1.7 million cubic yards of waste rock will be generated by the mining activities. All waste rock generated during mining will be placed in underground areas which have been previously mined or will be taken to the surface and used in the construction of plant facilities or the tailings impoundment. Waste rock generated during construction would be placed in the tailings impoundment or along Ramsey Creek. The tailings facility is in the Little Cherry Creek watershed approximately five miles northeast of the mill. The facility will be built over a 16 year period and will involve building a dam to a height of approximately 370 feet. The impoundment will store approximately 100 million tons of tailings which will be produced by the operations.

Noranda will dispose of water inflows from the mine and adits using a land application disposal (LAD) method. There are two areas submitted for the land application. A drip/spray irrigation system will be installed over an area of approximately 221 acres. The system will allow the discharge of 2,000 gallons per minute of excess water. The permit allows for up to 472 acres of land application if mine inflows exceed what has originally been estimated.

An important feature of the Montanore project for this analysis is the extensive environmental review process the project has received. The long lead time appears to be the result of the project being located near a wilderness area and the large scope of the project. The case represents the upper bound of the environmental requirements needed to bring a mining operation online. Another interesting aspect of this particular case is the decision by the Montana Department of Health and Environmental Science to require Noranda to petition for a change in water quality standards of ambient waters instead of obtaining a Montana Pollution Discharge Elimination System permit. The significant requirements for compliance are discussed below.

The review process for Montanore was initiated with exploration activities. The conceptual mine plan was submitted to the USFS in June 1988 after exploration activities

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[38] Construction on this adit was suspended in 1991 in response to concerns that the construction was increasing the amount of nitrates in Libby Creek (MDSL & USFS, 1992).

determined that the ore body was economic. The submission of the mine plan triggered the NEPA/MEPA process. An extensive scoping process was undertaken by the lead agencies on the project with the purpose of identifying the important environmental issues of the project. An interesting aspect of the process relevant to the Montanore project is that four lead agencies were designated which include: U.S. Forest Service (USFS), Montana Department of State Lands (MDSL), Montana Department of Natural Resources and Conservation (MDNRC), and Montana Department of Health and Environmental Sciences (MDHES). Additionally, five cooperating agencies are also involved with the review (U.S. Fish and Wildlife Service (USFWS), Hard Rock Mining Impact Mitigation Board (HRMIB),Corp of Engineers (COE), Bonneville Power Administration) (MDSL & USFS, 1990). The results were then used to develop possible alternatives which could be evaluated during the NEPA/MEPA process. The agencies identified six significant environmental issues during the scoping and analysis process. These were:

- changes is wildlife habitat and population, particularly the grizzly bear;
- changes in type and quality of general forest recreational activity and on the area's aesthetic qualities;
- changes in the Cabinet Mountain Wilderness character, such as the opportunity for solitude, natural integrity, and opportunity for primitive recreation;
- socioeconomic changes, including employment, income, housing, community services, population, and public finance;
- concerns for the location and stability of the tailings impoundment; and
- changes in quantity and quality of water resources and effects on aquatic life (MDSL & USFS, 1992).

The alternatives were developed and released as part of the DEIS on October 10, 1990.[39] Significant comments on the DEIS persuaded the agencies to draft and release a Supplemental DEIS which was released on November 8, 1991 and contained additional information used to evaluate alternatives. Further analysis led to a drafting and release of the FEIS on October 1992. The ROD for the project was released in September of 1993 but has been appealed. Thus, project start up will be delayed until the appeals on the project have been resolved. A list of significant requirements for the project is presented in table 4.1.

Noranda has petitioned MDHES for a change in the quality of ambient water standards in addition to applying for a more traditional MPDES permit for water discharges.[40] The analysis by the agencies indicated that surface and ground water quality would be affected by Noranda's discharges to the land disposal areas, and seepage from the tailings impoundment. Montana's "non-degradation" standard establishes ambient water quality standards as required. However,

[39]The DEIS was delayed five months and had contributions from approximately 250 authors (Pincock, *et al.*, 1990).

[40]Noranda has requested changes in standards for TDS, Ammonia, nitrate/nitrite, chromium, copper, iron, manganese and zinc for surface water. Ground water standards requested are for TDS, nitrate/nitrite, chromium, copper, iron, manganese and zinc (MDSL & USFS, 1990).

the regulations also give MDHES, the ability to modify the standard from the ambient level.[41] Noranda's petition described the proposed change in water quality standards which pertain to surface and groundwater discharges resulting from mining activities.

Table 4.1 Permits and Approvals for Montanore Project

Level of Government	Agency	Permit or Requirement
Federal	USFS	POO, NEPA, Timber Sales Contract, Special Use Permit
	USF&W	Biological Clearance
	Bonneville Power Adm.	NEPA
	USACE	CWA (404 Permit)
State of Montana	MDSL	MEPA, Operating Permit, HRIMP
	MDHES(AQB)	Air Quality Permit
	MDES (WQB)	GWDP, Stormwater Discharge Permit, Change in Quality of Ambient Waters,
	MDNR	Water Rights Permit, MFSA
	MDFWP	Stream Preservation Act
	MHRIMB	HRIMP
Local	Lincoln Conservation District	HRIMP

Impacts of Permitting Process

The extensive nature of the review process for the Montanore project resulted in both design modifications and time delays. The design modifications are relatively minor in scope and mainly deal with additional mitigation and monitoring requirements. Changes in production technology are minimal. Time delays for the project however, have been extensive. The details of these impacts on the project will be discussed in detail below.

[41] MDHES can approve a change in water quality standards if the changes are a result of a "necessary social or economic development" (MDSL & USFS, 1992). The changes may not preclude present or anticipated uses of water resources or violate any water quality standards established by regulation.

Design Modifications. Environmental concerns raised during the public comment period encouraged the applicant to make a number of design modifications to the original mine plan. The significant changes include:

- revisions to the estimated water balance;
- modification of grizzly bear mitigation plan;
- addition of a mitigation plan for wetlands and the Northern Beechfern; and
- updated monitoring plans for surface and ground water, fisheries and aquatic life (MDSL & USFS, 1991).[42]

Noranda revised water balance estimates with the results of additional analysis by the company and the agencies. The revisions led to the reduction in the quantity of mine inflows being discharged in the third year of construction and the quantity of seepage from the tailings impoundment which would not be intercepted until year 16 of operations. The analysis used lower and more sensitive detection limits than previous studies. The revised plan eliminates the possibility that water quality standards for manganese and copper would be exceeded.

The grizzly bear mitigation plan was modified after a cumulative effects model was used to estimate effects on bears and their habitat.[43] The revised mitigation plan includes the closure of roads in KNF on either a seasonal or year-round basis to increase habitat values. This would be supplemented with habitat acquisition activities to provide necessary mitigation for grizzly bears.

A number of comments were received on the DEIS which were concerned with the effect of the operation of wetland resources. Noranda responded to these concerns by conducting additional wetland mapping and impact analysis. The results indicated that 21 acres would be affected by the development.[44] Therefore, Noranda proposed a mitigation plan which includes building new and enhancing existing wetlands onsite. Additionally, Noranda would develop wetland mitigation areas offsite at Poorman Flat and near the tailings impoundment on lands administered by the USFS (MDSL & USFS, 1991).

Analysis of vegetation effects indicated that the proposed development would result in the loss of large populations of the Northern Beechfern. The plant species is a USFS designated sensitive plant species. Noranda developed a mitigation plan that reduces the loss of the species

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[42]Less extensive modifications were also made to other alternatives for the project including: revisions to the proposed water quality and aquatics monitoring plan; development of an air monitoring plan; and incorporation of a change in the impoundment design to reduce tailings seepage into the underlying ground water (MDSL & USFS, 1991).

[43]The analysis using this model indicated the original analysis erred in the number of habitat units which were estimated. The estimates were revised from 1,174 to 782.

[44]Noranda originally used the COE 1989 definition of a "wetlands" to guide the study. Using this definition 36 acres were affected by the development. The agency later rescinded the rule and asked Noranda to reevaluate the area using a 1987 definition. This led the result that only 21 acres would be affected.

in the area around the tailings facility. The plan involves salvage and transplant of individual ferns from the project area to other similar habitats, primarily in suitable sites along Bear Creek, Libby Creek and Big Cherry Creek.

The company has also modified monitoring plans for surface and ground water and aquatic life. Noranda will use lower detection limits, where appropriate and achievable, in the analysis of surface and ground water.[45] Mine and adit inflows will be tested for barium, thallium, beryllium, nickel, selenium, and antimony during initial construction. The same metals would be analyzed in the first year of operations in the tailings pond water. Fish populations would be monitored at three year intervals in a single appropriate stream reach.

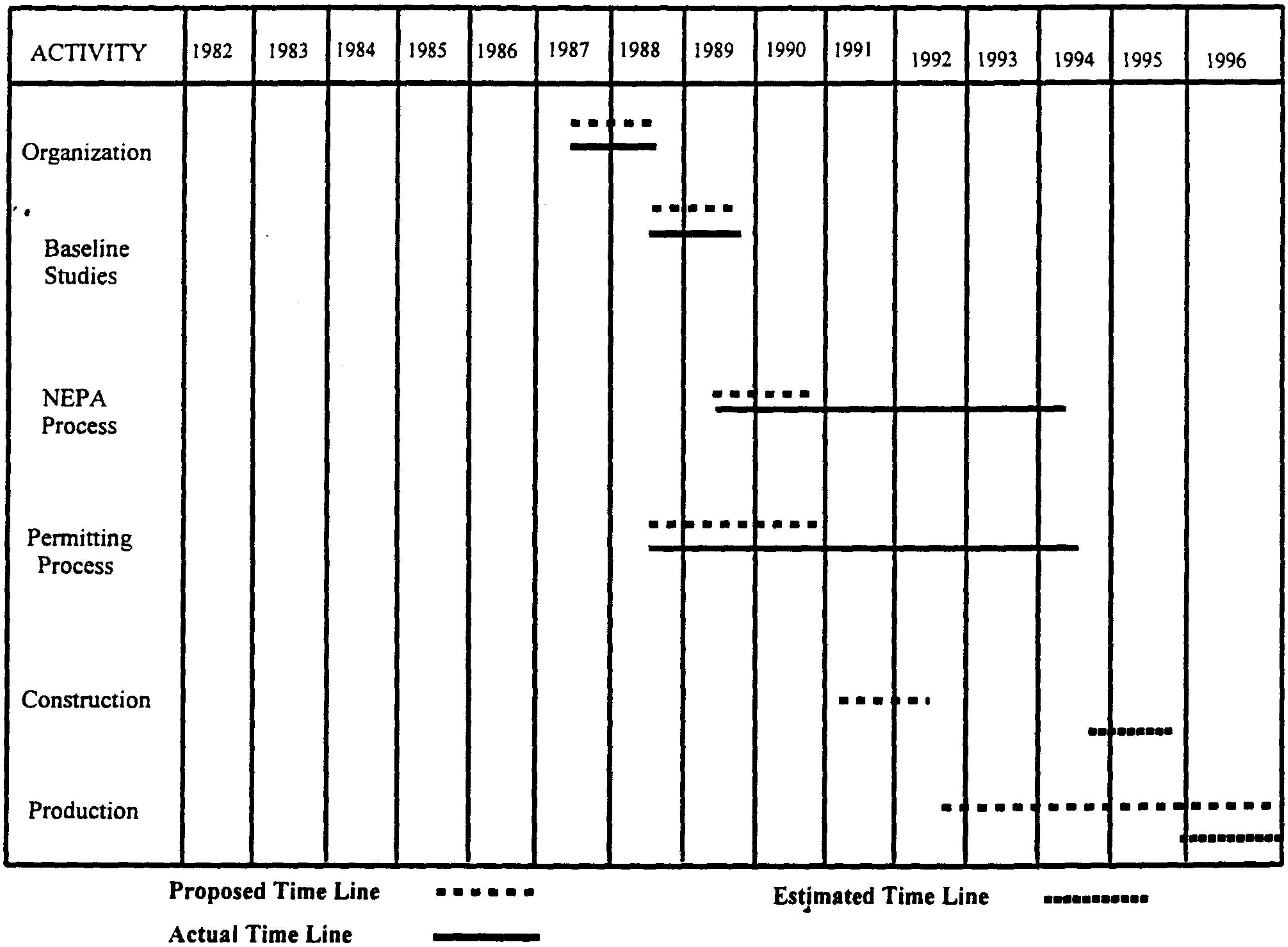
Timeline Impacts. Evaluation of the timeline for the project indicates that time delays encountered by Noranda for the Montanore project have been extensive (see figure 4.3). Early estimates indicate the DEIS was expected to be completed in May, 1990 and the FEIS in November of the same year. The ROD on the project was issued in September 1993. This indicates the NEPA/MEPA process has extended three years beyond company estimates. The project is likely to face further delays because of the current appeals of the ROD. The delays encountered by Noranda for the Montanore project are similar to those for the Jardine Mine. This is not a surprising result given the fact that both mines are located in highly sensitive environmental areas and the demanding Montana permitting requirements.

4.2 Jardine Mine Case Study

The Jardine Mine has a number of interesting aspects which make it relevant for this study. First, the mine is located in a highly sensitive environmental area (near Yellowstone National Park). Thus, the company experienced a number of additional measures at the site to insure compliance. These actions were undertaken during exploration as well as during development stages. Second, the mine was permitted in the mid 1980's which allows the analysis to consider the extent of evolving state regulations and whether this is affecting mining operations. Third, the mine is located primarily on private holdings but still required approval from all three levels of government before development could begin. Finally, the case can be compared with those from the other states within sensitive areas to determine if the requirements are similar.

[45]Where these limits are unreasonable, Noranda would develop detection limits using procedures described in 40 Code of Federal Regulations Part 136, Appendix B, Definition and Procedure for the Determination of the Method Detection Limit during construction, operational and post-operational monitoring (MDSL & USFS, 1991).

Figure 4.3 Montanore Project Timeline



Mine History

The Jardine Mine[46] is located in the Gallatin National Forest in Park County, Montana, near the town of Jardine (see figure 4.1). The project is in the Bear Creek drainage which is a tributary of the Yellowstone River. The underground gold mine was a joint venture between Homestake Mining, Co. and American Copper & Nickel (ACN) with ACN acting as the operator but is now operated by TVX Gold (Pincock, *et al.*, 1990). The mine was originally permitted

[46]The mine was awarded the Northern Excellence Award by the USFS. The honor recognizes the operator's successful compliance record, efforts to inform the public through a Citizens Advisory Committee, the use of water rights to protect fish resources, funding of a bald eagle nest management plan, and reducing socioeconomic impacts by hiring local employees (Pincock, *et al.*, 1990).

for an eight year life but further exploration led the company to extend the life to a potential twenty years. The mine disturbs approximately 410 acres of which 28% had been previously disturbed. All the mining and milling activities are located on private lands. The tailings facility was originally located both on USFS and on private lands but as a result of a recent land exchange the facility is now located entirely on private holdings.

Operations consist of an underground, adit-accessed mine with a conventional mill. Production averages 150,000 tons per year utilizing cut-and-fill and room-and-pillar mining methods (Pincock, *et al.*, 1990). Tailings from the mill operation are dried and then backfilled into the mine as a slurry to fill stopes as mining progresses upward. The tailings are also used to stabilize walls and to prevent falling rock from diluting mined ore (MDSL & USFS, 1986).

The milling facility includes crushing, grinding and cyanide leaching activities in a two stage process. The first stage is a flotation process which begins by crushing and grinding the ore to expose the gold bearing sulfide minerals. A slurry is formed with the crushed ore and water with a consistency of 36% solids. The slurry is then subjected to a froth flotation which separates and concentrates the metals form the ore. The second stage of the milling operation involves filtering and leaching the froth concentrate with a cyanide solution. Gold is precipitated from the solution with the addition of zinc dust. The zinc/gold precipitate is further refined in a electrolytic furnace producing bullion dores containing both minerals.

A major component of the mine was the inclusion of a state-of-the-art tailings facility. The zero-discharge impoundment was designed to reduce the moisture content and cyanide levels of the tailings. Tailings are subjected to a three stage filtration system at the site. The facility is not only being utilized to treat tailings from present operations but historic tailings which are being relocated to the site are also being treated.

Impacts of the Permitting Process

The permitting process experienced by the operator of the Jardine project was quite extensive. The permitting process involved a number of baseline and socioeconomic studies, mitigation measures and took approximately three years to complete. This is a relatively extensive analysis for a project of this size. The operation experienced a number of design modifications and time delays which will be discussed in length. The discussion will first focus on the requirements needed for compliance in order to bring this project online.

Exploration at the Jardine site was begun by Anaconda Minerals Co. in the early 1980's. An interesting aspect of the exploration project was not only its success at locating a valuable ore body but a voluntary effort by Anaconda and Homestake to employ mitigation measures in the area. One thousand tons of arsenic waste was removed and transported to a hazardous waste site in Idaho by the two companies at a cost of $407,000 (Pincock, *et al.*, 1990). When the discovery of the ore body was determined valuable, Homestake approached the three relevant agencies to begin the permitting process.

An inter-disciplinary team was formed in 1980 to study the proposed project. The team required the company to complete extensive baseline and monitoring studies which exceeded minimum requirements.[47] Once the initial review was complete a Memorandum of Understanding was signed by MDSL and the USFS with the agreement to conduct a joint NEPA/MEPA review.[48] The NEPA/MEPA process was initiated after a Hard Rock Mining Mitigation Plan and Operating permit application were filed in late 1983 and early 1984. A DEIS was completed and released in October 1985. This was followed by a public comment period where a number of comments were accepted. A FEIS was then released on the project in April, 1986. The following July, all necessary permits were approved which allowed the company to begin construction in 1987. This led to the official opening of the mine in September of 1989.

The most demanding requirements of the Jardine project for the applicant was completing the NEPA/MEPA process and obtaining an approved Hard Rock Mining Mitigation Plan, Operating permit, and Air Quality permit. A list of all the requirements are contained in table 4.2. Approval of the project required the applicant to make design modifications and meet a number of stipulations. Many of these requirements were the result of the comments received during the public comment period from interested parties or other governmental entities.

Table 4.2 Permits and Approvals for Jardine Mine

Level of Government	Agency	Permit or Requirement
Federal	USFS	POO, NEPA
	USF&W	Biological Clearance
	USACE	CWA(404 Permit)
State of Montana	MDSL	MEPA, Operating Permit, HRMP
	AQB	Air Permit
	WQB	MPDES, Tailings Approval
	BWM	Solid Waste Approval
	MDNR	MSFA
	MDC	HRMP
	MHP	Archaeologic Clearance
Local		HRMP

[47]The baseline monitoring included three air stations, 21 ground water monitoring wells and surface water sampling stations (Pincock, *et al.*, 1990). The results of the baseline studies were included in a four volume operating permit application. The baseline monitoring as well as current monitoring activities exceed minimum requirements.

[48]The USFS and MDSL both acted as "lead agencies" throughout the process.

Design Modifications. Three public hearings were held by MDSL on the project between the release of the Draft and Final EISs. The major concerns raised during this process included those surrounding wildlife, air and water quality, socioeconomic impacts and road and power line alternatives (MDSL & USFS, 1986). The company reacted to these concerns and made a number of changes to the design of the project. These were discussed in the FEIS and include:

- an employee transportation and traffic-reduction plan for the Jardine road;[49]
- use of sediment control practices, relocation of septic tank and drainfield further from Bear Creek;
- separation of potentially toxic liquid wastes from sanitary wastes;
- provisions to prevent seepage of slurry water from the mine;
- slurry pipeline specification for withstanding corrosion and earth-quake stresses;
- provisions for spill control and leakage detection;
- disposal of tailings originating in cyanide circuit in a lined tailings dump;
- revised water use requirements;
- revised mine access road plan;
- wildlife monitoring plan around tailings facility and fencing around the seepage pond; and
- implementation of a noise reduction plan. (MDSL & USFS, 1986).

These modifications were made to the project plan and implemented in the FEIS. The applicant was also required to met a number of other mitigation and monitoring requirements before approval was given.[50]

Additional requirements were placed on the firm with the approval of the Hard Rock Mining Mitigation Plan (HRMMP). This institutional requirement is designed to identify and mitigate major socioeconomic impacts to community infrastructure. The major stipulations for this project included providing the county with a $500,000 pre-tax payment which was used to upgrade the Jardine road, in addition to the program implemented by the company to reduce traffic along the road. The HRMMP also required the company to reduce socioeconomic impacts by hiring 80% of the workforce locally.

The operator was also required to develop a mitigation plan to protect the cultural resources in the area. This was the result of an extensive cultural resource inventory of the area which encompassed 3,100 acres on private and USFS lands (MDSL & USFS, 1986). The survey discovered historical sites which represent two important historical mining and milling development periods in the west (1890-1900 and 1920-1948). The applicant agreed to remove

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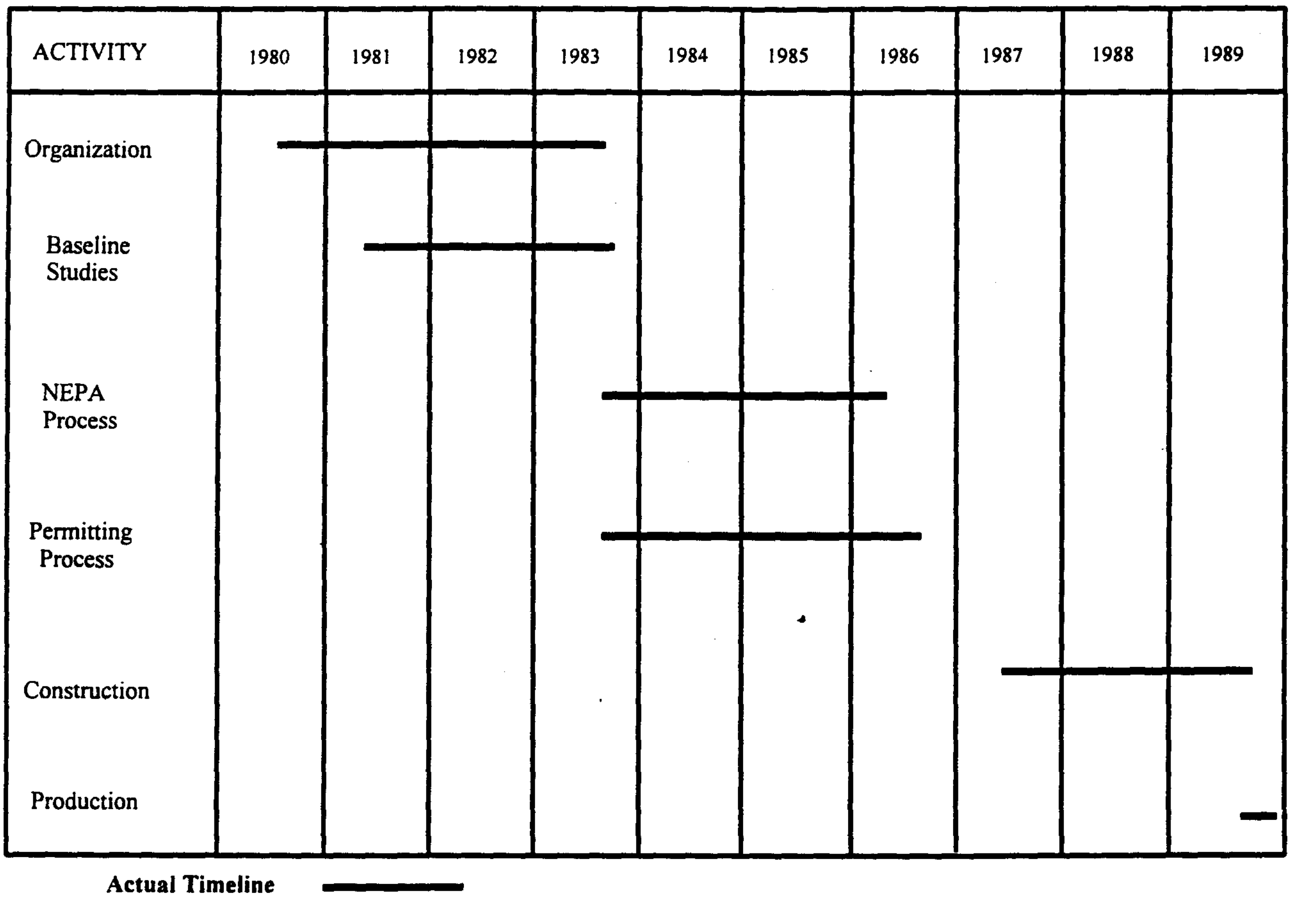
[49]This included such measures as: cash incentives to employees utilizing carpools; limiting parking at the site to 50 vehicles; and provide busing to the mine if employment exceeded 100 (MDSL & USFS, 1986).

[50]Monitoring requirements include: surface and ground water quality; wildlife impacts; tailings impoundment construction; reclamation and revegetation activities (USFS &MDSL, 1986). The details of these measures are discussed in the FEIS p. I-23 through I-25 and the ROD released by the USFS in May, 1986.

16 structures which were important historical sites as part of the mitigation plan.

Timeline Impacts. Examination of figure 4.4 indicates the significant time required to gain approval from all relevant agencies for the Jardine mine. The total time needed to complete the permitting process was approximately three years. This is partially interesting since the majority of the development took place on private lands. Despite the land ownership federal, state and local agencies still had jurisdiction. This is quite a contrast to cases in other states.

Figure 4.4 Jardine Mine Timeline



Delays can also be attributed to the mine being located in an environmentally sensitive area five miles north of Yellowstone National Park. Environmental amenities in the area include grizzly bear habitat, bald eagle nesting, elk migration and a stream which flows through the park. The sensitive nature of the area generated a great deal of public concern for the project. While the development in general received support from the public, it was repeatedly expressed that the project should only be approved with a number of specific conditions. Addressing all these issues required a great deal of reevaluation of the project which delayed the project during the NEPA/MEPA process. This included extensive baseline studies which were above and beyond what is normally required of mining projects in other parts of the state.

4.3 Summary

The analysis of these two cases demonstrate the demanding requirements of the Montana permitting process. Requirements to bring the two projects online are much more demanding than cases in other states. This is partially attributed to the Montana permitting system but also to the location of the sites near very sensitive environmental areas. The impacts on the compliance process are lengthy time delays and a number of design changes which appear to be more extensive for the Jardine mine. This is especially interesting given the size the of mine and the location primarily on private holdings. The case represents a striking difference with cases in other states of similar size and land ownership.

5.0 NEVADA

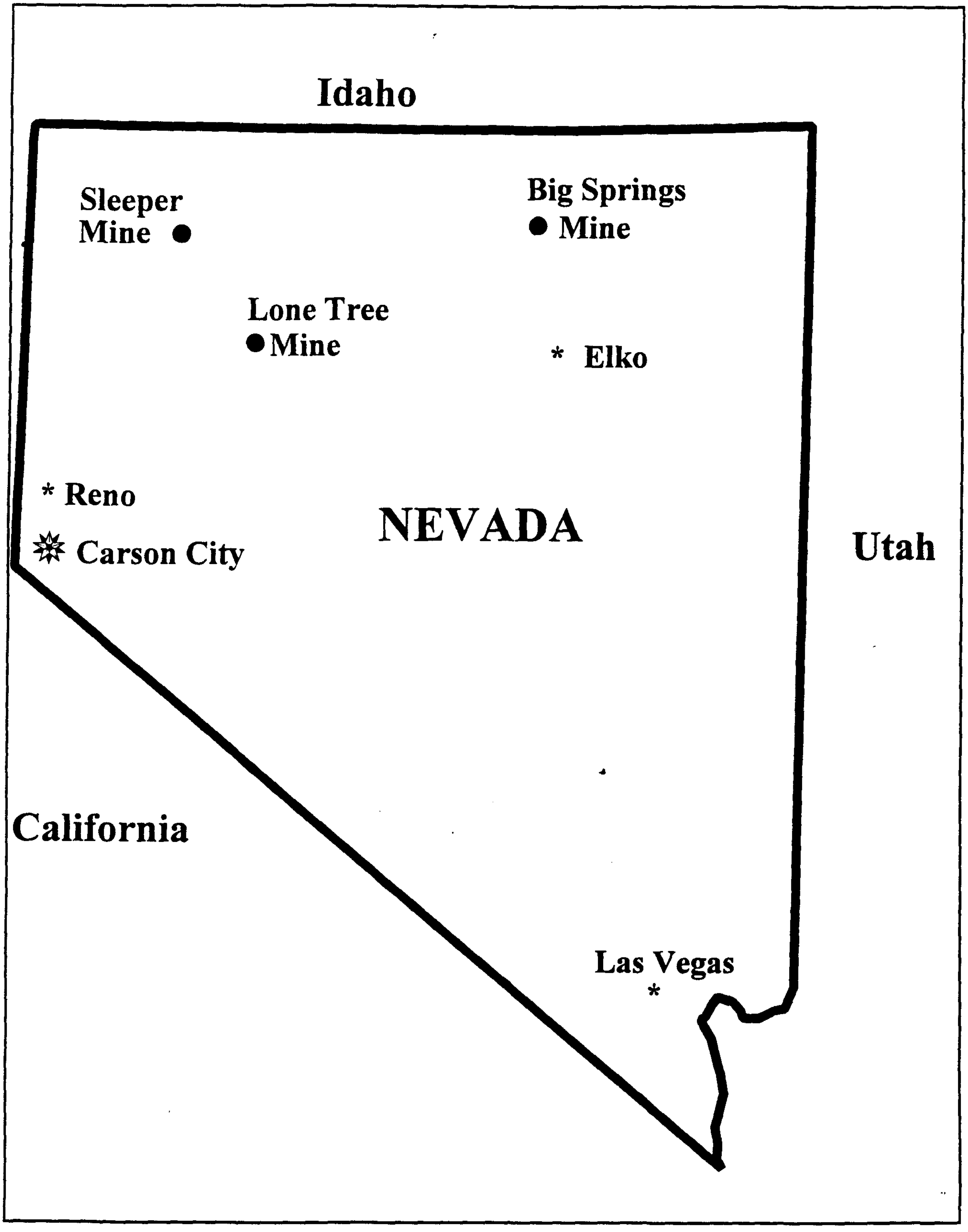
Case studies from Nevada include Sleeper, Lone Tree and Big Springs mines. Sleeper and Lone Tree mines are located in Humbolt County while Big Springs is in Elko County (see figure 5.1). Sleeper is presently owned and operated by AMAX Gold, Inc. and is an open pit gold mine which began operations in 1986. The Lone Tree mine is being operated by Santa Fe Pacific Gold Corporation which began producing gold in August of 1991. The Big Springs mine is also a gold project which is operated by Independence Mining and has been in production since 1987.

The Sleeper mine makes an interesting case study because developers were able to satisfy NEPA requirements for this open pit operation by completing an EA. While this has traditionally been quite common for mines in Nevada it is not common in other states. AMAX Gold was also successful at obtaining permits from other agencies in a very short period of time. Actual compliance requirements were completed in approximately six months (Pincock, *et al.*, 1990). The project has since gone through four significant expansions which required additional permits.

The Lone Tree operation was also able to move through the compliance process in a relatively short period of time. Santa Fe completed exploration, permitting and construction in slightly more than two years. This was primarily due to the fact that the mine is located on private lands which reduced the number of the federal regulations pertaining to the operation. The relatively unique land ownership situation makes this an interesting case study.

The Big Springs mine has been chosen for the study because it seems to represent the other end of the spectrum of how mines may be regulated within Nevada. This mine, operated by Independence Mining Corp., is under the regulation of the USFS. The site was chosen by the USFS to be a "showcase" mine because it has demonstrated excellence in environmental protection. The case will provide insight into what requirements may represent the upper bounds

Figure 5.1 Nevada Case Studies



on environmental standards in Nevada.

5.1 Sleeper Mine Case Study

The Sleeper mine was chosen for a case study because of the speed at which the operator was able to achieve compliance. This was mainly the result of the mine originally being permitted as a small open pit operation. The mine has since been dramatically expanded. The case is also interesting for comparison reasons. This is due to the fact that the site was originally permitted in 1986. This gives some insights into how the regulations within Nevada have evolved. A comparison of this mine to those which were more recently permitted will indicate whether increased regulations have negatively harmed mining within the state.

Mine History

The Sleeper Gold Mine, which is solely owned and operated by AMAX Gold Inc., is located in Humbolt County, Nevada approximately thirty miles northwest of Winnemucca. The site is in Desert Valley, adjacent to the Slumbering Hills at an elevation of approximately 4160 feet. The present operation includes two open pits (Sleeper and Wood), a heap leach facility, mill and tailings facility. During 1990, the mine produced 14.2 million tons of ore and waste of which 500,614 tons was milled and six million tons were heap leached (Epler, 1991). Recovery of gold was 196,585 ounces from milling and 53,546 ounces from leaching and silver production totaled 391,886 ounces. Production figures for the mine from 1986-1991 are listed in table 5.1.

Table 5.1 Sleeper Mine Production 1986-1991

Year	Production Au(oz)	Production Ag(oz)
1986	128,000	94,000
1987	158,696	-
1988	230,410	-
1989	256,000	339,650
1990	250,131	391,886
1991	183,346	289,463

Source: Nevada Bureau of Mines & Geology, 1992

The mineralization, consisting of a low-grade gold and a minor silver deposit, at the Sleeper mine was first discovered in 1982. Further exploration led to the discovery of the ore body in 1984. Company officials met with state and federal regulators concerning the project the same year. The decision to develop the mine was made by AMAX Gold management in July, 1985 despite poor market conditions. The project was originally proposed as a small open pit mine and mill operation which would process 500 tons of ore per day. The relatively small nature of the operation and the use of accepted techniques allowed the company to complete feasibility studies and permitting activities very quickly. AMAX Gold was able to complete all feasibility studies and permitting requirements in less than six months. This allowed mine construction to begin in October of 1985 and mining activities in January of 1986.

Impacts of the Permitting Process

One of the more interesting aspects of the Sleeper mine was the ability of the company to achieve environmental compliance in a very short amount of time. This is mainly due to the original operation being relatively small and the environmental compliance process in Nevada at the time was quite limited. Significant regulations have since been enacted in the state which requires a more stringent review of an operation. Thus, the operation was able to acquire all relevant permits and achieve NEPA compliance within a six month period.[51] The process was initiated by AMAX Gold in September of 1984 when company officials met with regulating agencies to discuss necessary documents. The company then submitted a POO to the USBLM in March, 1985 which initiated the NEPA process.

The USBLM made the decision to complete an EA on the project and issued a Finding of No Significant Impact (FONSI) one month later. This decision was based on the fact that the proposed site was in a remote area where conflicting land use issues were not present. The applicant was then able to acquire the other necessary permits in May of the same year and began construction in August. The most demanding approval requirements were the POO and EA for the USBLM, a Special Use permit with the county, and water, air and tailings permits filed with the state. Necessary permits needed for the original project are listed in table 5.2. Construction of the site was complete and operations were able to begin in January, 1986.

Another major reason for the environmental compliance being achieved so quickly is the original project was relatively small with a production rate of 500 tons per day. This allowed the company to avoid major permitting requirements. The operation has since gone through a number of expansions which required additional permitting. The major expansions included: a heap leach pad (1,650 tpd) was permitted and constructed in 1986; the mill was increased to a capacity of 800 tpd from 500 tpd; the Wood Pit was opened which increased production from 0.75 million tons per year to 4.5 million tons per year; and expansion of the initial leach pad and construction of a second pad in 1988 increasing leaching production to 3,000 tons per year (Pincock, *et al,* 1990). These upgrades required the operation to submit additional NEPA documents as well as additional permits.[52] This sequential permitting allowed the operation to be brought online very quickly and to avoid time delays.[53]

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[51]This does not include baseline studies.

[52]Additionally, AMAX Gold was required to obtain an NPDES permit after studies indicated that pit dewatering would require the discharge of 5,000 gpm (Pincock, *et al.*, 1990). The mine is presently being dewatered at a rate of 15,000 gpm (Mining World News, 1992).

[53]The sequential permitting was the result of further definition of the reserves. Original estimates did not fully define the extent of the reserve base. Thus, the company made the decision to expand operations after permitting of the original facility was complete.

Table 5.2 Permits and Approvals for Sleeper Mine

Level of Government	Agency	Permit or Requirement
Federal	USBLM	POO, NEPA
State of Nevada	BAQ BMRR BWM DWR	Air Permits (Con, Oper.) WPC Solid Waste Approval Water Appropriation Tailings Dam Permit
	NDHPA	Archaeologic Clearance
	DW	Habitat Modification
Local Requirements	Humbolt County	Special Use Permit

Design Modifications. Review of available literature indicates that design modifications during the compliance process were minimal at the Sleeper mine. The company has employed a number of techniques at the mine site, however, to deal with environmental problems of the operation. The most notable of these is the creation of a temporary wetlands from mine dewatering activities. Additionally, the company has employed a technique to reduce wildlife mortality around the tailings facility, a truck wash pad which allows solids to be removed with a backhoe and an overland conveyor system (Mining World News, 1992).

One of the more challenging problems of the Sleeper mine, like many other open pit operations, is how to deal with excavation which extends below the water table. The water table at Sleeper lies forty to fifty feet below the surface which required the mine to be dewatered throughout its life. Instead of using a traditional method which disposes of the water by using injection wells, AMAX Gold, USBLM, the State Water Engineer, and the Nevada Department of Wildlife made a decision to create a temporary wetlands with the discharge. This is accomplished by placing a number of wells around the perimeter of the pits. Groundwater is then pumped at a rate of 15,000 gpm into an adjacent clay area. The result is a 3,500 acre wetlands which has provided habitat for a number of waterfowl, deer, foxes, coyotes, raptures and other wildlife (Mining World News, 1992). A cooperative agreement between AMAX Gold, USBLM, and the Nevada Department of Wildlife will transfer all water rights to NDW which will maintain the wetlands after mine closure (Pincock, *et al.* 1990).

Another solution developed by company employees to reduce wildlife mortality involved an innovative approach to dealing with the toxic nature of tailings facilities. Usually, tailings are netted to restrict wildlife from encountering high levels of cyanide associated with the facility.

This was not possible at the Sleeper facility because the tailings were too large to place netting around. Company employees thus developed a technique which diluted solutions associated with the tailings. Once the solution is diluted it is placed in the tailings facility. The operation also places tailings at the site in thin layers which takes advantage of an ultra-violet degradation of the residual cyanide. The process has been successful at diluting new tailings to non-toxic levels.

The overland conveyor system, which is used to move crushed ore to the leach pads, was employed to reduce transportation costs, and hydrocarbon and dust emissions. The 1.5 mile conveyor includes dust suppression consisting of bag houses at every transfer point along the system. The system cost the company $3 million to install and requires two employees to operate (Mining World News, 1992).

Time line Impacts. Earlier discussion of the case indicated that environmental compliance at the Sleeper mine was achieved in a relatively short period (see figure 5.2). Thus, the time line impacts are not significant for the case. While this fact only does not lead to any powerful insights an interesting result is apparent when this case is compared with the other cases from Nevada. One of the reasons for the brisk manner AMAX Gold was able to achieve compliance is that a number of significant environmental regulations pertaining to mining operations were not in place at the time the mine was permitted. Nevada has since implemented reclamation requirements, strict hazardous water pollution standards and increased the requirements for wildlife protection. Despite the obvious increases in environmental requirements the timeline impacts of the process on mining operations still is relatively small for projects in Nevada when compared with other states. This is apparent with the two other cases examined where both mines were able to achieve compliance within a year despite the increase in regulations.

This result may be changing with the apparent change in attitude of the federal agencies as to how they evaluate mining projects in the state. Traditionally, federal agencies in the state have approved mining projects with an EA verses a more extensive EIS. With the increased environmental pressures, it appears that agencies will soon be requiring projects to complete the more extensive EIS. This has the potential for significantly increasing time requirements needed for compliance.

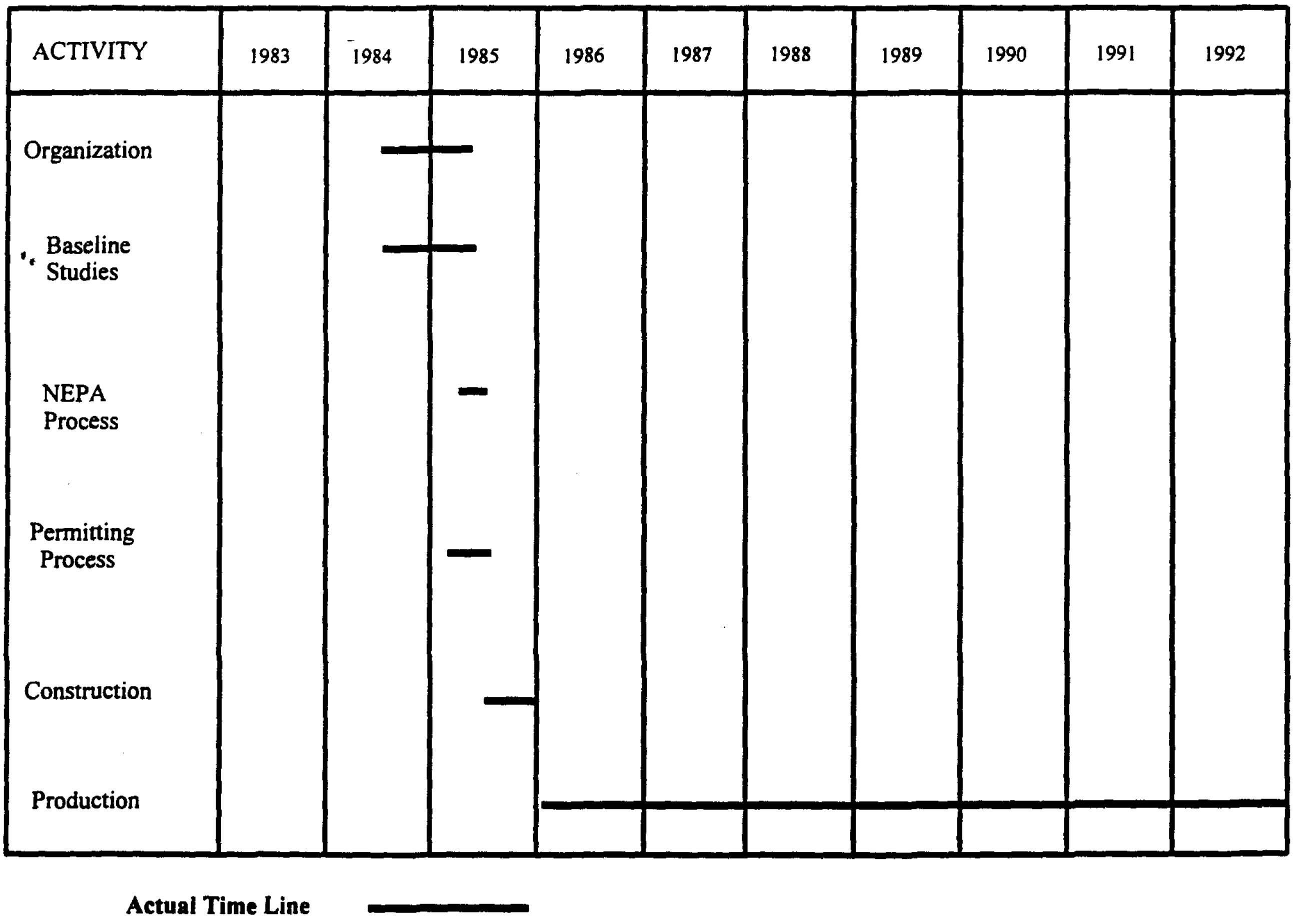
5.2 Lone Tree Mine Case Study

The Lone Tree Mine was chosen as a case study because the original operation was located entirely on private lands. This allowed the operation to be approved without review by any federal agencies. The case is interesting from a comparison standpoint with the other cases studies to determine how projects on private lands may have fewer complications in achieving environmental compliance.

Mine History

The Lone Tree Mine is solely owned and operated by the Santa Fe Pacific Gold, Corp. of Albuquerque, New Mexico. The mine is located approximately 33 miles east of Winnemucca

Figure 5.2 Sleeper Mine Timeline



and 19 miles west of Battle Mountain adjacent to Interstate 80 in Humbolt County (see figure 5.1). Operations consist of a conventional open-pit mine, heap leach pad, mill, waste rock dumps, and tailings facility. Production at the mine was initiated in 1990 and was approximately 165,000 ounces of gold in 1993. The original operation involved only a heap leach recovery process after testing indicated that milling was not necessary to achieve high recovery (Dillard, 1992). Once operations were underway the decision was made to expand the operation to include a mill facility. This consisted of oxide circuit and refactory circuit which utilizes a autoclave vessel. The entire system is expected to be brought online late in the second quarter of 1994. Production is expected to increase to 200,000 ounces per year once the mill is in full operation by early 1994. Actual and estimated future production rates are listed in table 5.3.

The original approved operation is located entirely on private holdings which has experienced many recent as well as historic mining activities. Reconnaissance exploration by the company was initiated due to the favorable geology in the area and a number of other producing

Table 5.3 Lone Tree Mine Production 1991-1994

Year	Production Au(oz)
1991	36,424
1992	129,000
1993	165.000 (app.)
1994	200,000 (est.)

Source: Nevada Bureau of Mines & Geology, 1992.

mines in the near vicinity. A discovery well at the site was drilled in July 1989, which revealed a promising mining potential. Company officials made the decision to develop the property and were able to achieve production at the site within 25 months (Dillard, 1992). The life of the mine was originally proposed to last for ten years.

The deposit is a mixture of oxides and sulfides which requires alternative processing techniques. The oxide ores are presently being heap leached in two ways. Low-grade ores are placed on the heap leach without being crushed. The recovery rate of 40% is well below other methods but low costs allow the production to continue at a profit. Higher grade ores are crushed and then placed on a alternative heap leach with a recovery rate of approximately 82%. Sulfide ore has been stockpiled since mining activities began. The ore will be processed in a 2,500 tons per day sulfide mill which is part of a major expansion scheduled to be complete in late 1993. The mill will utilize a low pressure and temperature autoclave for the sulfide oxidation process. Anticipated ore recoveries are expected at 90% with a production rate of 200,000 ounces of gold per year.

Impacts of the Permitting Process

The compliance process for the Lone Tree mine was limited to state and local requirements. This is due to the fact that the original mine is located entirely on private land holdings.[54] The majority of the permitting requirements were handled by different bureaus within the Nevada Division of Environmental Protection (see table 5.4). The project was not required to prepare any NEPA documentation since a federal decision was not required for project approval.[55] The most demanding requirements for Santa Fe were obtaining a Water Pollution Control permit from Bureau of Mining Regulation and Reclamation and a NPDES permit from

[54]Federal review of the projects in Nevada will not be required for any environmental permits because the state issues all permits under federally approved CAA, CWA and RCRA programs. Thus, federal review of mining projects in the state will only occur when the site is located on public lands.

[55]Current expansion activities at the site will require federal review. The company will be required to complete a NEPA document to proceed with the expansion. Federal review was required for the expansion, which included the development of a milling facility, because the site is located within the public domain.

Bureau of Water Permits and Compliance.[56]

Design Modifications. Review of the literature reveals that design changes initiated by the company as a result of the permitting process were minimal. The project did, however, have to negotiate with Sierra Pacific Power Company to resolve problems associated with the pit being located below the company's power lines. The conflicting land use problem was resolved by Santa Fe providing $4 million to have the lines moved to an alternative location. The move was somewhat complicated because the lines are a very important source of power for residents in the western part of the state. This gave the power company only a limited opportunity in the spring and fall to decommission and move the power lines. This appears to be the only major obstacle the company had to face when developing the property. This may be the direct result of a limited review by both the government and the public of the proposed project throughout the compliance process.

Table 5.4 Permits and Approvals for Lone Tree Mine

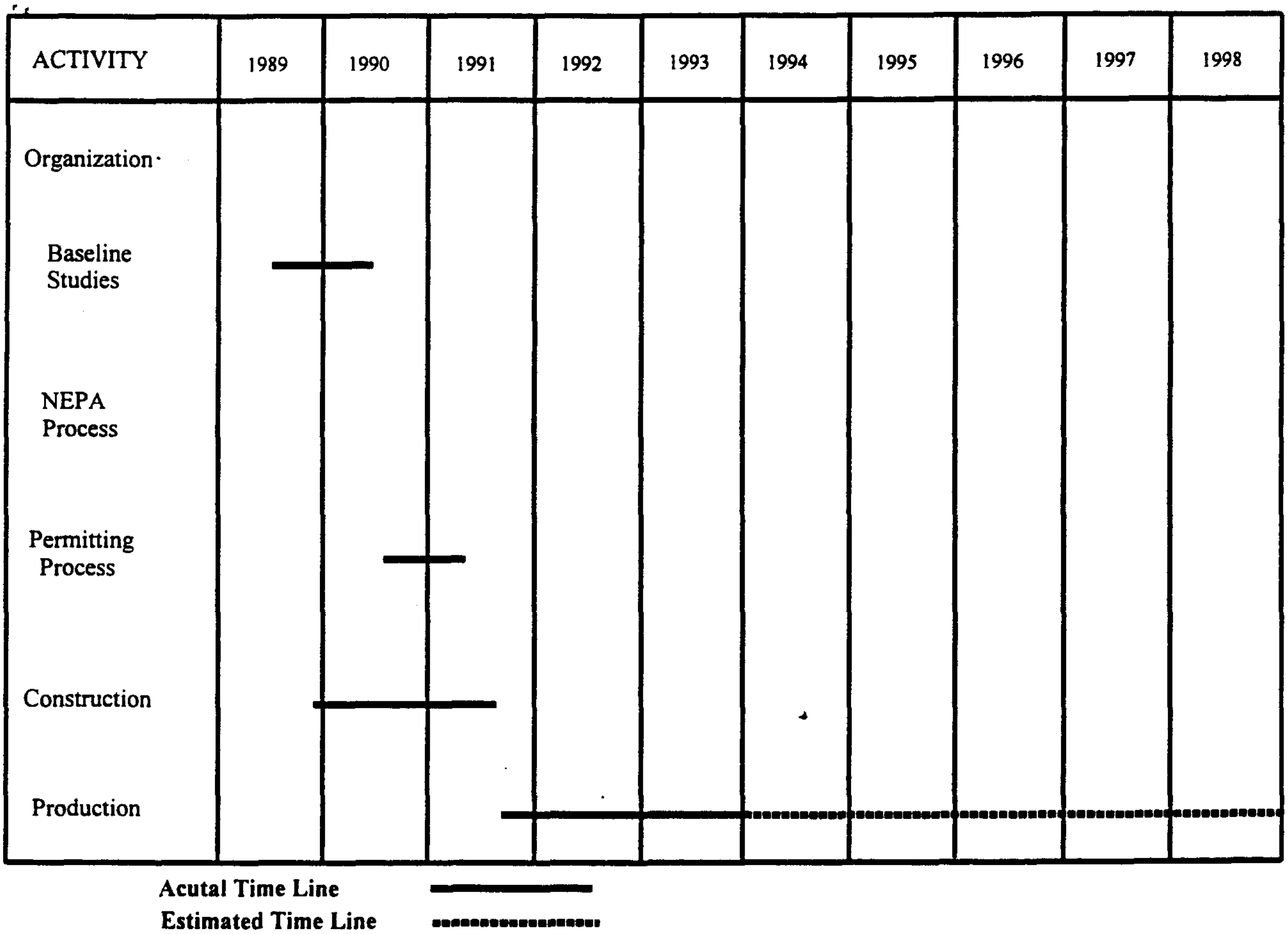
Level of Government	Agency	Permit or Requirement
State of Nevada	BAQ	Air Permits (Con, Oper.)
	BWPC	NPDES
	BMRR	WPC
	BWM	Solid Waste Approval
	DWR	Water Appropriation
		Tailings Dam Permit
	NDHPA	Archaeologic Clearance
	DW	Habitat Modification
Local Requirements		Special Use Permit

Timeline Impacts. The time requirements needed to gain environmental compliance for the Lone Tree mine were relatively short compared with mining projects in other areas. Santa Fe Pacific was able to obtain approval for the mine from all relevant agencies and develop the mine within two years. The actual environmental compliance process for this project appears to have been completed in one year (see figure 5.3). This was partially the result of the project being located entirely on private land holdings. This allowed the company to avoid any

[56]Santa Fe had to obtain a NPDES permit for the mine because operations require the mine to be dewatered. A discharge of 13,000 gpm is required. The operation was also required to comply with new storm water regulations promulgated as part of the amendments to the CAA.

environmental review required by federal agencies. Although the company was able to bypass any NEPA requirements the time requirements are similar to the other case studies in Nevada which *are* located within the public domain. This indicates that Nevada's highly streamlined compliance process is not affected by the number of agencies or requirements involved.

Figure 5.3 Lone Tree Mine Timeline



5.3 Big Springs Mine Case Study

The Big Springs mine makes for an interesting case study for several reasons. The first is the designation of the site as a "Hardrock Showcase Mine"[57] by the USFS. This designation

[57]The mine was designated a Showcase Mine on August 30, 1990 (Independence Mining Co.)

recognizes the company's efforts to operate the mine in a environmentally sensitive manner. This analysis will focus on the question of how this designation may have affected the permitting of the mine. Additionally, the mine is located on both USFS and USBLM lands. Thus, the analysis can provide some insight as to how the number of active agencies involved can affect the permitting process.

Mine History

The Big Springs Gold and Silver mine is a joint venture between Independence Mining Company Inc. (IMC) and Bull Run Gold Mines, Ltd. with IMC acting as the operator. The operation is located approximately sixty miles north of Elko in the Independence Mountains at an elevation ranging from 7400 to 8400 feet (see figure 5.1). The operation presently includes two separate open pits,[58] a transport corridor and heap leach and milling facilities which disturb approximately 600 acres of USFS, USBLM and private land holdings. Total ore reserves were estimated at 3.3 million tons, of which 1.7 mt would be milled and 1.6 mt would be heap leached (USFS & USBLM, 1987). Original plans projected the mine to have a life of ten years with gold production estimated to be 60,000 ounces per year. Actual production data are presented in table 5.5.

Table 5.5 Gold Production of Big Springs Mine, Elko County, Nevada

YEAR	PRODUCTION Au (oz)	PRODUCTION Ag(oz)
1987-88	106,000	-
1989	60,376	4,416
1990	73,224	3,060
1991	69,539	3,327

Source: Nevada Bureau of Mines and Geology Special Publication 1992.

The ore bodies at the mine site are discontinuous and thus required the development of three separate open pits. Ore is mined, using conventional methods, at approximately 2,600 tons per day with a stripping ratio of 10 to 1 (USFS & USBLM, 1987). The operation requires approximately six million tons of waste rock to be removed and disposed of annually with a total capacity of 35 to forty million tons. Waste dumps near the three open pits were developed to handle waste rock materials. The gold recovery system at the mine site consists of a crushing and grinding facility, an ore roaster, heap leach facility, a tailings impoundment, and a gold recovery plant. A combination of milling and heap leach operations are present with high-grade ores being milled and low-grade ores being heap leached. The gold recovery plant utilizes a carbon adsorption recovery process for gold recovery. The tailings facility was built close to the milling operation and involves a dam and reservoir near the head of a small local drainage.

[58] A third small pit, Mac Ridge was part of the original operation in 1987 and 1988 before it was mined out. This was the highest open pit operation in Nevada at an elevation of 9500 feet (Independence Mining Co.).

The Freeport-McMoran Gold Co. made the initial discovery of the main ore bodies at the Big Springs site as a result of drilling activities in 1982. Early baseline studies began in 1986 and the ore body was determined to be economic. The Big Springs Joint Venture filed a POO with the USFS and USBLM in April of 1986 which initiated the NEPA process. To analyze the environmental affects of the proposed plan, the USFS and USBLM organized an interdisciplinary (ID) team in May, 1986.

The ID team conducted an evaluation which included a site visit, a public scoping hearing, interviews of interested parties and circulation of a draft EA. Comments generally supported the project, however, 39 specific environmental and land use issues were identified (USFS & USBLM, 1987). These concerns were mainly directed at the effect of the mine on grazing activities; habitat for the Lahontan cutthroat trout; and recreation activities. The ID team addressed these issues in a Final EA which was released with a FONSI in May, 1987 (USFS & USBLM, 1987). A list of permit requirements are provided in table 5.6.

The USFS designated the site a Hardrock Showcase mine in 1990. The purpose of this program is to highlight operations which are successful at meeting the "multiple-use" ideal of the USFS. This status is achieved by demonstrating that a mineral extraction operation can be coordinated with other uses and values. This is implemented through a partnership between a federal land management agency, the mining operation and other local government entities. A showcase area is defined as one which encompasses a number of competing land use activities or resource values. The goal of this program is to demonstrate that these competing uses can coexist with all stakeholders involved. To achieve this status, it appears that the operator has to implement a number of additional mitigation measures which are designed to protect alternative uses and values.

Impacts of the Permitting Process

Analysis of this case indicates that the operation does propose a number of design modifications to maximize environmental protection while timeline impacts where insignificant. The most significant design changes include: those specific to reducing harmful effects on the Lahontan cutthroat trout and habitat; construction of fences to restrict cattle from entering the site; partial backfilling of the Mac Ridge Pit; construction of a new campground facility; and participation of USFS in other regional environmental studies. The details of these design modifications will be discussed below.

Design Modifications. The majority of the design modifications were to minimize harmful effects to the Lahontan cutthroat trout which is a federally listed threatened species. Design changes include: location of the mill site; specific road construction techniques; and the location of the waste dumps. IMC chose to relocate the mill at a site in a valley away from valuable fish habitat area near the mouth of the North Fork Canyon. The reason for moving the facility can only partially be attributed to improving fish habitat because the new location moved the mill six miles closer to the mining operation and thus reduced transportation costs.[59]

Table 5.6 Permits and Approvals for Big Springs Mine

Level of Government	Agency	Permit or Requirement
Federal	USFS	POO, ROW, NEPA
	USBLM	POO, ROW, NEPA
	USF&W	Biological Clearance
State of Nevada	BAQ	Air Permits (Con, Oper.)
	BMRR	WPC
	BWM	Solid Waste Approval
	DWR	Appropriations of Pubic Waters Tailings Dam Permit
	NDHPA	Archaeologic Clearance
	DW	Habitat Modification
Local	Elko County	Zoning and Building Requirements

Additionally, IMC decided to modify the construction of the road from the mine to the mill to reduce the possibility of sedimentation in the North Fork and Humbolt rivers. This involved constructing a narrower road and utilizing highway belly-dump trucks instead of larger mine hauling equipment.[60] Other mitigation measures used to reduce sedimentation involved moving the waste dumps to an area further from mining activities to ensure stability. Also a number of sediment traps were constructed at the mine and along haul roads to catch run-off silt. IMC indicated that costs attributed to changes in mine design to preserve the trout habitat range from $10 to $20 million (Independence Mining Company).

Another significant change in operations involved concurrent reclamation activities at the Mac Ridge Pit. This decision to partially backfill the pit was made by IMC after consultation with USFS indicated concerns over the visual impacts of the pit to drivers traveling along the nearby Mountain City Highway. This involved a sequential mining process at the pit with initial areas backfilled with material mined in later stages. This method not only reduced visual impacts

[59]This location was chosen late in the EA process because the operator was able to acquire private lands making the site a viable option.

[60]Operators have also employed a backhoe recontouring method to roads at the site. This is one of the first attempts at using this method which enables natural contours to be restored even in steep terrains. The results at the site have been favorable.

of the pit but also reduced the costs of transporting waste to the nearby waste dump.[61] The area which was backfilled was then seeded with twelve species of grasses, wild flowers and shrubs.

Other mitigation measures included building new campground facilities and restricting wildlife and grazing animals from the site. The company agreed to build a new campground area because of a number of concerns that the mine would harm local camping activities. IMC constructed a $30,000 campsite in the Jack Creek area to mitigate any recreational displacement caused by mining activities. Additionally, the company constructed off-ramps in original camping areas to increase access. To reduce the affects of the mine on wildlife and grazing animals seven miles of fencing was constructed to reduce access to the site. This had an added benefit by improving riparian resources on the North Fork and Humbolt rivers by excluding cattle from the area.

IMC is also participating with USFS in a regional study to determine environmental impacts in the area. The study, the Cumulative Impact Analysis of the Independence Mountains, involves a number of investigations to analyze the streams in the region. IMC is contributing funds to help support a state-of-the-art inventory and classification of twenty streams in the Independence Mountains. Additionally, funding has been contributed for extensive upland vegetation mapping of the area.

Timeline Impacts. Investigation of the time requirements needed to achieve environmental compliance indicate that they were relatively minimal compared to mines in other regions (see figure 5.4). This is consistent with the other case studies in Nevada. The NEPA process was initiated in April 1986 when the developer submitted a POO to the USFS. The next month, an interdisciplinary team was organized to analyze the project and write all NEPA documents. An EA was completed and a FONSI issued in May, 1987. The project also received relevant state permits during this same period.

The relatively short time requirements can be attributed to a couple of influences. First, the decision by federal agencies to only complete an EA dramatically reduces time requirements needed to achieve NEPA approval. Second, an interdisciplinary team was organized early in the permitting process. This allowed key issues to be identified early and coordinated the agencies involved. Finally, the centralized permitting system in Nevada requires less time to complete than in other states. These important influences allowed the developer to gain approval of the project in a one year period.

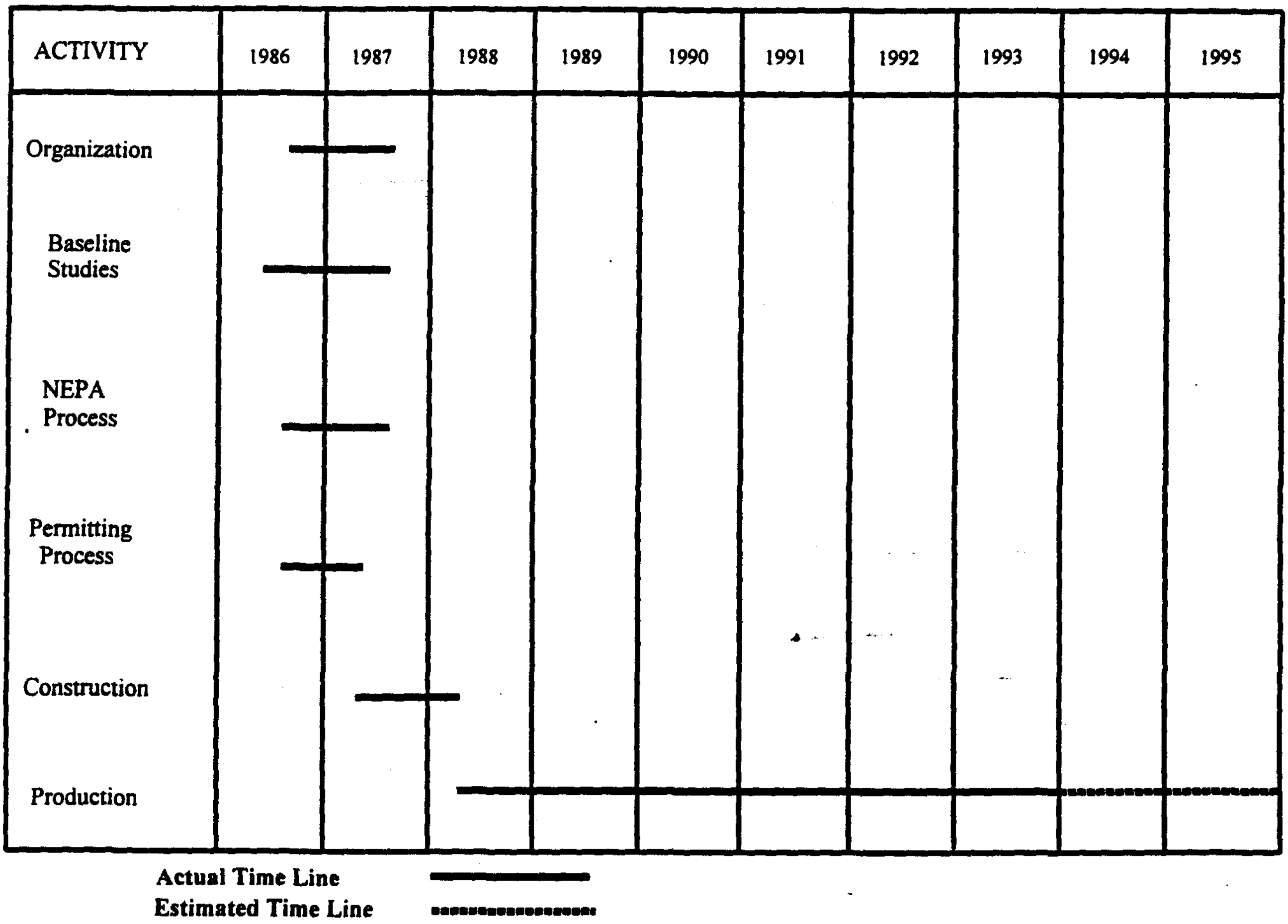
5.4 Summary

Analysis of the three cases from Nevada indicate that impacts from the environmental compliance process were minimal. All three mines were able to obtain all necessary approvals in less than a year with minimal design changes. This is an interesting result since the mines had

[61] Additionally, with less material being placed at the waste dump, the site is no longer visible from the highway.

to deal with different degrees of regulation. The Lone Tree mine was only required to complete state and local requirements while the Sleeper operation was permitted in the mid 1980's before increasing state regulations were enacted. This indicates that the regulatory environment relevant to mining operations in Nevada allows mines to be permitted with minimal complications regardless of the number of agencies or requirements involved. This appears to be the result of the streamlined compliance process and the lack of public opposition for most mining operations in the state. This is somewhat of a unique situation when compared with other states.

Figure 5.4 Big Springs Mine Timeline



REFERENCES

Alaska Department of Natural Resources, Division of Mining "Mining Reclamation Regulations", 11 AAC 97, July, 1992.

"Alaska-Juneau Mine Project Description," Echo Bay Exploration, Inc. February, 1989.

AMAX Engineering and Management Services Company, Plan of Operations for the Sleeper Project. Submitted to USBLM, Winnemucca, Nevada, March 7, 1985.

Amax Inc., "Mount Emmons Environmental Report Volume I," March, 1981a.

Amax Inc., "Mount Emmons Environmental Report Volume II," March, 1981b.

Baldrige, Anne, Battle Mountain Gold Company, Interview January 5, 1993.

"Battle Mountain Finds New Gold Reserves," Engineering and Mining Journal, vo. 191, no. 12, 1990.

Battle Mountain Resources Inc., "112 Permit Application San Luis Project, Costilla County, Colorado" submitted to the Colorado Mined Land Reclamation Division, November, 1989.

Battle Mountain Resources Inc., "112 Permit Application San Luis Project, Costilla County, Colorado" submitted to the Colorado Mined Land Reclamation Division, September, 1989.

Battle Mountain Resources Inc., "112 Permit Application San Luis Project, Costilla County, Colorado" submitted to the Colorado Mined Land Reclamation Division, April, 1989.

Bull & Associates, Environmental Baseline - Alaska-Juneau Project, prepared for Echo Bay Exploration Inc., February, 1989.

City and Borough of Juneau, Alaska, "Kensington Gold Project Large Mine permit M-06-90, Recommendation Document," October 1992.

City and Borough of Juneau, Alaska, "Ordinance of the City and Borough of Juneau, Alaska," Serial No. 89-47am. October, 1989.

Coggins, George Cameron and Wilkinson, Charles F., Federal Public Land and Resources Law, Second Edition. The Foundation Press, Inc., Mineola, New York, 1987.

Dersch, John, United States Forest Service, Interview, January, 15th, 1992.

Dillard, Gary, "Santa Fe Pacific's Newest Gold Mine a Winner," Rock Mountain PAY DIRT, May, 1992.

Echo Bay Exploration. Inc. "A-J Mine Project," Submitted to City and Borough of Juneau, November, 1990.

Echo Bay Exploration Inc., "Alaska-Juneau Mine Project Description, February, 1989.

Epler, Bill "Amax pondering how to explore deep potential; Are high-grade Intercepts 1,000 feet deep for real or just teasers?" Rocky Mountain PAY DIRT, July, 1991.

Fairbanks Gold Ltd., "Fort Knox Project Environmental Assessment Report," August, 1991.

Fairbanks Gold Ltd., "Fairbanks Gold Ltd. Annual Report," 1990.

Goldfarb, R.J., Leach, D.L., Pickthorn, W.J., and Paterson, C.J., "Origin of Lode-gold Deposits of the Juneau Gold Belt," Southeast Alaska: Geology, v. 16, p. 440-443, 1989.

Independence Mining Company and United States Forest Service "Showcase Gold Mining," No Date.

Independence Mining Company "U.S. Forest Service Designation of Big Springs Mine as a Showcase Operation" Press Release, September, 1990.

"Is Alaska Poised for a Mining Boom?" Engineering and Mining Journal vol. 192, no. 11, 1991.

Kensington Venture, "Kensington Gold Project, Alaska; Draft Applicant's Proposal", April, 1990.

Kensington Venture Partners, "Applicant Proposal Kensington Gold Project", September, 1990.

Laitos, Jan G., Natural Resources Law - Cases and Materials, West Publishing Co., St. Paul, MN., 1985.

McDonald, Lisa A. and Martin, Wade E. "Environmental Regulation For Mines in Southeast Alaska - And Its Effects On Project Design, Timeframes, And Uncertainty, A Preliminary Review" U.S. Bureau of Mines, OFR 105-92, October, 1992.

Montana Department of State Lands and United States Forest Service, "Final Environmental Impact Statement Montanore Project," October, 1992.

Montana Department of State Lands and United States Forest Service, "Supplemental Draft Environmental Impact Statement Montanore Project, " October, 1991.

Montana Department of State Lands and United States Forest Service, "Draft Environmental Impact Statement Montanore Project, " October, 1990.

Montana Department of State Lands and the United States Forest Service, "Jardine Joint Venture

Project Final Environmental Impact Statement," April, 1986.

"Montanore Mine News," Engineering and Mining Journal, vo. 191, no. 2, February, 1990.

Nevada Bureau of Mines & Geology, " The Nevada Mineral Industry, 1991" Special Publication, 1992.

Pincock, Allen & Holt, " Mineral Permit Regulations and Practices for the Western USA - Nevada, Montana, Idaho, Oregon, Washington and Federal. July, 1990.

Richins, Rick T. "Environmental Risk - Case Study. Managing Environmental Risk During Permitting, Construction, Operation and Closure (?) of Mining" presented at CIM Mineral Economics Committee "Back to Basics" Symposium, Toronto, Ontario Canada, January 16, 1992.

Seaborne, Rick, United States Environmental Protection Agency, Interview October 29, 1992.

"Sleeper Mine is Wildlife Haven" Mining World News, vol. 4, no. 6, November/December 1992.

Sporleder, Lisa E. "Spotlight on Nevada's Gold Mining Companies" Engineering and Mining Journal, vol 190, no. 1, January, 1989.

Stange, Jay, "Kensington Mine Closer to Permits; Forest Service Rejects Last Appeal of Impact Statement," Juneau Empire, July 30, 1992.

Tyler, David W. and Beale, Geoff, "Amax uses practical approach to dewatering at its Sleeper Mine" Mining Engineering, vol. , no. 2, February, 1991.

United States Bureau of Land Management, "A-J Mine Project Final Environmental Impact Statement," USBLM-AK-ES-92-028-2800-980. May 1992.

United States Bureau of Land Management, "A-J Mine Project Draft Environmental Impact Statement," USBLM-AK-ES-91-010-2800-980. January 1991.

United States Bureau of Land Management, "Preliminary Draft Environmental Impact Statement for the A-J Mine Project," USBLM-AK-PT-001-2800-980, October 31, 1989.

United States Forest Service, "Kensington Gold Project, Final Environmental Impact Statement," R10-MB-159, February, 1992.

United States Forest Service, "Kensington Gold Project, Record of Decision", February, 1992.

United States Forest Service, Kensington Gold Project, Draft Environmental Impact Statement, FS-6200-28(7-82). June, 1991.

United States Forest Service, "Kensington Gold Project, Alaska, Final Scoping Document, Environmental Impact Statement," July, 1990.

United States Forest Service, "Mount Emmons Draft Environmental Impact Statement," January, 1982a.

United States Forest Service, "Mount Emmons Final Environmental Impact Statement," August, 1982b.

United States Forest Service and United States Bureau of Land Management, Environmental Assessment; Big Springs Project, Elko County, Nevada, May, 1987.