DRAFT

ENVIRONMENTAL ASSESSMENT PROPOSED MOTHER LODE PROJECT

Prepared by

Bureau of Land Management
Battle Mountain District
Tonopah Resource Area
Tonopah, Nevada

With the Assistance of

ENSR Consulting and Engineering
Alameda, California

May 1989

ENSR

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PROPOSED MOTHER LODE PROJECT

Prepared by
U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Battle Mountain District
Tonopah Resource Area
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With the Assistance of
ENSR Consulting and Engineering
1320 Harbor Bay Parkway
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Abstract: This Draft Environmental Assessment (EA) documents the environmental analysis of the Mother Lode Project, a precious metals extraction operation proposed by the U.S. Nevada Gold Search Joint Venture (USNGS) in southern Nye County, Nevada. The project would involve the construction, operation, and abandonment of an open-pit mine and processing facilities on public land administered by the Bureau of Land Management (BLM). The proposed project is described in a Plan of Operations submitted to the BLM Tonopah Resource Area, Battle Mountain District, which is responsible for reviewing the plan to determine compliance with BLM regulations governing surface mining under the General Mining Laws (43 CFR 3809) and the implementing regulations (40 CFR 1505) of the National Environmental Policy Act (NEPA). As part of BLM's review process, this EA describes the projected impacts of the proposed mining operation on the natural and human environment. Based on public input and the design of the proposed facilities, the analysis emphasizes the following affected resources: air quality; groundwater and surface water quantity and quality; soils and reclamation potential; vegetation and wildlife; cultural resources; socioeconomics and community resources; and aesthetics. The analysis considers the No Action Alternative and two facility location alternatives.

Public Meeting: A public meeting will be held at the Beatty Community Center in Beatty, Nevada on Thursday, June 1, 1989 at 7:00 p.m. to allow the public to provide oral comment on the adequacy, completeness, or accuracy of the Draft EA.

EA Contact: This Draft EA is being circulated for public and agency review. Questions and comments should be addressed to the contact identified below by June 16, 1989.

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SUMMARY

Introduction

This Environmental Assessment (EA) documents the conclusions of environmental analyses of the proposed Mother Lode Project, a precious metals mining and processing operation near Beatty in southern Nye County, Nevada. The proposed project would involve the construction, operation, and abandonment of facilities for extracting and processing gold ore.

U.S. Nevada Gold Search Joint Venture (USNGS) proposes to mine approximately 600,000 tons of ore per year. At this mining rate, gold production is estimated at approximately 25,000 ounces of gold per year. The project would have an estimated 2-year life of operation, based on current estimates of potential reserves.

Major project facilities would include an open pit; waste rock disposal area; stockpile areas for topsoil and sulfide ore; leach pads; and ancillary support buildings (maintenance shop and trailers, office, laboratory, and recovery building). The surface disturbance would total approximately 75 acres of public land.

Alternatives to the proposed action are analyzed in the EA. Alternatives considered in detail in the analysis include the No Action Alternative and two facility location alternatives. An alternative of backfilling the open pit was initially considered but was subsequently eliminated from detailed analysis in the EA for a combination of economic, technical, and environmental reasons (see Section 1.5).

Public Involvement

A public scoping process was conducted prior to preparation of the EA in order to solicit public input on the important issues and concerns associated with the proposed project. This process included mailings of public scoping documents to agencies, organizations, and individuals; a public meeting in Beatty; a 30-day written comment period; and meetings with local, state, and federal governmental officials and representatives of community services. The scoping process identified the following environmental resources for analysis in the EA:

- Water Resources
- Socioeconomics
- Air Quality
- Wildlife
- Cultural Resources
- Visual Resources

Summary of Project Impacts

The Mother Lode Project would result in impacts to ecological resources in the project area, including wildlife and vegetation. Impacts to human resources would include visual impacts and both beneficial and adverse socioeconomic impacts. The proposed development would occur in a region in which mining is an important and acceptable land use; with the implementation of project alternatives and recommended mitigation measures, projected impacts for the Mother Lode Project are not judged to be significant. Specific impact conclusions for affected resources are summarized below.

The proposed project would meet the standards of BLM regulations governing surface management of public lands under the General Mining Laws (43 CFR 3809). Implementation of the project as described in USNGS' Plan of Operations, including mitigation measures identified in the EA, would not result in the undue or unnecessary degradation of public lands.

Air Resources

The proposed project would generate air pollutant emissions and result in increased levels of particulate and other pollutants in the atmosphere around the project. However, projected emissions are predicted to be very small and would meet applicable State of Nevada air quality standards. Air pollutant emissions and control technologies are subject to review and approval by the Nevada Division of Environmental Protection (NDEP). Permit applications have been submitted by USNGS.

Geology and Mineral Resources

The proposed project would extract economically viable gold reserves. It would not interfere with future resource recovery efforts except in very limited areas. Proposed designs for the mine and other facilities recognize and account for seismic and other geologic hazards in the area.

Water Resources

No long-term adverse impacts to groundwater quantity or quality are anticipated. The proposed groundwater monitoring program is designed to mitigate potential impacts of groundwater withdrawal.

There are no perennial streams on the project site; no adverse impacts to surface water would occur from the proposed project.

Soils

Construction and operation of the proposed project would disturb approximately 75 acres of soil resources. Loss of soil resources would result from accelerated water and wind erosion and buried suitable topsoil material. Topsoiling and revegetation would reduce the long-term impacts associated with soil erosion by increasing revegetation potential and promoting long-term stabilization of treated areas.

Vegetation

Impacts associated with the proposed project would include vegetation removal and loss or reduction of plant productivity. Approximately 75 acres across two vegetation types would be affected by construction activities. The project would result in the loss of approximately 2 AUMs of grazing preference. This would not represent a significant impact to livestock grazing in this area.

Vegetation cover and productivity would gradually be restored on disturbed areas following reclamation and revegetation.

Wildlife

The proposed project would affect local populations of small mammals, songbirds, and reptiles. No major impacts to other wildlife species or regional wildlife populations would be expected.

Approximately 75 acres of wildlife habitat would be impacted resulting in loss of prey species which would affect local populations of area predators and raptors. Habitat would be restored following project abandonment with revegetation of disturbed areas. Impacts of habitat loss to big game species would be minimal. No impacts to federal or state-listed threatened or endangered wildlife species are expected to occur. Crucial habitat for the desert tortoise does not occur in the project region.

Potential impacts to waterfowl and other wildlife species resulting from cyanide poisoning at the heap leach solution ponds is a concern. USNGS has committed to netting and fencing the ponds to mitigate impacts to waterfowl and other wildlife.

Land Use and Recreation

Land Use. The mining and processing operation would be consistent with federal and Nye County land use plans for the area and would be compatible with surrounding land uses. Approximately 2 AUMs of grazing would be lost. This would not be a significant amount. Post-mining land use would return to rangeland/wildlife habitat for the portion of the site excluding the open pit.

The proposed project is located within the Bullfrog Herd Management Area for wild horses and burros. Open water would attract these animals; however, fencing should eliminate potential impacts.

Recreation. The proposed project would not significantly impact dispersed recreation on public lands. The existing use is light, and the region has abundant acreage of public open-space lands.

Aesthetics

Visual Resources. The proposed project would introduce high levels of visual change; however, the visual contrast would not exceed acceptable levels in an area designated for activities which require major modification of the existing visual conditions. The visual effects of the project would be reduced by application of mitigation measures designed to reduce the visual contrast of the Mother Lode mine and waste disposal area.

Noise. The nearest sensitive receptor is over 4 miles from the project site. Noise from general operation of the Mother Lode Project would rarely, if ever, be perceptible at these sensitive receptors.

Socioeconomics

Population. The proposed project (including workers and their families) would increase area population by approximately 93 to 128 people during peak construction activity, by 61 to 85 persons during the overall 1989 construction period, and by more than 125 during project operations. These increases would generate the beneficial and adverse effects described below.

Economy. The proposed project would reinforce the mining industry in Nye County. The project would increase employment in Nye County. Nye County would experience an increase in revenues from property, net proceeds, and sales taxes directly paid by USNGS and indirectly from mine workers who own property and spend their earnings in the local communities. Community facilities and services could improve due to the increased population base, if new revenues are allocated for community facilities such as parks and recreation, library, schools, and road improvements.

Employment. Nye County mining employment would increase moderately, generating minor secondary employment increases in other sectors of the economy. The greatest employment increase would be a total of 89 direct and indirect employees during the peak construction activity during the third quarter of 1989. During operations, 45 permanent workers would be added at the project and an estimated 9 jobs would be created in other sectors.

Fiscal Effects. During the 2- to 3-month construction period, the project would result in short-term, negative net fiscal effects on public service providers faced with an increased demand for services. Over the long term (during operations) increased property tax, sales tax, and net proceeds tax revenues would provide positive net fiscal effects for Beatty and Nye County.

Housing. The proposed project would generate an increase in demand for short-term rental housing during construction that would exceed the available supply in the Beatty area. Over the longer term operations period, USNGS would provide housing for their operations workforce.

Public Facilities and Services. The construction and operations phases of the project would intensify existing water supply and sewage problems in Beatty. A pipeline (which USNGS is providing) and a transmission line are required for the water supply system. An additional rapid infiltration bed, required to meet existing sewer system needs, is projected to begin operation in summer 1989. The capacity of these services must be increased to serve the project-related demand for these services.

The proposed project would increase school enrollment during operations by approximately 67 children in Beatty and exceed capacity in grades 1-8 until new classrooms become available in fall 1989. Service agencies may face short-term increases in demand with no commensurate increase in staff or resources. The Beatty Medical Clinic and the sheriff's department would require additional staff to serve the increased population associated with operations. The demand on the fire department and social services may also require increased staff. USNGS has committed to providing a helipad at the Medical Clinic and a part-time librarian to help offset the impacts on public facilities and services.

Community recreation facilities in Beatty, particularly the ballfields and pool, are already at capacity; therefore, the increased population associated with the proposed project would further affect these resources.

Transportation

Truck traffic to the project would be minimal and would not be expected to affect traffic or road conditions to any measurable degree. The proposed project would increase traffic levels in the site vicinity, particularly during peak hours at shift change times. The resulting traffic levels would be well below highway capacities, however, and would not significantly reduce current levels of service.

Summary of Cumulative Impacts

The BLM conducted a cumulative impact assessment to determine potential impacts associated with the Mother Lode Project and other 'reasonably foreseeable future actions' (40 CFR 1508.7). A discussion of the analysis is presented in Chapter 4 of this EA. The assessment identified the following potential cumulative impacts.

Air Resources

No significant cumulative air quality impacts are projected to occur from the Mother Lode Project. Particulate emissions would be highest in the immediate vicinity of each project and would not result in cumulative air quality impacts.

Water Resources

Significant cumulative water resource impacts are not projected for the Mother Lode Project together with other potentially interrelated projects due to the presence of hydrologic boundaries which separate the groundwater source for the Mother Lode Project from the aquifers used to supply water for the other projects. In addition, the estimated radius of the drawdown from groundwater pumping of each of the interrelated projects would not intersect one another.

Operation of the projects would not be expected to cause cumulative water resource impacts to sensitive areas such as the Ash Meadows springs, Devils Hole, local springs in Oasis Valley, springs near the Park Headquarters in Death Valley National Monument, or the Town of Beatty municipal water supply.

Vegetation and Wildlife

No significant cumulative impacts are anticipated to vegetation and wildlife. Vegetation and wildlife habitat loss would be short-term and, with the exception of the open pits, the habitat would be reclaimed following completion of mining activities. Potential adverse impacts of cyanide-laden waters to waterfowl and other wildlife would be mitigated by making these areas unavailable to wildlife, in compliance with Nevada Department of Wildlife permit stipulations.

Land Use and Recreation

Impacts to land use and dispersed recreation on public lands would be site-specific and not interrelated with the Mother Lode Project. There is abundant open-space land available in the region.

Socioeconomics

The increase in population associated with the interrelated projects would result in cumulative socioeconomic impacts in the Beatty area. Short-term adverse fiscal impacts are anticipated due to the immediate need for increased public services prior to the arrival of increased tax revenues.

Housing demand is expected to exceed the available supply of housing during both the construction and operation phases of the interrelated projects. Bond Gold and USNGS would both provide housing for operations employees to help offset these impacts.

Public services and facilities anticipated to be impacted by development of the interrelated projects include:

- Police and fire protection
- Judicial system
- Medical services
- Schools
- Water and sewer system

The financial requirements to meet these increased demands would come from intergovernmental revenues, which would lag behind the service demands, and from voluntary funding or advance financing by the operating companies.

Agency Preferred Alternative

The Bureau of Land Management proposes to approve the Plan of Operations for the Mother Lode Project with the following list of mitigation measures to prevent undue or unnecessary degradation of federal lands and to provide for reasonable reclamation:

WR-1	V-2	VR-2
WR-2	CR-1	VR-3
V-1	VR-1	SE-1

These measures are described in Section 3.12 of this EA. The reclamation plan is considered an integral part of the Plan of Operations; concurrent reclamation is to be incorporated where feasible.

The Agency Preferred Alternative is Alternative 2. This alternative would disturb approximately 75 acres of federal land; approximately 159 acres would be removed from use by livestock and wildlife within the fenced area for the project. The visual impacts would be reduced somewhat compared to the other alternatives by the location of the leach pads and waste dump in an area partially screened from view by Bare Mountain.

USNGS must have all required federal and state permits approved prior to issuance of the BLM Record of Decision.

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PURPOSE AND NEED FOR ACTION

This Environmental Assessment (EA), prepared in compliance with the National Environmental Policy Act (NEPA), describes the potential environmental impacts of U.S. Nevada Gold Search Joint Venture's (USNGS') proposed development of the Mother Lode Project, a precious metals mine and processing operation. The project is located in Nye County, Nevada, approximately 7 road miles east of Beatty. The proposed project would produce approximately 2,400 tons per day (TPD) of ore.

An estimated 1.2 million tons of ore would be mined over the estimated 2-year operational life of the project. Gold is a major commodity on domestic and foreign markets with extensive industrial and commercial uses. Demand in the United States has exceeded domestic production from new mines and scrap recovery in recent years, and the difference has been met with imports or reduction of existing inventories. The demand for precious metals is expected to continue, if not increase, for the remainder of the century. Additional domestic production, such as the proposed project, would reduce the need to import gold and would improve the country's foreign trade balance.

USNGS' proposed project is described in a Plan of Operations submitted in December 1988, as amended January 1989, to the Bureau of Land Management (BLM), Battle Mountain District, Tonopah Resource Area Office. Because the proposed mine and processing facilities would be located on unpatented mining claims administered by the BLM, the operations are required to comply with procedures and standards described in BLM regulations for surface mining of public lands under the General Mining Laws (43 CFR 3809). These regulations recognize the statutory right of mineral claim holders to develop federal mineral resources and encourage such development consistent with the Mining and Mineral Policy Act of 1970 and the Federal Land Policy and Management Act of 1976. The regulations require BLM to review proposed operations to ensure that: 1) adequate provisions are included to prevent undue and unnecessary degradation of federal lands; 2) measures are included to provide for reasonable reclamation; and 3) the proposed operations will comply with other applicable federal, state, and local laws and regulations.

This EA was prepared according to BLM surface management regulations (43 CFR 3809) and the implementing regulations (40 CFR 1505) for the National Environmental Policy Act (NEPA). The purposes of the EA are to assess the potential environmental impacts of the proposed mine and processing operation, to determine if an Environmental Impact Statement (EIS) is required, and to aid the BLM Authorized Officer in reviewing USNGS' proposed Plan of Operations.

1.0 PROPOSED ACTION AND ALTERNATIVES

1.1 Introduction

The U.S. Nevada Gold Search Joint Venture proposes to construct and operate an open-pit mine and heap leach facility, hereinafter referred to as the Mother Lode Project, near Beatty, Nevada (Figure 1-1).

The Mother Lode Project involves the operation of an open-pit mine, heap leach, and carbon adsorption recovery circuit for gold doré production. Total drill-proven reserves to date equal 1.2 million tons of oxide ore that can be crushed, agglomerated, and heap leached. Mining in the first year would supply an estimated 600,000 tons of ore material for heap leaching, while producing approximately 900,000 tons of waste rock (strip ratio 1.5:1). At this mining rate, gold production is estimated at approximately 25,000 ounces of gold per year. Reserves, as now estimated, would be exhausted over a 2-year mining period, although potential exists for additional reserves within the project area. Feasibility, preliminary engineering, and other mining studies conducted by USNGS are summarized in this project description. A list of the permits and approvals required for construction and operation is included in Table 1-1.

1.2 Project Area

The Mother Lode deposit is located approximately 7 road miles east of Beatty, Nevada (Figure 1-2). It is reached from U.S. 95 by traveling east on Fluorspar Canyon Road and northeast on Tates Wash Road. The first 4 miles are a gravel road, while the last 3 miles are an unimproved dirt road which would require upgrading to facilitate increased travel.

The Mother Lode property encompasses 344 claims located within T12S, R48E, Sections 3, 4, 5, 6, 7, 8, 9, 10, 16, 17, 18, 19, 20, 21, and 22; and T12S, R47E, Sections 1, 12, and 13, all of which are located in the Fluorine Mining District, Nye County, Nevada. The proven ore reserve, the "Mother Lode" deposit, is located in the eastern half of T12S, R48E, Section 7.

The project properties within the claim boundaries (Figure 1-2) comprise approximately 6,850 acres. The project area would encompass less than 250 acres within the fenced area of which approximately 75 acres would be disturbed.

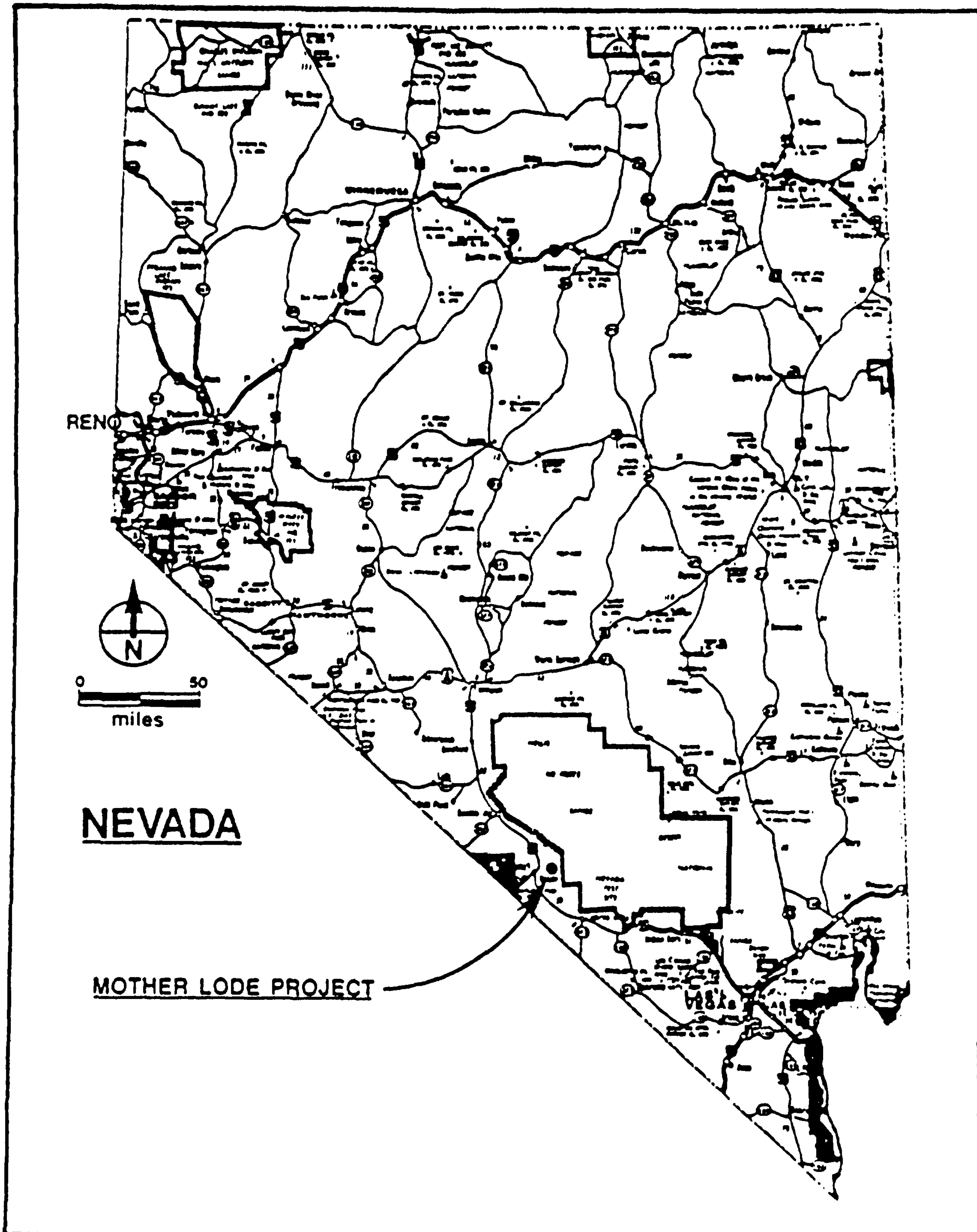
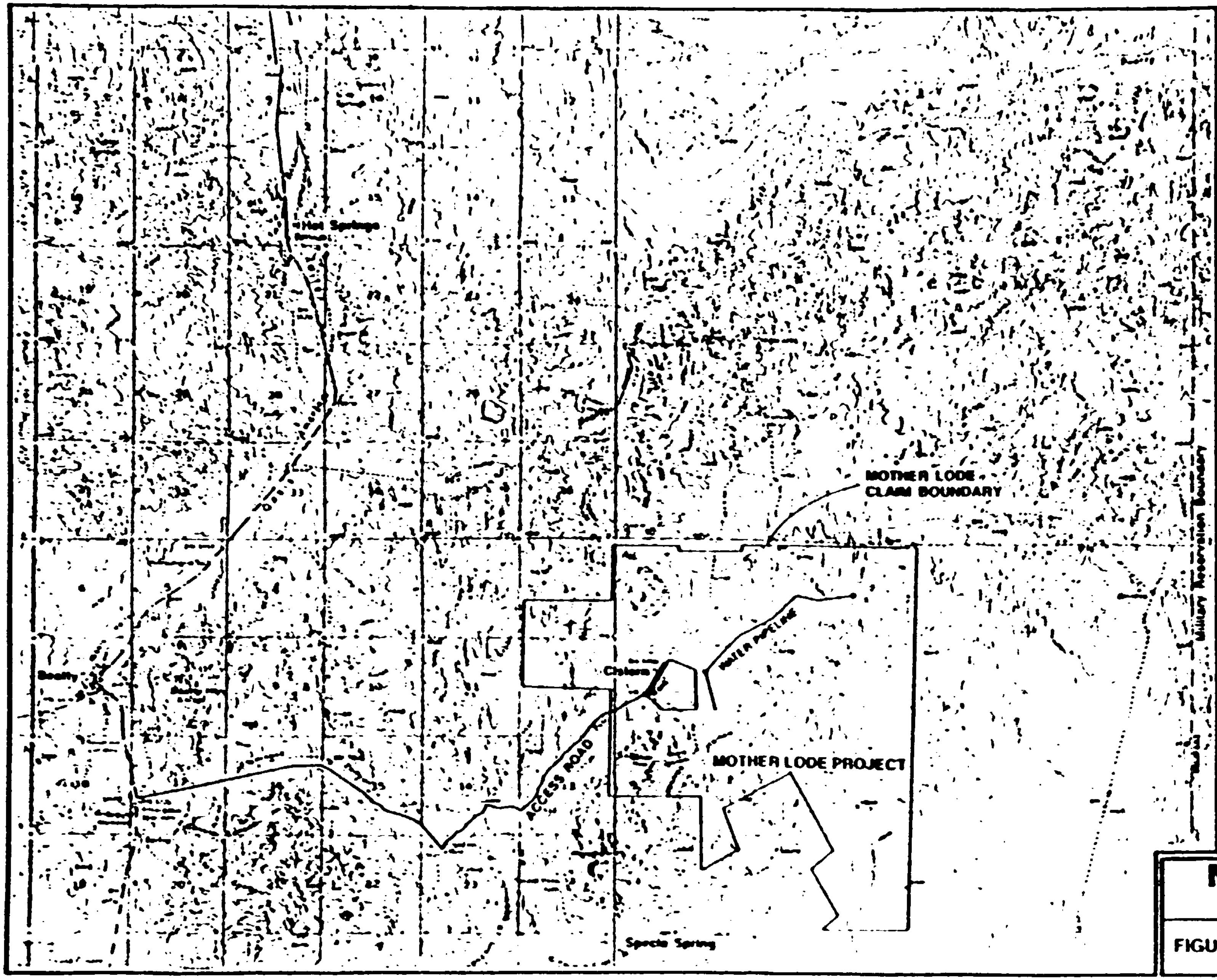


FIGURE 1-1 PROJECT LOCATION

TABLE 1-1

PERMIT REQUIREMENTS FOR THE MOTHER LODE PROJECT

Agency	Required Permit or Authorization
Federal	
Bureau of Land Management (Coordinated with NV Division of Historic Preservation & Archaeology; consultation with Advisory Council within Section 106 process of NHPA)	Environmental Assessment and Approval of Plan of Operations
	Archaeological Clearance
Fish and Wildlife Service	Compliance with Endangered Species Act
	Compliance with Eagle Protection Act
State	
NV Division of Environmental Protection	Air Quality Registration Certificate (Permit to Construct)
	Air Quality Permits to Operate
	Zero Discharge Permit
NV Department of Wildlife	Modification of Habitat Permit
NV Division of Historic Preservation & Archaeology (Coordinated with BLM)	Archaeological Clearance
NV Division of Water Resources	Permit to Appropriate Public Waters
NV Division of Health	Sewage Disposal System Permit
NV State Inspector of Mines	Notification of Opening and Closing of Mine



Site Location: R48E, T12S, Section 7

MOTHER LODE PROJECT

FIGURE 1-2 REGIONAL OVERVIEW

1.3 Site Geology

The project site is located at the northeastern extreme of Bare Mountain in southern Nye County. Located within the Great Basin region of the Basin and Range Physiographic Province, the regional setting is characterized by isolated erosional remnants of fault-block mountain ranges separated by aggraded desert plains.

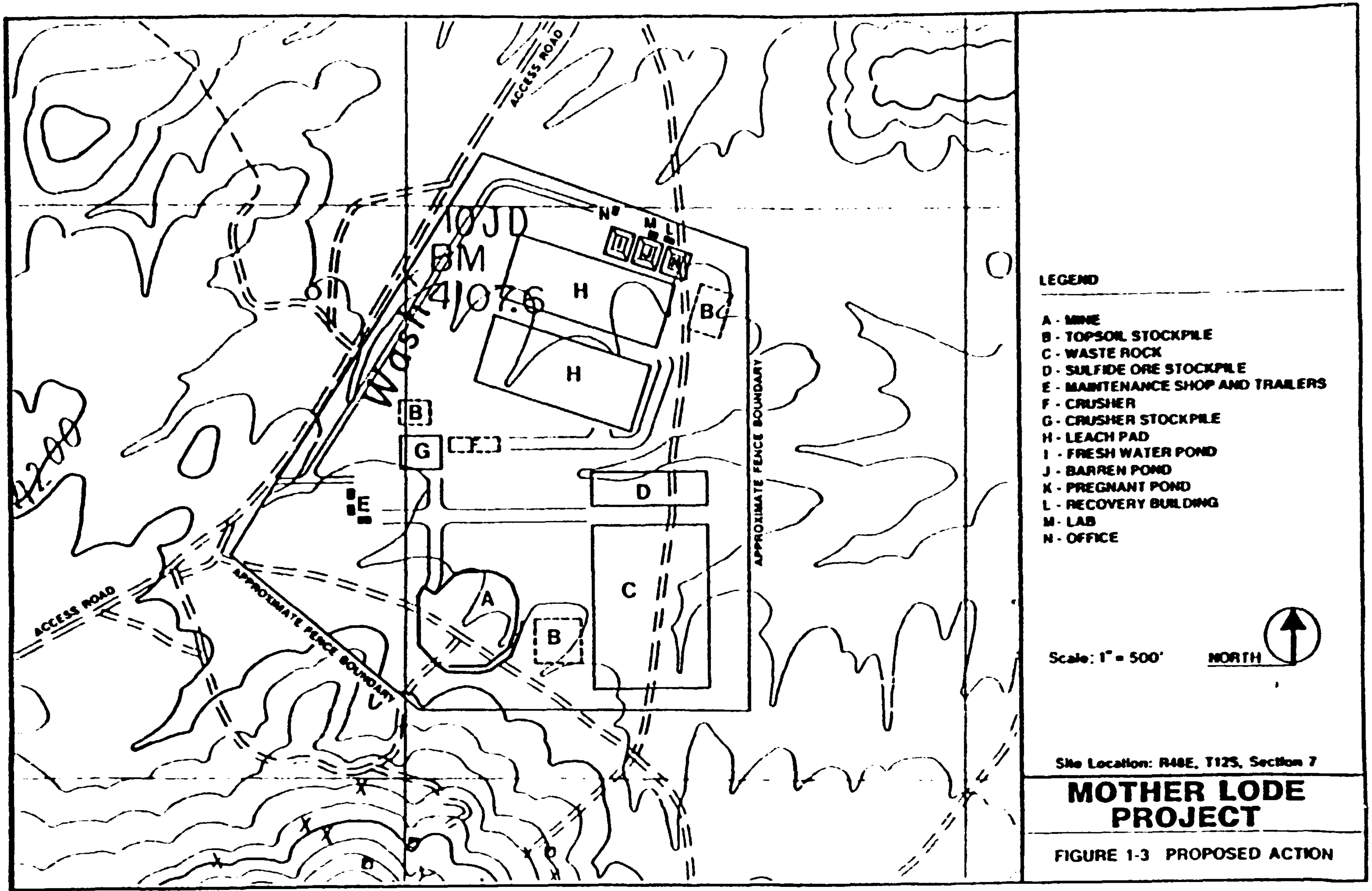
Bare Mountain is bounded by the Quaternary and upper Tertiary sediments and volcanics of Crater Flat to the east and southeast. To the west and north are the upper Tertiary sediments and volcanics which form Yucca Mountain. North and northwest of Bare Mountain, intensely deformed volcanic rocks and sediments of Tertiary age form the Bullfrog Hills, which continue to the west of Beatty. Quaternary alluvium fills the Amargosa Desert, bounding Bare Mountain to the southwest.

The first mining activity on Bare Mountain is dated at 1861, with a gold discovery on the southern tip of the mountain. Mining activity on the northern portion of the mountain began in the early 1900s. Gold, silver, mercury, fluorite, and base metals were produced in varying amounts. The Daisy Fluorspar Mine to the west and the Sterling Gold Mine to the south are currently in operation.

The Mother Lode oxide deposit is hosted in altered, intensity folded and faulted Paleozoic sediments and Tertiary intrusive rocks. The deposit occurs from the surface, under a thin veneer of soil, to a depth of approximately 200 feet. Refractory sulfide mineralization occurs below the oxide ore and is currently being drilled and evaluated for future reserves.

1.4 Description of Proposed Action

The proposed mine and heap leach facilities are located within the Crater Flat watershed. The surface mining operation would commence at an elevation of 4,160 feet with the ultimate depth of the pit at 3,960 feet. The heap leach would be located approximately 2,000 feet northeast of the mine site (Figure 1-3). The Proposed Action would disturb approximately 75 acres.



MOTHER LODE PROJECT

FIGURE 1-3 PROPOSED ACTION

USNGS proposes to improve 2.5 to 3 miles of the dirt access road along Tates Wash from the Daisy Fluorspar Mine in T12S, R47E, Section 23, to the Mother Lode mine site. The road improvement would entail grading and surfacing.

The Mother Lode oxide project is projected to have a life of 3 years, including construction, operation, and reclamation. The project life may be extended if additional exploration drilling proves successful. There is a known sulfide ore reserve under the present oxide reserve that cannot be feasibly treated by heap leaching. This sulfide reserve will continue to be evaluated for extent of mineralization and treatment methods.

The Mother Lode Project would employ an average construction workforce of 50 with a peak construction workforce of 75 expected in summer 1989. The operations workforce would average 45.

1.4.1 Mining Operation

The economically minable portion of the Mother Lode deposit is presently confined to a single location on the project site. The project layout and operation described below are based upon a combination of technical, economic, and environmental considerations.

1.4.1.1 Open Pit. The shape and configuration of the open pit are primarily defined by the mineralization and economics that dictate the mine plan, whereas pit slopes and benches are influenced by the geologic and geotechnical characteristics of the pit area. Initial engineering indicates that the final pit slope would be 45 degrees with standing walls at 62 degrees. The pit would have a maximum depth of 200 feet, and the benches would be 20 feet in height. Haul roads would be 50 feet wide, with ramps having a maximum 10 percent grade.

Pit bench heights and widths are based on detailed exploration data. The geologic and geotechnical characteristics of the materials exposed during pit excavation would be monitored regularly. Modification of the planned pit slopes may be necessary in order to accommodate actual conditions. Approximate dimensions of the final pit would be 600 feet by 600 feet for an overall area of 8.3 acres.

Topsoil overlying the pit location would be stripped and stockpiled to the southeast of the pit (Figure 1-3) for later use in site reclamation. Ore would be mined by typical open-pit methods involving drilling, blasting, loading, and hauling. Almost all overburden and ore would require drilling and blasting. Ore would be loaded by a front-end loader and/or a hydraulic shovel and hauled to the crusher to be crushed, agglomerated, and then loaded onto the heap leach pad.

The open-pit mining schedule involves one 10-hour shift per day, operating 5 days per week. Mining/leaching operations would operate year around.

A maximum of 4,500 tons of ore and 6,750 tons of waste (depending on strip ratio) would be moved each day of operation. A total of 600,000 tons of ore and 900,000 tons of waste would be removed each year; 1.2 million tons of ore and 1.8 million tons of waste would be removed during the life of this project.

1.4.1.2 **Mining Equipment.** The major mining equipment proposed for the Mother Lode Project includes the following:

1 - hydraulic excavator (5 yd.)(Cat 245)
1 - grader
1 - water truck
1 - powder truck
7 - 50-ton haul trucks (Cat #773) (includes 2 spares)
2 - loaders (Cat #988B)
3 - dozers (Cat D8)
1 - dozer (Cat D6)
2 - blasthole drills (includes 1 spare)
10 - pickup trucks

This equipment may be revised during the life of the mine to suit mining conditions.

1.4.1.3 **Waste Dumps.** The waste dumps would be located due east of the pit boundary (Figure 1-3). The waste dump would be able to accommodate, at a minimum, the approximately 1.8 million tons of waste projected for the life of the project.

The waste dumps would be developed by end-dump construction techniques with the active dump face lying at the waste rock's angle of repose. The waste rock is primarily composed of Paleozoic sediments. Assumptions used in conceptual dump design were: a) waste rock has a 38-degree angle of repose, and b) a swell factor (from in-situ to dumped rock) of 30 percent.

It is anticipated that natural drainage of the dumps will take place as a result of material segregation during dumping. No groundwater, springs, or ore has been encountered during condemnation drilling in the area of the waste dump site.

1.4.1.4 **Portable Crushing Facility.** A portable diesel-electric crushing plant with a capacity of 450 tons per hour would be used to crush the ore to 1.25 inches. A pug-mill agglomerator would be used to agglomerate the ore, using cement and water. A loadout hopper would be used to load the crushed, agglomerated ore into haul trucks for hauling to the heap leach.

The crushing/agglomerating facility would contain the following major equipment:

1 - 30 x 42-inch jaw crusher
2 - 5 x 16-foot double-deck screen (end to end)
1 - 4-foot standard cone
1 - pug-mill agglomerator
1 - 140-ton cement hopper and feeder
1 - 600kw diesel-electric generator

A schematic facility flowsheet is shown in Figure 1-4.

1.4.1.5 **Mine Support Facilities.** Mine site service facilities for the project would consist of a 50- by 75-foot maintenance shop; a tool trailer; explosives magazine; mine office trailer; three 10,000-gallon above-ground diesel fuel tanks; one 500-gallon gasoline tank; and a lube-oil storage trailer. Electric power would be generated on site with portable generators (see Section 1.4.3.1). Communications would be by radio. Most of the structures for the project would be portable or easily disassembled steel buildings. These facility locations are shown in Figure 1-3.

1.4.1.6 **Drilling and Blasting Procedures.** A system of drilling and blasting, coupled with the use of a loader-dozer combination, would be used to excavate both ore and waste at the mine site. Blastholes would have a 6.5-inch diameter and be drilled with a percussion/rotary blasthole drill. The blasthole configuration is expected to be a 12- by 12-foot pattern with a 24-foot depth. Approximately 100 holes (maximum) would be blasted using approximately 110 pounds per hole of ammonium nitrate fuel oil blasting agent, coupled with a non-electric (primer cord) blasting

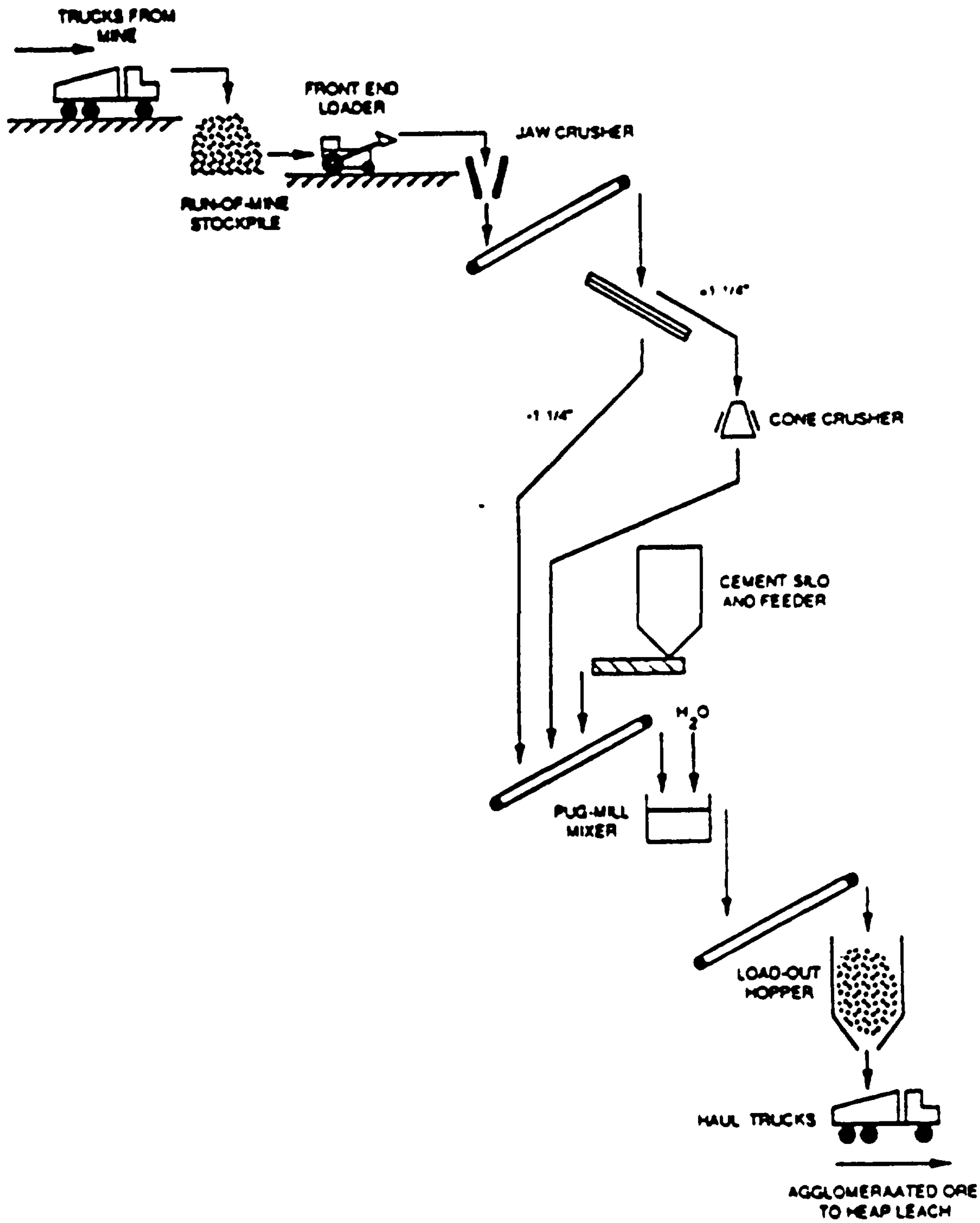


Figure 1-4
Crushing - Agglomerating
Operation

system. Charge sizes would be less than 1,000 pounds per cap delay. Production blasting would occur during the daytime shift a maximum of 5 times per week. Explosives would be transported by truck and stored on site in approved storage facilities.Scaled distance formulas based on industry standards (DuPont Blasters Handbook, 16th Edition) would be used to establish safe seismic disturbances and air blast limits. Although no problems are anticipated due to the blasting, monitoring equipment would be used and mitigation procedures would be employed should unexpected problems occur. The closest known occupied residence is approximately 6 miles from the mine site.

1.4.1.7 **Haul Roads**. After blasting, both the waste rock and ore would be loaded into 50-ton haul trucks with a front-end loader or hydraulic shovel. Waste rock would be hauled to the waste dump area. Ore would be transported to the crusher/agglomeration area and from there to the heap leach pad.

Several haul roads would be constructed to provide access from the pit to the waste dump site. Haul roads, for the most part, would be 50 feet wide with maximum grades of 10 percent. The running surface would be approximately 50 feet wide with an additional 8 feet for safety berms and internal ditches. Dust generation on the haul roads would be minimized by routine sprinkling with water and/or use of BLM-approved chemical binders. Haul roads of similar construction would also be built within the pit. In-pit haul roads would be of sufficient width (50 feet) to allow haul vehicles to pass abreast. Daily maintenance would be performed on all haul roads.

A primary haul road would be constructed for transporting ore from the open pit to the crusher-agglomerator-leach pad. Initially, the main haul road to the leach pad would be approximately 2,000 feet in length and would eventually be shortened to approximately 1,000 feet as the pad area grows. The same construction techniques employed for the waste dump haul roads would be used. Maximum road grades would be maintained at 10 percent or less.

Approximately 4 miles of new road construction is anticipated for pit roads, haul roads, access roads within the site, and water well access roads.

1.4.2 Ore Processing

USNGS proposes to utilize heap leach recovery concepts for this project. Metallurgical testing has shown that crushing to a coarse size (1 to 2 inches) would provide excellent percolation properties at acceptable gold extraction rates. Milling of the oxide ore did not show any advantage over heap leaching.

Ore would be mined, crushed, agglomerated, and stacked in two 20-foot lifts on an impermeable plastic liner (pad). Dilute cyanide solution would be applied over the heap with drip irrigation, leaching the gold. The ponds holding the cyanide solutions would be of double-lined plastic construction. Carbon adsorption would be used to recover the gold from the cyanide solution.

When the project is complete, the heaps would be water-washed to remove the residual cyanide. This wash water along with any cyanide process water would be evaporated in the ponds, destroying the cyanide.

The proposed heap leach pads and recovery facility would be located approximately 1,000 feet northeast of the open pit (Figure 1-3). Up to two expanding pads for leaching would be utilized, depending on variations in minable ore reserves. The leach pads and process solution ponds would ultimately cover approximately 22 acres. Sufficient impermeable plastic pad area would be constructed to contain approximately 1.2 million tons of ore.

1.4.2.1 Process Facility Construction

Leach Pads. The leach pad sites would be dozed and/or graded to an approximate 2 to 3-percent crosspad slope toward the pipes to the pregnant pond. All trees, shrubs, and large rocks would be removed. Topsoil would be removed and stockpiled adjacent to the disturbed sites (Figure 1-3) for use in site reclamation at the end of the project life. After grading, the pad site would be rolled and compacted with a mechanical vibrating roller, using water to aid compaction. This base would be approximately 4 to 6 inches in thickness.

A 60-mil polyethylene plastic liner would then be installed in sections over the packed base. Then 4-inch drainpipes at 20-foot centers would be installed to aid in heap drainage. The laying and welding of the plastic would be performed by an experienced and licensed liner installation company. All welds would be checked and certified by that company.

Solution Ponds. The solution storage pond sites would be excavated by dozer. All trees, shrubs, and large rocks would be removed. The excavated ponds would be rolled and compacted with a mechanical vibrating roller, using water to aid the compaction. This packed base would be approximately 4 to 6 inches in thickness.

A 40-mil polyethylene plastic liner would be installed over this packed base and welded on site. This would be the secondary or fugitive solution collection liner. A polyethylene drainage net would be laid on the sides of the ponds, and pea gravel and a polyethylene drainage net would be laid on the pond bottom. A 40-mil polyethylene plastic liner would be installed over the polyethylene drainage net and welded on site. This would be the primary liner to contain the weak cyanide solutions used in heap leaching.

A monitoring and fugitive collection system would be installed on the pond bottom between the primary and secondary liners. A 6-inch drainpipe would be installed at the lowest corner of the pond to collect any fugitive liquors. A 6-inch PVC pipe would connect the 6-inch drainpipe and run up the side of the pond to monitor and collect any fugitive liquors from the drainpipe.

The two ponds (pregnant and barren) would each have a capacity of more than 1.5 million gallons for a total capacity of more than 3 million gallons. A 12-inch deep, plastic-lined overflow trench would connect the pregnant and barren ponds at the top level of each pond to allow one pond to overflow to the other. The ponds are designed with sufficient excess storage capacity to handle a 24-hour, 25-year storm event with a 48-hour power loss.

The solution ponds would be covered with a plastic mesh screen which would hang above the ponds and be attached to the sides.

Fresh Water Storage Pond. The estimated daily water requirements for the project are 100 to 250 gallons per minute (gpm). A 1.5 million gallon capacity freshwater storage pond would be excavated by dozer, and all trees, shrubs, and large rocks would be removed. The excavated pond would be rolled and compacted; the compacted base would be approximately 4 to 6 inches in thickness. A 40-mil polyethylene liner would be installed over this packed base and welded on site.

Ancillary Process Facilities. A 25- by 50-foot steel building would be constructed to house the equipment for carbon adsorption, carbon stripping, carbon regeneration, doré melting, and cyanide addition. This building would have a 6-inch reinforced concrete slab with 4-inch concrete berms to contain and drain any liquids back to the barren or pregnant pond.

A 5-strand non-antelope barbed wire fence would be installed around the perimeter of the project area to isolate the facilities from intrusion from livestock or other animals.

A diesel-fired (3.5 gallons per hour) crucible furnace would be installed in the metal recovery facility to flux and melt the gold-coated steel wool to produce a gold doré. This melt furnace would be hooded and vented through the roof with a 2,500-cubic-feet-per-minute fan exhausting to a 12-inch stack extending 4 feet above the roof peak.

1.4.2.2 **Processing Facility Operation** The flowsheet for the process is shown in Figure 1-5.

The processing facilities would operate 24 hours per day, 7 days per week. During startup, all impoundments and distribution lines would be tested for leak integrity. The leach process is started by pumping weak cyanide solution (at a concentration of about 1 pound per ton [0.05 percent] with a pH of 10-11) to the drip irrigation system on top of the ore heap. The solution percolates down through the heap, leaching the gold and recovering it on the leach pad liner; the gold-bearing solution is channeled to the pregnant pond.

The pregnant solution is pumped through five columns of activated carbon which adsorb the gold from the solution. The solution, now barren of gold, flows to the barren solution pond. The barren solution is then brought back up to the required cyanide level and irrigated on the ore heaps. It is anticipated that it will require approximately 72 days to leach the gold from the ore. After one section of ore is leached, that section would be shut down and the irrigation would proceed to another section of freshly stacked ore.

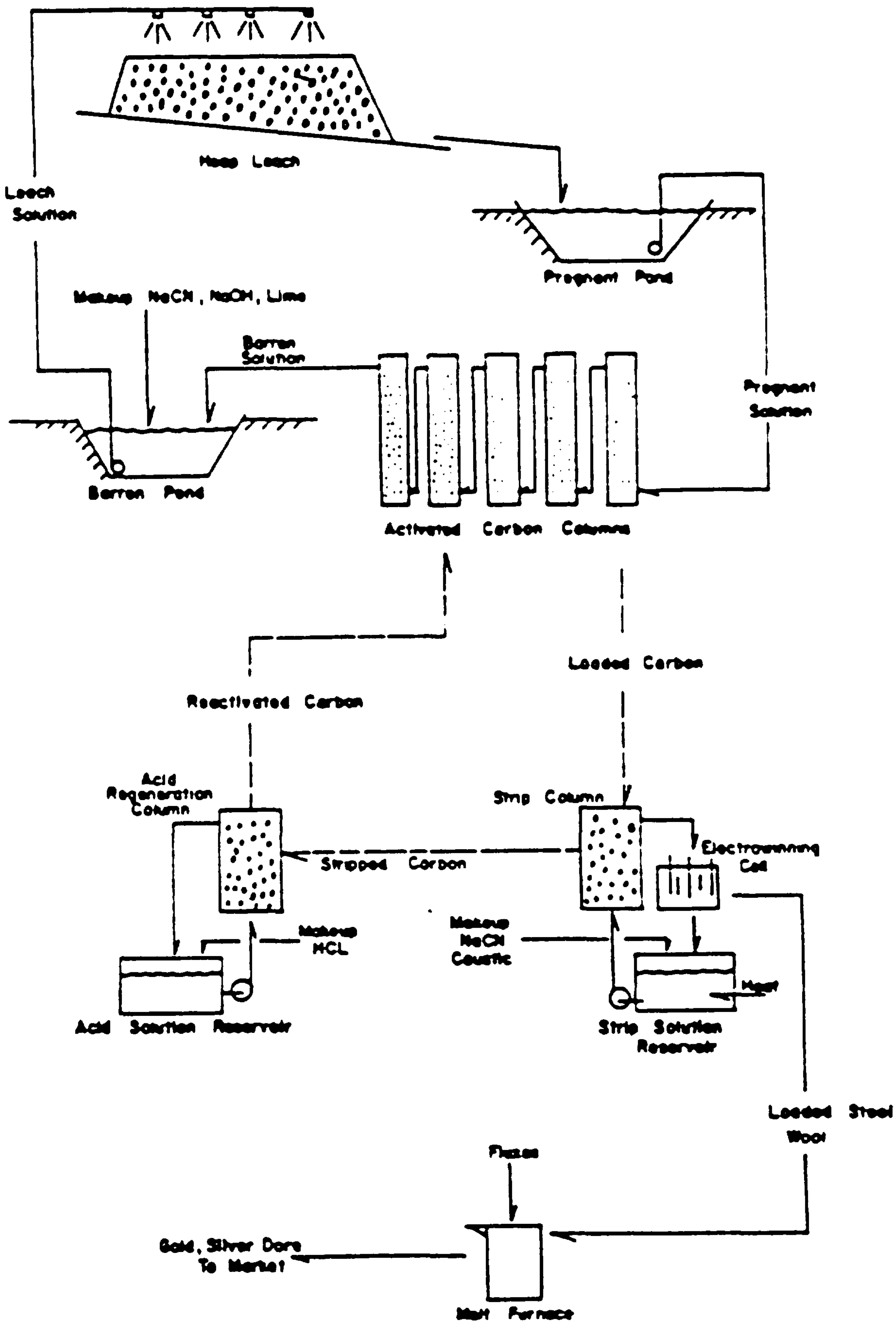


Figure 1-5
Process Flowsheet

After the first carbon column is loaded with gold, the carbon is transferred to the strip column where hot caustic-cyanide solution is circulated through the carbon, stripping the gold. The gold in the strip solution is plated on steel wool in an electrowinning cell.

The stripped carbon is then washed and transferred to the acid wash column where dilute hydrochloric acid neutralizes and washes the calcium carbonate and other impurities from the carbon. The neutralized hydrochloric acid is discharged to the barren pond. After acid washing, the regenerated carbon is transferred back to the end of the carbon adsorption circuit to be used again to adsorb the gold from the pregnant solution.

1.4.2.3 **Chemical Handling.** Sodium cyanide would be added periodically to the barren pond and to the caustic strip circuit. Cyanide would be delivered to the site in cyanide "flo-bins". Prior to use, the intact "flo-bins" would be stored adjacent to the recovery building. When needed, the flo-bins would be brought onto the isolated concrete pad where the cyanide would be added to the barren pond via a mix tank, using a circulating slipstream of barren pond water. Other chemicals, such as lime or caustic, would be added to this mixing tank when required.

Descaling agents (approximately 10 ppm) would be continuously added at the pump suction line of both the pregnant and barren pond pumps. The small amount of hydrochloric acid would be stored and added away from the cyanide area.

Listed below are the major chemical reagents to be used in the ore processing:

- sodium cyanide
- sodium hydroxide
- lime
- hydrochloric acid
- descaling agents
- melting fluxes

All toxic chemicals would be handled in isolated areas. If a cyanide spill should occur outside of the isolated areas, any contaminated ground would be excavated and put on the heap leach pads. Also, calcium hypochlorite would be kept on site for cyanide neutralization, if needed.

1.4.3 Ancillary Facilities

1.4.3.1 **Power.** Electric power for the process plant, laboratory, and miscellaneous uses around the heap leach would be provided by a 365-kilowatt (kw) diesel-powered generator with a 365 kw standby generator. The crushing plant would use a trailer-mounted 600 kw diesel-powered generator. The equipment maintenance shop would have a 100 kw diesel-powered generator The two water wells would each have their own 100 kw diesel-powered generators. Estimated power requirements for the overall project are approximately 1,000 kw.

1.4.3.2 Water Supply. Water for the heap leach, road maintenance, mining, and crushing operations would be provided from two wells located northeast of the project site in the center of T12S, R48E, Section 8. Anticipated maximum water needs are approximately 100 to 250 gpm (24-hour). The water would be pumped through a pipeline into the water storage pond, which would have a capacity of 1.5 million gallons. From the water storage pond, a pump would distribute water to the various areas of use. Drinking water would be provided by commercial sources (bottled water) and transported to the mine site.

1.4.3.3 Drainage Control. All facilities would be protected from inundation from direct runoff and moderate storm events by berms and diversion channeling. Use of natural drainage courses would be maximized to reroute runoff. Surface flow in areas impacted by the dumps, pits, and haul road would be controlled and channeled around the facilities. All diversions would be designed in a manner to minimize potential erosional impacts.

Little or no accumulation of surface water in the mine pit is anticipated. The water table is considerably lower than the projected pit bottom, as indicated during exploratory drilling.

No major adverse sediment erosional conditions are anticipated because the project site is on an elevated pediment. Further, the nearest major drainage is Tates Wash, about 1,000 feet northwest of the open pit and leach pads.

1.4.3.4 Fuel Storage. Fuel for the diesel-powered equipment and diesel generators would be stored in three 10,000-gallon tanks; two 1,000-gallon satellite tanks at the water well locations; and one 500-gallon gasoline tank for the gas-powered equipment. Tanks would be above ground and surrounded by berms with sufficient freeboard to contain the tanks' contents in the event of spillage or tank rupture.

1.4.3.5 Sanitary and Solid Waste Disposal. All sanitary wastes would be treated in an on-site, state- and county-approved septic leach field. All non-hazardous solid waste would be handled in accordance with applicable federal, state, and county laws. Refuse would be disposed of in an approved landfill facility on the project site.

1.4.3.6 Housing. USNGS would provide housing in Beatty for the operations workforce and their families.

1.4.3.7 Public Services and Facilities. In order to help offset the increased demand on community services in Beatty, USNGS has: 1) offered to provide a part-time librarian; 2) constructed a helipad at the Medical Clinic; and 3) offered to construct a 1-mile water supply pipeline.

1.4.4 Emission and Pollution Controls

1.4.4.1 Fugitive Dust From Roads and Disturbed Surfaces. Roads and disturbed surfaces within the mining and processing areas would be watered and treated, if necessary, with a dust suppression chemical to control fugitive dust. The specific control used would be determined in consultation with the Nevada Division of Environmental Protection and the BLM.

1.4.4.2 Particulate Emissions. Fugitive dust emissions from the facility will be estimated for two categories: uncontrolled and controlled. Uncontrolled emission estimates will be based on data for emissions from the sources when control devices are not used. The controlled estimates will be based on conservative efficiency ratings derived from EPA calculations.

1.4.4.3 Toxic Emissions. The ore itself and the processing operation both have the potential to produce small amounts of toxic contaminants. These toxic substances include mercury and arsenic, which occur naturally in the ore, and cyanide in the form of either hydrogen cyanide (HCN), or sodium cyanide (NaCN), which are inherent in the processing operation.

Mercury is a component of the ore mineralogy and is present in small amounts. Typically, negligible mercury vapor is produced in the crushing and leaching extraction circuits. In the leaching circuit, the same leaching process which separates the gold from the ore would also separate some mercury from the ore. The mercury would behave similarly to gold and would only be in a volatile form as an off-gas emitted during the final doré melting operation. No recovery of the mercury is planned because of its small concentration; therefore, it would be vented to the atmosphere.

Arsenic present in the ore is found to have limited solubility in the cyanide leaching solution. Therefore, any arsenic which is present would remain in the spent leach heaps, and arsenic would not be carried into the downstream refining process.

The leaching agent to be used to recover the desired metals is sodium cyanide (NaCN). Aqueous solution of this substance can produce gaseous hydrogen cyanide (HCN), dependent upon the pH of the solution. At the expected pH of 11, very little HCN generation would occur. Ambient air monitoring near the heaps and ponds of similar operations has shown the HCN to be almost undetectable; therefore, no emission control is planned for HCN emissions other than to maintain the solution pH above 10.5.

Sodium cyanide can be emitted at the project as a particulate. The sodium cyanide would be delivered in non-dusting briquettes in flo-bins and would not be exposed to the atmosphere until put into solution. Under these handling constraints, negligible amounts of particulate sodium cyanide are expected.

1.4.5 Reclamation Plan

1.4.5.1 Slash Clearing and Topsoil Stripping. When encountered on the project site, slash would be isolated, piled, and left in place for establishment of microenvironments for rodents and small mammals. Slash clearing would be done on sites to be disturbed. As currently planned, the pit and overburden dumps are located and have been designed to provide stable areas and slope for reclamation.

Once the slash has been removed, topsoil stripping would begin. Where present, topsoil would be stripped to a depth of 10 to 20 inches from the mine pit, waste dump site, and heap leach areas. Topsoil stripping would take place in areas deemed suitable by the soil survey and would be done using dozers, scrapers, trucks, and loaders. The topsoil would be stored in designated areas, as shown in Figure 1-3. Where practical, stockpiles would not exceed 20 feet in height with a 10-foot height preferable to decrease potential wind erosion and compaction.

Stockpile sideslopes would not exceed 2:1 gradient to reduce water erosion potential and permit the establishment of protective vegetation cover.

1.4.5.2 Interim Reclamation. Ongoing reclamation is intended as the Mother Lode Project proceeds. As soon as possible after a facility is no longer in use, recontouring, retopsoiling, and revegetation would be conducted.

Exploration drill sites and roads, unless subject to mining or additional exploration work, would be reclaimed. Seeding would be conducted during late fall to take full advantage of spring precipitation. Topsoil stockpiles would be seeded with fast-growing species, as approved by the BLM.

1.4.5.3 Final Reclamation

Open Pit Reclamation. The open pit would be constructed with safety benches, as necessary, to enhance slope stability. This would minimize public hazard at abandonment and would meet safety requirements.

Although no topsoil would be applied in these areas, mine pit walls with gradient of 2:1 or greater and the mine pit bottoms would be broadcast seeded. Natural encroachment of surrounding native species is expected to occur on the sites. Grasses and assorted shrubs are expected to colonize these isolated areas over time.

Waste Dump Reclamation. The waste dump crests would be partially regraded upon completion of mining at the site. Dump slopes would be minimized where practical, thus facilitating access by cattle to most portions of the area. Additionally, slope contours would be graded to blend into the surrounding topography, and proper drainage would be maintained on either side of the area.

All flat benches of the dump would be ripped and/or scarified to produce a rough surface for the anchoring of reapplied topsoil. Topsoil would be applied to the surface of all waste rock areas, to the extent topsoil is available. Reapplied soil would be left in a loose, cloddy condition (no use of disc or plow is required) to aid in moisture retention and decrease wind erosion losses. These sites would be seeded using BLM-approved seed mixtures and techniques to enhance adequate reclamation potential. The waste rock disposal faces would be seeded one time only.

Road Reclamation. Unless otherwise authorized by the BLM for land resources management or recreational access, all road corridors to the mining areas would be closed and reclaimed. Similarly, unless so authorized, other identified arterial or mine access roads would also be closed and reclaimed following mine closure.

The reclamation methods would utilize seed mixtures and application procedures acceptable to the BLM. After the road is abandoned, grading would reestablish natural drainage ways. All culverts would be removed and the crossing contoured back to a condition similar to the pre-existing drainage areas. The road would be "outsloped" to permit natural drainage. This can often be done by "pulling" the berm and respreading it across the road. Where available, topsoil would also be respread. Borrow ditches would be filled in to permit outsloping and allow water drainage off the corridor area. Intersecting dips or water bars would be installed at locations marked by BLM personnel.

Where practical, the compacted roadbed would be ripped to the depth of the wearing surface and then retopsoiled. The requirement may be waived if, in the opinion of BLM personnel, the roadbed is compacted too densely to permit a reasonable ripping success. A disc, plow, or similar piece of equipment would be used to break up the clods and help prepare the soil in the roadbed for seeding.

Fencing would be left around areas which the BLM considers beneficial to exclude from grazing allotments to allow revegetation to take hold or prevent access of livestock. The remaining fencing would be removed to reestablish access as similar as possible to conditions prior to mining activities.

Heap Leach and Pond Reclamation. Reclamation of the heap leach area would have the goal of creating contoured, revegetated mounds of crushed rock which blend unobtrusively into the surrounding ridges and slopes of the leach site. Heap solutions would be evaporated so that once the site is abandoned, the only runoff would be from incident precipitation.

Neutralization. Washing of the older heaps would progress on an intermittent basis until cyanide and gold levels are sufficiently low in the off-flow solution. Intermittent operation of the washing cycle allows air to enter the heap and aid in the breakdown of cyanide species.

Due to the high evaporation rate expected at the Mother Lode site during the summer months, it is likely that the washes would be conducted on the older, leached-out heaps in order to supply makeup water to the system.

The washing of the heaps would be done in accordance with the guidelines established by the Nevada Division of Environmental Protection. The heaps, due to agglomeration, would be washed to a level of free cyanide in the rinsate of 1 milligram per liter for three consecutive days and until the total zinc and copper concentrations show less than a 50 percent increase above their background concentrations in the source water (well water). Additionally, cross sectioned samples of the heap would be taken for compliance with the Nevada Division of Environmental Protection criteria of less than 10 milligrams of WAD (based on the modified ASTM Weak Acid Dissociable Method), cyanide per kilogram of dried ore.

Recontouring the Neutralized Heaps. Following washing of the heaps, the perimeter berms of the plastic liner would be removed to facilitate free drainage from the heaps. The heap edges can be recontourec with a bulldozer. During recountouring, the heap material would be spread out to cover all earthworks and liner material that are not needed for operation of the remaining heaps. The liner and drainpipes under the heaps would remain intact.

Recontouring the Process Ponds and Associated Facilities. After the pond water is neutralized and evaporated, the pond liners would be folded over the evaporate and buried in place. The ponds would then be filled with excavated material from pond construction to a level which would prevent ingress of water.

The recovery building and lab would be removed and the concrete slabs broken up and buried in the ponds. Other materials such as plastic piping would also be buried in the ponds. All building sites would be recontoured.

Revegetation. After recontouring, all areas would be covered with the topsoil that has been stockpiled during pad and pond construction. The areas would then be revegetated with an approved seed mixture. All reclamation and revegetation would be conducted to the satisfaction of the BLM Authorized Officer.

1.5 Alternatives to the Proposed Action

Based on the results of the public scoping process, review of the proposed Plan of Operations for the Mother Lode Project, and USNGS' engineering studies, two types of alternatives were selected for analysis in the EA: 1) the No Action Alternative and 2) facility location alternatives. These alternatives provide flexibility to USNGS during their final design and enable BLM to mitigate any significant site-specific impacts identified during the environmental review process.

An additional alternative identified during the scoping process involved backfilling the open pit at project completion with the waste material generated during the life of the project. This alternative was not carried through the detailed environmental analysis for the following reasons: 1) the rehandling of the waste rock would make the project financially infeasible for the Applicant; 2) future expansion of the pit to mine additional ore would be precluded by backfilling the pit following completion of the oxide project; and 3) environmental impacts identified in Chapter 3 of this EA would be increased by additional handling of the waste rock.

Based on an estimated cost of $0.85 per ton to backfill the pit with excavated waste rock, it would cost approximately $1.53 million to backfill the pit with 1.8 million tons of waste rock. This additional cost would render the project uneconomic. In addition, the reduction in net profits would result in a reduction in state tax revenues. The adverse environmental impacts include generation of fugitive dust from waste transport, disturbance to wildlife, and additional energy consumption. This alternative would provide the benefit of decreasing the acreage of permanent disturbance and the long-term visual impact once the waste rock were returned to the pit. However, the material would have to be temporarily stockpiled during operation, resulting in disturbance of vegetation, wildlife and grazing habitat, and cultural resources.

As part of the engineering study, USNGS evaluated alternative measures to conserve water during operations. Although no specific alternative processes were identified, USNGS' Plan of Operations provides for recycling and reuse of make-up water during the heap leach and ore processing cycles in order to minimize the project's water consumption.

1.5.1 No Action Alternative

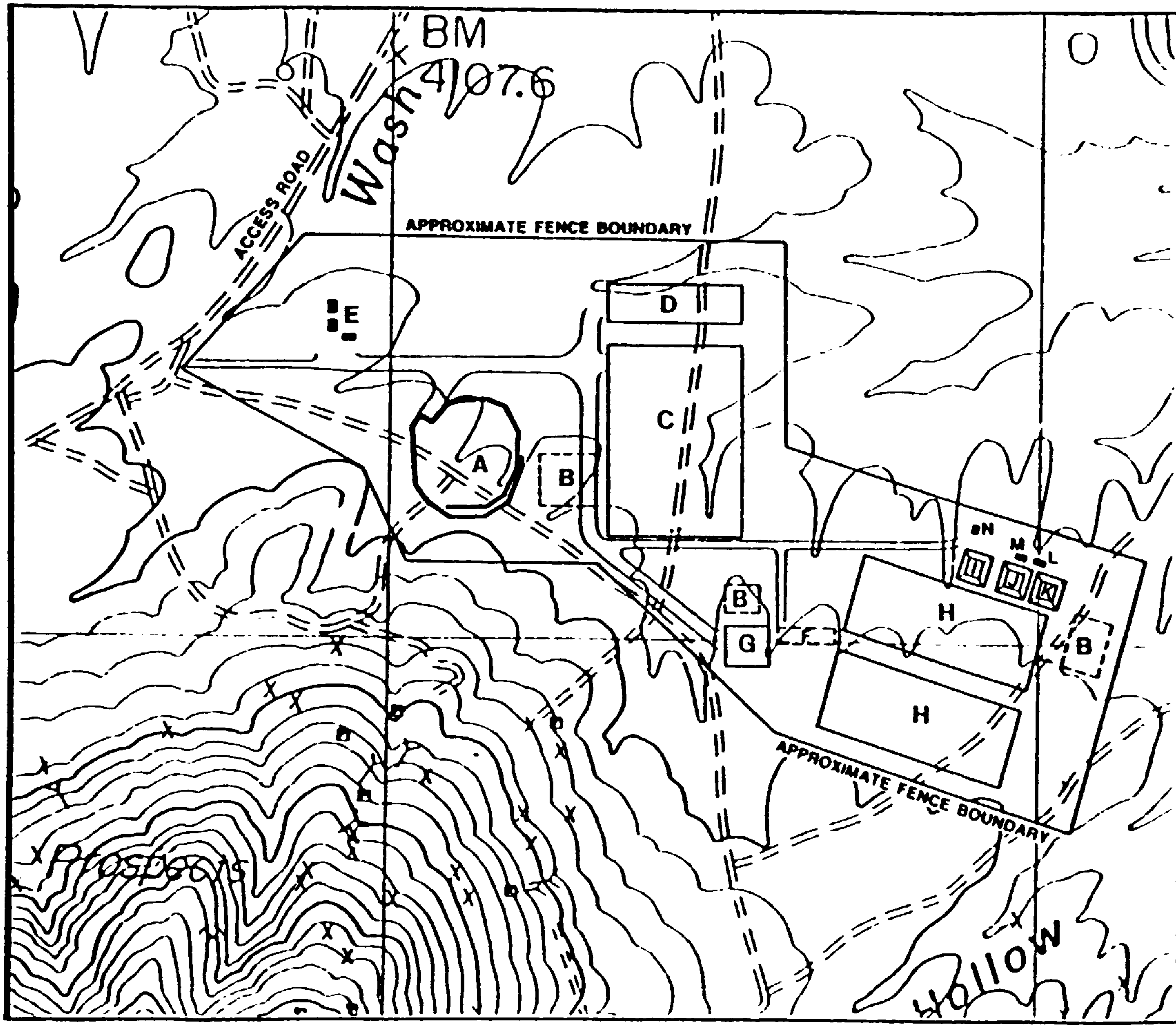
Under the No Action Alternative, development of the Mother Lode Project would not be allowed. Evaluation of the No Action Alternative is required by NEPA (40 CFR 1505). It is the BLM's responsibility to evaluate this alternative as well as to ensure compliance with the surface mining regulations (43 CFR 3809) of the General Mining Laws and other federal, state, and local laws (see Table 1-1), including the Endangered Species Act and the National Historic Preservation Act. In order to ensure that the mining plan would not result in undue and unnecessary degradation of federal lands, the BLM is responsible for implementation of reasonable reclamation and stipulation of measures to mitigate significant environmental impacts.

The General Mining Laws grant a mining claimant the legal right to extract and process the mineral resources it has claimed. Therefore, based on all of the applicable regulations, BLM could disallow the Mother Lode Project only if the proposed operation were not in compliance with the applicable laws with the application of mitigation measures, if necessary.

1.5.2 Alternative Facility Locations

USNGS has developed two alternative site plans for location of the processing and support facilities. In Alternative 1 (Figure 1-6), the waste rock disposal area, sulfide ore stockpile, and maintenance shop would be in the same location as the Proposed Action. The crushing and processing facilities would be located to the southeast of the pit and waste rock area. Alternative 1 would encompass approximately 180 acres with disturbance of 75 acres.

In Alternative 2 (Figure 1-7), the waste rock pile and sulfide ore stockpile would be located to the north of the pit. The crusher, crusher stockpile, leach pads, and processing plant would be located east of the pit. This alternative would encompass approximately 159 acres with disturbance of 75 acres.



LEGEND

A - MINE
B - TOPSOIL STOCKPILE
C - WASTE ROCK
D - SULFIDE ORE STOCKPILE
E - MAINTENANCE SHOP AND TRAILERS
F - CRUSHER
G - CRUSHER STOCKPILE
H - LEACH PAD
I - FRESH WATER POND
J - BARREN POND
K - PREGNANT POND
L - RECOVERY BUILDING
M - LAB
N - OFFICE

Scale: 1" = 500'

NORTH

Site Location: R48E, T12S, Section 7

MOTHER LODE PROJECT

FIGURE 1-6 ALTERNATIVE 1

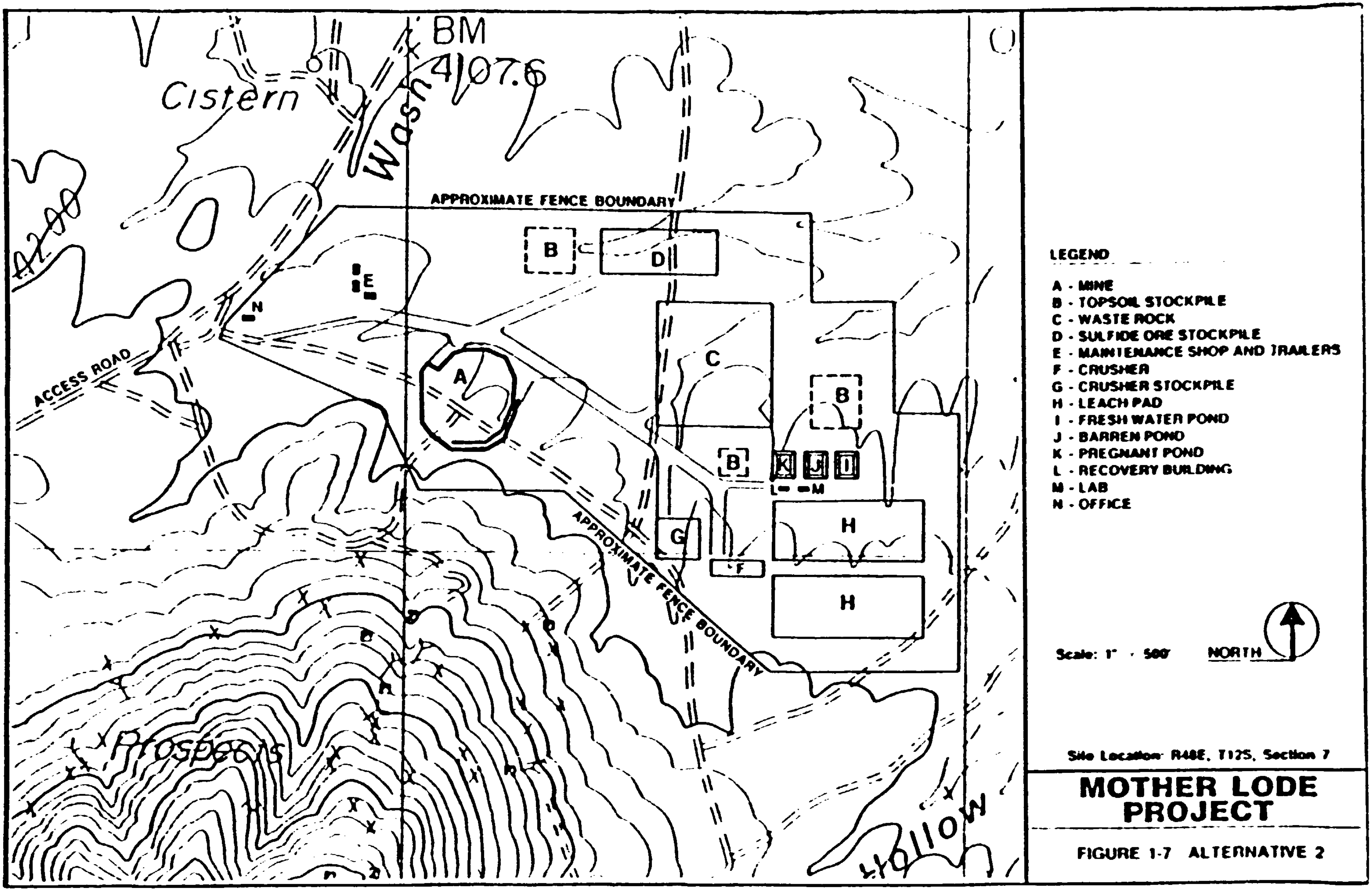


FIGURE 1-7 ALTERNATIVE 2

2.0 AFFECTED ENVIRONMENT

Chapter 2 describes the environment that would be affected by development of the Mother Lode Project. Information summarized in this chapter was obtained from published sources; unpublished materials from interviews with local, state, and federal agencies; and reconnaissance surveys of the project site. The study area varies with different resources. For some resources such as vegetation and soils, the affected area was confined to the immediate "area of concern" of the minesite and the ancillary facilities. For other resources, such as air resources and socioeconomics, a regional study area was delineated, and the affected environment was considered in a regional context.

A technical memorandum was prepared to support the baseline description and impact analysis for water resources; this report is included as an appendix to the Environmental Assessment (EA). In addition, a cultural resources technical report is on file for review at the Tonopah Resource Area Office of the Bureau of Land Management (BLM).

2.1 Air Resources

Baseline meteorology, air quality, and dispersion conditions at the proposed project site were estimated from on-site data (Beatty) and data records from the closest monitoring stations in south-central Nevada (Tonopah and Las Vegas).

2.1.1 Temperature and Precipitation

Table 2-1 summarizes temperature and precipitation data from stations nearest the site. National Climatic Data Center data from Tonopah (94 miles to the northwest) are listed along with local observations from Beatty. The differences between temperature and precipitation measurements at Beatty and Tonopah are most likely due to elevation differences between these two locations. Given an approximate elevation of 4,100 feet mean sea level (MSL) for the Mother Lode Project area, actual on-site conditions probably lie somewhere between the values indicated by the Beatty and Tonopah data.

TABLE 2-1

REGIONAL TEMPERATURE AND PRECIPITATION DATA

Station	Elevation (feet)	Years of Record	Period of Record		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum, Minimum, and Mean Temperatures (°F)																	
Tonopah	5426	33	1936-1968	Max	65	68	77	83	98	102	104	100	96	87	73	70	104
				Min	-15	-7	6	9	18	26	40	31	23	15	2	-13	-15
				Mean	30.1	34.7	39.8	48.7	56.8	63.3	73.9	71.8	64.3	52.9	38.8	33.5	50
Beatty	3320	3	1985-1987	Max	64.4	75.2	80.6	99	96.8	108	109[1]	102	102.2	88	77	62.6	109
				Min	15.8	14	24	31	37	48	51	54	38	8	4	18	4
				Mean	40	43.7	49.3	60	65.7	76.3	80.3	83	68.2	58.7	44	38	58
Mean Monthly Precipitation (Total Inches)																	
Tonopah	5426	33	1936-1968		0.31	0.37	0.55	0.58	0.47	0.24	0.43	0.33	0.40	0.47	0.45	0.37	5.08
Beatty	3320	3	1985-1987		0.54	0.57	0.82	0.23	0.29	0.05	0.17[1]	0.11[1]	0.17	0.29	1.00	0.61	3.00

Data Sources: Tonopah data provided by National Climatic Data Center, Asheville, NC. Beatty data compiled by ENSR from observations collected at Beatty High School.

[1] Incomplete data

Temperature data indicate relatively wide diurnal and seasonal variability which is typical of dry climates such as Nevada. Warmest temperatures are in July with coldest temperatures between November and January. Measured extremes during the 33-year data base at Tonopah range from 104°F in the summer to -15°F in the winter. The data base from Beatty over a 3-year period ranges from 109°F to 4°F. The mean annual temperature from Tonopah of 50.7°F is cooler than the Beatty annual mean of 58.9°F.

Precipitation in the region is sparse, averaging 3 to 5 inches annually. The 33-year precipitation data base of Tonopah shows heaviest amounts falling as rain in spring and snow in winter. The most rain occurs during March and April, and the most winter precipitation occurs in October and November. Data from Beatty are less complete but are comparable in trend.

2.1.2 Winds

Table 2-2 presents the digital wind speed and direction frequency distribution data for Beatty for the years 1985 to 1987. These data indicate a maximum wind direction frequency from the north with a secondary maximum from the south. Average wind speed is 8.3 miles per hour (mph) with 41 percent of the observations in the 6 to 10 mph range. This data summary is based on a single reported observation per day at the Beatty High School.

Figure 2-1 illustrates a windrose for Las Vegas for calendar year 1981. The Las Vegas data were used as input to the air quality modeling assessment of project emissions because these data are the nearest source of continuous wind speed and direction data. The wind data from Las Vegas show most winds come from the south or southwest.

2.1.3 Dispersion Conditions

Dispersion conditions are affected by two parameters: stability and mixing depth. Stability defines the ability of the atmosphere to disperse a given pollutant concentration. Unstable conditions represent maximum dispersion while stable conditions represent minimum dispersion. Mixing depth defines the atmospheric volume through which dispersion may take place. Estimates of atmospheric stability taken from the 1981 Las Vegas data indicate about 25 percent of the observations are associated with unstable conditions, 40 percent with neutral, and 35 percent with stable. Average wind speeds are highest for neutral conditions and decrease

TABLE 2-2

BEATTY, NEVADA

WIND SPEED AND DIRECTION JOINT FREQUENCY DISTRIBUTION (PERCENT)

	Wind Speed (MPH)							
Direction	0-5	6-10	11-15	16-20	21-25	>25	All Speeds	Mean Wind Speed (mph)
N	10.1	14.3	6.2	2.7	1.3	1.2	35.8	10.7
NE	1.1	1.9	0.9	0.2	0.0	0.0	4.1	7.7
E	0.9	0.3	0.0	0.0	0.0	0.0	1.2	4.3
SE	2.1	3.1	1.2	0.2	0.0	0.0	6.6	7.7
S	8.7	14.2	7.9	2.1	0.7	0.1	33.7	10.0
SW	2.6	3.8	2.2	0.8	0.6	0.0	10.0	10.0
W	0.6	0.5	0.0	0.0	0.0	0.0	1.1	5.9
NW	1.8	2.9	1.5	0.9	0.1	0.1	7.3	10.1
All Dir.	27.9	41.0	19.9	6.9	2.7	1.4	99.8	8.3

Based on a single observation per day at Beatty High School.

ANNUAL WIND ROSE
LAS VEGAS, NEVADA
1981

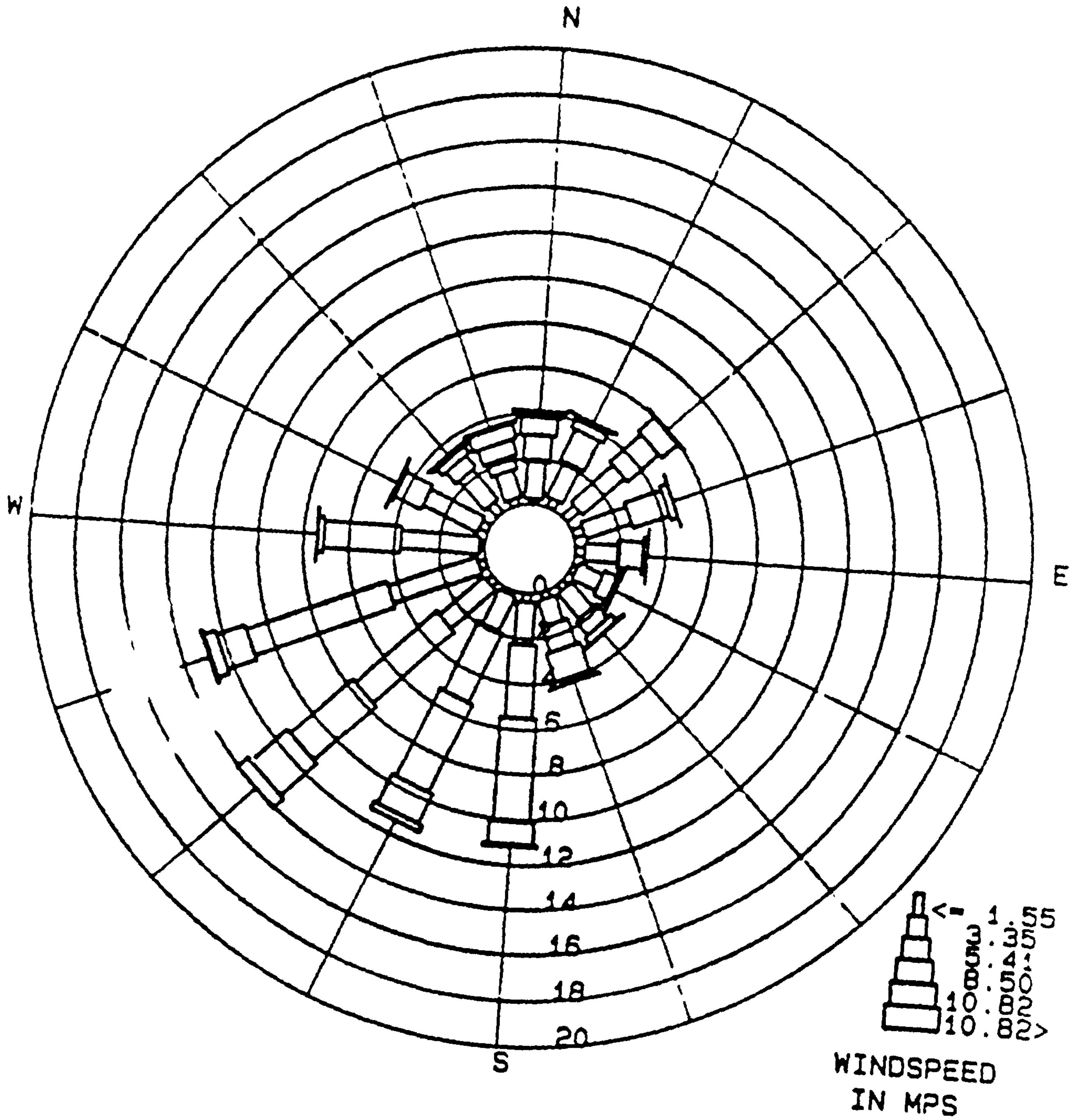


Figure 2-1

as the stability and/or instability increases. Mixing depths are at a maximum during the afternoon and during summer when solar insulation is strongest.

2.1.4 Air Quality

The area surrounding the proposed project is designated attainment, meaning that the area complies with all state and federal ambient air quality standards. The nearest nonattainment area is Las Vegas, which is well outside the impact area of the proposed project. Nye County, in which the proposed project would be located, is designated a Class II area for Prevention of Significant Deterioration (PSD) purposes, meaning that moderate, well controlled industrial growth is permitted.

The PSD Class I area nearest to the proposed project is the John Muir Wilderness in California, which is approximately 95 miles west of the project. Death Valley National Monument, located aproximately 12 miles southwest of the Mother Lode Project, is a Class II area.

Particulate data for Lehman Caves and Gabbs, Nevada are summarized in Table 2-3. These sites were selected because they are the nearest sites to the project area with representative monitoring data based on topography, land use, and exposure.

Table 2-3 summarizes particulate data collected by the Nevada Division of Environmental Protection (NDEP) between 1983 and 1988 for Lehman Caves; between 1983 and 1986 for Gabbs (data subsequent to 1986 are not available for the Gabbs site); and for 1988 for the Bullfrog Project near Beatty. Data are available for only 1 year for the Beatty area; therefore, Gabbs and Lehman Caves data are also included. Gabbs was selected as representative because of similarities between it and the project site in terrain, elevation, and population. However, Gabbs is somewhat affected by industrial operations in the vicinity, so these data probably overstate the background particulate levels in remote areas with little or no industrial pollution. On the other hand, Lehman Caves is in an area relatively unaffected by industrial or urban pollution sources. The Lehman Caves data are often used to define background particulate levels in undeveloped areas of Nevada.

The measurements summarized here are for total suspended particulate (TSP). State of Nevada air quality standards for TSP are 75 micrograms per cubic meter and 150 micrograms per cubic

TABLE 2-3

TSP PARTICULATE DATA SUMMARY 1983-1986

Site	Annual No. of Samples	Annual Geometric Mean	24-Hour TSP Concentration ($\mu g/m^3$)[1] 1st High	2nd High	Number of Samples Exceeding Standards Nevada >150 $\mu g/m^{3(1)}$	Federal >260 $\mu g/m^{3(1)}$
Lehman Caves						
1988	51	16.0	70	52	0	0
1987	59	11.9	33	30	0	0
1986	44	9.3	50	31	0	0
1985	60	8.4	76	34	0	0
1984	56	8.9	36	31	0	0
1983	54	6.8	67	28	0	0
Gabbs						
1986	40	23.5	58	42	0	0
1985	57	30.0	101	82	0	0
1984	57	36.4	232	100	1	0
1983	54	24.0	100	95	0	0
Bullfrog Project						
1988[2]	53	17.4	52	49	0	0

Source: Nevada Division of Environmental Protection

[1]Micrograms per cubic meter

[2]Data are particulate matter under 10 μm (PM-10).

Air Quality Standards (49/m³)	Nevada	NAAGS
24-hour average	150	150

meter 24-hour average. The 24-hour concentrations can be exceeded up to once per year. The federal government has recently repealed their TSP standard in favor of a standard for smaller respirable particles sized 10 microns in diameter or smaller, commonly referred to as PM-10. No long-term PM-10 data have been collected near the project site.

In the 4 years of data shown, there was only one exceedance in Gabbs in 1984. A value of 232 micrograms per cubic meter was measured which exceeds the Nevada standard of 150 micrograms per cubic meter for a 24-hour average. These high values are usually associated with local duststorms on extremely windy days. Lehman Caves data show no exceedances in the 4 years shown.

2.2 Geology, Mineral Resources, and Paleontology

2.2.1 Geologic Setting

The project site is located on the northeastern edge of Bare Mountain in southern Nye County, Nevada. The project site lies within the Great Basin region of the Basin and Range Physiographic Province, which is characterized by isolated erosional remnants of fault block mountain ranges separated by aggraded desert plains.

The site is bounded to the south-southwest by Bare Mountain, which is composed of late Precambrian to late Paleozoic sedimentary rocks which have been subjected to repeated episodes of folding and faulting (Cornwall and Kleinhampl 1961). Crater Flat occupies the area east and southeast of the site; it is underlain by Quaternary and alluvial deposits.

The Bullfrog Hills to the northwest are composed of deformed Paleozoic sediments and Tertiary volcanics. The structural fabric of the region is dominated by north and northeast-trending basin and range normal faults of probable late Teritiary to Recent Age, with downward movement in the valleys (Cornwall 1972).

2.2.2 Geologic Hazards

Potential geologic hazards at the site were evaluated based upon literature review, aerial photograph interpretations, preliminary geotechnical investigations, and detailed geologic mapping. Evidence of seismic activity in the project area is demonstrated by numerous north-south trending fault structures. However, no fault scarps suggestive of recent seismic activity have been identified in the project area. Additionally, no historic earthquakes have been recorded in the region. The nearest recorded historic earthquake occurred on January 30, 1934 in the Excelsior Mountains, approximately 125 miles north of the project site (von Hake 1974). This earthquake measured 6.5 on the Richter scale. Nuclear blasts which register up to 5.0 on the Richter scale occur at the Nevada Test Site approximately 50 to 100 miles to the north and east. These blasts are not expected to adversely impact the project area.

Secondary seismic effects due to liquefaction of saturated sandy soils are limited by the dry climate and deep water table. The possible occurrence of seismic liquefaction appears minimal because of a lack of susceptible soils. Hydrocompaction of loess soils does not appear to be a potential hazard in the project area, as geotechnical studies have not identified any appreciable loess soils thus far.

Testing for expansive soils or clay-rich soils is in progress, and results are expected by mid-March 1989. Expansive soils have not been identified to date; however, an unknown amount of clay-rich soils are present onsite. If sufficient clay-rich soils exist, this material may be used as a secondary liner under the heap leach pads.

No active or potential landslides or rockfall hazards were noted during surficial geologic mapping at the project site. The limiting factors are the dry climate and thin upland soils.

2.2.3 Mineral Resources

The project site is located in the Bare Mountain or Flourine mining district, which has produced a variety of minerals since the discovery of gold there in 1905 (Lincoln 1923). Most of the mineral production of the district has come from the northern part of Bare Mountain (Cornwall 1972). Large amounts of fluorspar have been mined since 1918, and small production of mercury, ceramic silica, volcanic cinders, and pumicite has been recorded (Cornwall and Kleinhampl 1961). Minor showings of gold, silver, and tungsten have been found in several prospects, but no production has been recorded. Current mineral production in the area includes the Sterling Gold Mine to the south and the Daisy Fluorspar Mine to the west.

The hydrothermally altered host rocks in the deposit exhibit strong argillic alteration (i.e., clay formation) which includes pyritization. Lesser amounts of silicification are also present in the deposit. The deposit is localized at or near the intersection of north, northeast, and northwest-trending fault structures. The orebody is concealed under 10 to 40 feet of alluvial fill, and there is no geochemical or geophysical expression of the mineralization. Preliminary studies to date indicate that all gold in the deposit is micron size and is typically associated with pyrite and or iron oxide staining. Minor amounts of silver, mercury and arsenic are also present in the ore.

Exploration for additional reserves is on-going, and future reserves could include extensions of the identified orebodies, low-grade ore deposited as waste rock, and other as yet undiscovered orebodies in the area.

2.2.4 Paleontology

No paleontological resources or potentially important geological formations have been identified at or near the project area (Waski 1989). This information was confirmed by Dr. James Firby, Professor of Paleontology, University of Nevada, Reno (1989).

2.3 Water Resources

This section summarizes the groundwater and surface water resources of the project area. More detailed information is included in a Water Resources Technical Memorandum included as Appendix A of this document.

2.3.1 Groundwater

2.3.1.1 Regional Groundwater Conditions. The project area is located within the Basin and Range Province as defined by Fenneman (1931). The area in general is a good example of Great Basin topography (Winograd and Thordarson 1975). The southeastern portion of the Great Basin where the project is located is referred to as the Carbonate Rock Province of the Great Basin.

The region is comprised of intensely fractured Precambrian and Paleozoic carbonate and clastic rocks and block-faulted Cenozoic volcanic and sedimentary strata (Winograd and Thordarson

1975). Five different major hydrogeologic units occur in the vicinity of the project area: the lower Paleozoic Clastic Aquitard; the Paleozoic Carbonate Aquifer; the volcanic unit of welded and non-welded tuffs (often called the tuff aquitard); the Paleozoic Slide Blocks; and the alluvium (see Appendix A for further details). Three types of groundwater reservoirs have been identified in the region including: alluvium (valley-fill); volcanic-rock; and carbonate-rock aquifers (Rush 1970). The lower clastic aquitard, the lower carbonate aquifer and volcanic unit or tuff aquitard control the movement of groundwater in the region (Winograd and Thordarson 1975). The Paleozoic carbonate rocks are generally more permeable than the noncarbonate rocks due to the development of secondary permeability.

Recharge to aquifers within the Carbonate Rock Province is supplied primarily through infiltration of precipitation and melting snow in the mountains and adjacent alluvial fans. The noncarbonate rocks generally store and transmit only small amounts of water and act as barriers to groundwater flow or as relatively impermeable caps on regional aquifers. Valley-fill deposits are located in structural depressions between the mountain ranges and consist of unconsolidated to partly consolidated deposits derived from adjacent mountains. Valley-fill deposits that are connected by underlying permeable carbonate rocks may form deep regional groundwater systems that may connect several valleys. Groundwater from these large systems is discharged as springs, evapotranspiration in low lying areas, and groundwater flow into rivers and lakes (Eakin 1966).

The project area is within the Oasis Valley-Fortymile Canyon groundwater basin as defined by Winograd and Thordarson (1975). Water within this groundwater basin recharges in the Pahute Mesa, Timber Mountain area and generally moves southwestward toward the Oasis Valley and southward to the Amargosa Desert via Crater Flat and Fortymile Canyon. Locally, the project area is within the Crater Flat flow system (Sharp 1989; see also Figure 1 of Appendix A).

Bare Mountain essentially acts as an impervious block sitting in the midst of the groundwater basin flow paths. Water does not move through Bare Mountain (Sharp 1989). Groundwater recharged to the north seeking to move southward and ultimately discharge is diverted around Bare Mountain. Bare Mountain divides the groundwater flow into three different components. First, farther to the north water moves to the southwest and west of Timber Mountain Caldera and the Pahute Mesa area, being diverted by Bare Mountain toward the Oasis Valley. Second, water flows southward into the Crater Flat flow system which continues to move southward into the Amargosa Desert. Third, groundwater moves from the north to the southeast, through Fortymile Wash and the Lathrop Wells area (see Figure 1 of Appendix A).

The Crater Flat flow system discharges in the Amargosa Desert west of the Ash Meadows fault. In the Amargosa Desert, the Crater Flat flow system combines with the groundwater flow from Amargosa Desert. There is a major regional flow boundary between the Amargosa Desert flow system and the Ash Meadows flow system in the southeastern part of the area (see Figure 1 of Appendix A); therefore, the project area is hydraulically separated from Devils Hole and the Ash Meadows springs. Rush (1970) indicates the recharge is approximately 220-acre-feet per year to Crater Flat, primarily from runoff, snowmelt, and rainfall from Bare Mountain, and snowmelt and runoff in Crater Flat.

In the Ash Meadows groundwater basin delineated by Winograd and Thordarson (1975), regional groundwater flow is from the north and northeast to the south and southwest. The western boundary of the flow system is coincident with a normal fault that extends approximately from Devils Hole to Lathrop Wells. North and south of the fault the western boundary of the Ash Meadows flow system is inferred from the contact of the lower carbonate aquifer on the east and lower clastic aquitard on the west and from topographic divides and local water levels (Sharp 1989; see also Figure 1 of Appendix A).

2.3.1.2 Local Groundwater Conditions. USNGS has conducted subsurface drilling to better characterize the water bearing characteristics of the rock. The northernmost site drilled (see Figure 1 of the Water Resources Technical Memorandum in Appendix A) indicated some permeability and that a portion of the water supply could be developed here. Farther east in Crater Flat, alluvial material and volcanics were found at depth (approximately 1,540 feet) which have water bearing potential. Depth to groundwater in the project area is approximately 200 feet.

Based on Czarnecki and Waddell (1984), the transmissivity of the groundwater in the area is approximately 7,500 gallons per day per foot, and the storage coefficient is approximately 0.0048 (Sharp 1989; see also the Water Resources Technical Memorandum in Appendix A).

A water sample was obtained from the northernmost drill hole for the project (see Figure 1 of Appendix A). Concentrations of the major cations and anions indicate the water to be of a calcium-magnesium-sulfate type. Four constituents were found to exceed drinking water standards: iron, manganese, sulfate, and total dissolved solids.

Existing water rights on file with the State Engineer for the general area are listed in Table 4 and shown in Figure 2 of the Water Resources Technical Memorandum in Appendix A. There are no existing water rights in the immediate vicinity of the project site. There are two spring permits in the general vicinity. The springs (Specie Spring and an unnamed spring) are at a much higher elevation than the project test hole water levels. The closest private well to the project site (Permit 48436) is located approximately 8 miles to the southeast.

2.3.2 Surface Water

2.3.2.1 Regional Surface Water. The Great Basin Physiographic Province is characterized by a series of north to south-trending mountain ranges that drain internally to broad intervening alluvial valleys. There are no large perennial streams in the region. The Amargosa River, approximately 5 miles southwest of the project site, is the only stream within several miles of the project area. The Amargosa River is considered to be intermittent near Beatty. The Amargosa River flows south into the Amargosa Desert.

2.3.2.2 Local Surface Water. The project site is located at the headwaters of two ephemeral drainages (Tates Wash and Joshua Hollow) which in extreme events eventually drain to the Amargosa River over 30 miles to the southeast. The drainage areas above the facilities are approximately 2.0 and 1.3 square miles for Tates Wash and Joshua Hollow, respectively. Average annual precipitation at the site is approximately 4.6 inches. Runoff from the project site is limited to short periods after high intensity storms or rapid snow melt. Runoff from the project site flows north and east into Crater Flat. The estimated 100-year, 6-hour rainfall depth is 1.8 inches, and the 100-year, 24-hour depth is 2.7 inches. Mean annual runoff for the site is 0 inches per year. Additional surface water information is included in the Water Resources Technical Memorandum in Appendix A.

2.4 Soils

Detailed soil mapping and sampling were conducted by ENSR soils personnel in April 1988. This survey area comprised approximately 1,147 acres within which the sites for the Proposed

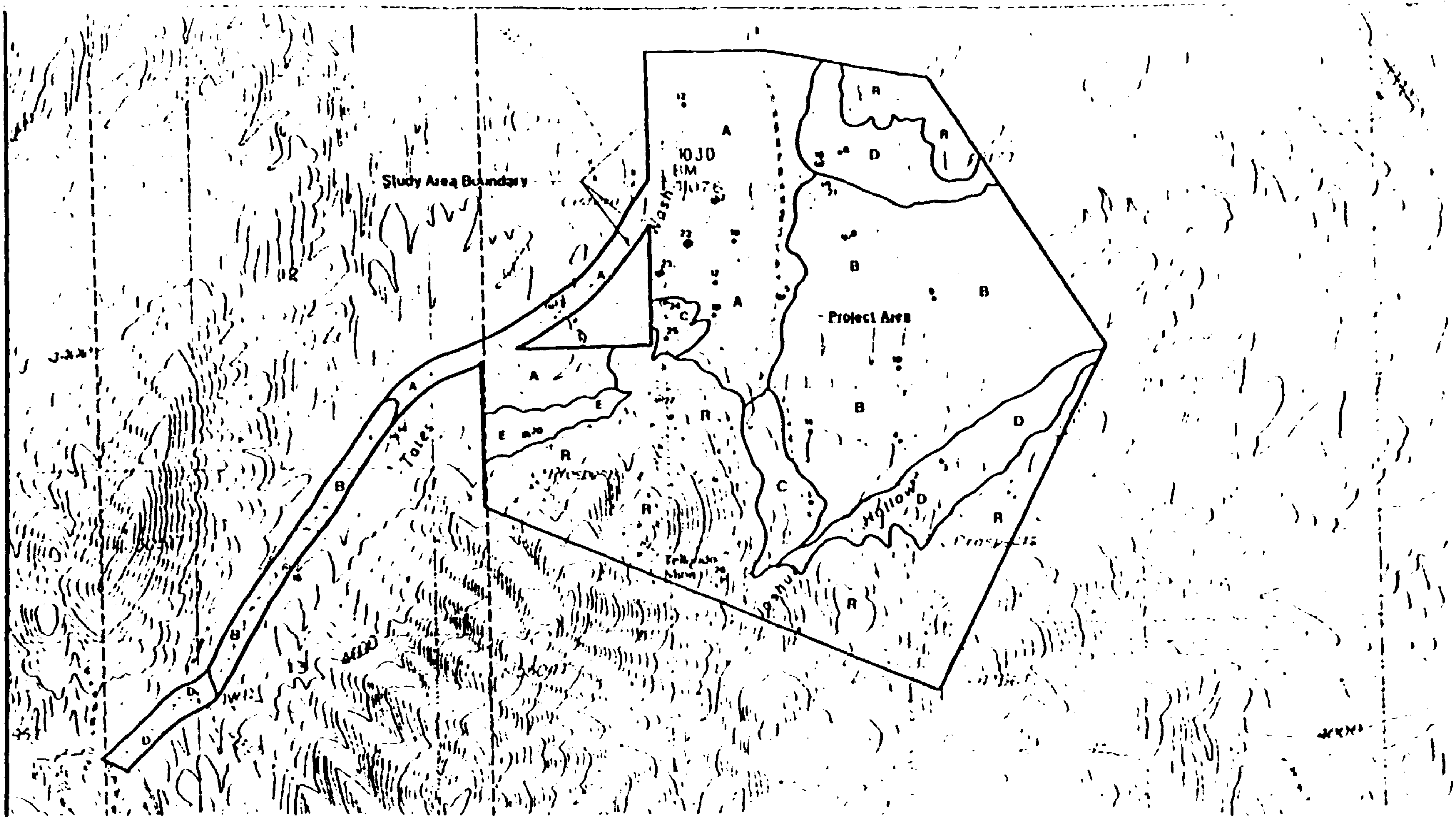
Action and alternatives are located. The soils map of the area surveyed is presented as Figure 2-2. Table 2-4 summarizes the soil map unit characteristics; Table 2-5 provides soilclassification, sample numbers, and other related information for the individual soils described in the project area: Appendix B contains soil profile descriptions and soil laboratory data as well as a listing of parameters and analytical procedures for topsoil analysis.

2.4.1 Soil Map Unit Descriptions

The region is characterized by broad, alluvium-filled basins bounded by steep mountain ranges. Extrusive igneous bedrock (ash flow welded tuffs) is dominant, with hydrothermally altered zones and sedimentary rocks occurring in some areas. This geologic pattern generally results in very shallow (less than 10 inches) and shallow (10 to 20 inches) soils on steep ridge crests, shoulders, and upper sideslopes. Progressively deeper, coarse-textured, and somewhat sorted soil materials occur downward from the colluvial sideslopes to the alluvial fans and fan aprons. The soil temperature regime is 'thermic' (mean annual soil temperature between 15°C and 22°C), and the soil moisture regime is 'typic aridic' with less than 8 inches of annual precipitation.

Within the project area itself, the slopes and hills of Bare Mountain are dominated by rock outcrops and the Tecopa soil (Map Unit R). It is very shallow, well drained, and formed in residuum from carbonate and quartzite rocks. Soil textures are very gravelly sandy loams and loams. A steep, north-facing, colluvial slope of Bare Mountain contains the Pineval soil (Map Unit E). It ranges in depth from shallow to deep with an average profile depth of 23 inches. Soil textures are very gravelly sandy loam and loam. A thin to thick duripan zone is present immediately above the bedrock contact.

A large alluvial fan-like surface (pediment) is present to the north of Bare Mountain. It gently slopes to the north and northeast. At the interface of Bare Mountain and the pediment surface there is a more recent alluvial fan which contains two soils - Dedas Variant and Zalda Variant (Map Unit C). Both soils are moderately deep (20 to 40 inches to a duripan) and have greater than 35 percent coarse fragments throughout the soil profiles. This material is a younger alluvial fan deposit which overlies the hard duripan found at depth on the pediment surface to the north and northeast. Soil textures are gravelly sandy loam. Neither soil has a zone of clay accumulation.



LEGEND

A - Tapco-Tapco Variant gravelly sandy loams Complex, 2 4% slopes
B — Dedas-Zalda gravelly sandy loams Complex, 2 6% slopes
C — Dedas Variant - Zalda Variant very gravelly sandy loams Complex, 2 4% slopes
D — Unnamed Argids, red, gravelly sandy loams Complex, 2 20% slopes
E - Pineval gravelly sandy loam, 25 45% slopes
R - Tecopa Rock Outcrop Complex, 15 75% slopes

Soil Profile Description
Soil Profile Description (also sampled for soil laboratory characterization)

North

Revised 8/88

MOTHER LODE PROJECT

FIGURE 2-2 SOILS MAP

TABLE 3-4

SOIL MAP UNIT DESCRIPTIONS

Map Unit Number	Map Unit Name	Percent of Map Unit	Inclusions Within Map Unit		Slopes and Terrain[1]	Parent Material Type[2]	Erosion Hazard of Bare Surface[3]	
							Water	Wind
A	Tapco - Tapco Variant gravelly sandy loams Complex, 2-4% slopes	40% 35%	Lealandic Longjim Arizo (drainage channel)	10% 10% 5%	Nearly level to very gently sloping very shallow, shallow and moderately deep soils on an old pediment surface	Thin aeolian sandy loam material over older clay loam and clay alluvium. Hard, indurated "duripan" at base of soil	Moderate	High
B	Dedas - Zalda gravelly sandy loams Complex, 2-6% slopes	45% 40%	Zalda Variant (mod. deep)	15%	Same as above but dominantly very shallow and shallow soils	Same as above	Moderate	High
C	Dedas Variant - Zalda Variant very gravelly sandy loams Complex, 2-4% slopes	60% 30%	Zalda	10%	Nearly level to very gently sloping moderately deep soils on more recent alluvial fan surfaces (over an old pediment)	Alluvium from mixed rocks	Moderate	High
D	Unnamed Argids, red gravelly sandy loams Complex, 2-20% slopes 1) Fine-loamy, Typic Durargid (mod. deep) 2) Fine-loamy, Typic Haplargid (mod. deep) 3) Fine, montmorillonitic, Xerollic Paleargid	 30% 40% 20%	Tapco	10%	Very gently sloping to moderately steep, moderately deep to deep slightly red soils on bedrock uplands	Alluvium and residuum from slightly red older tuff and quartzite	Moderate	High
E	Pineval gravelly sandy loam, 25-45% slopes	70%	Pineval, shallow Rock Outcrop (includes large boulders)	15% 15%	Moderately steep to steep moderately deep and shallow soils on north-facing mountain sideslopes	Colluvium and residuum from carbonates, quartzite, and volcanic rocks	Moderate	High
R	Tecopa - Rock Outcrop Complex, 15-75% slopes	50% 40%	St. Thomas	10%	Moderately sloping to very steep very shallow and shallow soils and rock outcrop on hills and mountain peaks and sideslopes	Residuum and colluvium from carbonate and quartzite rock	Moderate	High

[1]Terminology from USDA-SCS. June 1981.

[2]Terminology from USDA-SCS. June 1981.

[3]Erosion hazard class taken from SCS Official Soil Series Descriptions for water erosion hazard, and National Soils Handbook (SCS 1983) criteria for wind erosion hazard.

TABLE 2-5

SOIL SERIES CHARACTERISTICS

Soil Series Name	Map Unit	Sample Numbers[1]	Soil Classification: Family	Soil Classification: Subgroup	SCS Soil Series Information[2]
Arizo	A (Inclusion)	—	Sandy-skeletal, mixed (calcareous), thermic	Typic Torriorthent	
Dades	B	4,10	Loamy-skeletal, mixed, thermic, shallow	Typic Durargid	10-85, Nye Co., NV1736, T
Dades Variant	C	9,24,25	Loamy-skeletal, mixed, thermic	Typic Durargid	10-85, Nye Co., NV1736, T
Longjim	A (Inclusion)	15	Loamy-skeletal, mixed, thermic, shallow	Typic Durorthid	4-81, Nye Co., NV1314, T
Lealandic	A (Inclusion)	12,14	Clayey-skeletal, montmorillonitic, thermic	Typic Durargid	12-85, Nye Co., NV1316, T
Pineval	E	20	Loamy-skeletal, mixed, mesic	Durixerollic Haplargid	9-85, Eureka Co., NV0755, E
St. Thomas	B (Inclusion)	—	Loamy-skeletal, carbonatic, thermic	Lithic Torriorthent	6-73, Clark Co., NV0158, E
Tapco	A	2,5,7,13, 17,18,19	Clayey, montmorillonitic, thermic, shallow	Typic Durargid	12-78, _____, AZ0269, E
Tapco Variant	A	22,23	Fine, montmorillonitic, thermic	Typic Durargid	12-78, _____, AZ0269, E
Tecopa	B	26,27	Loamy-skeletal, mixed (calcareous), thermic	Lithic Torriorthent	7-79, Inyo Co., CA0819, E
"Unnamed" Argids					
(1)	D	3	Fine-loamy, mixed, thermic	Typic Durargid	—
(2)	D	6	Fine-loamy, mixed, thermic	Typic Haplargid	—
(3)	D	16	Fine, montmorillonitic, thermic	Xerollic Paleargid	—
Zalda	D	8,21	Loamy, mixed, thermic	Typic Durorthid	9-85, Nye Co., NV1321, E
Zalda Variant	C	1,11	Loamy-skeletal, mixed, thermic	Typic Durorthid	9-85, Nye Co., NV1321, E

[1] All sample numbers are preceded with "GX" (for GEXA), e.g. GX-5.

[2] For soils mapped and classified site-specifically as series variants or taxadjuncts, the SCS information is for the official soil series, not the variant. A variant is soil that is sufficiently different from any established or tentative soil series that it would warrant establishment as a new soil series. A new SCS Form 5 (Soil Interpretation Record) would be developed for this new soil. However, known acreages of this new soil are not large enough (at least 2,000 acres) to justify establishment of a new series. As a result, this soil is called a variant of the soil it most closely resembles.

The pediment surface itself contains two soil map units - A and B. Both contain shallow and moderately deep soils over the very hard duripan. The duripan is estimated to be one-quarter million years old (Peterson 1988). Tapco is shallow and has a zone of clay accumulation immediately above the duripan. Tapco Variant is similar but is moderately deep. Neither soil has a large percentage of coarse fragments. Both soils comprise Map Unit A.

Map Unit B is composed of Dedas and Zalda soils. Both are shallow soils over the hard duripan. Dedas has greater than 35 percent coarse fragments, and Zalda has less than 35 percent. Both have a gravelly sandy loam texture. Soils of Map Unit B lack the slightly thick zone of clay accumulation above the duripan that is present in the soils of Map Unit A.

A final soil map unit is composed of several soils that are developing in residuum and colluvium from older tuff and quartzite on rolling bedrock controlled uplands (Map Unit D). These soils are mapped on uplands on the north and northeast edges of the study area and along a small portion of the access road. They have gravelly sandy loam textures, are slightly red in color, are moderately deep and deep, and lack the underlying duripan which exists beneath the adjacent pediment.

2.4.2 Suitability of Soils for Topsoiling

Twenty-seven soil profiles were fully described from backhoe pits dug in all six soil map units. Fourteen of those profiles were also sampled for laboratory characterization. Samples were retrieved for each major soil horizon or contrasting layer. Samples were analyzed at Inter-Mountain Laboratories (IML) in Sheridan, Wyoming for the following parameters:

- pH
- Electrical conductivity
- Saturation percent
- Soluble calcium, magnesium, and sodium
- Sodium adsorption ratio
- Organic matter percent
- Calcium carbonate percent
- Particle-size distribution, including very fine sand
- Coarse fragment percent
- Selenium (selected horizons)

Recommended topsoil salvage depths were generated for each map unit and are summarized in Table 2-6.

TABLE 2-6

TOPSOIL SALVAGE DEPTHS

Map Unit Number	Name	Recommended Topsoil Salvage Depth (Inches)
A	Tapco - Tapco Variant Complex	10/10[1]
B	Dedas - Zalda Complex	13
C	Dedas Variant - Zalda Variant Complex	24
D	Unnamed Argids Complex	30
E	Pineval	23
R	Tecopa - Rock Outcrop Complex	0

[1] Map Unit A has 10 inches of suitable surface material over 10 inches of hard clay which is underlain by the hard, cemented duripan. This clay material could be used as a natural clay liner on top of the duripan. Even though it is suitable material for possible salvage, it is not recommended for salvage as topsoil.

The recommended depths are average values for all samples contained within each map unit. Evaluation of the soil physical and chemical data indicated no limiting features. The soils have moderate pH values, low electrical conductivity (EC), low sodium adsorption ratio (SAR), and suitable soil textures. The high clay zones in Map Unit A are not recommended for salvage (see Footnote 1, Table 2-6). All other features are suitable. A few samples were analyzed for the presence of selenium (princes plume, a selenium indicator plant species, was present in Map Unit A), and none was detected. The percentage of coarse fragments was, in some cases, somewhat high (30 to 40 percent), but generally was low. Coarse fragments are not limiting (for reclamation plant growth) below 45 percent (Peterson 1988).

The critical variable for these soils is depth. All available soil material above the duripan is suitable for salvage. This favorable suitability is due in part to a slightly higher elevation with somewhat more precipitation and subsequent soil development. The study area also has a general north-facing aspect, and this somewhat reduces the sun's intensity and drying effects (evapotranspiration) on the soils.

2.5 Vegetation

Vegetation information presented for the proposed project was obtained from agency contacts (BLM and Nevada National Heritage Program) and from field surveys conducted by ENSR (April 1988). The vegetation survey area comprised approximately 1,147 acres within which the sites for the Proposed Action and alternatives are located. Field studies involved mapping vegetation types, measuring vegetation cover and species composition, and conducting a rare plant survey within the study area. Table 2-7 lists the plant species observed during the April field studies.

2.5.1 Vegetation Communities

Four vegetation communities are present within the study area which is located between the mountain peaks of Yucca Mountain to the north and east, and Bare Mountain to the south. The vegetation types include blackbrush, mixed desert shrub, mixed desert shrub/forb, and sagebrush (Figure 2-3). Quantitative data were collected by ENSR during the April field studies. Table 2-8 summarizes the aerial coverage and average cover, density, and height values of each vegetation type within the study area. Average carrying capacity for the study area vicinity

TABLE 2-7

PLANT SPECIES OBSERVED WITHIN THE MOTHER LODE PROJECT AREA

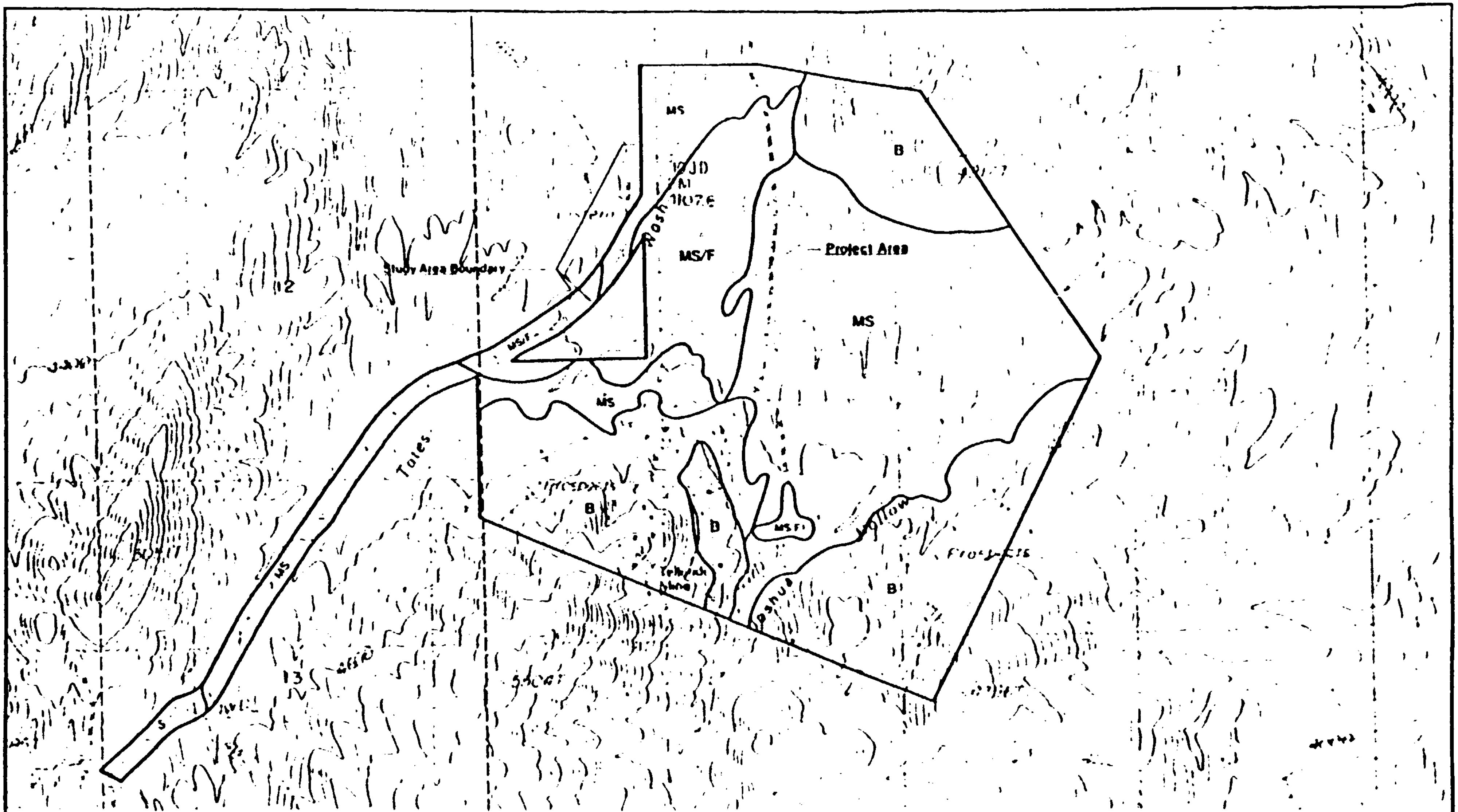
Common Name	Scientific Name	Community[1]			
		B	MS	MS/F	S
Grasses/Forbs					
Bluegrass	*Poa* sp.	x			x
Bottlebrush squirreltail	*Sitanion hystrix*				x
Desert needlegrass	*Stipa speciosa*	x	x	●	x
Fiddleneck	*Amsinckia* sp.	x	●	x	x
Filaree	*Erodium cicutarium*	x	x	●	
Foxtail chess	*Bromus rubens*	●	●	●	●
Globemallow	*Sphaeralcea ambigua*	x	x	●	x
Indian paintbrush	*Castilleja* sp.	x	x		x
Lupine	*Lupinus* sp.		x	x	
Milkvetch	*Astragalus* sp.	x	x	x	
Phlox	*Phlox* sp.				x
Princes plume	*Stanleya pinata*		x	●	
Russian thistle	*Salsola kali* (roadside)	x	x	x	x
Tansy mustard	*Descurainia pinnata*		x	x	x
Shrubs					
Anderson thornbush	*Lycium andersonii*	x	●	●	x
Antelope bush	*Purshia glandulosa*		x		x
Beaver tail cactus	*Opuntia basilaris*	x			
Big sagebrush	*Artemisia tridentata*	x	x		●
Blackbrush	*Coleogyne ramosissima*	●	●	x	●
Bladder sage	*Salazaria mexicana*		x	x	
Buckwheat	*Eriogonum* sp.	x			
Bud sagebrush	*Artemisia spinescens*			●	
Butterfly bush	*Buddleja utahensis*	x			
California buckwheat	*Eriogonum fasciculatum*	x			x
Cheeseweed	*Hymenoclea salsola*		x	●	x
Cliffrose	*Cowania neomexicana*	x			
Creosote bush	*Larrea tridentata*	x	x		
Fourwing saltbush	*Atriplex canescens*	x	x		x
Goldenhead	*Acamptopappus shockleyi*		x		
Goldenweed	*Ericameria cooperi*		●	x	●
Hedgehog cactus	*Echinocereus* sp.	x			
Joshua tree	*Yucca brevifolia*	x	x		
Littleleaf horsebrush	*Tetradymia glabrata*	●	●	x	x
Many-headed barrel cactus	*Echinocactus polycephalus*	x			
Mormon tea	*Ephedra viridis*	x		x	x
Nevada ephedra	*Ephedra nevadensis*	●	●	●	●
Rubber rabbitbrush	*Chrysothamnus nauseosus*	x	x	x	x
Sage	*Salvia dornii*		x		
Silver cholla	*Opuntia echinocarpa*	x	x	x	x

TABLE 2-7 (CONTINUED)

Common Name	Scientific Name	Community[1] B	MS	MS/F	S
Spiny hopsage	Grayia spinosa	@	@		x
Spiny horsebrush	Tetradymia spinosa	x	x		
Terete-leaved rabbitbrush	Chrysothamnus teretifolius	x	x	x	x
Twinberry	Menodora spinescens	x	x		@
Yellowbrush	Chrysothamnus viscidiflorus	x	@		@
Winterfat	Ceratoides lanata	x	@		

[1]B = Blackbrush, MS = Mixed Desert Shrub, MS/F = Mixed Desert Shrub/Forb, S = Sagebrush.

@ = Dominant species within vegetation community.



LEGEND

VEGETATION TYPE

B – Blackbrush
MS – Mixed Desert Shrub
MS/F – Mixed Desert Shrub/Forb
S – Sagebrush

▭ – Echinocactus polycephalus location

North

MOTHER LODE PROJECT

FIGURE 2-3 VEGETATION MAP

TABLE 2-8

VEGETATION TYPE DATA SUMMARY FOR THE PROJECT AREA

Vegetation Type	Acres (Relative Percent)	Average Total Plant Cover Range (percent)	Average Shrub Density (shrubs/acre)	Average Shrub Height Range (inches)
Blackbrush	459 (40)	24 - 46	5,313	6 - 24
Mixed Desert Shrub	535 (47)	38 - 44	5,060	12 - 30
Mixed Desert Shrub/ Forb	143 (12)	30 - 34	3,373	6 - 24
Sagebrush	10 (1)	28 - 34	3,036	12 - 30
TOTAL	1,147[1]			

[1] This is the total acreage of the survey area delineated in Figure 2.5-1.

is 53 acres/animal unit month (AUM) (Oyler 1988). Each of the vegetation types is described below.

2.5.1.1 Blackbrush. Approximately 40 percent of the study area contains the blackbrush vegetation type. This type primarily occupies moderately steep to steep (up to 75 percent) slopes on low hills, mountain sideslopes, and ridge tops. The low hills of the eastern portion of the study area are heavily dominated by blackbrush with associated species including Nevada ephedra and foxtail chess. The blackbrush type located on the lower mountain sideslopes in the southwest corner of the study area is dominated by these species in addition to spiny hopsage and littleleaf horsebrush. This type also occupies the steep higher elevation ridge tops and sideslopes commonly associated with rock outcrop. These areas typically are dominated by blackbrush, cliffrose, butterfly bush, Mormon tea, Nevada ephedra, buckwheats, terete-leaved rabbitbrush, and foxtail chess. A large concentration the many-headed barrel cactus was located on the steep east and northeast-facing slope near the Telluride Mine and Tram.

2.5.1.2 Mixed Desert Shrub. The mixed desert shrub type is the most extensive community within the study area, accounting for nearly half of the acreage. This type primarily occurs on the gently sloping pediment-alluvial fan located in the central and eastern portions of the study area. It also is present along lower mountain sideslopes. This community is characterized by a mixture of several shrub species, without dominance by an individual species. Common species include blackbrush, Nevada ephedra, Anderson thornbush, winterfat, and goldenweed. Less common shrub species are yellowbrush, spiny hopsage, and littleleaf horsebrush. Common understory species include foxtail chess, fiddleneck, and filaree. Bladder sage, fourwing saltbush, and big sagebrush commonly occur along the drainages of Tates Wash.

2.5.1.3 Mixed Desert Shrub/Forb. This vegetation type occurs on the level to gently sloping pediment-alluvial fan area in the central and western portions of the study area and along Tates Wash. Based on field observations made by the ENSR soil scientist, it appears that this area has experienced fire. Unlike the other vegetation types present, this community is dominated by ground cover of forb species. Dominant species include princes plume, filaree, globemallow, milkvetch, and fiddleneck. Desert needlegrass and foxtail chess are common grasses. The shrub component of this community includes Nevada ephedra, cheeseweed, Anderson thornbush, and bud sagebrush.

2.5.1.4 **Sagebrush.** Less than 1 percent of the study area contains the sagebrush type. This community is present along the west end of the access road where big sagebrush dominates the drainages and low hills. Associated shrub species include blackbrush, Nevada ephedra, goldenweed, twinberry, rubber rabbitbrush, and yellowbrush. The sparse understory contains foxtail chess, bottlebrush squirreltail, desert needlegrass, phlox, and fiddleneck.

2.5.2 Threatened and Endangered Plants

No plants officially listed by the U.S. Fish and Wildlife Service or the State of Nevada are known to occur within the study area and immediate vicinity based on information provided by the Nevada Natural Heritage Program (Knight 1988) and BLM Tonopah Resource Area (Grover 1988; Oyler 1988).

No federal candidate species are known to occur within or near the study area based on Nevada Natural Heritage Program data. A list of "target" species considered for the field clearance surveys was generated based on potential habitat characteristics. ENSR conducted searches for the Funeral Mountain milkvetch (Astragalus funereus) - FC2 species, Mojave sweet pea (Lathyrus hitchcockianus), Ripley's gilia (Gilia ripleyi), and the Mojave fishhook cactus (Sclerocactus polyancistrus) - FC3 candidate species in April 1988. None of these species were encountered during the April field surveys. All cacti and yucca species are protected by the Nevada Cactus-Yucca Law. This law requires that BLM issue a permit for commercial taking in the event that large numbers of cactus plants would be impacted. The manyheaded barrel cactus is the most common cactus species present within the study area. The largest concentrations are located in the blackbrush type on the steep mountain sideslopes near the Telluride Mine and Tram. This area was plotted on topographic maps (Figure 2-3).

2.6 Wildlife

Wildlife information for the project area and vicinity was gathered from publications (Lee et al. 1983) and interviews with resource specialists of the Nevada Department of Wildlife (Las Vegas), BLM (Tonopah), and Nevada Natural Heritage Program. A site visit was conducted in conjunction with the vegetation field studies in April 1988 to identify habitats and observe species present within these areas. Table 2-9 lists the wildlife species observed during the April field studies.

TABLE 2-9

WILDLIFE SPECIES OBSERVED IN THE PROJECT AREA AND VICINITY

<u>Yearlong Residents</u>

- Burro (sign)
- Badger (diggings)
- Coyote (sign)
- Ord kangaroo rat (burrows)
- Valley pocket gopher (diggings)
- Belding ground squirrel (burrows)
- Desert cottontail (sign)
- White-tailed antelope squirrel
- Desert woodrat (midden)
- Ringtail cat (sign)
- California myotis (probable - 2 bat roosts in crevices)
- Gambel's quail (feather, dusting bowls)
- Loggerhead shrike
- Chukar
- Bushtit
- Northern raven
- Longnosed leopard lizard
- Western fence lizard
- Sagebrush lizard
- Chuckwalla
- Desert spiny lizard
- Collared lizard
- Rock wren
- Say's phoebe
- Western kingbird
- Poor-will

<u>Winter Visitors</u>

- Lapland longspur

<u>Migrants</u>

- Sage thrasher
- White-crowned sparrow
- Black-chinned hummingbird
- Cooper's hawk

Source: ENSR April 1988 field survey observations.

As described in the vegetation section, the existing environment consists of plant communities and wildlife habitats characteristic of the Great Basin Desert and the northern Mojave Desert. Wildlife habitat includes open stands of low and dwarf shrubs with trees virtually absent within the study area. Surface water is extremely scarce and limited to Specie Spring, located approximately 3 miles south of the proposed project, and the Amargosa River, which is approximately 4 miles northwest of the project area. These water sources are important to the area's wildlife diversity and crucial to the survival of some species.

Typical species of the project area and vicinity include mammals such as black-tailed jackrabbit, coyote, badger, ringtail cat (in abandoned mines), and kit fox; raptors such as the raven, turkey vulture, prairie falcon, golden eagle, red-tailed hawk, and kestrel; songbirds including the rock wren, Say's phoebe, and western kingbird; gamebirds including chukar and Gambel's quail; and reptiles such as the sagebrush lizard, leopard lizard, collared lizard, chuckwalla, and rattlesnake. Small mammals known to occur within the project area and vicinity include Ord kangaroo rat, desert woodrat, valley pocket gopher, Belding ground squirrel, and white-tailed antelope squirrel.

Mule deer habitat in the Bare Mountain area is considered marginal with low densities. An estimated 30 to 40 deer utilize the Amargosa River area (Beatty vicinity) from spring through fall, and they winter in the Bullfrog Hills and Bare Mountain area. In mid-1988, the BLM began a long-term study of wintering mule deer near the project area. A 100-foot transect was established in 1988 approximately 100 yards southeast of the access road in Section 13 (Grover 1989a). Major mule deer populations and year-long range occur approximately 50 miles north of the project area in the Silver Peak/ Palmetto and Magruder Sylvania Mountain ranges of the BLM Esmeralda Resource Area (Lee et al. 1983).

Although desert bighorn sheep rams occasionally use the Bullfrog Hills to the west during the winter and spring months, bighorns are not known to occur in the Bare Mountain area south of the project area. A release of 20 to 30 bighorn sheep in the Bare Mountain area is planned by the Nevada Department of Wildlife for 1991. Wild burro sign has also been documented in the study area and vicinity (Grover 1988).

Both chukar and Gambel's quail occur within the project region. While Gambel's quail are fairly common in the project area, chukar densities are low. Critical use periods within these areas include summer and fall months. These birds typically move to the lower elevations during the cooler months from November to April.

Although there are no historical records of raptor nests in the study area based on Nevada Department of Wildlife's data base (Haley 1988), potential nesting habitat exists there for such raptors as the golden eagle, red-tailed hawk, and prairie falcon (Grover 1988). No evidence of nesting raptors was found in the April raptor nest survey conducted by ENSR and BLM. Ravens and a migrant Cooper's hawk were the only raptors seen during the survey.

Occasional use by waterfowl and shorebirds occurs in the Amargosa River area (north and south of Beatty) since migration routes tend to follow the Amargosa River valley.

No threatened or endangered wildlife species are known from or are likely to occur in the area potentially affected by the proposed project (Knight 1988; Grover 1988). Crucial habitat for the desert tortoise, a FC2 candidate species, does not occur in the project region (Haley 1988). The project area is located near the northern distribution limits and close to the elevational limits of this species. The Amargosa toad, a FC2 candidate species, is known to occur in springs, canals, and other wet areas 5 miles southwest of the project area (i.e., Amargosa River valley).

2.7 Land Use and Recreation

2.7.1 Land Use and Land Use Plans

2.7.1.1 Existing Land Use. Nye County encompasses 18,064 square miles (11.5 million acres) in southcentral Nevada. It is the largest county in Nevada and the third largest county in the United States (Planning Information Corporation [PIC] 1988). Almost 98 percent of this area is administered by federal, state, and local governments and Native American tribes. A relatively small portion of the total land area (approximately 2 percent) is privately owned. The U.S. Department of Energy's Nevada Test Site and the Nellis Air Force Base Test Range comprise a restricted access enclave of approximately 3 million acres. Ownership in the Beatty and proposed project vicinity is similar to the county as a whole. With the exception of scattered patented lands, the land around Beatty is administered by the BLM. BLM land extends 6.5 miles west of Beatty to Death Valley National Monument and 11.5 miles east of town to Nellis Air Force Base (PIC 1988).

Land uses in Nye County include mining, livestock grazing, agriculture, wildlife habitat, recreation in national forests and monuments, government withdrawals (Indian reservations and test sites), and residential and commercial use in small rural communities.

Land use in the project vicinity is dominated by open space and mining. The small community of Beatty, located approximately 7 road miles west of the project area, is largely residential in nature with supporting public facilities. The Rhyolite area, located approximately 9 miles west of the project area, is an historic gold mining town with a few existing scattered residences and historic structures.

Other existing land uses in the vicinity of the proposed project area include an AT&T communications site on Bare Mountain and several active mining operations.

Part of the access road that USNGS is proposing to use was constructed for and is used by AT&T for access to their AT&T communications site. The AT&T access road is a 50-foot wide ROW (#NEV066111) located in T12S, R47E, Sections 13-17 and 24 (Ross 1989).

The Daisy Fluorspar Mine is located approximately 3 miles southwest of the proposed project. Other mines -- the Gold Ace Mine, Panaca Mine, Diamond Queen Mine, and the Telluride Mine -- are found on the east and west sides of Bare Mountain.

2.7.1.2 Land Use Plans. A land use plan is considered the basic element of the 1970 Nye County General Plan, which was updated in 1978 and is still in effect, even though the county does not use it as a working document when making land use decisions (Williams 1989). A few key elements in the 1978 Nye County Land Use Plan are:

- Current and past uses of the land resources should be a guide for the development of future planning elements.
- The concept of multiple use should be the overriding policy in planning for federally controlled lands.
- The mining and agricultural uses of lands are strongly held as a best use for much of the land within Nye County.

Future land uses in Nye County are expected to follow current trends. Mining and military activities are projected to increase, while ranching and grazing uses are projected to remain steady.

Land use control on private land is exercised by the County Commissioners and the County Planner through enforcement of subdivision and mobile home/recreational vehicle park regulations (Williams 1989). This control extends over the entire county including unincorporated communities such as Beatty; only the incorporated Town of Gabbs is exempt. Nye County has no zoning regulations at the present time and none are proposed (Williams 1989).

Given the large percentage of federal land in Nye County, Forest Service and BLM management programs will continue to have great influence on land use in the county. The BLM's Esmeralda-Southern Nye Resource Management Plan (Record of Decision for Planning Area A, 1986) generally follows a philosophy of multiple use. Specific objectives pertinent to the project area include:

- To improve opportunities for economic development by substantially increasing the amount of non-federally owned land within the planning area.
- To make available for use and encourage the development of mineral and energy resources to meet national, regional, and local needs, consistent with declared national objectives for an adequate supply of minerals at reasonable market prices.
- To ensure a system for transmission of utilities through the planning area by establishing corridors which will meet the long-range planning needs for utility companies and avoid sensitive resource values.

2.7.2 Recreation

Outdoor recreation resources in Nye County range from historic ghost towns to hunting, fishing, and camping opportunities. BLM-managed lands play a significant role in the recreation setting. The major activities include hunting for big game (deer and cougar) and small game (chukar, rabbit, quail, and dove), hiking, mountain climbing, camping, photography, sightseeing, rockhounding, and off-road vehicle (ORV) driving.

There are no developed recreation facilities and only limited undeveloped, dispersed recreation opportunities in the project area (Grover 1989b). Sightseeing, hunting, and ORV use represent the largest outdoor recreation activities in the project area (Grover 1989b).

Death Valley National Monument is located approximately 12 miles southwest of the project area. Between 1986 and 1987, the number of visitors to Death Valley National Monument increased approximately 13 percent to 692,964.

2.7.3 Wilderness

The closest potential wilderness area is the Grapevine Mountains Wilderness Study Area (WSA), located approximately 20 miles northwest of Beatty, and approximately 25 miles northwest of the project site, along the California/Nevada border in Esmeralda and Nye Counties. This 66,800-acre unit is generally located at the northern end of the northwest-trending Grapevine Mountains.

The preliminary decision is to recommend all 66,800 acres within the Grapevine Mountains WSA as nonsuitable for wilderness designation (BLM Esmeralda-Southern Nye Record of Decision, Planning Area A, 1986). A final decision will be made by the United States Congress after 1991. All wilderness study areas will continue to be managed under the BLM's Interim Management Policy and Guidelines for Lands Under Wilderness Review until completion of the wilderness review process.

2.7.4 Grazing

The project area is located within the Razorback Allotment. This allotment encompasses 70,893 acres. It is an individual allotment with a total preference of 1,344 AUMs on a yearlong lease. The lessee has been running full active preference over the last 5 years. This allotment has been allocated on the basis of approximately 53 acres/AUM (Oyler 1989). Grazing by cattle is very infrequent at the site because of the long distance from water.

2.7.5 Wild Burros and Horses

The project area is located within the Bullfrog Herd Management Area. The BLM recommends an appropriate management level in this area of 12 wild horses and 218 wild burros (Pogacnik

1989). The BLM did a complete field count on August 1, 1988. There were 256 burros and 0 horses counted. The BLM planned to do a gather of some burros to get the herd down to the appropriate management level of 218; however, there was a challenge to that plan so the operation is currently on hold (Pogacnik 1989). There is no herd management area plan for this area. Wildhorse and burro use is infrequent at the site because of the long distance from water.

Data on animal condition are scarce; however, visual observations and the belief that the burro populations are increasing tend to indicate that, overall, the burros are in at least fair condition (Pogacnik 1989). Vegetative conditions within the Bullfrog Herd Management Area vary.

Competition for forage occurs between horses and burros, and cattle, as their diets overlap. There are some areas of apparent overgrazing; however, it is difficult to distinguish between horses, burros, and cattle grazing patterns (Pogacnik 1989). Habitat conflicts between horses, burros, cattle, and wildlife also occur and are generally related to the availability and distribution of water. Water within the Bullfrog Herd Management Area is especially limited causing increased competition for forage and space. Water is particularly scarce east of Beatty. The only naturally occurring water source in the proposed project area is Specie Spring, located approximately 3 miles south of the proposed project site (Pogacnik 1989).

2.7.6 Areas of Critical Environmental Concern (ACECs)

At the present time, there are no designated ACECs within the project area (BLM 1986; Pogacnik 1989).

2.8 Cultural Resources

2.8.1 Regional Overview

The earliest ethnographic data available for Southern Paiute and Shoshoni peoples who utilized the Mojave Desert region is that gathered during interviews in 1935-1936 by Julian Steward (1970). His information is the basis of ethnographic models devised to interpret settlement and subsistence patterns of prehistoric populations.

Although major temporal units for the region's prehistory are well established, absolute dates are not clearly associated, especially for early intermediate periods. In addition, cultural periods have been assigned a plethora of names in the archaeological literature of the Mojave Desert region, due in part to a tendency for establishing localized chronologies (Pippin 1984; Warren and Crabtree 1986) during investigation of major sites. A bibliography of this literature has been prepared by Pippin and Zerga (1981).

The cultural sequence described here was developed by Warren and Crabtree (1986). It derives from a chronology published by Bettinger and Taylor (1974) and modified by Warren et al. (1980), with dating based on a range of characteristic projectile points and associated radiocarbon dates. Further definition is organized around changes in other distinctive artifact types, such as pottery, or such additions to the tool kit as groundstone. These dated periods are not homogeneous in time or space, for variations and overlap in cultural remains occur within sites characteristic of each period.

Lake Mojave Period (10,000 B.C. - 5,000 B.C.), the Early Man complex, is characterized by surface sites on the shores of extinct lakes. Artifact assemblages include heavy core tools, simple crescents, ovoid and keeled scrapers, leaf-shaped, long stemmed, shouldered short stemmed, and fluted projectile points, but not grinding tools.

Pinto Period (5,000 B.C. - 2,000 B.C.) sites contain artifacts with some Lake Mojave Period artifact characteristics, implying an ongoing tradition of tool form and manufacture. Simple flat milling stones in these sites point to the beginning of a seed processing technology accompanying the generalized hunting and gathering subsistence systems of a mobile people using resources in a wider variety of ecological zones.

The Gypsum Period (2,000 B.C. - A.D. 500) is characterized by medium to large stemmed and notched projectile points, as well as smaller point types, indicating a gradual transition from dart and atlatl to bow and arrow. Increasing numbers of grinding stones connote greater reliance on seeds.

The Saratoga Springs Period (A.D. 500-A.D. 1,200) shows continuity with the Gypsum Period. Smaller projectile points and numerous grinding stones dominate assemblages.

The Shoshonean Period dates from A.D. 1,200 to the time of European contact. Diagnostic artifacts include small Cottonwood and Desert Side-notched points and various types of brownware pottery. According to Steward (1970:59, 94), historic Shoshone population was centered in Oasis Valley, northwest of the project area.

Historically, Europeans appear to have entered the region in 1853, when Fremont passed through Nevada, "leaving near present-day Beatty" on his way to California (Elliot 1973). There was little activity in the area in the late 1800s. In 1881, 3,000 acres were under cultivation in eastern Nye County, and the nearest mining activity was located in the Gold Mountain District in Esmeralda County, about 40 miles to the northwest. Nye County mineral production declined from a gross yield of over $900,000 in 1878 to a low of just over $35,000 in 1900 (Couch and Carpenter 1943). Prospectors discovered gold in the Bullfrog mining district in 1904, and activity centered around Rhyolite, about 10 miles west of the project area. Maximum gross yield from mineral production for Nye County was almost $10 million in 1918.

In 1905, gold was discovered in Fluorspar Canyon on the northeast slope of Bare Mountain, and the gold camp of Telluride was started (Lincoln 1982). Gold production lasted less than a year, and Telluride later became a mercury mining camp. Gold and silver production in the Bare Mountain Mining District ranged between $1 to $3 million; fluorspar (fluorite), mercury, volcanic cinders, pumicite, and uranium have also been mined in the district (Cornwall 1972).

The Beatty post office was established in 1905, and the town was important as a shipping point for nearby mining communities. In 1906, the Las Vegas and Tonopah Railroad was constructed to Beatty; the Tonopah and Tidewater and the Bullfrog-Goldfield Railroads also operated here (Mordy and McCaughey 1968).

2.8.2 Cultural Resources Inventory

Intermountain Research has conducted four surveys to identify cultural resources present in the project area; these surveys covered the entire project area. A fifth survey consisted of extensive recordation of selected historic sites. A total of 37 prehistoric sites, 17 historic sites, and 1 site with both prehistoric and historic components have been identified within the project area. A summary of these sites is included below.

The Prehistoric sites include 11 toolstone quarries, 5 knapping stations, 4 temporary camps, 4 task sites, 3 multi-purpose sites, 5 isolated artifacts, and 6 sites of undetermined type. The historic sites consist of 7 domestic/habitation sites (including Telluride and Bond mining camps), 6 mining-related sites, and 5 prospects. A site with both prehistoric and historic components consists of a large prehistoric quarry with chert and quartzite flakes and a historic stone mining cairn and two mining excavations (this site is included in the lists of both prehistoric and historic sites above).

2.9 Aesthetics

2.9.1 Visual Resources

The BLM has implemented a visual inventory and analysis process to provide a systematic interdisciplinary approach to the management of aesthetic values on public lands. The Visual Resource Management system provides methodology needed to inventory existing scenic quality and assign visual resource inventory (VRI) classes based on a combination of scenic values, visual sensitivity, and viewing distances. Visual resource classes have been established to serve two purposes: 1) as an inventory tool portraying relative value of existing visual resources, and 2) as a management tool portraying visual management objectives. Management objectives for each of the four visual resource classes are listed in Table 2-10.

The study area for the proposed Mother Lode Project contains a VRI Class II area in Perlite Canyon and a small Class III area associated with "badlands" topography near and to the north of the cistern (T12S, R48E, Section 7). The rest of the area in the viewshed of the project is designated VRI Class IV (Figure 2-4).

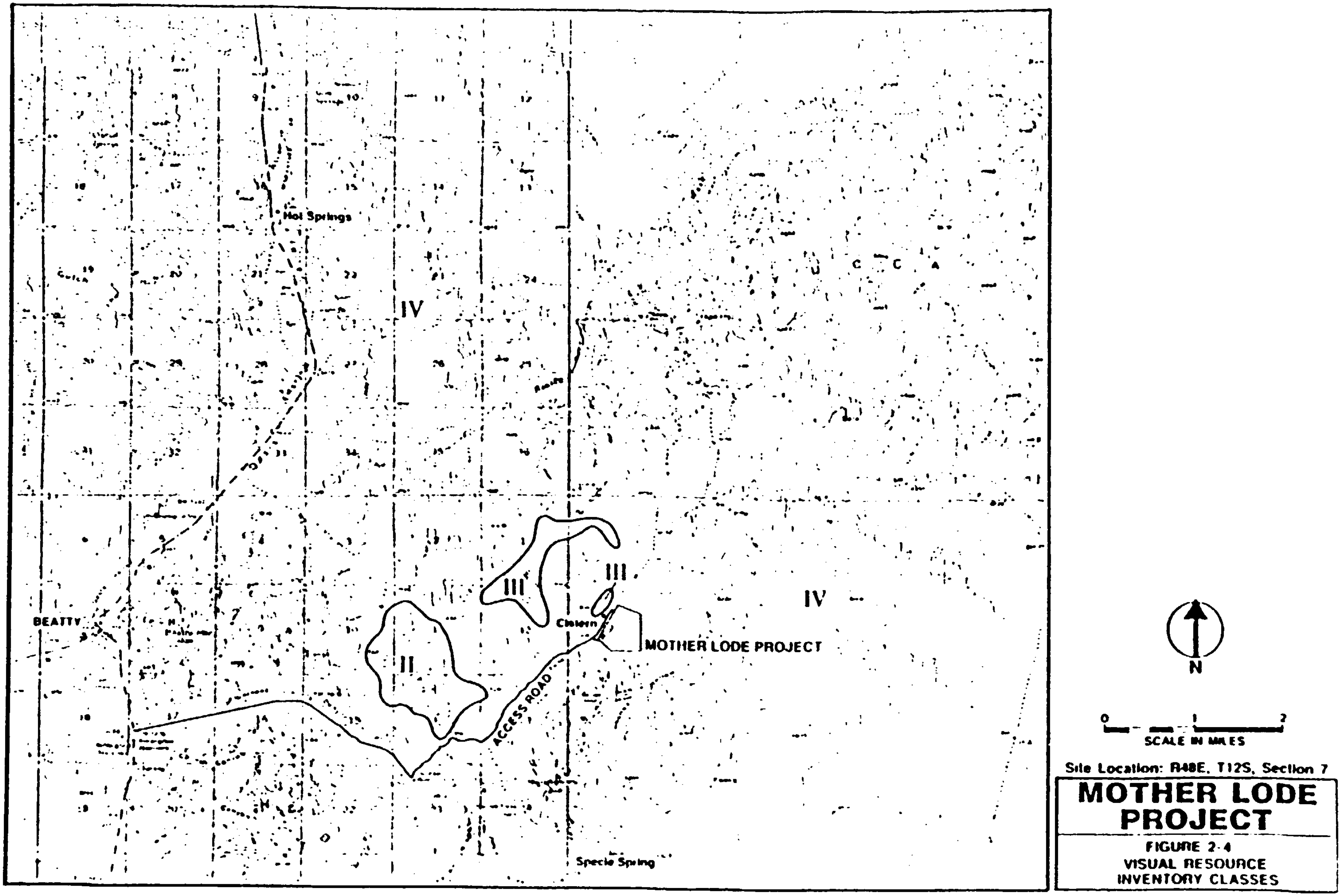
A scenic quality evaluation of the study area indicated that most of the area warranted a relative quality rating of C (the lowest on a scale from A to C) in comparison with other landscapes in the Basin and Range Physiographic Province (U.S.D.I. 1986). The C rating is attributable largely to a lack of variety in visual elements and the abundance of similar visual character throughout the province. Beatty Mountain and portions of Bare Mountain are rated B because of more rugged, and thus more dramatic, cliffs and rock outcrops in those areas. The eroded and pock-marked "badlands" terrain to the north of the cistern is also rated B because of its unusual textural character and colors that contrast sharply with most of the surrounding area. Perlite

TABLE 2-10

VISUAL RESOURCE MANAGEMENT CLASSES

Class I Objective:	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective:	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective:	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective:	The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.
Rehabilitation Areas:	Areas in need of rehabilitation from a visual standpoint should be flagged during the inventory process. The level of rehabilitation will be determined through the resource management planning (RMP) process by assigning the VRM class approved for that particular area.

Source: BLM Manual Handbook 8410-1.



Site Location: R48E, T12S, Section 7

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FIGURE 2-4
VISUAL RESOURCE INVENTORY CLASSES

Canyon is rated A for scenic quality because the drama of the unusual rock formations and the sense of enclosure one experiences combine to provide a visual effect that is uncommon in the area.

Visual sensitivity is rated low for most of the study area because visitor use levels are very low (backcountry). Sensitivity is rated moderate for Perlite Canyon and the cistern badlands because of expressed local concern for these resources. Viewing distances are ranked foreground-middleground for the entire study area. The backcountry area surrounding the mine site is largely screened by terrain from the viewshed of travelers on U.S. 95 and residents of Beatty. Observation points were established near the cistern and on the entrance road to represent the few users who do visit this backcountry valley. The valley would be foreground-middleground for these viewers.

The composite result of the visual characteristics noted above is VRI Class IV rating for much of the study area, which would accommodate activities resulting in "major modification" of the existing visual character. The small Class III area would accommodate only moderate levels of visual change. In contrast, the existing landscape character is to be maintained in the area rated Class II with only low levels of visual change permitted.

2.9.2 Noise

A description of the environment potentially affected by noise emissions from the proposed project includes identifying noise sensitive receptors and existing noise sources in the vicinity, characterizing terrain features that may affect noise transmission, and determining existing noise levels.

The proposed project would be located in a small basin between Tates Wash and Joshua Hollow about 7 road miles east of Beatty. The nearest noise receptor is over 4 miles away, near U.S. 95.

Existing noise sources include natural sounds from wind, birds, and insects; low-level equipment sounds from project-related mining exploration activity; and occasional noise from low-level aircraft overflights related to the nearby Nellis Air Force Base practice range.

The project site is surrounded by complex, varied terrain. The basin is effectively isolated from sensitive receptors by ridges of hills and mountains that would function as noise barriers in most cases.

Monitoring of existing noise levels was not deemed necessary because of the remote location of the project area and the paucity of existing noise sources. Existing noise levels were instead estimated, based on EPA literature and ENSR file data for similar sites. Existing noise levels are estimated to fall in a range of 30 to 50 decibels, A-weighted (dBA). The middle of the range represents typical noise levels in small rural communities. Lower levels would be typical of the area when human activity is not occurring and there is little or no wind. The upper end of the range would be typical of windy periods with brief excursions above 50 dBA expected during low-level aircraft overflights.

2.10 Socioeconomics

The primary study area for the socioeconomic assessment is Nye County in southcentral Nevada, including the communities of Beatty and Amargosa Valley and the historic townsite of Rhyolite. There are no incorporated towns within Nye County except Gabbs; therefore, all administrative functions are provided by the county government in Tonopah. The primary governing bodies are the Nye County Commissioners and the Planning Commission. Other advisory bodies include a seven-member school board, a five-member hospital board, and other town boards.

The County Commissioners set the annual budget for the Town of Beatty and enact ordinances and policies on the recommendation of the five-member Beatty Town Advisory Council. The Town of Beatty has a mill levy and generates ad valorem tax revenues for the county and school district. Federal agencies such as the BLM play a major administrative role in Nye County since nearly 98 percent of the land area of the county is under federal administration.

2.10.1 Population

The population of Nye County increased 54.6 percent between 1980 and 1987; the estimated population in Nye County was 13,989 in 1987 (Table 2-11). The 1985 special census figure

TABLE 2-11

STUDY AREA POPULATION 1980 TO 1985

	1980	1981	1982	1983	1984	1985	1986[1]	1987[1]	1988[1]	Percent Increase 1980 to 1988
Beatty	740	839	874	900	880	925	903	957	1,011	36.6
Amargosa Valley	1,024	902	964	954	994	1,191	785	673	675	(34.1)
Tonopah	2,319	3,518	3,854	3,381	3,657	3,340	NA	NA	NA	44.0[2]
Nye County	9,048	10,005	11,934	12,348	13,385	13,385	13,493	13,989	NA	54.6[3]

Source: U.S. Bureau of the Census, Census of Population 1980.
Special Census of Nye County - Summary Report - August 1985.
Nye County

[1] Estimated, Planning Information Corp.

[2] 1980 to 1985.

[3] 1980 to 1987.

includes 865 people associated with the U.S. Department of Energy Nevada Operations Office residing in Nye County.

During the 7-year period from 1980 to 1987, the population of Beatty grew 29 percent, and Amargosa Valley actually declined in population by 29 percent since fiscal year 1982-1983 (PIC 1988). Amargosa Valley has lost population due to the closing of the American Borate Company (ABC) Mine. The 1988 population of the Town of Beatty was estimated at 1,011 (PIC August 1988). Bond Gold estimates approximately 600 workers are currently working on the Bullfrog Project which would increase the population to approximately 1,600, assuming some workers live outside the Beatty area (Bond Gold 1989). Most of the growth in population throughout Nye County can be attributed to increased military and mining activity. Table 2-11 shows the population of Beatty, Amargosa Valley, Tonopah, and Nye County.

2.10.2 Economic Base

The economy in Nye County depends largely on two basic industries: mining and military activity including Nellis Air Force Base, the Tonopah Test Range, and the Nevada Test Site. Other important sectors include tourism and government. Beatty is one of the three largest Nevada entrances to Death Valley National Monument and provides services and overnight accommodations for tourists traveling to the Monument as well as those traveling through Nevada on U.S. 95. Tonopah acts as a regional center for Nye County since it is located midway between Reno and Las Vegas. It is also the county seat of Nye County and provides county-wide public services and facilities.

2.10.3 Employment and Income

Due to the nature of the primary industries in the area (mining and military), it is understandable that fluctuations in employment and income occur regularly. The frequent upswings and downturns of the major economic sectors cause instability among the non-basic sectors and result in fluctuations in unemployment rates and a general sense of economic instability. Table 2-12 shows employment by place of work from 1981 through 1987 for Nye County. Fluctuations in the mining and construction sectors have occurred throughout the period. The services sector represents 12.9 percent of total employment and has shown a steady increase from 1981 through 1987, except for a slight decline in 1986.

TABLE 2-12

NYE COUNTY EMPLOYMENT BY MAJOR INDUSTRY (ANNUAL AVERAGE)[1]

	1981	1982	1983	1984	1985	1986	1987	1987 Percent of Total
Total Employment	9,236	9,893	9,857	10,390	11,117	11,252	12,031	100 %
Farm	242	229	224	213	204	213	213	1.8
Non-farm	8,994	9,664	9,633	10,177	10,913	11,039	11,818	98.2
Private	8,244	8,882	8,825	9,291	10,045	10,072	10,864	90.3
Ag., Serv., Fish, For.[2]	25	26	21	21	25	26	26	0.2
Mining	1,569	1,452	1,153	1,244	893	999	1,167	9.7
Construction	445	225	177	172	338	331	503	4.2
Manufacturing	95	95	83	88	94	115	101	0.8
T.C.P.U.[3]	158	170	149	142	145	134	206	1.7
Trade	682	695	646	675	720	661	729	6.1
F.I.R.E.[4]	472	334	317	394	423	417	440	3.7
Services	4,798	5,885	6,279	6,555	7,407	7,389	7,691	63.9
Government	750	782	808	886	868	967	954	7.9
Fed, Cir.	127	136	141	132	130	163	161	1.3
Military	76	63	67	65	63	65	65	0.5
State & Local	547	583	600	689	675	739	728	6.1

[1]Reflects non-agricultural employment by place of work. Includes all workers in Nye County regardless of place of residence and includes multiple job holders.

[2]Agriculture Services, Fishery, Forestry.

[3]Transportation, Communications, Public Utilities.

[4]Finance, Insurance, Real Estate.

Recently, mining activity has shown a dramatic increase in exploration and production. Nevada now produces over 50 percent of the gold mined in the United States and has 12 of the nation's largest gold mines (Clark, Nevada Employment Security Economic Update 1988). Nevada is the leading gold and silver producer in the United States. Statewide direct employment in gold and silver mining operations grew from 4,499 in 1985 to 6,300 in 1986. The statewide 1987 estimated average employment associated with mining was 7,900. Preliminary figures for 1988 show a considerable increase in mining employment state wide; over 10,400 jobs were associated directly with mining according to state estimates. Nye County mining employment accounted for 14.7 percent of the state total in 1987. The services sector is the largest employer in Nye County with 63.9 percent of total employment; the mining sector represented the second largest employment sector in 1987 with 9.7 percent of total employment, followed by the government sector at 7.9 percent (U.S. Bureau of Economic Analysis 1988).

The 3.4 percent unemployment rate in Nye County in December 1988 remained lower than the December state figure of 4.5 percent, despite fluctuations in employment among sectors (Nevada Employment Security Dept. 1989). This implies that populat... out-migration has kept pace with changing job opportunities.

Between 1984 and 1986, per capita personal income increased by 4.9 percent to $11,946 (U.S. Bureau of Economic Analysis 1988). Nye County ranks 15th out of 17 counties in Nevada in per capita income. The state average per capita personal income was $15,380. With the influx of more mining employment in the area, the per capita personal income should continue to increase.

2.10.4 Public Fiscal Conditions

Financial resources of the study area refer to government revenue sources and expenditures in Nye County and its communities. These financial statistics are important in helping to determine the fiscal impacts of industrial development on local government jurisdictions.

From 1984 to the current fiscal year 1989, assessed valuation throughout the area has grown at a moderate rate. Assessed valuation in Beatty declined in 1988-1989 due to personal property depreciation and little new development. However, from 1987-1988 to 1988-1989 Nye County assessed valuation increased by 20.5 percent. This is considerably higher than the average annual increase from 1984-85 and reflects a large portion (40 percent) of net mine proceeds. Table 2-13 shows assessed valuation for Beatty and Nye County.

2.10.4.1 Town of Beatty. Revenues and expenditures for the Town of Beatty have been examined over the fiscal period 1982-1983 through 1988-1989 and are presented in Table 2-14. All of the budget figures presented in the text and Table 2-14 are actual.

Revenues. The town receives operating revenues through four major sources: taxes [property and Supplemental City/County Relief Tax (SCCRT)], local licenses, fines and forfeitures, and "other" revenues. Total general fund revenues increased from $36,542 in 1982 to $91,027 in 1988. Miscellaneous revenues received by the town include payments from Nye County School District, grants from Nye County, and miscellaneous rents and sales.

Expenditures. The town's general fund expenditures are broken into three categories: general government, public safety, and culture and recreation. Total operating expenditures have increased from $35,186 in 1982 to $114,888 in 1988. This is due in large part to the growth in spending in the fire department, which was associated with hiring a full-time employee. Capital spending has varied between zero in most years to $13,000 for administration in 1986-1987.

Beatty maintains a separate debt service fund, supported by a property tax. The town is paying off a $90,000 building bond issued in 1973; the debt will be repaid in 1991. Currently, Beatty's debt capacity is $1.60 million, with $15,000 of debt outstanding, less than 1.0 percent of the legal debt limit.

2.10.4.2 Nye County. Nye County provides many governmental services to the Beatty area. The most important services provided include sheriff protection, road maintenance, general government, and judicial services. Trends in revenue and expenditures for the county general fund from 1982 to 1988 are shown in Table 2-15.

Revenues. The Basic City/County Relief Tax (BCCRT) and Supplemental City/County Relief Tax (SCCRT) have been the major sources of revenue for the general fund. In 1988, the BCCRT and the SCCRT accounted for 11 percent and 34 percent, respectively of the total general fund revenues.

TABLE 2-13

ASSESSED VALUATION BY JURISDICTION

	Tax Rate $100 Assessed Valuations 1988-1989	Fiscal Year 1984-1985	Fiscal Year 1985-1986	Fiscal Year 1986-1987	Fiscal Year 1987-1988	Fiscal Year 1988-1989	Average Annual Increase (Percent)
		Thousands of Dollars					
Nye County	.6205	280,987	310,566	328,156	347,552	418,900	10.5
Beatty	.1736	4,936	5,097	5,407	6,125	5,903	4.6

Source: Nevada Department of Taxation, Local Government Finance, 1984-1989.

TABLE 2-14

BEATTY TOWN GENERAL FUND REVENUES AND EXPENDITURES

	1982	1983	1984	1985	1986	1987	1988	1988 Percent of Total
Revenues:								
Taxes								
Property Tax	4,116	4,677	8,487	7,237	7,565	7,044	5,771	6.3
(other than net proceeds)								
Licenses & Permits	6,637	8,471	18,709	19,924	20,334	22,075	22,460	24.8
Intergovernmental								
SCCRT	10,849	12,151	11,256	13,149	12,760	15,357	19,884	21.8
MVPT	2,431	2,093	2,456	2,643	3,168	3,136	3,400	3.7
Other						1,425	2,646	2.9
Charges for Services	9,622	9,930	10,300	10,215	9,660	8,900	11,230	12.4
Misc.		3,226	842	742	8,115	917	14,136	15.5
Fines & Forfeitures	2,887	3,665	2,927	5,068	11,666	11,113	11,500	21.6
TOTAL REVENUES	36,542	44,213	54,977	58,978	73,268	69,967	91,027	100%
Expenditures:								
General Government	9,077	9,026	6,601	9,780	10,872	7,862	9,650	8.4
Public Safety	7,012	11,171	36,351	36,124	39,353	41,873	64,891	56.5
Culture/Recreation	19,097	25,011	23,959	25,897	31,902	40,155	40,347	35.1
TOTAL EXPENDITURES	35,186	45,208	66,911	71,801	82,127	89,890	114,888	100%

Source: PIC 1988

TABLE 2-15

NYE COUNTY REVENUE & EXPENDITURE ANALYSIS 1982 - 1988

(THOUSANDS OF DOLLARS)

	1982	1983	1984	1985	1986	1987	1988	Percent of Total (1988)	Average Annual Percentage Increase
Revenues:									
Taxes:	572,272	697,991	1,275,058	1,026,325	1,095,787	1,007,741	1,042,564	14.6%	10.5%
Licenses:	50,926	53,801	58,521	66,738	57,126	58,696	60,853	0.9	3.0
Intergovernmental:									
Fed In-Lieu	343,791	314,390	323,067	398,583	403,978	416,814	430,532	6.0	3.8
BPTT	37,168	* ,127	107,521	82,489	62,444	71,241	85,320	1.2	14.9
Cigarette	135,710	159,669	162,718	202,091	223,653	186,330	182,911	2.6	5.1
Liquor	20,845	25,131	29,535	32,312	35,479	27,671	27,311	0.4	3.3
State Gaming Lic.	127,496	124,497	124,152	120,773	130,422	129,728	137,423	1.9	1.3
BCCRT	364,808	351,412	549,928	706,661	667,159	728,066	800,422	11.2	10.0
SCCRT	972,531	1,673,013	1,686,842	1,779,571	1,855,966	2,239,634	2,415,840	33.8	16.4
MVPT	211,341	190,855	209,600	239,641	260,069	274,727	314,000	4.4	6.8
Motor Veh. Lic.	12,580	14,713	16,025	15,462	15,261	9,836	9,109	0.1	(5.8)
Repos Planning	0	0	0	44,651	80,187	97,960	191,294	2.7	62.4
Charges for Services	367,397	260,677	437,627	476,938	492,234	786,849	899,451	12.6	16.2
Fines & Forfeitures	72,406	110,192	86,977	114,697	164,329	188,464	184,714	2.6	16.9
Misc.	85,648	82,088	146,675	143,473	169,157	175,091	356,366	5.0	26.8
Total General Fund Revenues:	3,374,119	4,140,556	5,214,246	5,450,705	5,713,251	6,398,848	7,138,190	100.0%	13.3%

TABLE 2-15 (CONTINUED)

	1982	1983	1984	1985	1986	1987	1988	Percent of Total (1988)	Average Annual Percentage Increase
Expenditures:									
General Governments	2,275,086	1,754,251	1,677,106	2,003,552	2,453,930	2,622,601	2,500,828	39.6	1.6
Judicial	262,045	480,096	545,683	597,627	690,494	792,696	885,167	14.0	22.5
Public Safety	1,542,686	1,875,506	1,913,093	2,250,691	2,502,906	2,745,045	2,741,762	43.4	10.1
Health & Welfare	--	66,367	70,938	104,261	125,188	106,732	122,178	1.9	13.0
Other	27,742				39,820	67,476	63,349	1.1	14.7
Total General Fund Expenditures	4,107,559	4,176,220	4,206,820	4,956,131	5,812,338	6,334,550	6,313,284	100.0	7.4

Source: PIC 1988.

The county's general property tax is the next single most important revenue source representing nearly 14.6 percent of total revenues. In 1988-1989, the county-wide mill levy was the lowest it has been for over 6 years. Actual property taxes collected have fluctuated over the period. Locally generated revenues including licenses and fees, fines, and forfeits, and charges for services generated 15 percent of total revenues in 1988. Intergovernmental revenues include distributions of funds from federal and state sources. These sources generated 20 percent of total revenues during 1988.

The revenue area showing the greatest growth throughout the period other than miscellaneous and depository planning was fines and forfeitures with a 16.8 percent average annual increase. Charges for services grew by 16.1 percent, and SCCRT revenues grew by 16.4 percent during the period.

A recent fiscal analysis completed by PIC shows that the Nye County general fund has been increasingly dependent on intergovernmental revenues and service charges. Property tax revenues have become increasingly volatile due to the cap imposed in 1982. In 1987, property tax allocations to general fund activities fell drastically due to property tax proceeds being used for capital projects. This appears to be a short-term impact, but it has significantly affected operations of general fund activities for this year, particularly public safety.

A vote to increase the ceiling on the net proceeds of mines tax from 2 to 5 percent is scheduled on May 2. Passage of Senate Joint Resolution 22 would increase tax revenues that accrue to the State of Nevada and Nye County.

Expenditures. General fund expenditures are grouped into four major categories which include: general government, public safety, judicial, and health and welfare. General government includes executive functions, finance, assessor, and building and grounds. Historically, general government function expenditures have accounted for an average of 40 percent of the general fund. Overall general government spending is the second largest budget category in the county. Public safety has been the largest single category, averaging 48 percent of total general fund spending.

The judicial category includes district courts, attorneys, and the justice court system in all the towns in Nye County. Total judicial spending has averaged 14 percent of the general fund spending during the study period. Expenditures for the Beatty Justice Court have shown steady growth over the period. Beatty court has increased expenditures 22.5 percent from $262,045 in 1982 to $885,167 in 1988. All expenditure areas increased somewhat during the study period; public safety (10.1 percent), general government (1.6 percent), and judicial (22.5 percent).

One area where expenditures have obviously lagged during the period is in the area of capital improvements. The Nye County infrastructure is in need of upgrading. Additional space for government services is needed throughout the county, and new purchases need to be made to replace antiquated equipment. This process of upgrading the infrastructure is beginning in Nye County.

Between 1982 and 1987, Nye County has not exceeded 5 percent of the 10 percent debt limit set by the State. The county has 99 percent of its debt capacity available at this time. As shown in Table 2-15, operating expenditures have remained nearly constant between fiscal 1982 and 1987. Cumulative revenues have exceeded expenditures.

2.10.5 Housing

Nye County showed an increase of 2,109 year-round housing units from 1970 to 1980 (Table 2-16). The 1985 special census indicated total year-round housing units had grown by 1,766, for a total of 5,968 dwelling units county-wide. Of the 5,968 dwelling units, 974 are located in Beatty and Amargosa Valley. Table 2-17 shows permanent and temporary housing accommodations in Beatty and Amargosa Valley. The survey was completed by PIC in March 1987. Since the survey, new housing has been built and new mobile home units have been moved into many available lots within the Beatty town boundary. Most of these have been connected to the Beatty Water and Sanitation District lines.

The condition and type of housing varies throughout the county. The 1985 special census showed that of the 516 housing units in Beatty, 61 percent were mobile homes and 20 percent were wood frame houses. In Amargosa Valley, 80 percent of the 458 units were mobile homes and 7 percent were wood frame houses. A more recent study by PIC (1988), estimates approximately 400 housing units in Beatty (comprised of 10 percent stick-built single-family and multi-family structures, 50 percent owner-occupied mobile homes, and 40 percent units in mobile home parks). The discrepancy between the two numbers may be explained by the type of units

TABLE 2-16

TRENDS IN HOUSING UNITS 1970 TO 1985

	1970	1980	1985	1980 to 1985 Percent Charge
Nye County	2,093	4,202	5,968	42.0
Beatty	NA	320	516	61.3
Amargosa Valley	NA	412	458	11.2

Source: U.S. Bureau of the Census, 1980; 1985 Special Census of Nye County - Summary Report; Bureau of Business and Economic Research; UNR, 1970; Census of Population and Housing Microfilm File A.

TABLE 2-17

EXISTING HOUSING STOCK IN

BEATTY AND AMARGOSA VALLEY

	Beatty	Amargosa Valley
Housing Units		
Mobile Home	313	366
Wood Frame	101	34
Multiple	52	21
Other	50	37
Total	516	458
Vacancy	0%	NA
Mobile Home Park Spaces and Rentals	135	107
Mobile Home Rental Rates		
8' - 1 bedroom	$175-225	
10' - 2-3 bedrooms	$225-275	
12' - 2-3 bedrooms	$275-350	
14' - 3-4 bedrooms	$300-$375	
Temporary Housing		
Motels	195 + (60)[1]	0
R.V. Spaces	110	0

Sources: 1985 Special Census of Nye County Summary Report; Planning Information Corp., Yucca Mountain Draft Socioeconomic Studies; Lane Schultz; Planning Information Corp., Community Development Report, 1988.

[1] Under Construction.

counted. The 1985 special census may have counted units not legally in the water and sewer district. Motel units may also have been counted as households.

Beatty is largely a mobile home town, currently providing temporary housing for mining and other non-permanent workers. Many local residents own one-half blocks, which have been divided for mobile home spaces.

Beatty is currently faced with a severe housing deficit due to the construction phase of Bond Gold's Bullfrog Project. Every available housing unit and recreational vehicle (RV) site is essentially occupied (Stansbury 1989; Walker 1989). Many people looking for permanent housing are occupying RV trailers due to the shortage of available housing. The only available housing exists at Bond Gold's mancamp south of Beatty. An estimated 150 workers are currently living at the mancamp (Stansbury 1989). These accommodations are suitable for single construction workers who have not brought their families with them to the jobsite.

The influx of people has not only impacted the Beatty area, but has also filled up vacant housing throughout the Amargosa Valley. In summary, with the exception of Bond's mancamp, all available housing is essentially filled in Beatty and Amargosa Valley at the current time. According to Marvin Walker of the Beatty Water and Sanitation District, there are few vacant properties with water and sewer service in place; however, most of the original Beatty townsite has mains available in the street ready for tie-ins to the property. The Beatty Water and Sanitation District lists 23 mobile home parks serving a total of 245 mobile home units and RV spaces. Most of these spaces are 100 percent occupied during the winter with some availability during the summer months. At the existing mobile home parks, there are existing water and sewer hookups to serve an additional 40 mobile homes (PIC 1988).

The Rio Rancho Mobile Home Park offers 36 RV spaces. These typically have a 75 percent vacancy rate; they are currently 100 percent occupied. The other RV parks generally have temporary and permanent spaces available and cater to the traveler/tourist; currently these spaces are all close to 100 percent occupied.

Beatty has 5 motels with a total of 195 units. Owners and managers reported that they have recently experienced full occupancy. This is due largely to the construction phase of the Bond Gold project and other exploratory mining activity and drilling around Beatty. Prior to this influx of people, the occupancy ranged from 40 percent to 100 percent from October through May with the highest occupancy rates in the prime season.

In addition to the available Beatty housing, vacant housing and mobile home spaces exist in Amargosa Valley due to the closing of the ABC Mine. However, ABC cannot legally lease the trailer park at this time.

The Rhyolite townsite includes both private and public lands. The largest parcel is the old depot and surrounding property. Land in Rhyolite could be developed for additional residents. The BLM has designated the land outside of Beatty for disposal; therefore, individuals would have the opportunity to purchase BLM land for private use.

A recent newspaper article in the Death Valley Gateway Gazette identified a joint venture land development plan between a local developer and a Phoenix developer. The plan calls for an eventual 468-acre commercial, industrial, and residential development. Recently, 30 mobile home units in the plan were approved by state officials, with 260 units likely to receive approval within 60 days. If this development does occur, the immediate area housing shortage should be greatly improved.

The uncertainty of the status of military test site operations and mining activities in the area have contributed to the tight housing market. Developers are reluctant to take substantial risks when economic conditions are volatile; they also do not have the financial resources or commitment to develop the number of housing units needed to fill the current demand.

2.10.6 Public Facilities and Services

Nye County and the Town of Beatty provide facilities and services to area residents including the parks, library, fire protection and ambulance, law enforcement and court system, health services, and schools. Existing design capacities, public building space, and staffing levels are inadequate in the following areas: water and sewer, Beatty Court, the sheriff substation, and town administration, fire and ambulance, and public education.

2.10.6.1 General Government. The town advisory council functions as the only local form of general government in Beatty. The council holds town meetings and participates with other boards and committees. The town council oversees the use of the 4,860-square-foot Beatty Community Center, which is rented for meetings, conventions, weddings, etc. The town budget pays salaries for the part-time community center maintenance person, the librarian, assistant librarian, and the firemen.

2.10.6.2 Library. The 2,764-square-foot, 6-year old library serves the Town of Beatty, surrounding communities, and the school district. The library is administered by the Beatty Library Board. The library contains between 10,000 to 12,000 books (Holloway 1988). One librarian and one part-time assistant librarian are employed.

2.10.6.3 Parks and Recreation. The Nye County Parks and Recreation Commission assists towns in the development of recreation facilities (Wellman 1988). The Parks and Recreation Commission prefers to fund facilities rather than equipment and staff. Facilities must be publicly owned and built on public land to be eligible for parks and recreation funds. The Commission also prefers to use their resources to supplement financing for projects that use local funds and other grants and donations. There is currently no formal parks and recreation master plan or capital improvements program for the county (Hersman 1989).

Parks and recreation services in the Town of Beatty are administered by the five-member Beatty General Improvement District. There are two recreation complexes in the Town of Beatty. One 5-acre park includes a lighted ballfield, tennis court, restrooms, picnic area, a small playground, and a swimming pool.

The other complex is on a 40-acre parcel of land that was obtained from the BLM. Recreation planning for this facility was initiated in 1984. Recreation needs were determined by use of a community questionnaire, and the results were used in the planning process. Completed facilities on this parcel include a softball field, a football field/running track shared with Beatty schools, and restroom facilities. Planned facilities for the parcel include a group picnic area, an outdoor amphitheater, tennis courts, and parking. The timing of construction of these facilities is dependent on the availability of funding.

2.10.6.4 Fire Protection and Ambulance. Fire protection and ambulance services are provided by the Beatty Volunteer Fire Department. The department's service area extends 35 miles north of Beatty on U.S. 95, 24 miles south of Beatty, and 11 miles west to the California State line.

The 3,960-square-foot fire station contains three vehicle bays, training area, and equipment storage. The 2,700-square-foot ambulance building contains five vehicle bays. The department has three trucks, two ambulances, and a mobile first-aid station. The department employs one paid firefighter, 28 volunteer firefighters, and 9 volunteer EMTs. The department is rated one of the best in Nevada by the State Fire Marshall (Sullivan 1988).

2.10.6.5 **Law Enforcement and Justice Court.** Law enforcement is provided by the Beatty substation of the Nye County Sheriff's Department, which covers an area 40 miles north and east of Beatty, 10 miles south, and 8 to 10 miles west. Staff includes 1 lieutenant, 4 deputies, and 4 dispatchers. Two Nevada Highway Patrol officers are also stationed in Beatty.

The Sheriff's Department occupies approximately 670 square feet of an 1,870-square-foot building that the department shares with the Justice of the Peace Court. The substation has four holding cells with an eight prisoner capacity. The department has five patrol cars and one pickup truck. The communication dispatch is also located in the substation. The substation is overcrowded (Sullivan 1989).

The Justice of the Peace Court's jurisdiction extends from Esmeralda County to the Clark County line and from the California border to the Nevada Test Site. The court handles misdemeanors and other minor offenses and hears arraignments on gross misdemeanors and felony cases. The court employs one justice, one justice court clerk, and two clerical workers; the justice court is overcrowded (Sullivan 1989).

2.10.6.6 **Water and Sewer.** The Beatty Water and Sanitation District provides water and sewer services to the Town of Beatty. Currently, the district is plagued by two problems: the district's supply of quality water is nearly at capacity, and the sewage system's treatment pond is at capacity and is discharging sewage onto surface areas. As of February 1989, the sewer system had 851 sewer units not including the Bond Gold mancamp (Walker 1989); 1 sewer unit is equivalent to 1 residential unit.

Water is provided by four wells which produce approximately 600 gallons per minute (gpm). Two wells (280 gpm) produce good quality water; the other two wells (320 gpm) produce water which exceeds federal maximum fluoride content levels. The water system includes a 325,000-

gallon storage capacity. The water transmission system is relatively new with the oldest line installed in 1968.

Average water demand ranges from 200 gpm in the winter to an estimated 400 gpm in the summer. Peak water demand can reach 500 gpm in the summer. The good quality water and poorer quality fluoride water will be mixed to meet this demand until an additional well that has been drilled and a pump installed can be used for residential consumption. This additional well is projected to meet the water needs of the community.

In summary, the water supply is nearly utilized to capacity. With continuing growth in the future, the good well water will be mixed with the existing supply of poor quality water to meet water demands until the supply is expanded.

Water service fees range from $8.50 per month for 2,000 gallons for residential use to $46 per month for a commercial hookup. Tap fees are lower than other areas of the county at $200 for residential taps and $450 for a commercial tap. A capital improvement fee is $200 per dwelling unit for water and $200 per unit for sewer.

The sewer system serves the Town of Beatty and vicinity. The sewage collection system is relatively new (1978) and is in good condition. The sewage treatment aeration pond is currently at capacity (52,000 gallons per day) (Walker 1988). The Beatty system is illegally discharging sewer water onto the surface waters of the State (Walker 1988). The State has cited the Beatty Water and Sanitation District, and requires improvement to the sewer treatment system within 6 to 9 months or a $10,000 fine will be imposed. In response to these citations the district is building a rapid infiltration bed near the Beatty Airfield using community development block grant (CDBG) funds. The system has been reviewed by the State and should be operational by summer 1989.

The Beatty Water and Sanitation District uses operating revenues to operate and maintain the system. However, tap fees are not sufficient to pay for major capital facilities such as the new rapid infiltration bed. These fees will have to increase in order to more adequately plan for future capital needs. Sewer user fees are $8 per equivalent residential unit. Hookup fees are based on actual costs and average $500.

2.10.6.7 **Health.** Health services are provided by the Central Nevada Rural Health Consortium and supplied at the Beatty Medical Clinic. The clinic is open 8 hours a day, 5 days a week, and is staffed by one full-time physician's assistant (PA) and one full-time receptionist/medical assistant. The PA is on call during nights and weekends. A supervising physician travels to the Beatty Clinic weekly.

The clinic contains a reception room, four examination rooms, an x-ray room, a laboratory, and a conference room. Additions to the clinic planned for 1989 have been completed. The Beatty Clinic is oriented toward family practice. A new concrete helipad has been installed by USNGS.

2.10.6.8 **Electricity.** Electricity is provided by Valley Electric Association. There is adequate generating capacity to service the existing population (Hazelton 1988). Currently, transformer capacity to Beatty is 6 to 7 megawatts; Beatty utilizes 2.5 megawatts.

2.10.6.9 **Schools.** Nye County is a unified school district headquartered in Tonopah. The Beatty School has a current enrollment of 265 (February 1989). Grades kindergarten through 12 are all housed on the same campus. The school consists of 14 classrooms, a kitchen, lunchroom, auto mechanic's shop, gymnasium, and administrative office space. The optimum enrollment capacity for the school is 350 plus a total of 40 kindergarten students.

There are some problems associated with the school facility. There is no general assembly hall or playground for team sports such as softball and soccer. The campus also has drainage problems after heavy rains.

Table 2-18 shows capacity and enrollment by grade for the Beatty School. Presently the school is operating slightly below capacity, with 5 grades with enrollment over optimum capacity. The current staff is 21. A new modular unit will be operational by the beginning of the 1989-1990 school year.

Amargosa Valley School is also experiencing significant growth. As of February 1989, the school enrollment had increased by 29 students since last year. The current enrollment is 134. The school is nearly at capacity levels with the 5th and 6th grade over capacity.

TABLE 2-18

BEATTY SCHOOL, MAY 1988/FEBRUARY 1989

CAPACITY AND ENROLLMENT BY GRADE

Grade	May 1988 Enrollment	February 1989 Enrollment	Percentage of Capacity
K	18	21	105 %
1	21	25	125
2	12	27	135
3	14	16	64
4	12	15	60
5-6	28	16-17	110
7	12	18	72
8	9	14	56
9	19	32	128
10	18	24	96
11	18	21	84
12	20	21	84
Total	201	265	91%

Source: Beatty School, Mrs. Vera Metlor, Principal.

The assessed valuation of the Nye County School District has increased by 27 percent over the past 2 years. These increases are primarily due to increased mining activity and prices for mineral products, plus new businesses, home sites, and agriculture. The assessed valuation in Nye County for fiscal year 1988-1989 was $418,737,641 which generated property tax revenues of $3,907,241 to the school district. The county-wide school district general fund operating budget for fiscal year 1988-1989 is $13,887,151.

It appears that the school district is in sound financial condition with increasing tax revenues from increases in assessed valuation from mining activity. Problems do exist in facilitating capital improvement projects due to bonding requirements. In order for a bond issue to pass, the majority of Nye County must approve the bond. Because of the size of the county, areas lacking population are unable to get a majority vote on bond issues for a capital project in their area. A $30 million bond election was held March 14, 1989 and approved. The bond proceeds will be used for classroom improvements at the Amargosa Valley School and for construction of a new high school in Beatty.

2.11 Transportation

The transportation system in Nye County is influenced by the large land area of the county, geographic and land use constraints (e.g., the Nevada Test Site), low population densities, and the remoteness of many communities from major towns and cities. This has led to a heavy reliance on surface transportation, particularly an extensive highway network. The network consists of nearly 3,000 miles of federal, state, and county roads and highways, about one-third of which are paved.

U.S. 95 is the major highway in southern Nye County, linking Las Vegas to the south with the Reno-Carson City-Tahoe area via Tonopah to the north. Several state highways, including State Route (SR) 374 at Beatty, provide connections to the west from U.S. 95 to Death Valley, the Mojave Desert, and the Sierra Nevada Mountains. Access to the east from U.S. 95 between Tonopah and Las Vegas is restricted by the huge Nevada Test Site reservation of the U.S. Government. Consequently, there are no through highways connecting to the east from U.S. 95 in the Beatty vicinity.

U.S. 95 in the Beatty area is a two-way, rural highway with one 14-foot wide travel lane in each direction. It generally has narrow 4 to 6- foot wide paved shoulders flanking the travel lanes with bladed native gravel shoulders beyond the pavement. Other state highways are generally paved, all-weather roads with travel lanes averaging 12 feet or less. SR 374 is typical with two 12-foot travel lanes and bladed gravel shoulders at least 6 feet wide along most of its length.

Traffic carrying capacities for U.S. 95 and SR 374 are estimated at approximately 14,000 vehicles per day under good weather conditions, except in segments where hills and tight curves reduce travel speeds and sight distances. Capacity on U.S. 95 is reduced somewhat in the Town of Beatty because of reduced speed limits and increased traffic conflicts. Considering the low traffic volumes in the area, however, the effects on motorists are minimal. Current traffic volumes are well below capacity in all cases as indicated in Table 2-19. Projected traffic volumes for these roadways indicate "A" levels of service will be maintained on U.S. 95 and SR 374 in the Beatty area for the foreseeable future.

Beatty has twice daily bus service to both Las Vegas and Reno from a stop in the center of town; LTR, a branch of Greyhound, provides this service. No other public transportation is available.

There is a lighted, asphalt paved airstrip approximately 5,900 feet long, 3 miles south-southwest of Beatty. It has a signal beacon but no services. The nearest commercial airport with scheduled service is in Las Vegas, 120 miles away.

TABLE 2-19

1987 TRAFFIC VOLUMES IN THE BEATTY AREA

	U.S. 95 16 miles North of Beatty	U.S. 95 0.7 mile North of SR 374	U.S. 95 100 feet North of SR 374	U.S. 95 150 feet South of SR 374	U.S. 95 28 miles South of Beatty
Capacity[1]	14,000	14,000	14,000	14,000	14,000
Average Annual Daily Traffic[2]	1,285	1,670	2,655	2,570	1,680
Volume/Capacity Ratio	.09	.12	.19	.18	.12
Level of Service	A	A	A	A	A

[1]Nevada Department of Transportation 1984.
[2]Nevada Department of Transportation 1988.

3.0 ENVIRONMENTAL CONSEQUENCES

Chapter 3 presents a discussion of the environmental consequences that would result from construction, operation, and abandonment of the proposed Mother Lode Project or the alternatives. The chapter is organized as follows. Sections 3.1 to 3.11 present conclusions of the environmental consequences by resource topic. Section 3.12 lists recommended mitigation and monitoring programs, and Section 3.13 provides a summary and comparison of alternatives.

3.1 Air Resources

3.1.1 Proposed Action

Impacts to air quality from operation of the proposed project would result primarily from particulate and dust emissions from the mining and ore processing operations. Some gaseous emissions would also be released from the on-site diesel generators used to provide electrical power to the project. A small amount of gaseous air pollutants would be emitted from construction and mining equipment and fuel storage tanks, but these emissions would not be significant.

A summary of particulate emissions related to the proposed mining and ore processing operations is listed in Table 3-1. These emissions were derived from standard emission factors for mining and metallic minerals processing (EPA 1985), and are based on the expected maximum daily production of 4,500 tons per day (tpd) of ore and 6,750 tpd of waste. For the mining operation, truck hauling of ore and waste and wind erosion are the primary emission sources, while ore crushing and screening is the most significant emission source from the ore processing operations. Data in Table 3-1 are also given for particulate matter (PM) emissions sized at or below 10 microns (PM-10). PM-10 is believed to affect human health because particles in this size category can be inhaled into the lungs. EPA has recently replaced the total particulate air quality standard with a similar standard for PM-10. The emissions data shown here illustrate that only a small fraction of the particulate emissions fall in the PM-10 size fraction.

Particulate emissions from the mining and ore processing operations would be controlled using standard emission control techniques. At the processing plant, emissions from the primary and secondary crushers and screens would be controlled with fogging sprays, which are standard

TABLE 3-1

SUMMARY OF MINE PARTICULATE EMISSIONS

Operation	TSP[1] (lb/day)	PM-10[1] (lb/day)
Drilling	130	No Data
Blasting	45	No Data
Truck Loading	102	51
Truck Hauling	539	234
Truck Unloading	116	57
Wind Erosion	282	31
Crushers and Screens	383	94
Diesel Generators	56	No Data
Access Road	7	5

[1]Based on worst-case day of 4,500 tpd ore removal and 6,750 tpd waste removal.

practice for these sources and reduce emissions by an estimated 95 percent. Crushing and screening emissions would comply with federal New Source Performance Standards for the metallic minerals processing industry.

Fugitive emissions caused by mining activities (blasting, waste rock removal, ore and waste rock hauling, ore and rock dumping, and wind erosion) would be mitigated by the following methods which are part of the project design:

- blast hole optimization,
- minimizing drop height during ore and waste rock removal and transfer,
- prompt reclamation and revegetation of exposed areas, and
- watering and chemical dust suppression on haul roads.

The on-site diesel generators would also produce some gaseous emissions, namely nitrogen oxides (NO_x), carbon monoxide (CO), and hydrocarbons (HC). Based on generator size and operating time, emissions of these pollutants from the generators were estimated using standard emission factors (EPA 1985). The estimated daily emissions from these sources are

- NO_x: 664 pounds per day
- CO : 142 pounds per day
- HC : 60 pounds per day

The on-site fuel storage tanks would also add somewhat to the expected HC emissions. However, due to the relatively small tank size, minimal throughput, and low volatility of diesel fuel, it is expected that such emissions would be extremely small.

One final source of air emissions is potential air toxics stemming from impurities in the ore. The Mother Lode ore body contains small amounts of mercury and arsenic. Some of these contaminants would be released in particulate form through the dust generating activities at the mine. Also, some mercury would be dissolved into the pregnant heap leach solution and carried through the metal recovery operation to the crucible furnace, where it would be liberated and volatilized into the atmosphere. Based on mercury concentrations of the pregnant solution from pilot-scale testing, mercury emissions are estimated at about 2.5 pounds per day at the crucible furnace. Since the arsenic is not dissolved by the leach solution and instead is retained in the spent ore, no significant arsenic emissions are expected to occur at the crucible furnace.

The air quality impact of emissions from the proposed project would be regulated by the Nevada Division of Environmental Protection (NDEP). NDEP would review the proposal to ensure emissions comply with regulatory limits and that impacts are within applicable air quality standards. Compliance with the air quality standards is usually checked using an atmospheric dispersion model.

The air quality modeling analysis of project emissions was prepared following NDEP practices and guidelines. Concentration estimates were made using the EPA (1980) Complex I dispersion model, using meteorological data from Las Vegas. The Beatty High School data described in Section 2.1 were not suited for dispersion model input because they did not have 24 observations per day and did not include all required parameters. However, the Las Vegas data were compared with the Beatty data and were found to correlate reasonably well. The results of the modeling study are given in Table 3-2. At the maximum impact point, the 24-hour particulate concentration is estimated at 19 micrograms per cubic meter with an annual average prediction of 5 micrograms per cubic meter. At Beatty, concentration estimates of particulate are 1 microgram per cubic meter and 0.1 microgram per cubic meter for the maximum 24-hour and annual averages, respectively. Including background, the predicted concentrations comply with both the Nevada total particulate standard and the federal PM-10 standard.

Following NDEP rules, the modeling analysis described here includes only emissions from process sources such as crushers and ore handling and not fugitive dust from mining operations. Although not quantitatively modeled, mining emissions do add to the atmospheric particulate loadings and resultant air impacts. Fugitive dust from mining is most pronounced during dry, windy conditions when particulate matter is blown loose and carried downwind. However, any particulate that is emitted from the mine is expected to be redeposited on the ground within a short distance due to gravitational settling and turbulent deposition. Thus, any impacts to air quality from mining emissions are expected to be both infrequent and highly localized.

The dispersion modeling analysis also considered the impacts of NO_x, CO, and mercury emissions. These concentrations also fall well below applicable air quality standards. In Beatty itself, predicted impacts are for the most part below detectable limits. For mercury, the critical receptor of concern is the closest permanent residence or public campground, which for this study was selected to be the Daisy Fluorspar Mine, about 3 miles west of the Mother Lode site.

TABLE 3-2

SUMMARY OF ESTIMATED AIR POLLUTION IMPACTS

FROM USNGS OPERATIONS

(micrograms per cubic meter)

Pollutant	Averaging Period	USNGS Impact	Background Concentration	Total Impact	Air Quality Standard
Maximum Impact Point					
Particulate	Annual	2.3	5	7	75/50 [1]
Particulate	24-Hour	19.6	10	30	150/150 [1]
NO_2	Annual	1.4	15	16	100
CO	8-Hour	11.9	230	242	40,000
CO	1-Hour	41.8	230	272	10,000
Mercury	8-hour	0.4	0	0.4	1.2
Beatty Town Center					
Particulate	Annual	0.01	5	5	75/50 [1]
Particulate	24-Hour	0.12	10	10	150/150 [1]
NO_2	Annual	0.01	15	15	100
CO	8-Hour	0.14	230	230	40,000
CO	1-Hour	0.68	230	231	10,000
Mercury	8-Hour	<0.01	0	0	1.2
Fluorspar Mine					
Mercury	8-Hour	0.04	0	0.04	1.2

[1] State TSP standards/federal PM-10 standards shown.

In summary, operation of the proposed Mother Lode Project would generate air pollutant emissions and result in increased levels of particulate and other pollutants in the atmosphere around the project. However, ambient concentrations of all pollutants are predicted to be very small and would remain within present air quality standards. Thus, no significant impacts are anticipated.

3.1.2 Alternatives

No impacts to air quality would result from the No Action Alternative.

For the remaining alternatives, air pollution emissions and impacts would remain essentially the same as the Proposed Action, with only very minor differences due to changes in the ore and waste hauling distances. However, in both Alternatives 1 and 2, the hauling distances are relatively short, and these emissions should be minor.

3.2 Geology and Mineral Resources

3.2.1 Proposed Action

The geology and mineral resources impact assessment emphasized three primary topics.

- potential geologic hazards to project facilities or human life;
- potential hazards created by project facilities; and
- potential effects on future extraction of economic mineral resources.

Geologic hazards evaluated at the site include the occurrence of expansive soils and seismic hazards. Expansive soils have been identified at the subject site; however, preliminary studies indicate that their extent is limited in volume, and their potential effect on the site appears minimal at this time (N.A. Degerstrom 1989). Studies related to expansive soils are expected to be completed by the end of March 1989. Possible seismic hazards would include ground shaking and soil liquefaction. Geotechnical investigations currently in progress are utilizing specialized design measures to mitigate potential damage to facilities in the event of a major earthquake (Klohn Leonoff 1989; N.A. Degerstrom 1989).

Geologic hazards created by project activities would include steep slopes in the mine pit and waste piles and creation of saturated soil conditions that may give rise to hydrocompaction or liquefaction of susceptible soils. Steep slopes in the mine pit would be comparable to rock outcrops on nearby ridgetops. Pit design studies have not been completed; however, preliminary data indicate that significant bedding problems from rock strata are not anticipated (N.A. Degerstrom 1989). Moreover, 20-foot safety benches would be cut into the pit walls during operation and abandonment of the mine, which would contribute to stability and reduce the rockfall hazard in the pit.

The proposed project would not prevent future extraction of economic mineral resources except in very limited areas. Condemnation drilling has been conducted by USNGS to avoid placing waste piles, or processing facilities over mineralized zones. Sulfide ore would be stockpiled in a segregated pile to allow for future processing if warranted by economic conditions.

The projected heap leach recovery would be approximately 80 percent gold and 10 to 20 percent silver. This would result in beneficial economic use of the mineral resources. No paleontological sites are known to occur in areas that would be disturbed by the mine, processing facilities, or other ancillary facilities.

3.2.2 Alternatives

There would be no recovery of mineral resources from the project with the No Action Alternative.

The impacts to geology and mineral resources from the facility location alternatives would be similar to the Proposed Action.

3.3 Water Resources

This section summarizes the environmental consequences of the proposed project on the water resources of the area. More detailed discussion can be found in the Water Resources Technical Memorandum included as Appendix A of this document.

3.3.1 Proposed Action

3.3.1.1 Groundwater

Quantity. The mine and process facilities are expected to use about 400 acre-feet of water per year at an average rate of approximately 250 gpm. The Mother Lode Project is projected to have a 3-year life; however, USNGS has applied for 7-year water permits to include possible development of their sulfide deposit. Project wells are currently planned to be developed in Crater Flat to the north and east of the project (see Figure 1 of Appendix A). The shallow alluvium in Crater Flat appears to be unsaturated in the vicinity of the Mother Lode Project. Groundwater impacts would therefore be limited to confined aquifers and aquitards at depth such as welded and non-welded tuffs and possibly carbonate rocks (Hydro-Search Inc. 1989). Current static water levels in the area are approximately 200 feet below the surface (3,907 feet elevation).

Pumping tests have not been performed in the Crater Flat area to measure drawdown and to calculate aquifer parameters. Based on estimated values of transmissivity and storage coefficient and assuming 4,000 feet of water-saturated thickness, a maximum mine life (including the sulfide deposit) of 7 years, and a continuous supply requirement of 500 gpm (twice the expected use), the drawdown at a 5-mile radius was estimated to be 4.2 feet (Hydro-Search Inc. 1989). This is a very conservative estimate because it assumes no hydraulic barriers to the drawdown would be intercepted during the 7-year period of projected drawdown. In reality, the geologic materials exposed at the surface, subsurface geologic interpretations, and drilling results to-date by USNGS all conclude that relatively impervious barriers would be encountered to the west of the proposed wellfield (Hydro-Search Inc. 1989; Winograd and Thordarson 1975). This condition would result in greater than projected drawdown in the vicinity of the wellfield and a corresponding reduction in water level drawdown to the west (Hydro-Search Inc. 1989).

Bare Mountain acts as a hydrogeologic barrier in the local area to the south and west (see Appendix A for further details). There is also a hydrologic barrier to the southeast, west of Ash Meadows and Devils Hole (Winograd and Thordarson 1975; Sharp 1989). Groundwater flow direction is generally toward the south. In summary, because of existing hydraulic boundaries and groundwater flow direction, (Winograd and Thordarson 1975; Czarnecki and Waddell 1984; Sharp 1989; Hydro-Search Inc. 1989) the wellfield is somewhat isolated from other water users in the region and from sensitive areas of concern such as Ash Meadows, Devils Hole, and

Death Valley National Monument (see Appendix A for further discussion). Because of these hydraulic boundaries, groundwater impacts are also not anticipated to the residents and agricultural uses in the Amargosa Valley.

There are no other operating wells within 8 miles of the project; therefore, impacts to individual private water supplies are not anticipated. Because of the hydraulic boundaries present, the groundwater flow direction (see Appendix A for further discussion), and the relatively small amount of water withdrawal involved, no impacts are anticipated to the north, east, west, and south of the wellfield outside of the hydrologic boundary area (see Figure 1 of Appendix A). Consequently, no impacts are anticipated to springs north and northwest of the project or to the regional groundwater system including Death Valley National Monument, Ash Meadows, and Devils Hole.

Quality. There are a number of potential groundwater contamination sources associated with the project. Potential impacts from the open pit, waste rock dumps, and leach operations are not considered to be significant primarily because: adequate surface water diversion is provided; a moderate degree of hydrologic isolation is provided since groundwater is at least 200 feet below the surface in a low-permeability, fractured bedrock aquifer; and the arid climatic setting precludes the generation of seepage. All liquid systems, including all piping and ponds, will be tested for leaks prior to startup. This should minimize the potential for leaks from the piping and the ponds. In addition, a monitoring and collection system will be installed in the solution storage ponds to facilitate early leak detection and collection of liquor should any leaks occur. No adverse impacts to groundwater quality are anticipated from any of these sources, as discussed in detail in the Water Resources Technical Memorandum in Appendix A.

3.3.1.2 Surface Water. Impacts to surface water resources from the proposed project are expected to be minimal as a result of the semi-arid climate and the absence of significant surface water.

Pond systems are designed in excess of a 25-year rainfall event, in accordance with the requirements of the Nevada Division of Environmental Protection. The ponds are designed to handle a total of over 3,000,000 gallons of water. A 25-year, 24-hour event would produce, including the operating inventory of water, a total of 2,300,000 gallons of water. The ponds are not anticipated to breach as a result of expected rainfall events.

The confluence of Tates Wash with the Amargosa River is over 30 miles to the southeast of the project site. Flow would only reach the Amargosa River from Tates Wash in a very extreme generalized runoff event. Mean annual flow for the ephemeral drainage is expected to be negligible with flow expected only in response to high precipitation events, mainly as flash floods. These existing conditions are not expected to be altered significantly by the proposed diversions. Therefore, the proposed development is not expected to significantly affect the surface flow through the area. Furthermore, the risk of failure of access roads and flooding of the mine site from flash flooding is low because peak discharges and volumes should be relatively small.

The Amargosa River should not be affected.

3.3.2 Alternatives

There would be no impact to groundwater or surface water from the No Action Alternative.

Impacts to groundwater and surface water would be similar to the Proposed Action for both of the facility location alternatives. Alternatives 1 and 2 and the well locations are located within the same groundwater system as the Proposed Action; therefore, the impacts of water withdrawal and potential groundwater contamination would be the same. No adverse impacts to surface water are expected from the facility location alternatives.

3.4 Soils

Potential impacts of the proposed project on native soil resources were evaluated to determine the extent to which project activities would result in either soil compaction or losses via burial or accelerated erosion. Project area soils were also evaluated regarding their suitability for salvage and subsequent topsoil use for reclamation and revegetation. Table 2-6 summarizes recommended topsoil salvage depths for each soil mapping unit.

3.4.1 Proposed Action

Construction and operation of the proposed project would result in the unavoidable disturbance of approximately 75 acres of soil resources. The locations of soils suitable for salvage indicated in Figure 2-2. While the water supply well and pipeline would result in additional disturbance, USNGS does not propose to salvage this topsoil.

All of the disturbance area for the Proposed Action has soils suitable for salvage except a small 2-acre area on the southern boundary which is part of the Bare Mountain foothills and contains rock outcrop unsuitable for salvage. The large alluvial fan (pediment) north of Bare Mountain which constitutes the rest of the Proposed Action disturbance area has 10 to 13 inches of suitable topsoil material. Soil units A and B are mapped on this alluvial fan and have suitable soil material until a very hard "duripan" is encountered. As noted in a footnote to Table 2-6, Map Unit A has 10 inches of suitable soil over 10 inches of hard clay which in turn is underlain by the hard, cemented duripan. This clay material would be better used as a natural clay liner on top of the duripan. Although it is suitable material, it is not recommended for salvage as topsoil. Map Unit B lacks this clay layer, and the entire soil depth, an average of 13 inches, to the duripan is recommended for topsoil salvage.

The Proposed Action area has a weighted-average recommended topsoil salvage depth of 10.2 inches. Based on an average topsoil salvage depth of 10.5 acres throughout the project area, an average of approximately 107,000 cubic yards are available for salvage from the 75 acres of disturbance for the Proposed Action or the alternatives.

3.4.2 Alternatives

The No Action Alternative would not disturb native soil resources. An average of 11.3 inches of topsoil could be salvaged for Alternative 1. In Alternative 2, an average of 10.4 inches could be salvaged. As a result, there is no significant difference among the Proposed Action and the alternatives concerning the depth of topsoil available for salvage.

3.5 Vegetation

Impacts associated with the project include vegetation removal and loss or reduction of plant productivity.

3.5.1 Proposed Action

Approximately 75 acres would be affected by construction activities associated with the proposed mining operation (e.g., mine, leach areas, processing facilities, waste rock storage, topsoil stockpile areas, miscellaneous support). The disturbance would be limited to the mixed desert shrub/forb and mixed desert shrub vegetation types. These types, in addition to the blackbrush vegetation type, dominate the project area and vicinity. Based on an average carrying capacity of the study area of 53 acres/AUM, less than 2 AUMS/year is the estimated productivity loss associated with the proposed mining operation.

Impacts to federal or state listed threatened or endangered plant species are not expected to occur as a result of project construction and operation. No federal candidate species are known to occur near the study area. The study area was surveyed for species potentially present including the Funeral Mountain milkvetch, Mojave sweet pea, Ripley's gilia, and Mojave fishhook cactus. None of these species were encountered within the study area. The concentrations of the many-headed barrel cactus in the blackbrush vegetation type would not be impacted as they are located south of the proposed mining area (Section 2.5.2).

Air emissions were examined to assess potential vegetation impacts. Fugitive dust from mining operations would occur (Section 3.1); however, damage to vegetation is not expected. Dust deposition should pose only minor impacts since the effects would be highly localized.

Vegetation removal and associated productivity losses would be cumulative over the 3-year project life. After operations cease, vegetative cover and productivity would gradually be restored on disturbed areas.

3.5.2 Alternatives

The vegetative loss associated with the proposed mining operation (approximately 75 acres) would not occur with the No Action Alternative. A total of approximately 75 acres of vegetation would be affected by construction activities in Alternatives 1 and 2, with disturbance occurring in the mixed desert shrub and mixed desert shrub/forb vegetation types. Impacts to sensitive plant species would be the same as discussed for the Proposed Action.

3.6 Wildlife

3.6.1 Proposed Action

The construction and operation activities were evaluated with respect to impacts on big game crucial habitat; important chukar and Gambel's quail habitat; raptor nesting habitat and nest locations; and habitat for other wildlife groups. Overall, the project would affect local populations of small mammals, songbirds, and reptiles, but no major impacts to important species or regional wildlife populations would be expected.

Mining, with the associated waste rock disposal areas and construction and operation of the heap leach facilities would result in the direct physical disturbance of approximately 75 acres of vegetation and wildlife habitat (see Section 3.5, Vegetation). The types affected would be mixed desert shrub/forb and mixed desert shrub. These habitats and associated small mammal, reptile, and songbird species are typical of the Great Basin Desert and northern Mojave Desert. The loss of prey species would affect small numbers of local predators such as coyote, badger, and kit fox, and raptors such as the golden eagle, prairie falcon, and red-tailed hawk. The area of potential disturbance is small relative to the hunting range of these species. Habitat losses would be for the life of the project and longer depending upon reclamation success. Important big game use areas are well away from the project site.

Small numbers of mule deer are known to occur in the vicinity, but use is sporadic and impacts of habitat loss to the species would be minimal. Similarly, the project would not directly disturb bighorn sheep range. The project would reduce available habitat for chukar and Gambel's quail, but significant effects to local populations are not expected. Yearlong use areas for these gamebirds would not be affected by construction activities. No impacts to raptor nest sites are expected to occur as a result of the Proposed Action.

Waterfowl are not common in the study area and vicinity due to the scarcity of surface water. No wetlands are present within or adjacent to the study area. Occasional waterfowl use occurs in the Amargosa River area (approximately 4 miles northwest of the project area) and at springs located outside the study area. Waterfowl and shorebird migration routes do not cross the project area as the migration tends to follow the Amargosa River valley. USNGS has committed to fencing and netting the heap leach solution ponds; therefore, the ponds would not affect wildlife and waterfowl.

No impacts to threatened or endangered wildlife species are expected to occur. Crucial habitat for the desert tortoise does not occur in the project region. The Amargosa toad is known to occur in springs, canals, and other wet areas 5 miles southwest of the project area, but no habitat occurs in the project area.

In addition to the direct impacts of habitat loss, potential indirect wildlife impacts include the effects of increased human activity in the area. Indirect project impacts would include increased traffic, noise, and consumptive uses of wildlife, resulting in increases in wildlife road kills, legal and illegal hunting and shooting, harassment, and other disturbance. For the proposed project, workers would be expected to use existing RV sites or local lodging facilities (see Section 3.10, Socioeconomics, for a discussion of worker numbers and associated population increases).

3.6.2 Alternatives

The No Action Alternative would have no impact on wildlife. Alternatives 1 and 2 would impact approximately 75 acres of wildlife habitat. Impacts would be the same as described for the Proposed Action.

3.7 <u>Land Use and Recreation</u>

3.7.1 Proposed Action

3.7.1.1 Land Use and Land Use Plans. The proposed project would be located on unpatented mining claims administered by the BLM. Because unpatented ground is part of the proposed mining operations, USNGS must comply with 43 CFR 3809, BLM regulations governing surface mining, by submitting a detailed Plan of Operations to the BLM for review, comment, and approval. USNGS would comply with all BLM regulations governing surface mining under these General Mining Laws. Under the proposed project, approximately 188 acres of unpatented land would be affected. Most of the land proposed for the project has historically been used for mining, dispersed recreation, open space, and cattle grazing (see Sections 3.7.1.2 and 3.7.1.4).

The proposed project would be consistent with Nye County and BLM land use plans for the area, as both favor maintenance and encouragement of existing uses, the concept of multiple use on federal lands, and the development of mineral resources. There are no permits (i.e., building, land use, etc.) required from Nye County.

The location of the proposed project facilities would have no direct land use conflicts with the Town of Beatty. Other potential impacts to this community are discussed elsewhere in this report (e.g., socioeconomics, visual resources, transportation, etc.). The proposed project should have no other land use conflicts.

3.7.1.2 Recreation. Outdoor recreational resources including dispersed recreation, hunting, fishing, camping, and off-road vehicle use would be lightly affected by the proposed mining project because existing use is relatively light, and the region has abundant acreage of public open space lands available (Grover 1989b).

Based on a permanent increase in population of approximately 127 (including secondary impacts), with the majority locating in the Beatty area, an increase in demand on local community recreational facilities and programs is expected. Existing recreation facilities, particularly the ballfields and community swimming pool, are currently at capacity; consequently, the additional demand would create an adverse impact and most likely, a need for additional facilities (Crowell 1988)(see Section 3.12.7).

3.7.1.3 Wilderness. The closest potential wilderness area is the Grapevine Mountains WSA, located approximately 25 miles northwest of the project area. The proposed mining project would have no impact on the Grapevine Mountains WSA.

3.7.1.4 Grazing. The project area is located within the Razorback Allotment. The carrying capacity is based on approximately 53 acres/AUM. The proposed project, at this capacity, would result in the loss of forage for less than 2 AUMs. However, due to lack of water for livestock in the area, the fact that grazing may occur following completion of the project, and the short life span of the project, there would be no effect on livestock use. The area is infrequently grazed by cattle due to the distance from water.

3.7.1.5 Wild Burros and Horses. Wild burros and horses tend to concentrate in areas with available water supplies. Water within the Bullfrog Herd Management Area is especially limited causing increased competition for forage and space. Water is particularly scarce east of Beatty. The only naturally occurring water source in the proposed project area is Specie Spring, located approximately 3 miles south of the proposed project site (Pogacnik 1989). Any open water within the project area would be securely fenced (see Section 3 12.4). Fences in wild burro and horse herd management areas would be located to minimize interference with the normal distribution and movement of these animals (BLM 1986).

3.7.2 Alternatives

The No Action Alternative would result in no change to existing land use or recreation in the project area. Alternatives 1 and 2 would result in the same impacts to land use and recreation as the Proposed Action.

3.8 Cultural Resources

The National Park Service's National Register Criteria for Evaluation (NPS 1982) assess whether properties are significant in local, state, or national history, on the basis of their architecture archaeology, engineering, or culture. To merit National Register consideration, properties must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- be associated with events that have made a significant contribution to the broad patterns of history;
- be associated with the lives of persons significant in the past;
- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or may be likely to yield, information important in prehistory or history.

In accordance with Section 106 of the National Historic Preservation Act, an archaeological survey was conducted by Intermountain Research. Thirty-seven prehistoric and 17 historic sites were identified. Upon receipt of the final cultural resources report, the BLM, with the concurrence of the State Historic Preservation Office, will determine National Register eligibility.

Six prehistoric lithic scatters, although probably not eligible for National Register of Historic Places (NRHP) nomination on their own merit, may demonstrate eligibility potential as a district. These sites all contain an abundance of lithic tools which may predate 2000 B.C. and imply an unusual Early Archaic utilization of upland, streamside environments. Additional survey and evaluation of these sites is necessary prior to a final determination of eligibility.

Several moderate to large prehistoric quarry sites may also be eligible for NRHP nomination; these sites also require additional evaluation of their significance.

Once NRHP eligibility has been determined, effects to these properties will be ascertained and suitable mitigation options, if necessary, will be pursued. The BLM will address cultural resources impacts and associated mitigation in the Record of Decision.

3.9 Aesthetics

3.9.1 Visual Resources

3.9.1.1 Proposed Action. Visual impacts caused by the proposed project were analyzed using the procedures outlined in the BLM Visual Resource Contrast Rating Handbook (USDI BLM 1986). Visual impact significance was determined by comparing visual contrast ratings for the proposed project facilities with visual resource management (VRM) class objectives for the respective management class affected (Table 2-10).

The 250-acre project area is designated VRM Class IV because it is visually similar to most of the southern Nevada region and because it is situated in a small valley that receives very few visitors. A Class IV designation permits a high level of change to the characteristic landscape but requires that "every attempt should be made to minimize the impact of" the project (Table 2-10).

Visual contrast analyses were conducted from three "Key Observation Points" (KOPs): 1) approximately 1 mile west of the proposed open pit on Tates Wash Road, representing back country travelers approaching from the Beatty vicinity; 2) a spot in the small "badlands" area adjacent to the cistern, representing back country recreationists that may be drawn to the vicinity to see the cistern or to explore the rock formation; and 3) a point on U.S. 95 about 5 miles north of Beatty, near Bailey's Hot Springs RV Park, representing travelers approaching the Beatty area from the north and residents of Oasis Valley.

Development of the proposed project would introduce changes to the visual character of the project site that would be very visible from KOPs 1 and 2. The open pit would not be particularly obtrusive because it would be below grade, relatively small, and nestled against the base of the north ridge of Meiklejohn Peak. However, the sizes and geometric shapes of the waste rock pile and leach pads would represent obvious man-made changes to existing landscape character that currently appears predominantly natural despite several roads and a few remnants of historic mining in the area. Most importantly, exploration cuts indicate that at least a portion of the ore and overburden are very light to almost white in color. Waste dumps and ore piles exhibiting this light, bright color would contrast very strongly with natural surface soil and vegetation colors in the area which tend to be mostly muted grey greens, medium beiges, and browns.

Proposed recontouring and revegetation of the leach pads and ponds would notably reduce the long-term visual effects of those facilities (see Section 3.12.6.1). Proposed recontouring would also reduce the effects of the waste-rock pile somewhat, but the strong color contrast would continue for many years because the pile faces would not be spread with topsoil and revegetation would be very slow.

Visual effects would be strongest to viewers from KOP 2 because it is the closest to the project site. KOP 2 has the broadest and only unobstructed view of the entire proposed project. It is also the only KOP at which viewers would be likely to linger for more than a fleeting view, although only a small number of visitors are believed to use the area around KOP 2.

Visual effects observed from KOP 1 would be less intense because part of the proposed project, including the waste-rock dump and much of the mine pit, would be screened from view by terrain. Also, most viewers would be moving past the project site and would have only brief views of project facilities.

Views from KOP 3 would be only minimally affected by the proposed project because all proposed facilities would be screened from view by terrain. The only project-related activity visible from KOP 3 is the existing network of roads cut for exploration drilling on the northwest face of the north ridge of Meiklejohn Peak. Although visible, the road cuts do not demand the attention of the casual viewer because the network is over 9 miles from the KOP and is a relatively small part of a large and varied viewshed visible from KOP 3. In addition, as revegetation of the road cuts occurs over a period of years, the current color contrast will be reduced, and the existing disturbance will become more difficult to discern from the natural backdrop.

Although the proposed Mother Lode Project would introduce high levels of visual change, especially from KOPs 1 and 2, the visual contrast would not exceed acceptable levels in a Class IV area. It would be possible, however, to reduce the impacts through certain specific measures as required by the VRM Class IV management objective. Suggested measures are addressed in Section 3.12.

The distance of the Mother Lode Project from Death Valley National Monument and the intervening topography would likely preclude a visual impact on night sky views in the Monument.

3.9.1.2 Alternatives. The No Action Alternative would result in no additional visual effects on views from all three KOPs. The existing exploration drilling access road cuts on the northwest face of the north ridge of Meiklejohn Peak are visible from all three KOPs and would remain visible for a number of years until they revegetate.

Development of Alternative 1 would result in somewhat lower visual contrast than the Proposed Action as viewed from KOPs 1 and 2 because the leach pads would be largely screened from view by the waste rock dump. Visual effects on KOP 3 would be the same as described for the Proposed Action. Visual effects of developing Alternative 2 would be slightly less than for either the Proposed Action or Alternative 1 as viewed from KOPs 1 and 2. Because the waste-rock dump would be farther to the east, it would be partially screened from view by terrain from KOP 1. It would be farther from viewers at KOP 2 and therefore less visually prominent. Visual effects of Alternative 2 on KOP 3 views would be the same as described for the Proposed Action.

3.9.2 Noise

3.9.2.1 Proposed Action. Sources of noise from development of the proposed project would include rock drilling, blasting, loading and hauling of ore and waste rock, ore crushing and handling, and access road maintenance and repair. Table 3-3 lists a roster of major noise-emitting equipment together with maximum noise emission levels for the project. Emission levels are considered to be conservative (worst-case) because they are based on the high end of measured ranges for each unit of equipment (EPA 1971). Combined noise emission levels for the project would be approximately 105.7 dBA at a 50-foot reference distance assuming an unlikely worst-case scenario with all equipment operating simultaneously at maximum output. These extreme conditions would virtually never occur. They rarely would be approached, and then only for brief periods. Consequently, the results of the noise analysis would be considered extreme worst-case; typical project noise emissions would be less than the levels indicated in the analysis.

The proposed Mother Lode Project is quite remote. The nearest sensitive receptor is over 4 miles from the project site, near U.S. 95, where ambient noise levels are higher than in the back country due to highway traffic. Also, the site is a valley surrounded by hills and mountains that would function as barriers to noise. Calculating noise effects of the worst-case project emissions using only attenuation (noise level reduction) from spreading of sound waves over distance results in sound pressure levels slightly over 53 dBA at 4 miles from the project site. Noise of this level rarely would be discernible at residences in the Oasis Valley north of Beatty. Actual project noise emissions typically would be lower than the maximums calculated. In addition, project-generated noise levels at the nearest residence would be further reduced by attenuation from atmospheric absorption and from barrier effects of the intervening terrain. Consequently, noise from general operation of the Mother Lode Project would rarely, if ever, be perceptible at sensitive receptors.

The noise analysis does not quantitatively consider blasting noise because the short, once-per-day blasting period would have little if any effect on quantitative noise results. Blast noise would probably be audible at residential receptor areas but it would be at relatively low levels. The key considerations for blasting are time of day and potential for perceptible ground shaking. It is expected that controlled blasting for the mine would not generate perceptible ground shaking

TABLE 3-3

MAJOR NOISE SOURCES

Equipment Roster[1] Type	Equipment Roster[1] Size	Maximum Noise Emission Level Per Unit (dBA)[2,3]	Total Units[1]
Hydraulic Excavator	5 yard	93	1
Grader	14 foot blade	93	1
Water Truck	10,000 gallon	85	1
Powder Truck	10 ton	85	1
Haul Truck	50 ton	93	7 (2 spare)
Loader	10-12 yards	85	2
Dozer	335 HP	93	3
Dozer	165 HP	90	1
Rotary Percussion	6.5 inch	98	2 (1 spare)
Miscellaneous Vehicle	3/4 ton	75	10
Jaw Crusher	30" x 42"	100	1
Secondary Crusher	4' Standard Cone	100	1
Diesel-Electric Generator	600 kw	85	1

Sources: [1] USNGS 1988
[2] EPA 1971, CERL 1978, ENSR file data
[3] Reference distance = 50'

at sensitive receptors. Blasting would be limited to the hours between 8:00 a.m. and 10:00 p.m. to minimize the potential for disrupting the sleep of area residents.

In summary, noise effects of the proposed project would not be significant at noise sensitive receptors in the area.

3.9.2.2 Alternatives. There would be no noise effects from the No Action Alternative. Noise effects of Alternatives 1 and 2 would be similar to effects from the Proposed Action with total emissions essentially the same and noise levels at sensitive receptors slightly lower because the activity center would be farther from the receptors.

3.10 Socioeconomics

3.10.1 Proposed Action

This section evaluates the beneficial and adverse effects of the proposed project within the context of social and economic changes in the study area. The project-related impacts, both temporary and permanent, cannot be treated in isolation, but must be related to changes in the overall economic picture of the area, including the uncertainty associated with future U.S. Air Force and Department of Energy activities and increased mining exploration and development throughout the area. Cumulative effects may compound or offset one another and these effects may vary through different phases of development. Two impact assessment scenarios for construction are presented here based on: (1) Impact Assessment Scenario 1 - the most current housing information as of February 1989; and (2) Impact Assessment Scenario 2 - the assumption that additional housing will be in place during the entire construction period. Future changes in employment and phasing of other projects may result in changes to the impacts presented.

Calculations of impacts were based on known characteristics of the study area, supported by professional planning standards and empirical data from other mining projects in Nevada. Tables 3-4, 3-4A, 3-5, 3-5A, and 3-6 reflect the projections of impacts from project development during peak and average construction and during operations for the two scenarios. These projections are not meant to represent actual impacts, but to reflect a range of potential impacts given existing and proposed conditions.

TABLE 3-4

IMPACT ASSESSMENT SCENARIO 1*

PEAK CONSTRUCTION PHASE, 1989

PROPOSED PROJECT EMPLOYMENT, POPULATION,

HOUSING, AND SCHOOL-AGE CHILDREN PROJECTIONS

	Average Annual Employment[1]	Local Direct[2]	Non-Local Direct	Total Direct	Local Indirect	Non-Local Indirect	Total Indirect[3]	Total New Employment
New Employment	75	4	71	75	10	4	14	89

	Non-Local Direct	Non-Local Indirect	New Households
New Households[4]			
New Workers	71	4	
Single[5]	64	4	34
Married (1 Worker)[6]	7	0	7
Married (2 Workers)	0	0	0
Total New Households	39	2	41

	Beatty	Amargosa Valley
New Household Allocation[7]	33	8
New Population[8]		
Single Household	54	14
Married Household	20	5
Total	74	19
New School Children[9]		
Secondary	2	0
Primary	7	2
Total	9	2

Housing Preference[10]	
Single-Family	1
Multi-Family	4
Mobile Home	6
Other (RV or Motel)	30
Total	41

*Based on current (February 1989) housing information.

TABLE 3-4 (CONTINUED)

Notes:

[1] The average construction work force is 50 over the 3-month construction period. The peak work force of 75 will occur for 2 to 3 weeks in May 1989.

[2] The construction work force is assumed to be 5 percent local, 95 percent non-local (BLM 1980). Local workers will commute to and from their place of residence to work on a daily basis (McMyler, Kaiser Engineering 1987).

[3] Indirect construction employment is calculated using a construction employment multiplier of 1.2 based on 1978 employment location quotients and basic/non-basic employment. It is assumed that 70 percent of the indirect labor force are second persons in the direct labor households or current residents of the Beatty area (ERT 1980).

[4] The construction work force is composed of 90 percent single workers or married without family, and 10 percent married workers with family (McMyler, Kaiser Engineering 1987).

[5] It is assumed that single workers will double up; therefore only one housing unit would be required for two workers.

[6] Both husband and wife of 5 percent of the married workforce are assumed to work at the mine during construction.

[7] Eighty percent of the construction workers will reside in the Beatty area, 20 percent in Amargosa Valley.

[8] Population estimates are based on 2 persons per household for single households with direct workers, 2 persons per household for single households with indirect workers, and 3.5 persons per household for married households (BLM 1980).

[9] School-age children are estimated at 1.0 per married household. Eighty percent of school-age children are primary students, 20 percent secondary students (BLM 1980).

[10] Housing preferences are shown based on the following percentage distribution:

	Beatty (Percent)
Single Family (SF)	2
Multi-Family (MF)	10
Mobile Home (MH)	15
Other	73

[11] Totals on tables may not add up due to rounding errors.

TABLE 3-4A

IMPACT ASSESSMENT SCENARIO 2*

PEAK CONSTRUCTION PHASE, 1989

PROPOSED PROJECT EMPLOYMENT, POPULATION,

HOUSING, AND SCHOOL-AGE CHILDREN PROJECTIONS

	Average Annual Employment[1]	Local[2] Direct	Non-Local Direct	Total Direct	Local Indirect	Non-Local Indirect	Total[3] Indirect	Total New Employment
New Employment	75	4	71	75	10	4	14	89

	Non-Local Direct	Non-Local Indirect	New Households
New Households[4]			
New Workers	71	4	
Single[5]	50	3	42
Married (1 Worker)	19	1	20
Married (2 Workers)[6]	1	0	1
Total New Households	60	3	64

	Beatty	Amargosa Valley
New Household Allocation[7]	51	13
New Population[8]		
Single Household	42	11
Married Household	60	15
Total	102	26
New School Children[9]		
Secondary	5	1
Primary	21	5
Total	26	6

Housing Preference[10]	
Single-Family	1
Multi-Family	2
Mobile Home	27
Other	33
Total	64

*Assumes additional housing will be in place during construction.

TABLE 3-4A (CONTINUED)

Notes:

[1] The average construction work force is 50 over the 12-month construction period. The peak work force of 75 will occur for 2-3 weeks in May 1989.

[2] The construction work force is assumed to be 5 percent local, 95 percent non-local. Local workers will commute to and from their place of residence to work on a daily basis (McMyler, Kaiser Engineering 1987).

[3] Indirect construction employment is calculated using a construction employment multiplier of 1.2 based on 1978 employment location quotients and basic/non-basic employment. It is assumed that 70 percent of the indirect labor force are second persons in the direct labor households or current residents of the Beatty area (ERT 1980).

[4] The construction workforce is composed of 90 percent single workers or married without family, and 10 percent married workers with family (McMyler, Kaiser Engineering 1987).

[5] It is assumed that 20 percent of direct single workers will double up. The remaining single workers would live alone.

[6] Both husband and wife of 5 percent of the married workforce are assumed to work at the mine during construction.

[7] Eighty percent of the construction workers will reside in the Beatty area, 20 percent in Amargosa Valley.

[8] Population estimates are based on 2 persons per household for single households with direct workers, 1 person per household for single households with indirect workers, and 3.5 persons per household for married households (BLM 1980.

[9] School-age children are estimated at 1.0 per married household. Eighty percent of school-age children are primary students, 20 percent secondary students (BLM 1980).

[10] Housing preferences are shown based on the following percentage distribution:

	Beatty (Percent)
Single Family (SF)	2
Multi-Family (MF)	3
Mobile Home (MH)	43
Other	52

[11] Totals on tables may not add up due to rounding errors.

TABLE 3-5

IMPACT ASSESSMENT SCENARIO 1*

AVERAGE CONSTRUCTION PHASE, 1989

PROPOSED PROJECT EMPLOYMENT, POPULATION,

HOUSING, AND SCHOOL-AGE CHILDREN PROJECTIONS

	Average Annual[1] Employment	Local[2] Direct	Non-Local Direct	Total Direct	Local Indirect	Non-Local Indirect	Total[3] Indirect	Total New Employment
New Employment	50	2	48	50	3	10	7	60

	Non-Local Direct	Non-Local Indirect	New Households
New Households[4]	48	3	
New Workers			
Single[5]	44	3	23
Married (1 Worker)	4	0	4
Married (2 Workers)[6]	0	0	0
Total New Households	26	1	27

	Beatty	Amargosa Valley
New Household Allocation[7]	22	5
New Population[8]		
Single Household	36	9
Married Household	13	3
Total	49	12
New School Children[9]		
Secondary	1	0
Primary	5	1
Total	6	1
Housing Preference[10]		
Single-Family	1	
Multi-Family	2	
MH (??)	4	
Other (RV or Motel)	20	
Total	27	

*Based on current (February 1989) housing information.

TABLE 3-5 (CONTINUED)

Notes:

[1]The average construction work force is 50 over the 12-month construction period. The peak work force of 75 will occur for 2 to 3 weeks in May 1989.

[2]The construction work force is assumed to be 5 percent local, 95 percent non-local (BLM 1980). Local workers will commute to and from their place of residence to work on a daily basis (McMyler, Kaiser Engineering 1987).

[3]Indirect construction employment is calculated using a construction employment multiplier of 1.2 based on 1978 employment location quotients and basic/non-basic employment. It is assumed that 70 percent of the indirect labor force are second persons in the direct labor households or current residents of the Beatty area (ERT 1980).

[4]The construction work force is composed of 90 percent single workers or married without family, and 10 percent married workers with family (McMyler, Kaiser Engineering 1987).

[5]It is assumed that single workers will double up; therefore only one housing unit would be required for two workers.

[6]Both husband and wife of 5 percent of the married workforce are assumed to work at the mine during construction.

[7]Eighty percent of the construction workers will reside in the Beatty area, 20 percent in Amargosa Valley.

[8]School-age children are estimated at 1.0 per married household. Population estimates are based on 2 persons per household for single households for direct workers, 2 persons per household for indirect workers, and 3.5 persons per household for married housenolds (BLM 1980.

[9]Eighty percent of school-age children are primary students, 20 percent secondary students (BLM 1980).

[10]Housing preferences are shown based on the following percentage distribution:

	Beatty (Percent)
Single Family (SF)	2
Multi-Family (MF)	10
Mobile Home (MH)	15
Other	73

[11]Totals on tables may not add up due to rounding errors.

TABLE 3-5A

IMPACT ASSESSMENT SCENARIO 2*

AVERAGE CONSTRUCTION PHASE, 1989

PROPOSED PROJECT EMPLOYMENT, POPULATION,

HOUSING, AND SCHOOL-AGE CHILDREN PROJECTIONS

	Average Annual Employment[1]	Local Direct[2]	Non-Local Direct	Total Direct	Local Indirect	Non-Local Indirect	Total Indirect[3]	Total New Employment
New Employment	50	2	48	50	7	3	10	60

	Non-Local Direct	Non-Local Indirect	New Households
New Households[4]			
New Workers	48	3	
Single[5]	33	2	29
Married (1 Worker)	13	1	14
Married (2 Workers)[6]	1	0	1
Total New Households	40	3	43

	Beatty	Amargosa Valley
New Household Allocation[7]	34	9
New Population[8]		
Single Household	28	7
Married Household	40	10
Total	68	17
New School Children[9]		
Secondary	3	1
Primary	14	3
Total	17	4

Housing Preference[10]	
Single-Family	1
Multi-Family	1
Mobile Home	12
Other	29
Total	43

*Assumes additional housing will be in place during construction.

TABLE 3-5A (CONTINUED)

Notes:

[1] The average construction work force is 50 over the 12-month construction period. The peak work force of 75 will occur for 2-3 weeks in May 1989.

[2] The construction work force is assumed to be 5 percent local, 95 percent non-local. Local workers will commute to and from their place of residence to work on a daily basis (McMyler, Kaiser Engineering 1987).

[3] Indirect construction employment is calculated using a construction employment multiplier of 1.2 based on 1978 employment location quotients and basic/non-basic employment. It is assumed that 70 percent of the indirect labor force are second persons in the direct labor households (ERT 1980).

[4] The construction workforce is composed of 70 percent single workers or married without family, and 30 percent married workers with family (McMyler, Kaiser Engineering 1987).

[5] It is assumed that 80 percent of the single workers will live independently.

[6] Both husband and wife of 5 percent of the married workforce are assumed to work at the mine during construction.

[7] Eighty percent of the construction workers will reside in the Beatty area, 20 percent in Amargosa Valley.

[8] Population estimates are based on 1 person per household for single households for 80 percent of direct workers, 1 person per household for indirect workers, and 3.5 persons per household for married households (BLM 1980).

[9] School-age children are estimated at 1.0 per married household. Eighty percent of school-age children are primary students, 20 percent secondary students (BLM 1980).

[10] Housing preferences are shown based on the following percentage distribution:

	Beatty (Percent)
Single Family (SF)	2
Multi-Family (MF)	3
Mobile Home (MH)	27
Other	68

[11] Totals on tables may not add up due to rounding errors.

TABLE 3-6

IMPACT ASSESSMENT

OPERATIONS PHASE

PROPOSED PROJECT EMPLOYMENT, POPULATION,

HOUSING, AND SCHOOL-AGE CHILDREN PROJECTIONS

	Average Annual Employment	Local[1] Direct	Non-Local Direct	Total Direct	Local Indirect	Non-Local Indirect	Total[2] Indirect	Total New Employment
New Employment	45	2	43	45	6	3	9	54

	Non-Local Direct	Non-Local Indirect	New Households
New Households[3]			
New Workers	43	3	
Single	11	1	12
Married (1 Worker)	32	0	32
Married (2 Workers)[4]	0	2	1
Total New Households	43	3	45

	Beatty	Amargosa Valley
New Household Allocation[5]	36	9
New Population[6]		
Single Household	9	2
Married Household	93	23
Total	102	25
New School Children[7]		
Secondary	11	3
Primary	42	11
Total	53	14
Housing Preference[8]		
Single-Family	9	
Multi-Family	4	
Mobile Home	32	
Other (RV or Motel)	0	
Total	45	

TABLE 3-6 (CONTINUED)

Notes:

[1] The new operations work force is assumed to be 5 percent local and 95 percent immigrants.

[2] Indirect operations employment is calculated using an operations employment multiplier of 1.2 (PIC). It is assumed that 70 percent of the indirect labor force are second persons in the direct labor households.

[3] The operations workforce is composed of 25 percent single workers and 75 percent married workers.

[4] Both husband and wife of 5 percent of the married workforce are assumed to work at the mine.

[5] During operations, it is assumed that 80 percent of the new employees would live in the Beatty area, 20 percent in Amargosa Valley.

[6] Population estimates are based on 1 person per household for single households and 3.5 persons per household for married households (Dobra, Nevada Department of Minerals, December 1987).

[7] School-age children are estimated at 1.2 per married household. Eighty percent of school-age children are primary students, 20 percent secondary students.

[8] Housing preferences shown are based on the following percentage distribution:

	Beatty (Percent)
Single Family (SF)	20
Multi-Family (MF)	10
Mobile Home (MH)	70
Other	0

[9] Totals on tables may not add up due to rounding errors.

3.10.1.1 **Population.** The population in Nye County is highly dependent on three basic industries: military activity, mining, and tourism. Fluctuations in population are likely to occur due to the uncertainty of the status of military spending and the market for precious metals and other commodities. Nye County has shown considerable growth since 1980 and will likely continue to increase its population if current levels of activity continue in the major industries. Construction for the proposed project is scheduled to begin in spring 1989 and continue for approximately 3 months. A moderate population impact on the Beatty area would occur during this period.

The peak construction workforce is estimated at 75 workers; peak construction population is estimated at a maximum of 93 people in July 1989 (Table 3-4) for assessment scenario 1, and 128 people for assessment scenario 2 (Table 3-4A). This population level would remain relatively stable for a period of 2 to 3 weeks and then start to decline.

The effect of the project on the area population depends largely on the number of immigrating workers and demographic characteristics of their families.

Impact assessment Scenario 1 assumes limitations on housing availability; it is assumed that few construction workers would bring their families, and single workers would double up in motel accommodations in order to reside in Beatty. These conditions are not desirable for a construction workforce and would cause discontent among workers and potentially higher turnover ratio and law enforcement problems.

Impact assessment Scenario 2 assumes that adequate housing would be available through new mobile home developments and availability at the Bond Gold mancamp. Eighty percent of the direct single workforce would live alone. These conditions would create a more optimum working environment in which those workers who prefer to bring their families would have that option. A lower turnover rate and fewer law enforcement problems are likely to result with these conditions.

As illustrated in Tables 3-5 and 3-5A, the average increase in population in the area from the project is projected to be between 61 and 85 persons during construction in 1989. During operations from 1990 through 1991 or beyond, the operations population is projected at 127

(Table 3-6). There would be some overlapping impacts from construction workers and operation workers locating in the area.

This population increase represents moderate growth to the area during construction and operations and would be significant, from a cumulative standpoint, considering the ongoing development and operations start-up of the Bond Gold project. The average population increase would be 6 to 8 percent of the estimated pre-Bond Gold 1988 Beatty area population during construction. The population from operations would be 13 percent of the estimated 1988 Beatty area population. The rate of increase for operations is higher than recent annual population growth rates. From 1980 to 1988, the Beatty area experienced an average annual growth rate of 4.0 percent. At present, it is difficult to estimate the Beatty, Rhyolite, and Amargosa Valley population. However, it is known that approximately 600 construction workers are currently associated with the Bond Gold Bullfrog Project. In addition, the Saga Sterling Mine employs 25-35 people. If these people are added to the 1988 population, the current area population is closer to 1,600 people, and the population impact from the operations phase of the Mother Lode Project would be an increase of 8 percent to the Beatty area population.

Anticipated population increases resulting from development of the proposed project for each impact assessment scenario are summarized in Tables 3-4, 3-4A, 3-5, 3-5A and 3-6. These tables represent impacts related to peak construction employment (75), average construction employment (50), and operations employment (45), respectively, including direct and indirect employment related effects for impact assessment Scenarios 1 and 2.

In summary, most of the population increase is expected to occur in Beatty and Amargosa Valley. Because of the lack of facilities, services, and housing to attract people to other areas, the remainder of this analysis focuses exclusively on the Beatty and Amargosa Valley area, where during all phases of development, population growth would result in moderate impacts.

USNGS estimates production from the proposed project would end in 1991 with possible extensions if additional exploration drilling proves successful. At this time, if no additional economic activity is occurring in mining or related fields in Nye County, people directly or indirectly employed by the project would be expected to leave the area. The loss of population at project completion would be slightly less than the projected increases shown in Table 3-6.

3.10.1.2 Economy. The principal economic effects of the proposed project would be an increase in mining employment in Nye County and potential for an expanded retail and service economy. Total income in the area would increase. The 45 additional permanent employees at the mine would represent a 3.9 percent increase in the estimated 1987 mining employment in Nye County and less than 1 percent increase in total county employment. Most of the economic impact would occur in the Beatty area. The influx of new population and new employment in the area would stimulate the local economy. A few businesses and services may increase the number of employees. Increase of business would contribute to the local sales and use tax base within the local economy. The nine additional indirect jobs created would represent less than 1 percent increase in employment in the services and trade sectors in Nye County.

3.10.1.3 Employment. Employment impacts of the proposed project are also summarized on Tables 3-4, 3-4A, 3-5, 3-5A, and 3-6. The greatest impact on Nye County employment from the proposed project would be during the peak construction phase with an estimated total direct employment of 75. Total indirect employment associated with peak construction is estimated at 14 new workers. This peak level would be sustained for only a short period during the 3rd quarter of 1989.

Based on existing state labor force and unemployment figures for Nye County, it is estimated that 5 percent of the average construction employment level of 50 workers would come from in or near the study area. Immigrant labor would come primarily from other areas around the state and throughout the west, particularly Wyoming, Colorado, Idaho, California, and New Mexico (TIC 1988). The trained Nevada labor force is presumed to be fully employed because of the high level of activity in the mining sector in Nevada. Construction workers are migrating to Nevada from states throughout the West.

Secondary employment related to the construction of the mine complex was estimated using a construction sector multiplier of 1.2 (Isard 1976; Bureau of Economic Analysis 1980; ERT 1980). An average of 60 direct and indirect jobs would be created during the construction phase, of which 10 are projected to be filled by local area residents.

The development related increase in permanent operations workforce is expected to total 45 workers, with little carryover from construction. The indirect employment generated in the service sectors during operations was estimated using an employment multiplier of 1.2 (ERT

1980; PIC 1988). Two indirect multipliers were reviewed for the impact assessments. A 1.74 multiplier was developed from an economic analysis prepared by John Dobra on "The Economic Impacts of Nevada's Mineral Industry (1987)." This study suggests rural areas experience an increase of 0.74 workers per 1 mine worker. This model aggregated rural counties together including Elko and Hum oldt which may have a higher ratio of non-basic to basic workers than the more rural areas. The other multiplier is a more conservative estimate of 0.2 indirect workers per mine worker, which takes into effect the fact that many of the non-basic industries in rural areas of Nevada are actually generating services for basic sectors (e.g., motels, retail establishments, restaurants, casinos, etc., cater to tourism which is a basic industry). Therefore, the economic base methodology used for the 1.75 multiplier may be inaccurately estimating a higher ratio of non-basic workers to basic workers. The 1.2 multiplier was used for this assessment. The largest total employment would be in 1989 when construction is winding down and operations beginning. Forty-three (43) permanent employees are expected to move to the area from other regions throughout the country. In addition to permanent direct employees, indirect employees providing services for the newly created basic population are estimated at 9. Approximately 70 percent of the indirect labor force are estimated to be second persons in the direct labor households or current residents of the Beatty area. The production status of other area mining projects in the near future will determine the availability of local labor that could be hired by USNGS (see Section 3.10.1.7).

If milita expansions at the Nevada Test Site and mineral exploration in the area continue to increase the current rate, a higher percentage of non-local labor may be required. If the reverse is true, the overall non-local impact of the proposed project would be less. Higher direct cumulative employment figures may increase the indirect employment multiplier. Losses in direct and indirect employment would result upon project completion in 1992. Total employment losses would be slightly less than the new employment estimates in Table 3-6.

3.10.1.4 Fiscal Effects. Analysis of Nye County finances shows that the county is in sound financial condition; however, local expenditures for capital improvements and public facilities and services are far below national standards. The proposed project would contribute a net revenue increase to Nye County during the operations lifespan of 2 years. Revenue increases would result primarily from greater property, net proceeds, and sales tax revenues. The revenue projections are estimates based on current tax rates and assessment practices. Actual taxes may vary.

The principal revenue change for Nye County would result from an increase in assessed valuation attributable to the open-pit mine, leach facilities, and other support facilities. First-year property taxes for the mine are estimated in Table 3-7 based on capital expenditures incurred annually for project development. Real property is assessed at 35 percent of market value, and a 1.6182 mill tax rate is applied. Receipt of the revenues would lag 1 year behind installation of improvements because of conventional assessment and collection practices. In 1990, Nye County would receive an estimated $31,000 in taxes on labor, material, equipment, and capital assets from mine construction activities occurring in 1989. In 1991, based on 1990 capital construction expenditures at the mine, the estimated property taxes paid by USNGS would total approximately $33,000. Combined, these represent less than 1 percent of budgeted 1989 county-wide property taxes. At preliminary 1989 tax rates, 38 percent of this total would accrue to Nye County, 58 percent to the Nye County School District, and the remaining 4 percent to the state. These taxes would directly benefit Beatty and Nye County and would help to offset impacts related to the mine.

In addition to mine construction and operations, other commercial and residential activity would occur in Beatty, Amargosa Valley, and the surrounding areas. These developments would contribute to the tax base and add property tax and sales tax revenues to the Town of Beatty, Amargosa Valley, and Nye County coffers. Tax revenues have not been estimated for these developments due to their uncertainty at this time. During the period between project initiation and receipt of tax revenues, an adverse county-wide financial impact may be experienced because of increase in demands for services from population growth.

A net proceeds tax is collected on the production of gold and silver at property tax rates. This tax is based on estimated mining profits, which depend on gold and silver prices in the market. Tax revenues to Nye County are estimated at $180,000 per year during operations.

The proposed project would generate an annual payroll of $1.4 million during operations (1989 through 1991). Construction payroll for the [illegible] months of construction is estimated at $350,000. A portion of this total income would be spen[illegible] the area and would result in increased sales tax receipts throughout the area. Assuming 75 percent of these wages and salaries represent disposable income and the local spending (Nye County) capture rate is 20 percent for construction workers and 40 percent for operations employees, a total of $326,667 in new local

TABLE 3-7

INCREMENTAL TAX REVENUES GENERATED (ESTIMATES)

MOTHER LODE PROJECT - USNGS

(THOUSANDS OF $)

	Estimated 1989 Expenditures	Lagged[2] Tax	Estimated 1990 Expenditures	Lagged[2] Tax
PROPERTY TAX				
Construction				
Capital[1]	$1,900	$12	$ 600	$ 4
Capital Equipment[1]	2,800	17	0	0
Payroll	350	2	0	0
Operations				
Capital[1]	0		1,900	12
Capital Equipment[1]	0		2,800	17
Payroll	700	___	1,400	0
TOTAL CONSTRUCTION AND OPERATIONS EXPENDITURE	5,750	31	6,700	33
AVERAGE ANNUAL NET PROCEEDS TAX[3]				180
SALES AND USE TAX[3]				30
INCREMENTAL PROPERTY, NET PROCEEDS, AND SALES AND USE TAXES				246

[1] Improvements and equipment have not been depreciated.

[2] Lagged one year.

[3] Annual average estimates, not lagged (USNGS).

spending for goods and services would occur in 1989, and $420,000 would occur in 1990 and 1991. However, this amount of local spending would require an increase in the level of commercial development in Beatty. In Nye County, 2 cents per sales dollar goes to the state, 1.5 cents to the school district, and 0.5 cents to the county in the form of 'relief tax'. A supplemental reserve county/city tax of 1.75 percent is distributed by the Nevada Tax Commission to counties after individual county requests are reviewed and approved. Other sales tax receipts include corporate sales taxes and contractor use taxes.

With the increase in population and school-age children, there would also be increases in government service and facility demands requiring county, town, and school district expenditures. Typically, government entities would experience increased expenditures with little increase in revenues during the construction phase. Increases in expenditures would occur primarily in public safety, schools, welfare, and community support activities during the construction phase. There would likely be somewhat of a financial shortfall for all government entities affected during this period, primarily schools.

During operations, the largest increases in expenditure requirements would occur in schools, public safety, road maintenance, and recreational services. The effects of the increases in population and school-age children on public services and facilities are discussed in Section 3.10.1.6.

In summary, it is anticipated that the proposed project would result in short-term revenue shortfalls in Nye County, but surpluses would result once revenues of the project start accruing to the county taxing and service jurisdictions. These surpluses would result if the county continues to provide the existing level of service.

Upon project completion, Nye County would experience significant reductions in ad valorem and net proceeds tax revenues.

3.10.1.5 Housing. As described in Chapter 2, the existing housing market is very tight for lower cost and temporary housing, such as rentals and mobile homes, throughout the region. Future prospects for a change in this situation depend on development of new residential single-family, multi-family, and mobile home rental units. Continuing uncertainty about military employment, the nuclear waste repository, and mining activity in the region has been and will continue to be a hindrance to private development of rental housing units.

The Mother Lode Project is expected to create a peak total of between 41 and 64 new construction-related households by July 1989, an average of between 27 and 43 households for the duration of the construction activity, and 45 project-related households during operations based on impact assessment Scenarios 1 and 2.

If the housing stock remains at the current level (i.e., impact assessment Scenario 1), construction workers would be required to find housing outside of the Beatty and Amargosa Valley area and many would have to commute distances of over 180 miles a day. Amargosa Valley, which is approximately 40 miles from Beatty, has approximately 110 vacant mobile home spaces and multi-family housing units related to the now closed American Borate Company mine. Currently, the multi-family housing is boarded up and in litigation. The mobile home park is located on mill site claims and therefore, may not legally be available for lease. If these units and spaces became available to construction workers, housing impacts could be reduced in Beatty and other areas of Amargosa Valley. However, construction workers would still be required to commute over 90 miles per day. Currently, the primary source of housing in Beatty is motels; neither multi-family nor mobile home rentals are available. Motels could provide housing for most of the workforce if blocks of rooms were reserved in advance. Tourist business would be adversely affected; however, the summer months have the lowest occupancy rates in Beatty. These months coincide with the construction period, and motels would be able to accommodate the peak workforce. Most construction workers prefer rental units which provide some kitchen facilities, so motel rooms are generally less desirable than RV parks or mobile homes.

There is an abundance of private land in the Beatty and Amargosa Valley area available for development. There are also a number of lots within the Town of Beatty that could be developed for mobile homes or multi-family housing, and some development of owner-occupied single family units is occurring. Several constraints exist for developers, however, including: the unavailability of construction financing, land costs, a limited supply of contractors and construction labor, the risk associated with developing in an unstable economic setting such as Beatty and, most importantly, problems related to the quality and availability of water and sewage treatment. Some landowners have expressed interest in developing more mobile home sites in Beatty. One developer is pursuing development of a 460-acre commercial and residential housing development just south of Beatty. This proposed project is currently in the planning stages and hinges on financing and plan approval.

A shortage of housing creates several related problems if not resolved in a timely manner. Overcrowding in units that are available may cause worker dissatisfaction and high employment turnover rates that are both expensive and potentially socially disruptive. Construction workers, in particular, may camp randomly in the project area creating conflicts with private landowners and occupancy trespass problems for federal land managers.

Impact assessment Scenario 2 estimates impacts based on the assumption that housing would be available for most single workers who prefer to live alone and for married workers and their families. The Bond Gold mancamp has a capacity of approximately 400 and currently houses 150 workers. Bond Gold is willing to rent out available rooms to other workers in the area. Meeting the housing demand for the Mother Lode Project workforce would require considerable development throughout the Beatty and Amargosa Valley area in the next several months. Because several projects are beyond the planning stages, this development could be feasible, and housing demands could potentially be met.

These conditions would greatly improve the current housing situation in Beatty. However, because of the greater availability of family housing, there would be more construction workers who may opt to bring their families, which would cause a greater increase in population in the Beatty area during the construction phase.

The operations phase of the project would have greater impact on housing in Beatty. Although the estimated new household demand during operations (45 units) is less than construction demand, permanent operations personnel would desire more permanent housing including single-family, multi-family, and large mobile homes or modular units. USNGS has committed to provision of housing for the operations workforce and their families.

After the project is completed, vacancy rates in the area would increase unless there is an unmet housing demand from other economic activity in the area in 1991.

3.10.1.6 Public Facilities and Services

Health. The immigration of new population to the area could adversely affect already limited availability of health care facilities. Currently, there is only one full-time physician's assistant and two clerical/medical staff persons operating the Beatty Medical Clinic 5 days a week. A traveling physician visits the clinic once a week. The clinic has a case load of between 17 and 20 patients per day (Russell 1989). This is the maximum the clinic can handle per day. Clients currently must wait for several days before they can see the physician's assistant. With the estimated permanent population influx of 127 persons, additional full-time medical personnel, including a physician or another physician's assistant would be desirable. A full-time physician would decrease the number of patients traveling to Las Vegas or Tonopah for services that a physician's assistant is not licensed to perform. The existing facility has recently added two new exam rooms and is actively searching for a full-time physician's assistant to handle the influx of new populations. The nearest hospital facilities are in Las Vegas and Tonopah. USNGS is providing a concrete helipad at the Medical Clinic. There are approximately 9 volunteer emergency medical technicians (EMTs) associated with the fire department's ambulance service. The Fire Chief feels additional EMTs would be required to serve the additional population (Sullivan 1988).

Law Enforcement. The proposed project is expected to have moderate adverse impacts on the Nye County Sheriff's Department. During the construction phase, when people move to the area in search of employment at the mine, some transients would be unable to find a job and would be financially unable to leave the area or establish a residence. This situation, like that which has occurred with other mines in prior years, would foster increased work loads in the area of alcohol-related problems and traffic offenses for the sheriff's department (Zane 1988). The provision of adequate housing would be important in reducing the level of public disturbance during construction. The department would experience increases in case loads during the peak construction period. The Nye County Sheriff's Department may need to adjust the number of officers and patrols in some areas to avert problems.

With the influx of a population of over 125 during the operations phase of the project, the sheriff's department feels that additional personnel would be required to serve the population at the existing level of service (Sullivan 1988). In addition, the sheriff's office is currently inadequate to serve the existing population. The department feels that an additional three office spaces would be needed to provide reasonable service to the current Beatty population. When the mine construction begins, the new personnel would require additional space (Sullivan 1988). The jail facility in Beatty is adequate to serve the new population.

The Justice of the Peace also experiences overcrowding in the courtroom as well as administrative offices. With the influx in population, the court system may need to add a part-time assistant.

Fire. As described in Chapter 2, fire protection in Nye County is provided primarily by volunteer rural organizations. The proposed mine would have outside fire brigades and fire-fighting equipment available at the plant.

Impacts on the fire department would depend on where the majority of the new population locates. If the population is absorbed within Beatty, adequate coverage is currently available. The fire chief believes that if a sizeable part of the population locates at the Post Ranch south of Beatty, one of the existing two trucks should be housed in this location to reduce response time. Under this circumstance, a warehouse facility to house the fire truck would be required. A new truck may need to be added to the battalion (Sullivan 1988). Also, the increased population would supplement the staffing levels of the volunteer fire department programs. Additional EMTs would be required to handle the increased demand for emergency ambulance services.

Social Services. No dramatic increases in the case loads of social service agencies are expected to occur for the Mother Lode Project. Increased case loads likely to occur would include transient population assistance, domestic violence, and child abuse. If the construction workforce is not properly managed, social services issues could cause some problems within the area.

Utilities. Utilities, including electricity and telephone service, would adequately meet existing and projected future demand. Adequate power is available in Beatty for the existing and projected population.

Schools. School-age children migrating to the study area would attend the Beatty and Amargosa Valley schools. Enrollment would vary during peak and average construction and operations. Enrollment impacts would be greatest during the operations phase.

The Nye County School District would receive an enrollment impact, but would also benefit from increases in the tax base. Tables 3-4, 3-4A, 3-5, 3-5A, and 3-6 show the expected number of new project-related children by school level. During the peak construction period in 1989, the project is expected to result in a total student increase of between 11 and 82 based on impact assessment Scenarios 1 or 2. Average construction activity would impact the school district temporarily with between 7 and 22 new students. The existing facility and staff are not adequate to handle the higher number of primary and secondary students during peak construction. During peak construction for impact assessment Scenario 2, the school would be over capacity and would require one or two modular units and additional staff. This impact could be of a short-term nature, but if the additional classrooms and staff are available during the peak construction period, they would be in place during operations when the impacts of new school-age children would occur for the duration of the mine.

During operations, approximately 45 new households are projected to locate in the Beatty and Amargosa Valley area. The number of additional school-age children is estimated at 66, with primary students representing the majority (53) and secondary students a much lower level (14).

The operations phase would effect the capacity of the Beatty and Amargosa Valley schools in the primary grades 1 through 8. The school district passed a new bond issue in March 1989 which included construction of a new high school in Beatty. Construction of the facility will require 2 years, and the new high school will be ready for occupancy by 1991.

In the interim, the principal suggests that in order to adequately serve the incremental school enrollment once the mine starts operations, additional portable classrooms and staff would be required for the elementary grades. The high school facility has adequate capacity to provide education to the estimated 14 new students, but one new teacher may be required.

Water and Sewer. As described in Chapter 2, the construction and operations phases of the project would intensify existing supply and capacity problems for water and sewer in Beatty.

With provision of the new water supply pipeline by USNGS, the existing water system problems should be alleviated when the new well becomes operational.

Solid Waste Disposal. The capacity of the existing 20-acre county-operated landfill west of Beatty is sufficient to accommodate the increased population associated with mine development; only 5 acres have been filled to date. The remaining life of the landfill is 10 years (Yates 1988). Expansion of the facility should not be a problem because the landfill is located on BLM land.

Library. The library plans to expand the existing facility by approximately 480 square feet. This expansion will provide additional seating capacity and some space for book shelves. The librarian feels the current volume of books is adequate to serve the existing and projected populations (Holloway 1988). With the influx of school-age children, the library may need additional space for seating and additional personnel. USNGS has agreed to provide partial funding for additional staff.

3.10.1.7 Energy Consumption. The proposed project would primarily utilize diesel fuel. Minor amounts of gasoline would also be consumed for vehicular use. Diesel fuel consumption is estimated at 46 gallons per hour for the generators and 132 gallons per hour for mine and processing equipment operation. The total consumption would rise proportionally with the tonnage mined and with the increased depth of the pit.

3.10.1.8 Health and Safety. The use of hazardous materials for the Mother Lode Project should not pose significant safety risks. As discussed in Section 1.4.2.3, all toxic chemicals would be handled in isolated areas. Should a spill occur, USNGS would implement appropriate measures for neutralization, cleanup, and disposal.

3.10.2 Alternatives

The No Action Alternative would preclude development of the Mother Lode Project. Thus, both the beneficial and adverse environmental impacts listed in Section 3.10.1 would not occur. The No Action Alternative would preclude the development of economically significant precious metals reserves and associated beneficial employment and economic consequences. Similarly, it would avoid the short-term adverse impacts associated with project construction and operation.

Socioeconomic impacts associated with alternative facility locations would be the same as the Proposed Action.

3.11 Transportation

3.11.1 Proposed Action

Primary access to the proposed Mother Lode Project would come from U.S. 95 south of Beatty via Fluorspar Canyon Road and Tates Wash Road. All truck traffic would follow this route as would nearly all worker auto access. There is a secondary emergency access route available via Perlite Canyon. This route has more curves, is not maintained as well as the primary route, and is slower. Therefore, it likely would be less attractive to most workers. This difference would be accentuated upon completion of proposed project-related improvements to Fluorspar Canyon and Tates Wash Roads.

Estimates of traffic that would be generated by the proposed project were made based on the employment estimates developed by USNGS (1988). The project would employ a peak of 75 construction workers and would level off to 45 operating workers for the life of the project. Because of the scale of proposed operating characteristics of the project, simple, worst-case traffic impact scenarios were analyzed. The analysis addressed the peak construction and average operating work forces on site with the following assumptions:

- All workers would work a single day shift coterminous with peak traffic hours on U.S. 95.
- Each worker would drive a private vehicle to and from the work site daily.

These assumptions are considered to be conservative. For example, workers on mining and construction projects often average 1.5 to 2.0 or more occupants per commuter vehicle.

The results of the peak hour traffic analysis are presented in Table 3-8. The relative traffic flow increases on U.S. 95 for construction and operations traffic would be about 19 percent and 12 percent, respectively. Levels of service would remain in the "B" range which is quite good for peak traffic periods and is above the design standard for most rural highways.

TABLE 3-8

PEAK HOUR TRAFFIC EFFECTS OF THE
PROPOSED MOTHER LODE PROJECT

	U.S. 95 South of Beatty	
	Peak Construction[1]	Operations
Existing Traffic[2]	385	385
Project Related Increase[3]	75	45
TOTAL	460	420
Peak Hour Capacity[4]	1,800	1,800
Volume/Capacity Ratio	0.26	0.23
Level of Service	B	B

[1] 2nd Quarter 1989

[2] Estimated at 15 percent of annual average daily traffic (AADT)

[3] Assumes one shift per day and one occupant per vehicle.

[4] 1985 Highway Capacity Manual (TRB 1985) methodology; assumes approximately 1/3 heavy trucks in traffic stream.

Increased traffic would slightly increase accident risk at the intersection of Fluorspar Canyon Road and U.S. 95, but there are unobstructed views of approaching traffic and low traffic volumes. Consequently, the intersection is quite safe and any increase in accident risk would be very minor.Truck traffic to the project would be minimal and would not be expected to affect traffic or road conditions to any measurable degree. In summary, project related effects on highway transportation in the project vicinity would not be significant. There would be no notable effect on other transportation modes in the region from development of the Mother Lode Project.

3.11.2 Alternatives

The No Action Alternative would have no effect on area transportation. Alternatives 1 and 2 would have exactly the same transportation effects as the Proposed Action.

3.12 Recommended Mitigation and Monitoring Measures

This section identifies mitigation and monitoring measures. These measures are designed to: 1) minimize significant adverse impacts identified in the environmental impact analysis, 2) provide additional design recommendations for USNGS to consider in final engineering, and 3) meet the anticipated requirements of state and federal permits. This list includes specific measures that would be implemented by the BLM or other regulatory agencies and recommended measures that may be implemented by USNGS. Mitigating measures to be included as stipulations in the BLM's Record of Decision will be identified in the Final EA.

3.12.1 Air Resources

Measures to control air pollutant emissions are included in the project design; no additional measures are recommended

3.12.2 Water Resources

Mitigation Measure WR-1: Characterization of the waste rock and sulfide stockpile is currently underway to determine the potential for acid runoff. If tests indicate a potential problem, then a bed of crushed limestone would be constructed beneath the piles in compliance with Nevada Division of Water Resources stipulations.

Mitigation Measure WR-2: Pump tests have not been conducted in the area to quantify drawdown estimates. In order to verify the estimates and to ensure that if a change occurs it can be identified, a groundwater monitoring system will be implemented. On-site water supply wells will be monitored. An additional well completed by the U.S. Geological Survey in Crater Flat will also be monitored. (e.g., Well USW-VH-1 or USW-VH-2 as indicated on Figure 1 of Appendix A). The monitoring will continue through project operations.

Once the State Engineer has ruled on the water permit, BLM will review the permit stipulations for consistency with BLM's monitoring requirements.

3.12.3 Vegetation

Mitigation Measure V-1: Establishment of noxious weeds in disturbed areas will be monitored during construction and operation. In the event that weeds (e.g., Russian thistle) begin to inundate the project site, BLM will be consulted to determine effective means of control, if deemed necessary.

Mitigation Measure V-2: Final slopes on waste dumps and leach pads will be graded to a slope of 3 horizontal to 1 vertical. Waste dumps will be resoiled prior to revegetation.

3.12.4 Cultural Resources

Mitigation Measure CR-1: Specific cultural resources mitigation will be recommended by the BLM in consultation with the State Historic Preservation Office (SHPO). These measures will become stipulations in the Record of Decision.

3.12.5 Aesthetics

3.12.5.1 Visual Resources

Measure VR-1: To the extent practicable, the shape and form of waste dumps will be designed to repeat natural forms in the area. The project would be less visually obtrusive and would thus generate less impact if natural, curvilinear forms are used in the waste dump by rounding off the 'shoulders' of the dump and changing the dump profile from a plateau to an irregular ridge form.

Measure VR-2: Natural colors in the project area will be employed to the extent possible. This should include use of dull, non-reflective paint on structures in colors mimicking those seen naturally in the area but in slightly darker tones.

Measure VR-3: If, as anticipated, the waste rock from the mine contrasts strongly with natural surface and vegetation colors in the vicinity, the final 'layer' on the face of the dump should employ darker material approximating dominant natural colors.

3.12.5.2 Noise

USNGS has committed to blasting during daylight hours, preferably between the hours of 8:00 a.m. and 8:00 p.m. No additional mitigation is required.

3.12.6 Socioeconomics

Due to the level of mining development already occurring in the Beatty area from the Bond Gold Bullfrog Project, the development of the Mother Lode Project will exacerbate the housing, infrastructure, and service provision problems already existing.

Currently, there are a number of developers interested in providing additional housing for the Bond Gold construction workforce; however, results of their efforts to-date have not dramatically improved the existing housing problem. Housing appears to be the major impact from future mine development facing the Beatty area.

Few changes have occurred in the provision of public services and facilities. The services remain about the same as before Bond Gold started the construction of the Bullfrog Project which currently has a work force of approximately 600. Services which were inadequate before Bond Gold started construction, now are well below acceptable standards (see Section 4.3.5.5).

The following measures have been identified to provide a range of available options to mitigate adverse socioeconomic impacts.

Measure SE-1: Provision of current project information to local governments is a critical mitigating factor to enable planning agencies to respond effectively to projected changes in demand for housing, public facilities, and services. USNGS should continue to work with Nye County and Beatty and provide county officials with current estimates regarding employment, project startup and completion dates, company housing policies, school-age children, and anticipated recreational needs of the workforce and their families.

Measure SE-2: The projected shortage of housing during the construction phase could lead to prolonged camping or "occupancy trespass" on public lands. USNGS should attempt to limit this occurrence by working with federal land managers, county officials, other mining companies, and housing contractors.

Measure SE-3: Before housing for increased population can be developed in Beatty, adequate water quality and supply must be ensured. The Town of Beatty water and sanitation district should set its rates according to actual costs of operation with a substantial reserve fund set aside for emergency maintenance and operations problems. The district should also consider a plant investment fee to alleviate a similar situation in the future.

Measure SE-4: In order to help counter the projected financial burden of capital expenditures for public facilities and services in Beatty, the town and county could: 1) request supplemental funds from the state/county/city relief tax reserve funds to cover increased expenditures for the induced population; 2) request prepayment of taxes to reduce the lag time between construction impacts and tax receipts; and 3) negotiate with the county to earmark new net proceeds revenues for priority capital projects. If these requests were granted by the state, it would increase revenues to the Nye County budget for increased expenditures caused by the immigrating population.

Measure SE-5: USNGS could donate recreation supplies and/or maintenance equipment to the Beatty General Improvement District. USNGS could encourage its employees and their families to volunteer time and assistance in the development and maintenance of recreation facilities.

3.13 Summary and Comparison of Alternatives

3.13.1 Summary of Impacts

Table 3-9 summarizes the potential impacts associated with the proposed project. Information in the table was derived from the analyses for specific resources in Sections 3.1 through 3.11. Additionally, Table 3-9 provides perspective for balancing the various impact conclusions by reviewing the impacts in terms of the following criteria:

- Is the impact considered beneficial or adverse? The terms beneficial and adverse are subjective, however judgments are made regarding the overall nature of the projected change. These judgments are made in terms of the specific affected resource only.
- Is the impact avoidable or unavoidable? An avoidable impact is one that may be minimized or prevented if the recommended mitigation measures included in Section 3.12 are implemented. Certain impacts, however, would be unavoidable consequences of the proposed mine and processing operations.
- What is the duration of the impact? Here, short term is defined as the 3-year project life. Long-term impacts would last beyond the project life. These time frames are important in evaluating the overall trade-offs between the short-term use of the land for mineral extraction and long-term future uses.
- Would the impact represent either an irreversible impact or an irretrievable commitment of resources? An irreversible commitment of a resource is one which cannot be changed once it occurs; an irretrievable commitment means that the resource is permanently lost.

As shown in Table 3-9, implementation of USNGS' proposed Plan of Operations would result in both beneficial and adverse impacts. The beneficial impacts are primarily social and economic, deriving from increases in employment opportunities, tax revenues, and economic activity resulting from the proposed project. Not all of the social impacts would be beneficial, however, as housing demand is expected to exceed supply, and Nye County and Beatty are expected to experience added fiscal burdens to provide facilities and services for the immigrant population. Additional adverse impacts are associated with site-specific disturbances required to construct and operate proposed facilities.

Some of the adverse impacts summarized in Table 3-9 are unavoidable. These impacts are necessary consequences of a mining and processing operation. For example, vegetation and soil disturbances are required for facilities construction; particulate matter emissions cannot be

TABLE 3-9

SUMMARY OF IMPACTS OF THE PROPOSED MOTHER LODE PROJECT

Resource/Impact	Beneficial (B) or Adverse (A)	Unavoidable	Short Term[1]	Long Term[2]	Irreversible or Irretrievable	Mitigation Measures Identified
<u>Air Resources</u>						
Increased particulate matter emissions	A	Yes	Yes	No	No	No[3]
<u>Geology and Mineral Resources</u>						
Extraction of gold	B	Yes	Yes	Yes	Yes	No
<u>Water Resources</u>						
Potential adverse impacts of water withdrawal on downstream resources	A	No	Yes	No	No	Yes
<u>Soils</u>						
Disturbance of 75 acres of soil resources	A	Yes	Yes[4]	Yes[4]	No[4]	No[5]
Increased erosion on disturbed areas	A	Yes	Yes	No	No	No[5]
Loss of topsoil resource on non-salvaged areas	A	No	Yes	Yes	Yes	No
<u>Vegetation</u>						
Disturbance of 75 acres of vegetation	A	Yes	Yes[4]	Yes[4]	No[4]	No[5]

TABLE 3-9 (CONTINUED)

Resource/Impact	Beneficial (B) or Adverse (A)	Unavoidable	Short Term[1]	Long Term[2]	Irreversible or Irretrievable	Mitigation Measures Identified
<u>Wildlife</u>						
Disturbance of 75 acres of wildlife habitat	A	Yes	Yes[4]	Yes[4]	No[4]	No[5]
Increased wildlife disturbance and mortality	A	Yes	Yes	No	No	No
<u>Land Use and Recreation</u>						
Conversion of rangeland to industrial use	A	Yes	Yes	No	No	No
Conflicts with existing and future land use	A	No	Yes	No	No	No
<u>Cultural Resources</u>						
Disturbance of cultural resources	A	No	No[6]	No[6]	No	Yes[6]
<u>Visual Resources</u>						
Increased visual contrasts	A	Yes	Yes[4]	Yes[4]	Yes[4]	Yes
<u>Socioeconomics</u>						
Increased population	B,A	Yes	Yes	No	No	No
Increased employment	B	Yes	Yes	No	No	No

TABLE 3-9 (CONTINUED)

Resource/Impact	Beneficial (B) or Adverse (A)	Unavoidable	Short Term[1]	Long Term[2]	Irreversible or Irretrievable	Mitigation Measures Identified
Socioeconomics (continued)						
Increased economic activity	B	Yes	Yes	No	No	No
Increased Nye County revenues	B	Yes	Yes	No	No	No
Increased Nye County expenditures for services	A	Yes	Yes	No	No	Yes
Housing shortage	A	No	Yes	No	No	Yes
Shortage of public facilities and services	A	No	Yes	No	No	Yes
Increased school enrollment	A	No	Yes	No	No	Yes

Notes:

1 Short term is defined as the 3-year duration of the project.

2 Long term is defined as extending beyond project abandonment.

3 Emission controls are included in the Plan of Operations; additional mitigation is not considered necessary.

4 With the exception of the open pit, the disturbance area will be reclaimed; therefore, approximately 8 acres will be subject to long-term impacts.

5 The reclamation plan is included in the Plan of Operations and is therefore not considered mitigation.

6 Mitigation will be developed by the BLM in consultation with the SHPO to ensure no adverse impact to significant cultural resources.

completely eliminated; and certain visual impacts associated with new facilities are unavoidable Other impacts listed in the table can be avoided or further reduced by implementing the mitigation and monitoring measures identified in Section 3.12.

Most of the impacts identified for the proposed project would be short-term effects that would not extend beyond the project life. The conversion of rangeland/wildlife habitat to disturbed surface use would be a long-term consequence of the mining development although the overall duration of the effect depends on reclamation approaches. Most disturbed lands could eventually be returned to post-mining uses as rangeland and wildlife habitat.

Finally, few of the impacts identified represent either irreversible impacts or irretrievable commitments of resources. By design, the geologic formations of the open-pit mine would be irreversibly changed during mining, and the gold produced would be irretrievable once shipped to market. Such changes are the purpose of the proposed mining development. With the exception of the rangeland/wildlife habitat removed by the mine itself, other land commitments would be reversible after mining operations cease and reclamation plans have been implemented. Disturbance of cultural resources sites would be irreversible, although mitigation programs are designed to recover valuable information from the sites. Soil losses on areas where topsoil is not salvaged would be irreversible.

3.13.2 Comparison of Alternatives

Chapter 1 listed two types of alternatives to be evaluated in the EA: the No Action Alternative and facility location alternatives. These alternatives were discussed in appropriate places in the discussions for individual resources. The following paragraphs summarize the conclusions reached regarding the various alternatives, highlighting the trade-offs associated with each.

No Action Alternative. The No Action Alternative is included in the EA as required by NEPA, although BLM regulations allow BLM to reject a proposed Plan of Operations only under conditions where the proposal would violate certain federal or state laws or would result in the undue or unnecessary degradation of federal lands. The environmental analyses did not identify conditions that would constitute undue or unnecessary degradation, given environmental protection and engineering features included in the Plan of Operations and the mitigation recommendations incorporated into the EA. Violations of federal or state law appear unlikely, although several agencies must still evaluate specific design proposals and permit applications.

The No Action Alternative would preclude project development. Thus, the environmental impacts listed in Table 3-9 would not occur. The No Action Alternative would preclude the development of economically significant precious metals reserves and associated beneficial employment and economic consequences. Similarly, it would avoid the short-term adverse impacts associated with facilities construction and operation.

Facility Location Alternatives. The principal differences among these alternatives relate to the physical facility locations.

The air quality impacts would be similar for all alternatives; fugitive dust emissions would not vary significantly among the alternatives as the haul distances are very similar.

The geology and water resources impacts would not vary appreciably among the facility location alternatives. The facilities would be located within the same drainage basin and groundwater system for the Proposed Action and Alternatives 1 and 2. Therefore, the impacts of water withdrawal and potential cyanide contamination would be the same.

The amount of soils, vegetation, and wildlife habitat disturbance would be approximately 75 acres for all alternatives. The size of the "project area", e.g., the area to be fenced, varies from a maximun of 188 acres with the Proposed Action to a minimum of 159 acres with Alternative 2. The principal soils types and vegetation types (mixed desert shrub/forb and mixed desert shrub) affected would be the same for all alternatives. The amount of topsoil suitable for salvage would vary minimally from a maximum average depth of 11.3 inches with Alternative 1 to a minimum of 10.2 inches with the Proposed Action. Impacts to sensitive plant species and important wildlife habitat would be the same.

The BLM is in the process of assessing impacts to cultural resources identified in the project area. Once NRHP eligibility has been determined, potential effects to significant resources will be ascertained and suitable mitigation will be developed.

Visual impacts would be similar for the alternatives. Alternative 1 would result in lower visual contrast than the Proposed Action from KOPs 1 and 2; visual effects from KOP 3 would be the same as the Proposed Action. In Alternative 2, the waste rock dump would be partially screened from KOP 1; it would be less prominant from KOP 2. Visual effects of Alternative 2 would be the same as for the Proposed Action.

Noise effects of Alternatives 1 and 2 would be the same as for the Proposed Action as would transportation effects.

4.0 CUMULATIVE IMPACT ASSESSMENT

4.1 Introduction

The Council on Environmental Quality defines cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.... Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

This chapter of the EA analyzes potential impacts from construction or operation of projects interrelated in one or more ways with the Mother Lode Project. The analysis considers activities determined by the BLM to be "reasonably foreseeable"; past and present conditions have been considered as part of the existing environment (Chapter 2) and are reflected in the impact analysis in Chapter 3.

In evaluating potential cumulative impacts, it is important to recognize that future actions will be subject to site-specific environmental review by responsible agencies prior to implementation, including recommendation and adoption of mitigation measures, if necessary.

4.2 Description of Interrelated Projects

Other projects in the area were examined to determine if their environmental impacts would be interrelated with the impacts of the Mother Lode Project. Projects may be interrelated in various ways. For example, projects which are constructed during the same time period may compete for the same labor force. Additionally, socioeconomic effects on local services and infrastructure could be increased. Simultaneous construction or operation of projects could jointly add to the degradation of air quality. Projects could also have cumulative impacts on surface resources such as wildlife habitat. All potentially interrelated projects were reviewed to see if their location, time schedule, employment levels, air emissions, water demands, or surface disturbance would contribute to cumulative impacts with the Mother Lode Project. The criteria for consideration as an interrelated project included time schedule and location. The timeframe for the cumulative impact assessment is mid-1989 to mid-1992, the schedule for construction and operation of the Mother Lode Project. The geographic area extends from Springdale to the north, Death Valley

National Monument to the west, the Bare Mountain area to the south, and the military reservation to the east of the Mother Lode Project.

The projects considered in the cumulative impact assessment are summarized below; the project locations are shown in Figure 4-1.

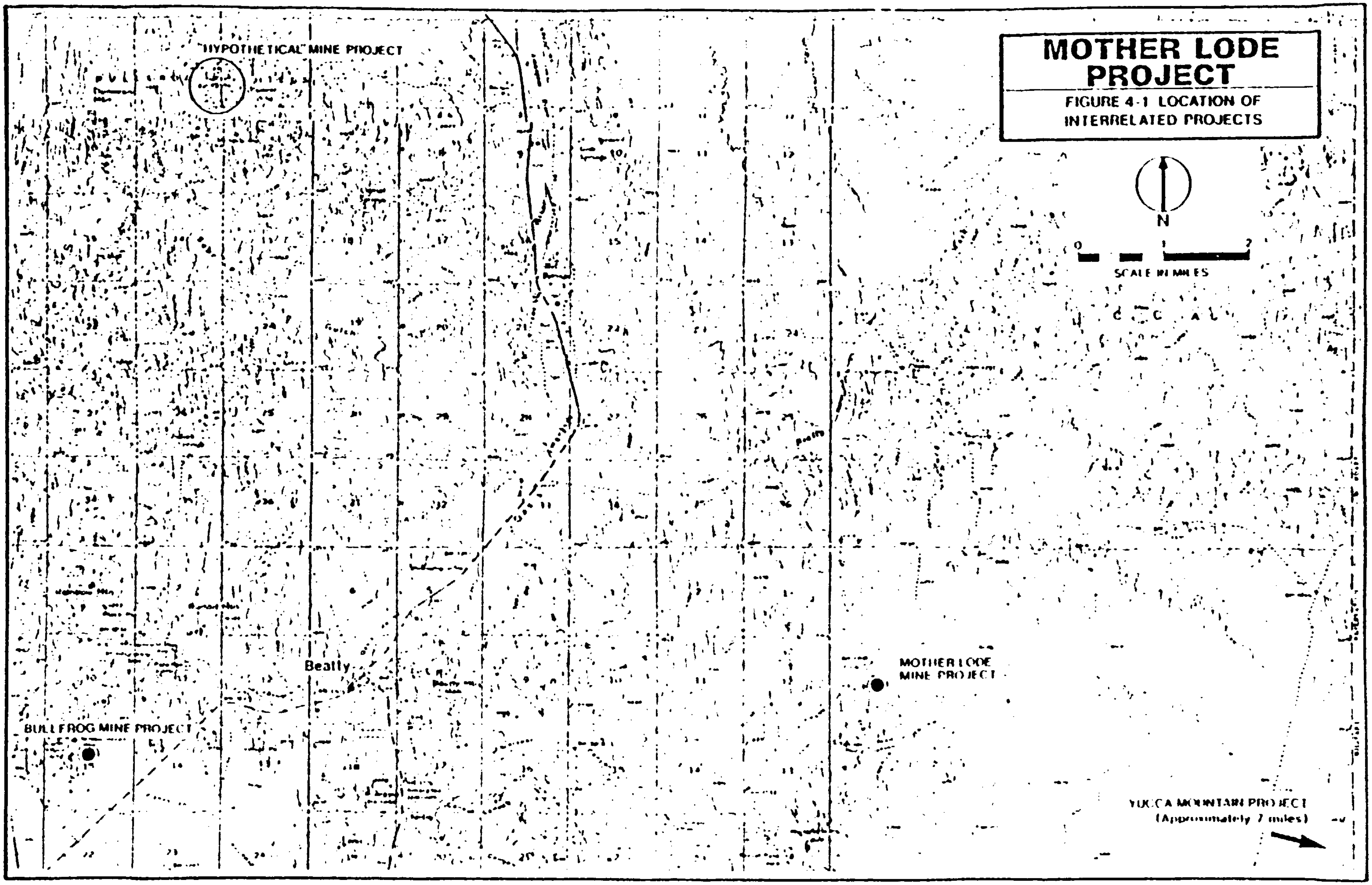
4.2.1 Bullfrog Project Operation

Bond Gold Corporation is currently constructing the Bullfrog Project, a precious metals mining and processing operation located approximately 3 miles west of Beatty. Bond began construction in the summer of 1988 and anticipates that the Bullfrog Project will begin operations in July 1989; the operations workforce is estimated at 328 people (Bond Gold 1989). Bond has been granted water permits by the Nevada State Engineer for the withdrawal of up to 2,000 gpm of groundwater for project operations. Project disturbance will total approximately 2,500 acres. The project life is projected to be 10 years.

4.2.2 "Hypothetical" Mining Project

The recent increase in mining activity in the Beatty area indicates the potential for cumulative environmental impacts. This judgement is based on the fact that several mining companies are involved in precious metals exploration, although to date no companies have announced plans to develop their claims. An evaluation of past and present mining notices to operate and an in-depth analysis of available geologic data has led to the conclusion that only one small location within the project area has the potential to be developed into a mine within the foreseeable (3-year) future. Therefore, BLM has hypothesized one mining project for the cumulative impact analysis.

The project would be located near the historic Pioneer Mine, approximately 8 miles north of Bond Gold's Bullfrog Project. Exploration has been ongoing in this area for a number of years, and a mineral deposit has been identified. The project would be an open-pit mining and heap leach operation; all mining and processing activities would be similar in type to the Mother Lode Project. Approximately 4,500 tons per day (tpd) of ore would be mined. The project would disturb approximately 100 acres of unpatented federal land. The project would employ approximately 100 people during construction and 75 people during operations. Estimated water use would be approximately 400 acre-feet of water per year at an average rate of 250 gpm.


MOTHER LODE PROJECT
FIGURE 4-1 LOCATION OF INTERRELATED PROJECTS
N
SCALE IN MILES
"HYPOTHETICAL" MINE PROJECT
Beatty
BULLFROG MINE PROJECT
MOTHER LODE MINE PROJECT
YUCCA MOUNTAIN PROJECT
(Approximately 7 miles)

4.2.3 Yucca Mountain Nuclear Waste Repository

The U.S. Department of Energy is currently conducting studies to characterize the suitability of a site near Yucca Mountain as a disposal area for high-level radioactive waste. The main activities projected to occur at Yucca Mountain from mid-1989 though mid-1992 are associated with collection of geotechnical, hydrologic, and environmental data. Although an estimated 675 people are expected to be involved at the peak of these activities in Nye County, studies conducted specifically for the proposed repository (PIC 1988) estimate that approximately 10 workers would reside in the Beatty area. The majority of the workforce currently lives in the Las Vegas area and is expected to continue to commute to Yucca Mountain during site characterization. The Yucca Mountain site is located approximately 13 miles east of the Mother Lode Project.

4.3 Cumulative Impacts

Environmental consequences of the proposed Mother Lode Project were evaluated in Chapter 3.0 for each resource topic, including air resources; geology, mineral resources, and paleontology; water resources; soils; vegetation; wildlife; land use and recreation; cultural resources; aesthetics; socioeconomic; and transportation. Of these resource categories, air, water, vegetation, wildlife, land use and recreation, and socioeconomic are appropriate for cumulative impact assessment in conjunction with the Mother Lode Project. Other resources, including geology, soils, cultural resources, aesthetics, and transportation would not result in unavoidable adverse impacts that could be cumulatively important and are not further evaluated in this EA. Geology, soils, visual, noise, and cultural resources impacts would be specific to each site and would not be issues of cumulative concern. The relative locations of the interrelated projects considered in this analysis would preclude cumulative transportation impacts.

4.3.1 Air Resources

This section presents the results of the examination of the cumulative effects of the potentially interrelated projects on air quality in the Beatty area. Impacts to air quality from the interrelated mining projects would result primarily from particulate and dust emissions from the mining and ore processing operations at each individual facility. A small amount of gaseous air pollutants would be emitted from mining and construction equipment, but these emissions are not significant.

The cumulative impact analysis specifically considered the proposed USNGS Mother Lode Project as well as the Bullfrog Project and the hypothetical mine development described above. Air emissions from the proposed nuclear waste repository site at Yucca Mountain should not be significant during the expected duration of the Mother Lode Project. At this time, Yucca Mountain will be in the developmental stage undergoing site characterization. Even though there will be some minor air emissions from drilling rigs and the like, such emissions are primarily gaseous pollutants, as opposed to the particulate released from mining operations. As such, repository site characterization will not add to the particulate burdens from existing and proposed mines near Beatty.

The cumulative air quality impact analysis of point source emissions for the mining projects was performed using the EPA COMPLEX I dispersion model. The modeling analysis described here includes only emissions from point sources such as crushers and ore handling and not fugitive dust from mining operations. The emissions from each mine are combined and treated as a single point source. The model was run for each mine separately as well as for the three mines combined.

Both the cumulative and the individual analysis show the highest air quality impacts to be in the immediate vicinity of each mine. In all three individual analyses, the predicted maximum average annual concentration and predicted maximum 24-hour concentration was within 1 kilometer of the mine.

A comparison of the predicted maximum annual average and maximum 24-hour average for each mine modeled separately to the cumulative results verifies the conclusion that maximum values are not significantly affected by the cumulative impact of the three projects. The predicted cumulative maximum annual average was 10.01 micrograms per cubic meter ($\mu g/m^3$) at the Bullfrog mine, while the predicted maximum annual average at the same location of the Bullfrog mine alone was 9.99 $\mu g/m^3$. This is a difference of 0.02 $\mu g/m^3$, or less than 1 percent of the standard of 50 $\mu g/m^3$ for annual average PM-10 concentrations.

Similarly, the predicted cumulative 24-hour maximum of 67.89 $\mu g/m^3$ was located near the Bullfrog mine. Modeled separately, the 24-hour maximum for the Bullfrog mine was 67.83 $\mu g/m^3$, a difference of 0.06 $\mu g/m^3$, less than 1 percent of the standard of 150 $\mu g/m^3$ for 24-hour maximum concentrations.

The cumulative impacts on the Town of Beatty were also analyzed with the model. Again, the maximum impacts predicted by the cumulative analysis were very close to those predicted by the analysis that included only the Bullfrog mine emissions, which is the closest of the three mining operations to Beatty. The predicted cumulative annual average at the Beatty location was 0.75 $\mu g/m^3$, while the value from the Bullfrog mine alone was 0.72 $\mu g/m^3$. This shows a difference of 0.03 $\mu g/m^3$, or less than 1 percent of the standard. The predicted annual average at the Beatty location was 0.01 $\mu g/m^3$ for both the Mother Lode mine and the hypothetical mine. The predicted cumulative 24-hour maximum concentration at the Beatty location was 3.53 $\mu g/m^3$. The corresponding value from the Bullfrog mine analysis was 3.47, showing that the other area mines had a contribution of only 0.06 $\mu g/m^3$.

Cumulative air quality impacts were also predicted for locations at Death Valley National Monument. As with the other locations, no significant cumulative effects were predicted. Annual mean impacts at the Monument were almost negligible, ranging between 0.05 and 0.09 $\mu g/m^3$ depending on location. Maximum 24-hour impacts were also extremely small at 1.0 $\mu g/m^3$ or less. Impacts to the Monument were highest along the eastern boundary near the Bullfrog Mine.

In conclusion, the cumulative effect of the three projects on air quality in the Beatty area would not be significant. The cumulative effect of the three mining projects on Death Valley National Monument would not be significant for the same reasons. Air quality impacts occur only in the immediate vicinity of area mines and are due almost entirely to the impact of the local mine. In addition, new mines would be required to control emissions to ensure compliance with federal and state standards.

4.3.2 Water Resources

This section discusses cumulative impacts to water resources from potentially interrelated projects including the Mother Lode Project, Bullfrog Project, a hypothetical mine, and the Yucca Mountain nuclear waste repository. Potential impacts to the municipal water supply for the Town of Beatty as a result of those operations are discussed in Section 4.3.5, Socioeconomics.

4.3.2.1 Regional Hydrogeologic Framework

The cumulative impact of existing and proposed projects on water resources is largely controlled by the project location with respect to the hydrogeologic framework of the area. In general, basin and range structure dominates the occurrence of significant water resources in the vicinity of Beatty. Downthrown valleys filled primarily with alluvial materials have been identified as the most significant sources of groundwater (Malmberg and Eakin 1962; Hydro-Search Inc. 1989). These valleys include Oasis Valley, northern Amargosa Valley, Crater Flat, and Sarcobatus Flat. Groundwater also occurs and has been developed by wells in consolidated volcanic and metasedimentary rocks in the various mountain ranges surrounding Beatty. However, development to date of this resource has been relatively minor in comparison to the valley fill materials, due to factors including low permeability (and resulting low well yields), high cost of drilling, depth to water, and generally poor access or remoteness from place of use.

Other rocks that constitute significant sources of groundwater in the region include carbonate sequences that, due to secondary permeability and stratigraphic position, act as regional aquifers (Winograd and Thordarson 1975). In general, these sequences where water-saturated occur to the east and southeast of the Beatty area (See Appendix A for further discussion).

4.3.2.2 *Groundwater Quantity*

The Bullfrog Project (currently under construction), located approximately 3 miles west of Beatty and approximately 10 miles west of the Mother Lode Project, is expected to use about 2,000 gallons per minute (gpm) of water over the 10-year life of the mine (BLM 1988). The Mother Lode Project is expected to use about 250 gpm over the 3-year life of the mine. The water permit applications request 7-year permits with the expectation that the mine life may be extended.

The Bullfrog Project water supply wells are producing water from alluvial material in the northern Amargosa Desert with a static elevation of approximately 3,250 feet above sea level from interbedded alluvial and volcanic materials in Crater Flat (Hydro-Search Inc. 1989). These water sources are distinct and separate from each other. Hydraulic barriers exist that prevent direct interaction of the water source (alluvial valley-fill material in Crater Flat) from the Mother Lode Project with the water source (alluvial material in Amargosa Desert) of the Bullfrog Project (BLM

1988; Hydro-Search Inc. 1989; Sharp 1989; Winograd and Thordarson 1975; Blankennagel and Weir 1973; Malmberg and Eakin 1962). Bare Mountain itself acts as a relatively impermeable block (Winograd and Thordarson 1975; Blankennagel and Weir 1973; Sharp 1989) to water movement in a southwesterly direction from the Mother Lode Project.

The Bullfrog Project wells are located in the northern portion of the Amargosa Desert groundwater system (Winograd and Thordarson 1975; Walker and Eakin 1963), whereas the proposed Mother Lode Project wells are located within the Oasis Valley /Fortymile Canyon groundwater system (Blankennagel and Weir 1973; Winograd and Thordarson 1975). The Oasis Valley/Fortymile Canyon groundwater system is indirectly connected to the Amargosa Desert flow system through Oasis Valley and ultimately the Amargosa Narrows near Beatty and farther south and west through southern Crater Flat and Fortymile Canyon (Winograd and Thordarson 1975; Blankennagel and Weir 1973; Malmberg and Eakin 1962). Because of the presence of the relatively impermeable rocks within Bare Mountain, flow is deflected around the mountain (see Appendix A). The groundwater body potentially affected by the Mother Lode Project would be in Crater Flat rather than Oasis Valley. No interrelation of potential groundwater resource impacts is expected to occur between the Bullfrog and the Mother Lode Projects because of the separate nature of the basin fill aquifers being tapped by the two well fields.

In summary, Bond Gold's Bullfrog Project and the USNGS Mother Lode Project are not expected to generate cumulative impacts to the groundwater resources in the area since their respective water sources are not interrelated and their respective impacts are not considered significant in themselves (Hydro-Search Inc, 1989; Sharp 1989). There is no interrelation between the two projects with respect to groundwater because: 1) the hydrogeologic framework of the region results in segregation of the alluvial aquifers being developed; 2) localized groundwater flow direction precludes interrelation of the two distinct groundwater bodies; and 3) duration and extent of their water requirements are limited.

The hypothetical mine considered in the cumulative analysis is located on the northeast flank of the Bullfrog Hills near the historic Pioneer Mine, to the north of Beatty and the Bullfrog Project. The hypothetical mine is located approximately 10 miles northwest of the Mother Lode Project. The hypothetical mine is assumed to be an open-pit heap leach operation similar in type and scale to the Mother Lode Project. Estimated water use for the project is approximately 400 acre-feet of water per year at an average rate of 250 gpm. Several assumptions were made in order to conduct a cumulative water resources impact assessment addressing the activities of the hypothetical mine:

1) The construction and operation of the hypothetical mine and the Mother Lode Project are concurrent.

2) Groundwater for the hypothetical mine is obtained from the alluvial fill aquifer in Sarcobatus Flat north and east of the mine site. This would appear to be the most likely source of water in this location according to Malmberg and Eakin (1962) and Blankennagel and Weir (1973).

3) The expected drawdown cone from the project, using the same conservative approach as was used for the Mother Lode Project (e.g., no consideration of hydraulic barriers) is negligible at a 5-mile radius from a well in T.10S R.46E Section 28 after 7 years. Parameters used to project drawdown include: transmissivity = 4,000 to 10,000 gpd per foot; specific yield = 0.10; and discharge = 250 gpm.

The water supplies for the Mother Lode and hypothetical mine projects are located in separate groundwater flow systems (Malmberg and Eakin 1962: Blankennagel and Weir 1973). The Armargosa River in Oasis Valley represents the western boundary of the Oasis Valley/Fortymile Canyon flow system in which groundwater is generally moving from north to south. Groundwater in Sarcobatus Flat flows north and west toward Death Valley (Malmberg and Eakin 1962). Development of groundwater resources from these two separate valley-fill aquifers would result in separate and distinct drawdown cones. The occurrence of volcanic rocks and relatively impermeable metasedimentary rocks in the ranges separating these two areas and direction of groundwater gradients between them preclude hydraulic interrelation of the two distinct groundwater bodies.

If the groundwater drawdown cones of the two projects were to intersect, then cumulative impacts from both projects operating together would be expected. Even if the hydrogeologic boundaries were ignored, the drawdown cones from the hypothetical mine project and the Mother Lode Project would not be expected to intersect since the projects are approximately 10 miles apart. Hydrogeologic boundaries that are present, however, would prevent this scenario from occurring.

In summary, the hypothetical mine operation in conjunction with the Mother Lode Project would not be expected to result in cumulative impacts with respect to groundwater in the area primarily due to the separate flow systems and hydrogeologic boundaries that exist in the area. Furthermore, any operation to the north of the Mother Lode Project west of the Oasis Valley and Bare Mountain would not be expected to have any cumulative impacts associated with the Mother Lode Project because of the hydrogeologic boundaries present. This, coupled with the relatively short duration of the amount of pumping involved with most mine projects and the long distances to sensitive areas, would indicate that cumulative effects from currently known mining operations and a specific hypothetical mine operation in the area are not anticipated.

Sensitive areas of interest and concern include the Ash Meadows springs and Devils Hole. As discussed in Section 3.3, the Ash Meadows flow system boundary occurring to the west of Devils Hole and along the line of the Ash Meadows springs essentially prevents hydraulic communication from areas to the northwest and west of the flow system boundary where the Mother Lode and Bullfrog Projects are located. As a result, no cumulative effects would be expected at the Ash Meadows springs or Devils Hole.

Other areas of concern, namely local springs in Oasis Valley, the Town of Beatty water supply, and low discharge/high elevation springs within the Death Valley National Monument are not expected to be impacted due to either the relationship of their elevation and/or distance from the existing and proposed alluvial valley-fill aquifers utilized by the mines. Areas such as the Amargosa Farm area (central Amargosa Desert) and high discharge springs near Park Headquarters in Death Valley National Monument would also not be expected to experience effects due to the long distances and amount of pumping involved with the existing and proposed mines.

In the future, if a number of very large, long-term mine operations were to co-exist in the area, it is possible that cumulative impacts could occur to the groundwater in the area. This would depend on the location of the mines, their source of water supply, and their operation schedules. At the time specific projects are proposed, environmental analyses of the impacts, both individual and cumulative, would be conducted.

The Yucca Mountain project is expected to use about 350 acre-feet of water per year over a 60-year period (DOE 1986). According to impact analyses conducted for the Yucca Mountain project, regional effects of withdrawing groundwater are expected to be negligible (DOE 1986). Various tests conducted indicated that large amounts of water could be withdrawn from beneath Yucca Mountain with no appreciable effect on the water level of the aquifer (DOE 1986). Water for the Yucca Mountain project is being obtained from elevations of 2,400 - 2,600 feet above sea level (DOE 1986) from wells (USGS designations J-12 and J-13) in Fortymile Wash approximately 13 miles to the east. USNGS is proposing to develop a water supply for the Mother Lode Project at a higher elevation (approximately 3,250 feet) and within a separate flow path in the Oasis Valley/Fortymile Canyon flow system. (Hydro-Search Inc. 1989). No interrelation with respect to groundwater resources is expected to occur between the Mother Lode Project and the Yucca Mountain repository due to the amounts of water being pumped, the time frame of the proposed mining activity, the distance between the two projects, and their respective locations within the Oasis Valley/Fortymile Canyon flow system.

4.3.2.3 Groundwater Quality. As discussed in Section 3.3, impacts to groundwater quality are not expected to occur from the Mother Lode Project. Cumulative impacts to groundwater quality are not anticipated from the Bullfrog Project or the hypothetical mining project. Design of mine facilities are based on non-discharge concepts to minimize potential impact to the environment and conserve water and reagents use in processing ore. Monitoring networks and post-mining reclamation work are also requirements of the permitting and mining process. Because of these factors, impacts to groundwater quality would not be expected.

4.3.2.4 *Surface Water.* *Because of the arid nature of the climate in the area*, and the lack of significant surface water resources, and assuming that drainage diversion channels, if required, would be properly designed with erosion control measures, no cumulative effects are expected from the potentially interrelated mining operations to surface water resources in the area.

4.3.3 Vegetation and Wildlife

The potentially interrelated projects would be expected to directly impact the following number of acres: Mother Lode Project - 75, Bullfrog Project - 2,550, and the hypothetical mining project - 100, for a total of approximately 2,725 acres. The majority of this disturbed acreage on public lands would be reclaimed by the operators following the completion of project operations. Therefore, there would be little long-term disturbance to vegetation or wildlife habitat on public lands. Although there would likely be short-term impacts to one or more of the same plant communities during the timeframes of these projects, this is not expected to be a significant impact. The activities at Yucca Mountain are sufficiently distant from the Mother Lode Project to preclude cumulative vegetation or wildlife impacts.

The Nevada Department of Wildlife has stipulated that the Bullfrog and Mother Lode Projects be constructed in a manner to mitigate potential impacts of cyanide-laden waters on waterfowl. These same stipulations would apply to operation of new mining projects.

Impacts to threatened or endangered plant and animal species have been evaluated for the Bullfrog Project and the Mother Lode Project; mitigation measures have been implemented to preclude significant impacts to threatened or endangered species. Site-specific studies for new mine developments would be conducted prior to construction to determine potential impacts to threatened or endangered species, and mitigation measures would be required.

4.3.4 Land Use and Recreation

Impacts to land use and recreation would generally be site-specific rather than interrelated with the Mother Lode Project. Most of the land in the area of the proposed projects has historically been used for mining, dispersed recreation, open space, and cattle grazing. The proposed projects would be consistent with these land uses. Approximately 2,725 acres, a majority of which is unpatented federal land administered by the BLM, would be disturbed by the proposed mining activities. The proposed projects would be consistent and compatible with existing land use planning documents and regulations. The location of the proposed project facilities would have no direct land use conflicts with the Town of Beatty or the Rhyolite townsite.

Outdoor recreational resources including dispersed recreation opportunities such as camping, fishing, hunting, and off-road vehicle use would not be adversely affected by the proposed projects because the existing use in these areas is relatively light, and the region has abundant acreage of public open space lands available.

The proposed mining projects are located in the 70,893-acre Razorback and the 538,397 acre Montezuma Grazing Allotments. There is one lessee authorized on each allotment. The combined grazing preference within both allotments is 11,496 animal unit months (AUMs) (approximately 50 to 53 acres/AUM). Combined mining activity from the proposed projects would result in the loss of forage for approximately 51 AUMS, less than 1 percent of the combined grazing preference.

The proposed projects would have no impact on the Grapevine Mountains WSA and only minimal impact on wild horses and burros.

The distance of the Yucca Mountain nuclear waste repository from the Mother Lode Project would preclude cumulative land use and recreation impacts.

4.3.5 Socioeconomics

The cumulative socioeconomic impact assessment evaluates the potential impacts associated with the operations phase of Bond Gold's Bullfrog Project, the Mother Lode Project, a hypothetical mining project near the historic Pioneer Mine, and the site characterization phase of the proposed nuclear waste repository at Yucca Mountain. The purpose of this section is to assess the extent to which these projects could affect: 1) population and employment growth, 2) school enrollment, 3) housing, 4) public services and facilities, and 5) fiscal conditions in the area. The projections associated with the socioeconomic cumulative analysis represent a general range of potential impacts which could be experienced with development of the interrelated projects. The figures are not intended to reflect specific numeric predictions.

It is likely that both Beatty and Amargosa Valley would experience substantial growth due to the combined affects of mining development and the Yucca Mountain repository site characterization studies. Therefore, it is necessary to analyze both the Beatty and Amargosa Valley areas for the cumulative impact assessment. The level of growth in Amargosa Valley would depend somewhat on the individual housing preference of the workforce for a more rural country setting as opposed to living in Beatty. The limited availability of housing in Beatty may also cause people to look at housing possibilities in Amargosa Valley. Amargosa Valley is therefore included in the cumulative assessment. The only services provided in Amargosa Valley are sheriff and fire protection, a small community center, a library, a senior center, a swimming pool and park, and the Amargosa Valley elementary school The Amargosa Valley health clinic was closed in 1988 by the Central Nevada Rural Health Consortium due to light caseloads.

The Beatty and Amargosa Valley area has experienced substantial growth from the construction phase of the Bullfrog Project. Peak direct employment during March was estimated at 686 workers for the project (Bond Gold 1989). The construction workforce is currently declining with operations scheduled to begin in June 1989. It is assumed that the current estimated area-wide population of approximately 2,600 and associated demands for housing, public services, facilities, and schools represent the existing baseline condition (May 1989). However, this condition will change as the operations phase of the Bullfrog Project begins. The primarily single-status construction workforce will be replaced by families with children. It is anticipated that changes in public service demands will occur as a more permanent workforce locates in the area.

Other factors contributing to baseline growth in the Beatty and Amargosa Valley area are associated with retirees, travel, and tourist-related activity. Death Valley National Monument and the mild Nevada winter climate promotes visits to the area throughout the year but especially between October and May. Baseline growth has primarily been associated with the tourist trade and military prior to the resurgence in mining activity 4 years ago.

Table 4-1 illustrates growth projections for the Beatty and Amargosa Valley area associated with the operations phase of the Bullfrog Project, the Mother Lode Project, a hypothetical mine, and the Yucca Mountain nuclear waste repository site characterization studies. Average annual employment on the table represents direct labor employment for each project. Local (resident) and non-local (immigrant) labor are estimated for each project. In addition, secondary (indirect) employment is estimated using a 1.2 multiplier. Secondary employment represents jobs created due to direct labor service demands. One direct job creates 0.2 indirect jobs using the 1.2 multiplier.

Table 4-1 also estimates new households from the immigration of non-local direct and indirect workers. During operations, a larger percentage of married households with school-age children are anticipated to locate in the area than during the construction phase. It is assumed that single households represent 25 percent of the workforce; married households represent 75 percent. New population is estimated based on the number of new households in the area. Single

TABLE 4-1

GROWTH PROJECTIONS
EMPLOYMENT, POPULATION, HOUSING, AND SCHOOL-AGE CHILDREN
OPERATIONS PHASE

	Average Annual[1] Employment	Local Direct	Non-Local Direct	Total Direct	Local Indirect	Non-Local Indirect	Total[2] Indirect	Total New Employment
New Employment								
Mine #1 (Bond)	328	16	312	325	43	19	62	390
Mine #2 (USNGS)	50	2	48	50	7	3	10	60
Mine #3	75	4	71	75	10	4	14	89
Yucca Mountain	18	1	17	18	3	2	1	21

	Non-Local Direct	Non-Local Indirect	Total
New Workers			
Mine #1 (Bond)	312	19	331
Mine #2 (USNGS)	48	3	51
Mine #3	71	4	75
Yucca Mountain	17	1	18
New Households[3]			
Mine #1 (Bond)			
Single	78	6	84
Married (1 Worker)	234	3	237
Married (2 Worker)	0	5	5
Total New HH	312	14	326
Mine #2 (USNGS)			
Single	12	1	13
Married (1 Worker)	36	0	36
Married (2 Worker)	0	1	1
Total New HH	48	2	50
Mine #3 (Hypothetical)			
Single	18	1	19
Married (1 Worker)	53	1	54
Married (2 Worker)	0	1	1
Total New HH	71	3	74
Yucca Mountain			
Single	4	1	5
Married (1 Worker)	13	0	13
Married (2 Worker)	0	0	0
Total New HH	17	1	18
Total			468

TABLE 4-1 (CONTINUED)

	Beatty	Amargosa Valley	Total
New Household Allocation[4]			
Mine #1 (Bond)	293	33	326
Mine #2 (USNGS)	40	10	50
Mine #3 (Hypothetical)	59	15	74
Yucca Mountain	8	10	18
New Population[5]			
Mine #1 (Bond)			
Single HH	67	17	
Married HH	676	169	
Total	743	186	929
Mine #2 (USNGS)			
Single HH	10	3	
Married HH	103	26	
Total	113	29	142
Mine #3 (Hypothetical)			
Single HH	15	3	
Married HH	155	39	
Total	170	42	212
Yucca Mountain			
Single HH	2	2	
Married HH	21	26	
Total	23	28	51
New School Children[6]			
Mine #1 (Bond)			
Secondary	65	7	
Primary	261	29	
Total	326	36	362
Mine #2 (USNGS)			
Secondary	9	2	
Primary	35	9	
Total	44	11	55
Mine #3 (Hypothetical)			
Secondary	13	3	
Primary	53	14	
Total	66	17	83

TABLE 4-1 (CONTINUED)

	Beatty	Amargosa Valley	Total
Yucca Mountain			
Secondary	2	2	
Primary	7	9	
Total	9	11	20

Notes:

[1]The operations w[illegible]orce is assumed to be 5 percent local and 95 percent immigrants.

[2]Indirect operations employment is calculated using an operations employment multiplier of 1.2 (PIC 1988). It is assumed that 70 percent of the indirect labor force are second persons in the direct labor households.

[3]The operations work force is composed of 25 percent single workers and 75 percent married workers.

[4]It is assumed that 90 percent of the Bond operations workforce would live in Beatty, 10 percent in Amargosa Valley. During operations, it is assumed that 80 percent of the new USNGS and hypothetical mine employees would live in the Beatty area, 20 percent in Amargosa Valley. Of the Yucca Mountain workforce projected to live in the Beatty/Amargosa Valley area, it is assumed that 45 percent of the workers would live in Beatty and 55 percent in Amargosa Valley (PIC 1988).

[5]Population estimates are based on 1 person per household for single households and 3.5 persons per household for married households (Dobra, Nevada Department of Minerals, December 1987).

[6]School-age children are estimated at 1.5 per married household. Eight percent of school-age children are primary students, 20 percent secondary students.

[7]Totals on tables may not add up due to rounding errors.

[8]The estimated Bond Gold operations employment figure of 328 was documented by Jack Bingham, March 29, 1989.

households are assumed to have 1 person per household; married households are assumed to have 3.5 persons in the household.

An estimated 1.5 school-age children are projected for each new married household. Of the total new school children, 80 percent are estimated to be primary students, 20 percent are secondary students. The footnotes following the tables give more detail on cumulative assessment assumptions.

Table 4-2 summarizes projected cumulative impacts for 1989 through 1992. The baseline population includes both Beatty and Amargosa Valley. The assumptions for the growth projections associated with the interrelated projects are clarified as footnotes to the tables.

4.3.5.1 Population. The population for the Beatty and Amargosa Valley area, including the construction population associated with Bond Gold, is estimated at approximately 2,600 people (May 1989). This population represents an increase of approximately 53 percent compared to the 1988 area population prior to the Bullfrog Project. It appears that as the Bond Gold construction phase ends and the operations phase begins, the more temporary construction workforce, which is primarily single status individuals, will be replaced by a higher percentage of permanent population with families. It is estimated that the population level will remain approximately the same during Bond's operations (10 years).

According to the USNGS project schedule, the Mother Lode Project construction and operations would be ongoing with the beginning of the Bullfrog Project operations. It is also assumed that the hypothetical mine would follow a similar schedule to the Mother Lode Project. During project construction, the Mother Lode Project is projected to increase the baseline population of 2,600 by 7 percent (193 people); the hypothetical mine would increase the local population by another 10 percent (258 people) during peak construction.

The operations phases of both the Mother Lode Project and the hypothetical mine are estimated to result in slightly lower population growth than during construction. Assuming baseline population is represented by the operations phase of the Bullfrog Project at 2,665 people area wide, the operations phase of the Mother Lode Project would increase that level by approximately 5 percent (142 people), and the hypothetical mine would add an additional

TABLE 4-2

ESTIMATED CUMULATIVE SOCIOECONOMIC IMPACTS
EMPLOYMENT, POPULATION, HOUSEHOLDS, AND SCHOOL AGE CHILDREN
BEATTY AND AMARGOSA VALLEY
1989-1992

	1989	1990	1991	1992
Baseline[1]				
Employment	793	807	816	823
Population	1736	1769	1791	1807
Households	717	728	737	747
School Age Children	283	287	290	293
Bond Gold				
Employment	390	390	390	390
Population	929	929	929	929
Households	325	325	325	325
School Age Children	362	362	362	362
Baseline with Bond Gold[2]				
Employment	1183	1197	1206	1213
Population	2665	2698	2720	2736
Households	1042	1053	1062	1072
School Age Children	645	649	652	655
USNGS				
Employment	60	60	60	60
Population	142	142	142	142
Households	50	50	50	50
School Age Children	55	55	55	55
Baseline with USNGS[2]				
Employment	1242	1257	1266	1273
Population	2807	2849	2862	2878
Households	1092	1102	1112	1122
School Age Children	701	704	708	710
Hypothetical Mine				
Employment	89	89	89	89
Population	212	212	212	212
Households	74	74	74	74
School Age Children	83	83	83	83
Baseline with USNGS and Hypothetical Mine[2]				
Employment	1332	1346	1355	1362
Population	3019	3052	3074	3090
Households	1166	1177	1186	1196
School Age Children	783	787	790	793
Other (Yucca Mountain)				
Employment	0	21	21	21
Population	0	51	51	51
Households	0	18	18	18
School Age Children	0	20	20	20

TABLE 4-2 (CONTINUED)

	1989	1990	1991	1992
Cumulative All Projects[2]				
Employment	1332	1367	1376	1384
Population	3019	3103	3125	3141
Households	1166	1194	1204	1214
School Age Children	783	807	810	813

Notes:

1 Baseline information was derived from Planning Information Corp. (1988), socioeconomic projections for Phase II, Nuclear Waste Repository Office. Baseline population is estimated to increase due to tourist and traveler trade. Mining-related increases are excluded from these projections. Baseline employment estimates are extrapolated from 1985 Nye County Special Census data; Beatty baseline employment represents 51 percent of total population, Amargosa Valley baseline employment represents 38 percent of total population.

2 These totals include existing conditions in Beatty in 1988, anticipated growth without the interrelated projects, plus direct and indirect growth associated with Bond, USNGS, the hypothetical mine, and Yucca Mountain.

8 percent (212 people) to the population (Table 4-2). Therefore, during the latter half of 1989, the estimated population in the Beatty and Amargosa Valley area would be 3,019. This is approximately 74 percent higher than the population estimated for early 1988 (prior to Bond's construction phase). This increase in population would be considered a major cumulative effect.

In addition to the growth in mining in the area, the site characterization phase of the Yucca Mountain nuclear waste repository is anticipated to begin in 1989. Although this initial phase of the project is expected to employ a peak workforce of 675 in Nye County, it is projected that only 18 employees would likely locate in the Beatty and Amargosa Valley area during this phase of development (PIC 1988). Therefore, the incremental increase in population in 1990 is estimated to be less than 1 percent.

4.3.5.2 Economy. The principal cumulative economic effects would be an increase in mining and construction employment. Direct and indirect employment from the interrelated projects would increase total employment in Nye County (Table 2-11) by approximately 5 percent and in the Beatty and Amargosa Valley area by 71 percent (Table 4-2). The USNGS direct and indirect impact would represent less than a 1 percent increase in overall Nye County employment and Beatty and Amargosa Valley employment estimates prior to Bond's construction phase. Most of the interrelated project employment increase would occur in the mining sector (a 39 percent increase in the 1987 mining sector employment estimate of 1,167). The remaining 107 direct and indirect jobs would be spread throughout the other employment sectors. Cumulative activity would affect increases in business activity, new business formation, real estate development, and a subsequent increase in local property and sales taxes.

4.3.5.3 Fiscal Effects. The rapid growth associated with mining activities would require that local government increase spending prior to the tax base being in place to pay for the increases in service and facility expansions. Each of the interrelated projects described would generate property, sales, and use taxes in the area through direct development activity as well as induced growth in residential development and the services and trade sectors. In addition, the three mines would generate additional net proceeds taxes which would go into the Nye County general fund. Net proceeds would also accrue to Beatty from the Bullfrog Project since it is within the Town of Beatty taxing district. Direct tax estimates for the mines are shown on Table 4-3.

TABLE 4-3

ESTIMATED INCREMENTAL TAX REVENUES

CUMULATIVE ANALYSIS

(THOUSANDS OF $)

	ESTIMATED 1988 EXPENDITURES	LAGGED TAX	ESTIMATED 1989 EXPENDITURES	LAGGED TAX	ESTIMATED 1990 EXPENDITURES	LAGGED TAX
PROPERTY TAX						
CONSTRUCTION/ OPERATIONS						
Bond Gold	$90,900	$548	$51,600	$311		
USNGS			$5,050	$31	$600	$4
Hypothetical Mine			$5,050	$31	$600	$4
TOTAL EXPENDITURE	$90,900	$548	$61,700	$373	$1,200	$8
OPERATIONS						
Bond Gold					$9,000	$6
USNGS			$700		$3,900	$32
Hypothetical Mine					$3,900	$32
TOTAL EXPENDITURE	$90,900	$548	$62,400	$373	$18,000	$78
AVERAGE ANNUAL NET PROCEEDS TAX						
Bond Gold						$1,184
USNGS						$180
Hypothetical Mine						$180
SALES AND USE TAX						
Bond Gold						$1,600
USNGS						$30
Hypothetical Mine						$30
INCREMENTAL PROPERTY, NET PROCEEDS, AND SALES AND USE TAX		$548		$373		$3,282

NOTE: IMPROVEMENTS AND EQUIPMENT HAVE NOT BEEN DEPRECIATED.

Of the interrelated projects, only the Bullfrog Project is located within the Town of Beatty boundaries. None of the developments are within the Town of Amargosa Valley taxing district. However, due to the revenue cap imposed by State legislation, Beatty does not have a property tax rate this year. All revenues for the Town of Beatty's operations will come from sales tax proceeds distributed by the State. Expansion of town facilities and services will be dependent on sales tax revenues and proportional contributions from intergovernmental State of Nevada and Nye County tax proceeds. It is likely that the costs associated with service expansion will be higher than revenues generated through the interrelated project activities due to the current tax structure imposed by the Nevada legislature.

The public services and facilities in Beatty and Amargosa Valley have historically been at a low level of service delivery. In the past, services have been delivered at a level lower than the national average, but the level has been acceptable due to the slow rate of growth in Beatty and the Amargosa Valley. Service provided by the Beatty town government include a town council, community center, library, and public fire protection and ambulance. Amargosa Valley town government provides a town council, community center, library, fire protection and ambulance service, swimming pool, park, and senior center. The Nye County government provides the following services to Beatty and Amargosa Valley: public safety, highway and road maintenance, social services, judicial, health services, public works, and county general government administration. Special districts provide parks and recreation, water, and sewer services to Beatty and school services to the area.

Where possible, services and facilities are provided by volunteers rather than paid staff, and most systems anticipate relatively constant or slowly increasing levels of service. As population increases, decisions on extensions of services and facilities tend to lag growth; as population declines, the need for services tends to be evaluated at lower rather than higher levels of service, and services tend to be cut commensurately. In general, a number of Beatty and Amargosa Valley public service systems are operating close to capacity. Expansion of these systems would require considerable capital outlays.

In comparing four states' local government expenditures, per capita expenditures in Nevada lag behind Wyoming and Colorado and are slightly higher than Montana expenditures per capita. Table 4-4 shows these per capita expenditures for the four states.

TABLE 4-4

LOCAL GOVERNMENT PER CAPITA EXPENDITURES
NEVADA, WYOMING, MONTANA, AND COLORADO
1986-1987

	Nevada	Wyoming	Montana	Colorado
Total Expenditures	$364	$553	$328	$877
Direct expenditures	324	410	285	604
Highway expenditures	37	65	30	63
Police Protection	37	61	27	78
Fire Protection	41	25	18	35
General Government Financial Administration	12	13	6	17

Source: U.S. Bureau of Census 1988

If future population projections are achieved, substantial investment in the areas of law enforcement, water and sewer facilities, fire and ambulance services, medical services, and education would be required to meet increasing demands in Beatty. Amargosa Valley residents use many of the public services provided in Beatty such as the clinic, court (judicial), and high school. However, new population in the Amargosa Valley area would also increase public service demands and require some additional operating funds for capital equipment and personnel. These funds will come primarily from ad valorem taxes on existing and new commercial and residential development, sales taxes, and other intergovernmental revenues.

The financial requirements needed to meet these demands would come from intergovernmental revenues which would lag behind demands for services, and from voluntary funding or advance financing by the operating companies. The overall fiscal impacts for the Town of Beatty and Amargosa Valley are likely to be adverse over the life of the mines. The fiscal impacts to Nye County government and the Nye County School District from the interrelated projects would likely result in a short-term shortfall, and a long-term benefit.

4.3.5.4 Housing. During the mine construction phase of the Bullfrog Project, housing has proven to be the major impact associated with population growth in the area. Housing demands in the latter half of 1989 would be even greater due to cumulative project activity. The housing projections for the cumulative analysis are illustrated in Table 4-2 (Households). The cumulative projection for all projects indicates a total of approximately 870 households by 1992; this compares to the existing level of approximately 390 households.

During the construction period of the Bullfrog Project, temporary housing such as RV parks, motels, and the mancamp have provided housing for a large percentage of the construction workforce. These accommodations would also be available during the construction phases of the USNGS mine and the hypothetical mine. However, overlapping of the construction and operations workforces would exacerbate the temporary housing problem, displacing tourists traveling through the area, and would require additional housing to meet total housing demand.

During mine operations, the demand for housing would be greater due to the permanent nature of the workforce and larger percentage of married households. The projection for permanent housing in late 1989 with the three mines operating is 63 percent higher than the 1988 baseline housing estimate prior to Bond Gold's construction impacts and 3 percent higher than the existing housing demand with the Bond construction workforce in the area. Of this total, the USNGS impact would represent a 7 percent increase in the 1988 baseline housing estimate and a 5 percent increase over the Bond Gold baseline housing estimate. Again, housing demands would be different during the mine operations phases; more permanent types of single-family, apartment, and mobile homes units would required to meet the anticipated demand by operations workers. Currently, this type and number of housing units is not available in the Beatty or Amargosa Valley area

Various Beatty landowners are considering the development of additional mobile home units; however, financing and commitment to project development appear to represent major constraints. These constraints suggest that mine developers would need to take an active role in assuring the provision of adequate housing for both their construction and operations workforces. USNGS has indicated they would provide housing for their operations workforce in a trailer park in Beatty, and Bond plans to provide approximately 50 housing units for their operation workforce. Housing is considered a major cumulative impact

4.3.5.5 Public Services and Facilities. Only minor changes have occurred in the provision of public services and facilities since Bond Gold started construction in the summer of 1988. The changes include: 1) Addition of two exam rooms and a full-time office assistant at the Beatty clinic. The clinic is hoping to hire 1-2 full-time physician's assistants. 2) Bond has drilled one new water well which produces approximately 200 gpm of good quality water. A second well has been drilled, and USNGS is installing 1 mile of pipeline to operate the well. 3) Bond has provided two modular buildings to provide four new classrooms for the Beatty school. The units will be available starting in the fall of 1989. Based on a current population of approximately 2,600 in the area, population in the area has nearly doubled with no corresponding improvements in public services. As the population continues to increase with the potential addition of two new mines, the service levels of most of the public services provided by the county and town governments would fall well below minimum acceptable service levels. To serve an additional population of 1,049 in Beatty and 285 in Amargosa Valley in 1992, the following public services and facilities would be required:

1) Law Enforcement - both space and staffing levels need to be increased (G. Sullivan 1989):

Beatty - 2 patrol officers
- 2 patrol cars
- Additional space preferably to utilize the entire existing building (1,870 square feet), by relocating the justice court
- 10 beds in the holding facility
- 1 dispatcher

Amargosa Valley - Third deputy
- 1 patrol car
- Third dispatcher
- Space is adequate at the existing facility except for the need for a temporary holding cell.

2) Fire Protection and Ambulance Service

Beatty - Beatty Volunteer Fire Department (B. Sullivan 1989)

Fire

- if development occurs south of town, a new substation is recommended
- 1,000-gallon pumper/tanker
- 10 to 15 volunteer firemen

Ambulance

- 1 ambulance
- 10 EMT Volunteers
- More fire hydrants in Beatty

Amargosa Valley - Amargosa Valley Volunteer Fire Department (Bright 1989; Copeland 1989)

Fire

- 1 quick response unit
- Service tanker
- 2,000 gallon pumper
- 7 volunteer firemen

Ambulance

- Amargosa Valley Volunteer Fire Dept.
- 3rd ambulance
- 7 volunteer EMTs

3) Judicial System (B. Sullivan 1989)

- New facility including larger courtroom, holding cell, jury room, office for defense council, office for district attorney, judges chamber, reception area, restrooms
- 1 clerk or clerical assistant

4) Medical Care (Obermiller 1989)

- One or two physicians assistants (PAs); with 2 new PAs, could re-open Amargosa Valley Clinic
- Existing facilities at Beatty and Amargosa Valley are adequate

5) Schools

Beatty (Mellor 1989a)

- 6 modular units in addition to the 2 modular units which will be added in the 1989-1990 school year (16 classrooms)
- Additional playground/activity space
- Staff
  - 11 elementary school teachers
  - 2 secondary teachers
  - 1 counselor
  - 2 special education teachers
  - 1 remedial teacher
  - 1 to 1.5 full-time office help
  - Additional lunchroom capacity

Amargosa Valley (O'Brien 1989)

- If 2 new classrooms and other school improvements are implemented in the 1989-1990 school year, Amargosa Valley would not need any new modular units. There may be some classrooms above optimum capacity
- 2 teachers
- 1/2 time counselor position

6) Water and sewer system - at the present time, the new sewer infiltration system is not yet operational. The district manager anticipates that the system should be operational by June 1989. At that time, the sewer system will adequately accommodate the cumulative population increase.

Currently, the present water supply is adequate to meet the needs of the population. During the winter months, the demand for water is substantially lower than during the three summer months. Once the second well is operational, Beatty's supply of good quality water will be approximately 480 gpm. The average demand for water is estimated at approximately 0.5 gpm per household. Assuming that there are an estimated 817 households in Beatty in 1992, the average demand for water would be 408.5 gpm, which would be satisfied by the current good quality water supply. However, during the summer months (June through August), demand for water can run as high as 4 gpm per household. In this case, with 817 households, peak demand would run at 3,268 gpm. Even if the supply of good quality water (480 gpm) and high fluoride content water (320 gpm) were combined, the peak demand for water would not be met. Water conservation measures would have to be implemented or a new supply of water found to meet peak consumption demand. These estimates do not account for increased demand from new businesses.

These public service and facility concerns are considered major impacts from a cumulative standpoint.

5.0 CONSULTATION AND COORDINATION

This Environmental Assessment (EA) was prepared by a Bureau of Land Management (BLM) interdisciplinary team with assistance from ENSR Consulting and Engineering (formerly ERT) of Alameda, California. Table 5-1 provides a list of the preparers and the qualifications and responsibilities of each in the preparation of the EA.

5.1 Public Involvement

The EA for the Mother Lode Project was prepared to BLM standards. The BLM, as the lead agency, implemented public and interagency consultation and coordination throughout the development of the EA.

Prior to development of the Draft EA, BLM completed a formal public scoping process. This process included: news releases regarding the proposed project and the EA process; mailing of scoping documents to agencies, organizations, and individuals; a public scoping meeting in Beatty; and meetings with many local, state, and federal agencies.

The public involvement process contributed significantly to the development of the EA by providing information to the EA team and by focusing the analysis on specific issues of concern to commenters. Issues raised during the scoping process are summarized below by environmental discipline.

Water Resources

- Short- and long-term impacts of withdrawal on local and regional groundwater and on federally protected resources.
- Effects of aquifer drawdown on Devils Hole annex of Death Valley National Monument and Ash Meadows National Wildlife Refuge.
- Contamination of groundwater and surface water resources from cyanide pond leakage.
- Surface water impacts from increased sediment loading.

TABLE 5-1

LIST OF PREPARERS

Name	Education/Experience	Responsibility
Bureau of Land Management		
Theodore J. Angle Area Manager	B. S. Wildlife Management 18 Years Professional Experience	Responsible Official, Quality Review
Victor Ross Technical Specialist	B. S. (Mining Engineering) 10 Years Professional Experience	Project Manager for BLM, Minerals Resources
Roger Oyler Technical Specialist	B. S. (Agricultural Range Management) 14 Years Professional Experience	Range and Wilderness
Lee Grover Technical Specialist	B. S. (Wildlife) 36 Years Professional Experience	Wildlife, Threatened and Endangered Species, Visual Resources, Recreation
Margaret Waski Technical Specialist	B. A. (Anthropology) 6 Years Professional Experience	Cultural Resources
Thomas Pogacnic Technical Specialist	B. S. (Wildlife Management) M. S. (Range Management) 7 Years Professional Experience	Wilderness, Wild Horses
ENSR Consulting and Engineering		
Valerie Randall Project Manager/EA Manager	B. A. (Urban Studies) 11 Years Professional Experience	EA Manager, Agency Liaison, Cultural Resources Coordination, Quality Review
Howard Gebhart Discipline Manager	M. S. (Meteorology) B. S. (Professional Meteorology) 11 Years Professional Experience	Air Resources Discipline Manager
James Nyenhuis Technical Specialist	M. A. (Communications Theory) M. S. Candidate (Soil Science) B. A. (History, Psychology, Speech) 12 Years Professional Experience	Soils, Reclamation

TABLE 5-1 (CONTINUED)

Name	Education/Experience	Responsibility
<u>ENSR Consulting and Engineering</u> (continued)		
Philip Hackney Tecnical Specialist	B. S. (Botany) 10 Years Professional Experience	Vegetation, Wildlife
Bernhard Strom Technical Specialist	M.C.R.P. (City and Regional Planning) B. S. (Urban Planning) 16 Years Professional Experience	Visual Resources, Noise, Transportation
Jennifer Kathol Technical Specialist	B. S. (Natural Resource Economics) 11 Years Professional Experience	Socioeconomics
James Beck Mining Engineer	B. S. (Mining Engineering) 12 Years Professional Experience	Engineering Coordination
Susan Hogg Morehouse Technical Specialist	M. S. (Hydrology/Physical Geology) B. S. (Hydrology/Physical Geography) 13 Years Professional Experience	Water Resources
William Thelsen Technical Specialist	M. S. (Recreation Resources) B. S. (Natural Resources) 7 Years Professional Experience	Land Use and Recreation, EA Coordination
Malcolm Gander Technical Specialist	M. S. (Geology) B. A. (Geology and Journalism) 7 Years Professional Experience	Geology and Mineral Resources
<u>Intermountain Research</u>		
Charles D. Zeier Archaeologist	M. A. (Anthropology) B. A. (Anthropology) 15 Years Professional Experience	Cultural Resources

Cultural Resources

- Disturbance of cultural resources in the project area.
- Disturbance of paleontologic resources, if present in the project area.

Air Quality

- Air quality impacts to the local area and to Death Valley National Monument.

Visual Resources

- Effect on local scenic values of public land.
- Impacts of project night lighting on night sky viewing within Death Valley National Monument.

Socioeconomics and Land Use

- Positive economic effects on Beatty and the State of Nevada.
- Effects on current capacity of Beatty's water supply.
- Effect on community services for the Town of Beatty, including schools, medical facilities, fire and police protection, solid waste disposal, sewage disposal, library, and recreational facilities.
- Increased demand for housing in the Beatty area during project construction and operation.
- Conflicts with existing and future land uses in the project area.
- Safety risk of accidental release of hazardous materials.

Biological Resources

- Implementation of reclamation plan in compliance with BLM standards.
- Fencing of project site to exclude terrestrial wildlife.
- Effectiveness of proposed mitigation measures.

NEPA Process

- Thorough evaluation of alternatives.
- Cumulative impact analysis.

5.2 List of Agencies and Organizations Consulted

Various federal, state, and other agencies were consulted during preparation of the EA. The following agencies, groups, and individuals, several of which have provided input, will receive copies of the Draft EA.

Federal

U.S. Department of Agriculture
- Soil Conservation Service

U.S. Department of Energy
U.S. Department of the Interior
- Bureau of Land Management
  - Nevada State Office
  - Battle Mountain District Office
  - Tonopah Resource Area Office (Battle Mountain District)
  - Stateline Resource Area Office (Las Vegas District)
- Fish and Wildlife Service, Reno
- National Park Service
  - Death Valley National Monument
  - Mining and Minerals Branch, Denver
- Pacific Southwest Region

U.S. Environmental Protection Agency
U.S. Geological Survey
U.S. House of Representatives
- Barbara Vucanovich
- James Bilbray

U.S. Senate
- Harry Reid
- Richard Bryan

State of Nevada

Department of Conservation and Natural Resources
- Division of Environmental Protection
- Division of Historic Preservation and Archeology

Department of Human Resources
Department of Minerals
Department of Transportation
Department of Wildlife
Governor Robert Miller
Nevada State Clearinghouse
University of Nevada, Reno

City and County

Nye County
- Cooperative Extension Service
- Administrator
- Assessor
- Board of Commissioners
- Planning Department
- School District
- Sheriff's Department
- Public Works

Beatty
- Beatty Chamber of Commerce
- Beatty Town Advisory Council
- Beatty Water and Sanitation District
- Beatty Clinic
- Beatty Library

Private Organizations

- Audubon Desert Task Force
- Battle Mountain Gold Co.
- Bond Gold Corp.
- California Desert Protection League
- Citizen Alert
- Colbin Cattle Company
- Cooperative Extension Service
- Cordex Exploration
- Crowell Fluorspar Mine
- Death Valley Gateway Gazette
- Desert Survivors
- Echo Bay Exploration
- GEXA Gold Corp.
- Gold Bar Mine
- N. A. Degerstom, Inc.
- Nevada Miners and Prospectors Assoc.
- Nevada Mining Assoc.
- Nevada Outdoor Recreation Assoc.
- Nevada Prospectors Assoc.
- Pahrump Valley Times
- Red Rock Audubon
- Round Mountain Gold Corp.
- Saga Exploration
- Sierra Club, Toiyabe Chapter
- The Wilderness Society
- U. S. Nevada Gold Search
- U. S. Precious Metals

Individuals

- George Barnes
- Dick Carver
- John and Matt Clogston
- Shirley Harlan
- John Hopkins
- Elizabeth Keal
- Delbert and Verna Lewis
- John Lupac
- R. McCall
- Frank Miller
- Glen Miller
- Les Monroe
- Robert Revert
- Sally Schumacher
- Margery Sill
- David Spicer
- George and LaRene Younghans

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ACRONYMS AND ABBREVIATIONS

AADT	-	average annual daily traffic
ACEC	-	Area of Critical Environmental Concern
AMP	-	Allotment Management Plan
AUM	-	animal unit month
BCCRT	-	basic city/county relief tax
BLM	-	Bureau of Land Management
CDBG	-	Community Development Block Grant
CFR	-	Code of Federal Regulations
CO	-	carbon monoxide
dBA	-	decibels, A-weighted
EA	-	Environmental Assessment
EC	-	electrical conductivity
EMTs	-	emergency medical technicians
EPA	-	Environmental Protection Agency
gpm	-	gallons per minute
HC	-	hydrocarbons
HCN	-	hydrogen cyanide
KOPs	-	key observation points
kw	-	kilowatt
lb/day	-	pounds per day
MH	-	mobile home
mph	-	miles per hour
MSL	-	mean sea level
NaCN	-	sodium cyanide
NDEP	-	Nevada Division of Environmental Protection
NDOW	-	Nevada Department of Wildlife
NEPA	-	National Environmental Policy Act
NHPA	-	National Historic Preservation Act
NO_x	-	nitrogen oxide
NRHP	-	National Register of Historic Places
NV	-	Nevada
PA	-	physician's assistant
PM	-	particulate matter
ppm	-	parts per million
PSD	-	Prevention of Significant Deterioration
RV	-	recreational vehicle
SAR	-	sodium adsorption ratio

SCCRT	-	supplemental city/county relief tax
SF	-	single family
SHPO	-	State Historic Preservation Office
SR	-	State Route
TSP	-	total suspended particulate
tpd	-	tons per day
USNGS	-	U.S. Nevada Gold Search Joint Venture
VRI	-	Visual Resource Inventory
VRM	-	Visual Resource Management
WSA	-	Wilderness Study Area

APPENDIX A

WATER RESOURCES TECHNICAL MEMORANDUM

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

The proposed Mother Lode project is an open-pit gold mine and heap leach operation approximately 7 miles east of Beatty, Nevada. The property is being developed by U.S. Nevada Gold Search Joint Venture (USNGS). The project will involve the construction, operation and abandonment of an open-pit mine, heap leach facilities, and support facilities for the precious metals operation.

The Mother Lode project will directly impact approximately 250 acres within USNGS's claim block. At the end of the operation, the mine and surface facility sites will be reclaimed to the standards of BLM's surface management regulations.

The project facilities will consist of an open pit, waste rock disposal area, sulfide ore stockpile, crusher, heap leach facilities, fresh water and process water ponds, and support facilities (maintenance shop, office, recovery plant, and supply storage). Additional ancillary facilities would include diesel generators, water supply system, access and haul roads, sanitary and solid waste disposal facilities, and fuel storage.

This Water Resources Technical Memorandum was prepared by ENSR as part of the Environmental Assessment process. The memorandum provides information on the water resources of potentially affected areas and discusses both surface water and groundwater quantity and quality. Additionally, potential impacts and mitigation measures are discussed. The technical memorandum presents a summary of studies of the affected environment and results of impact analysis. A detailed description of the project can be found in Chapter 1, "Alternatives Including the Proposed Action," of the EA.

Chapter 1 of this technical memorandum discusses the background, objectives, and scope of work of this memoranda. Chapter 2 discusses the existing environment. Chapter 3 discusses impacts to the environment and Chapter 4 presents mitigation necessary for the expected impacts.

1.2 Objectives

The overall objective of the water resources study was to compile sufficient data and information to assess potential impacts of the project and to develop control and mitigation plans. Specifically, the study satisfies the following objectives:

- To quantify and describe the existing surface water and groundwater hydrology and water quality.

- To identify impacts on surface water and groundwater hydrology and water quality as a result of construction, operation, reclamation and abandonment activities.

- To provide documentation and technical input into the EA.

- To provide close coordination and a free exchange of information between specialists conducting the water resources, soils, and vegetation studies.

1.3 Scope of Work

The following activities were jointly conducted for the various water resources tasks:

- Collection and Evaluation of Existing Information. A comprehensive literature survey of existing data and information on the surface water and groundwater hydrology, hydrogeology, and water quality was conducted. This information was obtained from the US Geological Survey, the Bureau of Land Management, the Nevada State Engineer, various scientific publications, and other state and federal agencies. Additional data and information were collected from secondary sources, including unpublished literature, interviews, hearing proceedings and field reconnaissance.

- Identification of Aquifers and Their Geologic Settings. Identification of both local and regional aquifers and their flow systems was performed based largely on published and unpublished literature and information.

- Evaluation of Wastewater Disposal Methods. An evaluation of methods for wastewater disposal was conducted and recommendations were made regarding the most practical methods.

- Analysis of Flow Frequencies. Flood peaks and volumes were calculated for the purpose of estimating flow information for the planned diversion ditches and structures.

- Inventory of Water Rights Including Springs and Wells. All water rights listed with Nevada State Engineer were evaluated with respect to potential impacts from the project.

- Determination of Water Quality and Potentiometric Heads. Available water quality data was used to establish existing conditions for the project area. Static water level data was interpreted to provide information of groundwater flow direction.

2.0 EXISTING CONDITIONS

2.1 Physical Setting

2.1.1 Physiography

The Mother Lode Project is located approximately 7 miles east of Beatty, Nevada. The project area encompasses approximately 250 acres at the northeastern extreme of Bare Mountain in Southern Nye County. Bare Mountain separates Crater Flat from the northern Amargosa Desert. North and east of Crater Flat is Yucca Mountain. Directly north of Bare Mountain is Oasis Valley, from which the Amargosa River drains through the Amargosa Narrows just south of Beatty into the northern Amargosa Desert. Elevation ranges from approximately 3,400 feet above sea level (asl) in Crater Flat to over 6,000 feet in Bare Mountain. The project area is at approximately 4,100 feet asl.

Regionally, the project area is located within the Basin and Range Physiographic Province as defined by Fenneman (1931). In general, the overall area in which the project is situated is a fine example of Great Basin topography (Winograd and Thordarson 1975).

Bare Mountain is surrounded to the east and southeast by the Quaternary and upper Tertiary sediments and volcanics of Crater Flat. To the east and north are the upper Tertiary sediments and volcanics which form Yucca Mountain. North and northwest of Bare Mountain, intensely deformed volcanic rocks and sediments of Tertiary age form the Bullfrog Hills, which continue to the west of Beatty. Quaternary alluvium fills the Amargosa Desert, bounding Bare Mountain to the southwest.

The northern edge of the Death Valley National Monument boundary is located approximately 10 miles to the west of the project area. The park headquarters are located approximately 30 miles to the southwest of the project area. Devil's Hole, a detached unit of the Death Valley National Monument, is located approximately 40 miles to the southeast. Ash Meadows springs are also located approximately 40 miles to the southeast of the project area. The Nevada Test Site is located approximately 6 miles to the east of the project area.

2.1.2 Climate

The project area lies within one of the most arid regions of Nevada. The climate of the Beatty area is characterized by low precipitation and humidity, and high summer temperatures and evaporation (US Weather Bureau 1960, 1965). Throughout the Great Basin region, precipitation increases with altitude, while daily and seasonal temperatures decrease (Winograd and Thordarson 1975).

The average annual precipitation ranges from 3 to 6 inches in the valleys and averages approximately 10 inches on most of the ridges and mesas (Winograd and Thordarson 1975). Precipitation in the higher areas could be as much as 20 inches per year (Rush 1970). The average annual rainfall at Beatty is approximately 4.6 inches, based on a 44-year average (Winograd and Thordarson 1975). The precipitation is seasonally distributed throughout the year, with a monthly high of 0.71 inches in January and a monthly low of 0.07 inches in June (Cornwall 1972). Because of considerable variations in storm patterns in the southwestern deserts, annual precipitation totals vary greatly from year to year. Precipitation records for the Beatty area indicate that a high annual total precipitation of 11.49 inches was observed in 1983 (Winograd and Thordarson 1975). The annual potential evaporation has been estimated to be about 5 to 25 times the annual precipitation (Winograd and Thordarson 1975). Most precipitation falls during the winter as snowfall and during the summer as high intensity thunderstorms.

2.2 Surface Water

2.2.1 Regional Setting

The Great Basin Physiographic region is characterized by a series of north- to south-trending mountain ranges that drain internally to broad, intervening alluvial valleys. There are no large perennial streams found in the region. The Amargosa River 6 miles west of the project site is the largest stream in the area and is considered to be intermittent near Beatty. The project area is located on the northeast flank of Bare Mountain. Bare Mountain essentially separates the project area from the Amargosa Desert to the south and west. The Amargosa River flows south through the Amargosa Narrows approximately 6 miles west of the project area and ultimately into Death Valley.

There are a number of ephemeral drainages in the area. The project site is located within the Tates Wash and Joshua Hollow ephemeral drainages, which drain into Crater Flat and flow south to join the Amargosa River approximately 35 miles south of Beatty. The largest ephemeral stream in the area is probably Beatty Wash to the north, which drains directly into the Amargosa River. Beatty Wash has several unnamed tributaries which approach the project site; however, the project site is not within these watersheds.

2.2.2 Surface Water Quantity

The project area is located at the headwaters of tributary drainages (Tates Wash and Joshua Hollow) to the Amargosa River. The drainage areas for Tates Wash and Joshua Hollow above the facilities are approximately 2 and 1.3 square miles, respectively. Runoff from the project area flows north and east into Crater Flat. There are no perennial or intermittent streams within the project area.

Average annual precipitation in the area is about 4.6 inches. Runoff from the project site is limited to short periods after high intensity thunderstorms or rapid snow melt. This is typical of much of the area of southwest Nevada due to the low precipitation amounts, high evapotranspiration and infiltration rates, and extremely dry antecedent soil moisture conditions (Riggs and Moore 1965). Since the area lies within one of the driest regions in the nation, thunderstorm rainfall amounts are low relative to most thunderstorm-prone areas in the nation. The estimated 100-year, 6-hour rainfall depth is 1.8 inches, and the 100-year, 24-hour depth is 2.7 inches.

Erosion, deposition, rapid changes in stream course, and flash flooding in drainages on young active alluvial fans are common. The project area is located in the upper portion of the Tates Wash and Joshua Hollow drainages where the quantity of runoff and consequently, potential hazards from active fans, is limited.

There are no flow data available for Tates Wash or Joshua Hollow. Flow events which pass through the project area are not expected to result in significant downstream flows. Peak flows for various runoff events were estimated for Tates Wash and Joshua Hollow using SCS methods (Table 1). The 100-year, 6-hour peak flows are 56 cfs and 46 cfs for Tates Wash and Joshua Hollow, respectively. Once flows reach Crater Flat, they are expected to attenuate rapidly in flood peak and volume due to the reduction in channel slope and channel losses. The energy of the flood will also decrease as a result of this attenuation. Eroded material from either above or throughout the project area is expected to be deposited a short distance downstream. However, due to the small area of the project site, eroded material is expected to be minimal. Only in extreme events would runoff originating in Tates Wash and Joshua Hollow actually reach the Amargosa River.

Mean annual runoff from the site was evaluated using a precipitation-elevation relationship developed by Riggs and Moore 1965. Estimated mean annual runoff for the site is 0 inches per year.

2.2.3 Surface Water Quality

There are no data available in the area for surface water quality. However, any surface water that does occur would be expected to be of poor quality, unsuitable for drinking water and probably marginal for irrigation purposes.

2.2.4 Surface Water Availability

There is no surface water available in the area. Spring discharge is discussed in Section 2.3.

2.3 Groundwater

2.3.1 Hydrogeologic Setting

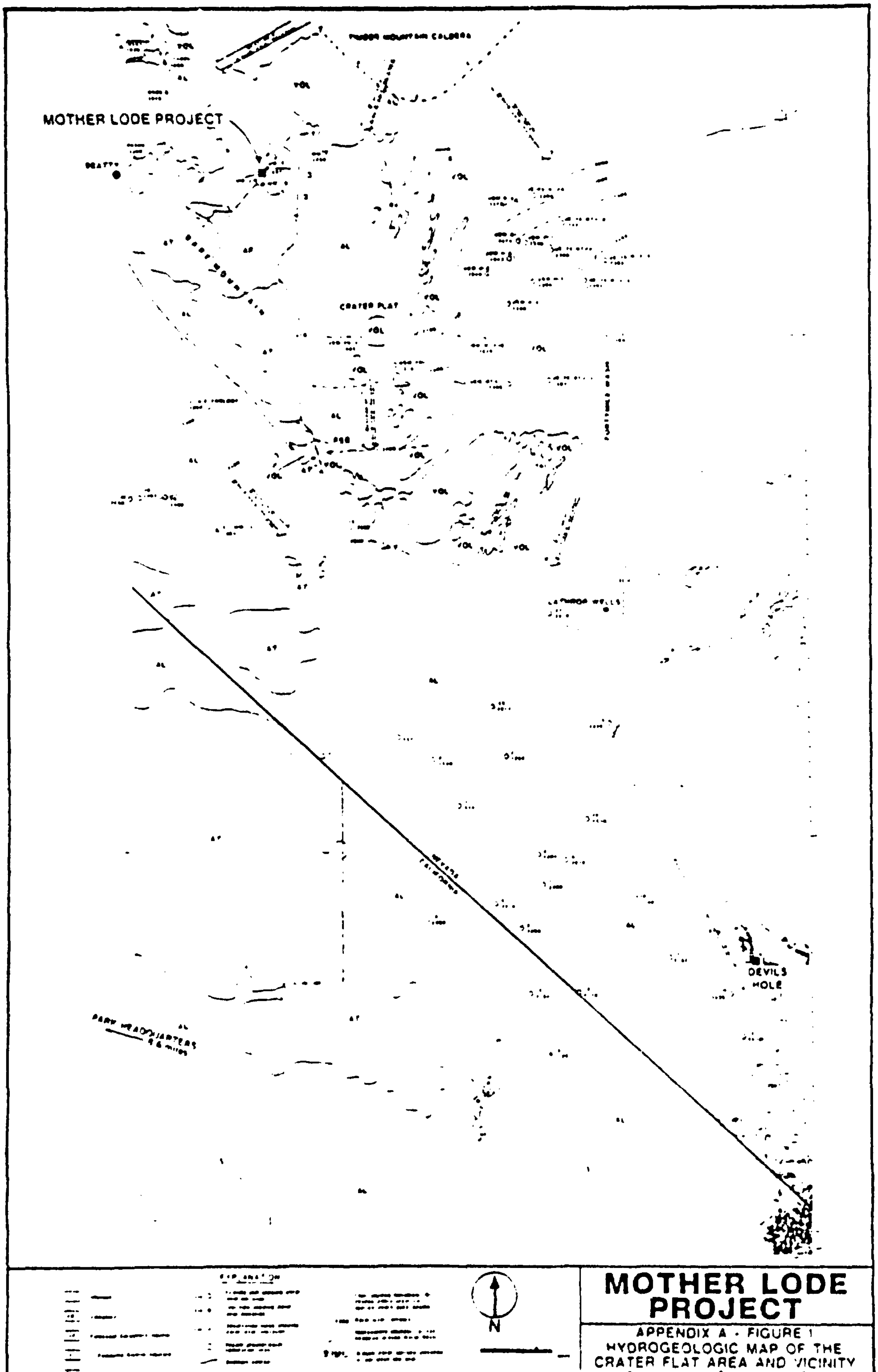
Geology. The region is comprised of intensely fractured Precambrian and Paleozoic carbonate and clastic rocks, and block-faulted Cenozoic volcanic and sedimentary strata (Winograd and Thordarson 1975). Based on USGS geologic mapping of the region, there are five different major hydrogeologic units that occur in the vicinity of the project area (Figure 1, Sharp 1989):

TABLE 1

ESTIMATES OF PEAK FLOWS FOR SELECTED

RETURN PERIODS FOR TATES WASH AND JOSHUA HOLLOW

Return period	Precipitation 6 Hour	Depth (ins) 24 Hour	Curve Number	Tates Wash Peak Flow (cfs) 6 Hour	Tates Wash Peak Flow (cfs) 24 Hour	Joshua Hollow Peak Flow (cfs) 6 Hour	Joshua Hollow Peak Flow (cfs) 24 Hour
5-Year	1.05	1.40	68	1	17	1	14
10-Year	1.25	1.70	68	8	44	7	37
25-Year	1.45	2.10	68	21	96	17	79
50-Year	1.60	2.35	68	34	137	28	112
100-Year	1.80	2.70	68	56	201	46	166



MOTHER LODE PROJECT

APPENDIX A - FIGURE 1
HYDROGEOLOGIC MAP OF THE CRATER FLAT AREA AND VICINITY

1. The oldest and the lowest unit is known as the lower Paleozoic Clastic Aquitard. This unit also includes some Precambrian rocks. The unit is generally made up of quartzite, shales, slates, and occasional interbedded limestone. The unit has little or no primary permeability.

Bare Mountain is an upthrust, upfaulted block of very ancient rocks, primarily the Clastic Aquitard rocks. A northwest/southeast fault is present along the west side of the mountain with the southwest side down. This fault constitutes the northeastern boundary of northern Amargosa Desert and it roughly parallels Highway 95 south of Beatty. A second fault runs north/south on the east side of Bare Mountain which forms the west flank of Crater Flat. The east side is down and the west side is up. A third fault runs from approximately the area of Beatty eastward and truncates the northern part of Bare Mountain. The ancient Clastic aquitard materials occur on the south side of the fault (Bare Mountain) and considerably younger volcanic materials occur on the north side of the fault indicating another downfault. Thus, Bare Mountain is a block essentially isolated, and at high elevation that is acting as an aquitard. The impermeable block is on the west side of Crater Flat and on the northeastern side of northern Amargosa Desert. Groundwater does not flow through Bare Mountain from Crater Flat to the Amargosa Desert.

A number of other outcrops of Clastic Aquitard rocks occur in the area. There are several outcrops at the southern end of Crater Flat immediately north of Highway 95. Several outcrops occur at the boundary between northern and central Amargosa Desert. A large area of Clastic Aquitard rock outcrops extends along the Nevada/California state line to the northwest along the Funeral range. This area of impermeable rocks essentially forms an impermeable barrier between northwestern or northern Amargosa Desert and areas to the south and southwest. As a result, groundwater flows to the southeast, rather than to the west.

2. The next youngest material is the Paleozoic Carbonate Aquifer, which is comprised primarily of limestones and dolomites. These rocks are fractured and also have solution openings due to circulating groundwater dissolving away the limestone and dolomite. This unit transmits groundwater. There are, however, some major shale zones within the Paleozoic Carbonate aquifer which do not transmit water. In general, however, the Paleozoic Carbonate aquifer is transmissive material capable of permitting regional movement of groundwater in large quantities. Crater Flat is the only area of major size of this aquifer material. There is some material mapped in the northeast part of Bare Mountain. However, there is some question as to how deep the aquifer material extends in this area. Geologic cross-sections of the area indicate that the aquifer materials are fairly shallow faulted plates dipping to the east and underlain by aquitard materials. Groundwater may not be moving through the

carbonate aquifer material in this area. There are no other substantial outcrops of the Paleozoic Carbonate aquifer material in the area.

3. The third unit in sequence is the volcanics unit. The volcanics are relatively young and occupy much of the area of the Nevada Test Site to the north and east, and cover the major area of Yucca Mountain on the east side of Crater Flat. Volcanics are found in drill holes in Crater Flat where they are interbedded with alluvial materials. Timber Mountain Caldera is also volcanic. The origin of Timber Mountain caldera is very similar to that of Crater Flat. The volcanic rocks tail out approximately at Highway 95. The volcanics are not present further south towards Furnace Creek and the mountains along the the California/Nevada boundary. The volcanics have a very complex structure. Tuffs are interspersed with flow rocks or welded tuffs. Consequently, there are impervious materials within the volcanics. There are also pervious materials with fractures in them. In general, the volcanic rocks could be considered as a poor, low grade aquifer, more pervious than the Lower Paleozoic aquitard but less pervious than the Paleozoic aquifer. Winograd and Thordarson (1975) referred to this unit as the Tuff Aquitard.

4. The fourth geologic unit is the Paleozoic Slide Blocks. These are Paleozoic rocks which are believed to have slid off Bare Mountain when Bare Mountain was uplifted as a block. In some of the drilling of Crater Flat, Paleozoic rocks have been found in between Tertiary volcanics and Tertiary alluvium. These Paleozoic rocks probably are remnants of slide blocks.

5. The fifth and youngest unit in the area is the alluvium. The alluvium occurs mainly west of the boundary between the flow system involving Amargosa Desert and Crater Flat, and the flow system on the east involving the Ash Meadows area. In Crater Flat, the alluvium materials are interbedded with the volcanics. The alluvium is comprised of sands and gravels. In general, particularly where the sand and gravel layers are distinguished, this unit is pervious. Therefore, the alluvium is a potentially water bearing material. Only in a few places where it has been deposited at great depth (including the area of Bond Gold Mine to the west of the Mother Lode and almost certainly Crater Flat) has this material attained such a thickness that the deep water levels of this general area permit it to be water saturated. Generally there is from 200 to 700 feet of unsaturated alluvium above the hydraulic surface.

Regional Flow Systems. Winograd and Thordarson (1975) conducted an extensive investigation into the flow systems in the area as part of the investigations concerning development of the high level nuclear waste repository at Yucca Mountain approximately 7 miles east of the project site. Much of the following discussion is based on their report.

Rush (1970) indicated there are three types of groundwater reservoirs in the region: valley-fill, volcanic-rock, and carbonate-rock aquifers. Alluvium beneath valley floors is commonly saturated only at great depth. Water in the valley-fill reservoirs generally leaks downward to underlying volcanic or carbonate rocks. The consolidated rocks of the area are mostly volcanic rocks; however, some extensive areas of carbonate rocks have been mapped (Rush 1970). The transmissivity of volcanic-rock aquifers of the western part of the area averages about 10,000 gallons per day per foot. The transmissivity of the carbonate-rock aquifer generally is much higher, resulting in low flow gradients (Rush 1970).

Volcanic-rock aquifers in the eastern part of the region locally transmit water downward to carbonate-rock aquifers. In the western part of the area, the volcanic-rock aquifers transmit a regional flow of water, as do the carbonate-rock aquifers of the eastern part of the area (Rush 1970).

In most of these hydrographic areas, initial groundwater development probably would result from the depletion of groundwater in storage rather than the salvage of any appreciable amount of subsurface outflow (Rush 1970). Rush (1970) estimated that 10 million acre feet of groundwater is in transient storage in the uppermost 100 feet of saturation beneath valley floors.

There are several regional flow systems in the area. These include: Amargosa Desert system; the Death Valley National Monument system; the Oasis Valley-Fortymile Canyon system; and the Ash Meadows and Devils Hole System.

Amargosa Desert. Walker and Eakin (1963) discussed the geology and groundwater of the Amargosa Desert to the west of Bare Mountain and the project site. The Amargosa Desert valley is surrounded by mountain ranges composed of rocks of Precambrian, Paleozoic, and Tertiary age, consisting principally of tuff and lava, dolomite, limestone, shale, siltstone, quartzite, and slate in varying proportions. These mountains (including Bare Mountain) were uplifted by faulting and tilting during the late Tertiary and early Quaternary time. Erosion products of the surrounding mountains have filled the basin of the valley with several hundred feet of alluvium, including lake and stream deposits.

Analyses of water from wells and springs in the area indicate that the water was suitable for irrigation but generally is medium-salinity water or poorer. Medium- to high-sodium water occurs locally with the poorer quality water and generally is found in the southern part of the area. Elevated boron concentrations may offer a problem in the growing of some crops, however (Walker and Eakin 1962). Locally, fluoride contents may be high.

About 1.4 million acre-feet of groundwater is estimated to be stored in the upper 1000 feet of saturated alluvial deposits beneath a four-township area roughly enclosing the area of principal concentration of wells in the Amargosa Desert. Walker and Eakin (1963) illustrated the effect of over-development on groundwater levels and suggested that pumping at the rate of 60,000 acre-feet a year would lower water levels in this area an average of 100 feet in about 25 years, and would intercept most of the recharge moving through the valley toward the area of natural discharge.

Death Valley National Monument. Death Valley National Monument is approximately 10 miles west of the project site. Groundwater occurs in fractures and solution openings in the Precambrian and Paleozoic age rocks in the Funeral Mountains. The carbonate rocks probably are the most permeable of the consolidated rocks in the area, and are considered by Miller (1977) to be part of an aquifer system through which water moves from the Amargosa Desert to discharge at several large springs near Furnace Creek and at Keane Wonder Spring. According to Miller (1977), interbasin underflow from the northeast supplies much of the total flow for springs in the valley and much of the groundwater recharge. Minor quantities of groundwater may enter the valley from basins to the west and northwest. Miller (1977) suggested that several large springs along the east side of Death Valley appear to be discharging from a large interbasin flow system that extends many miles to the north and east. Most of these springs occur near the contact of alluvial deposits and consolidated rocks; three springs discharge along major faults.

Miller (1977) suggested that the Death Valley groundwater system as a whole, in the area of Death Valley National Monument, is probably in a steady-state condition, with respect to recharge, storage, and discharge.

Miller (1977) also suggested that in a few small remote areas, recharge has diminished in recent decades. He attributed this to a general decline in rainfall since 1945.

Pistrang and Kunkel (1964) suggested that adequate precipitation falls on the tributary drainage area to supply all the recharge to Death Valley National Monument. The springs occur in the unconsolidated and semiconsolidated deposits. They proposed four hypotheses to explain the occurrence, source, and movement of the groundwater. The first assumes that water from precipitation at higher altitudes percolates into a network of faults and fractures, and discharges where the faults and fractures intersect the surface at lower altitude. The second hypothesis is similar to the first, but assumes that, from faults in the bedrock, water is conducted to the surface in pipes of travertine that were formed contemporaneously with the deposition of alluvial material. The third hypothesis assumes that water from precipitation percolates into the alluvial deposits, replenishes the water table, and occurs as springs where the water table intersects the surface. The fourth hypothesis assumes some combination of the first three.

Pistrang and Kunkel (1964) estimated that about 4,000 acre-feet of discharge occurs in the Furnace Creek Wash to the floor of Death Valley. Based on their discharge calculations, Rush (1970) concluded that probably only a few hundred acre-feet of recharge could be generated in the Furnace Creek watershed. Therefore, he concluded that much of the 4,000 acre-feet of discharge in the Furnace Creek Wash area may be from the Amargosa Desert. Rush (1970) also suggested that additional quantities of groundwater may flow from the Amargosa Desert to the valley floor of Death Valley to discharge largely by evaporation.

Winograd and Thordarson (1975) discuss a possible hydraulic connection between central Amargosa Desert and Furnace Creek Wash-Nevares Springs area in Death Valley via the Lower Paleozoic Aquifer.

Sharp (1989) also reported that it has been suggested that the source of water discharged at the Nervares and Travertine Springs in Death Valley National Monument, is probably through a connection to the lower Paleozoic Carbonate Aquifer. Sharp (1989) pointed out that this aquifer is very deep and that no drilling conducted to date in the vicinity of the project area has encountered the Lower Paleozoic Carbonate aquifer materials.

Oasis Valley - Fortymile Canyon. The groundwater flow system to the north, including the project area, was informally designated by Winograd and Thordarson (1975) as the Oasis Valley-Fortymile Canyon basin. The regional groundwater system probably includes Oasis Valley, Amargosa Desert west of the Ash Meadows fault, and possibly that part of Reveille Valley south of the topographic divide (Winograd and Thordarson 1975; Blankennagel and Weir 1973). Cactus Flat may drain southwestward to Sarcobatus Flat as part of the Sarcobatus Flat regional groundwater system. The southern part of Reveille Valley, north of Kawich Valley, and an extension of Railroad Valley may contribute groundwater either southward or eastward to Railroad Valley (Winograd and Thordarson 1975). Many of the hydrographic areas considered to be part of this groundwater flow system and the Ash Meadows flow system are closed topographic basins. Piezometric contours indicate that the regional groundwater flow is generally southwestward to the Amargosa Desert (Winograd and Thordarson 1975; Blankennagel and Weir 1973).

Groundwater in the system generally flows southwesterly through interconnected faults and joints toward Oasis Valley, and southward to the Amargosa Desert where most of the water is believed to be discharged (Winograd and Thordarson 1975; Blankennagel and Weir 1973). The volcanic rock aquifer is the principal medium through which the regional flow occurs; however, the valley-fill aquifer also transmits flow beneath the Amargosa Desert. Part of the combined groundwater outflow from the Ash Meadows and Oasis Valley-Fortymile Canyon regional systems may flow southward through carbonate rocks to Death Valley (Winograd and Thordarson 1975).

Malmberg and Eakin (1962) referred to this system as the Pahute Mesa System. They indicated Oasis Valley northwest of the project site is a major part of the Pahute Mesa flow system. Malmberg and Eakin (1962) estimated the average annual recharge to and discharge from Oasis Valley is on the order of 2,000 acre-feet. They suggested that about 250 acre-feet is derived from precipitation within the drainage basin and about 1,800 acre-feet is derived from underflow from Gold Flat. Blankennagel and Weir (1973) reported that the discharge could be considerably higher.

Discharge of groundwater in Oasis Valley is affected by evapotranspiration and underflow through the Amargosa Narrows to the Amargosa Desert. Malmberg and Eakin (1962) estimated the average annual natural discharge by evapotranspiration to be approximately 1,900 acre-feet. They estimated the average annual spring discharge and underflow to the Amargosa Desert to be about 400 acre-feet, although this figure may be too low (Blankennagel and Weir 1973).

Groundwater development in Oasis Valley has been limited largely to the development of numerous springs along the flood plain of the Amargosa River. Six of these springs are used for the municipal water supply for the Town of Beatty. The fluoride content of the water is significantly higher than drinking water standards (Malmberg and Eakin 1962). Water samples collected throughout the valley suggest that all groundwater in Oasis Valley, except that derived from precipitation on the Bullfrog Hills northwest of Beatty, contains excessive concentrations of fluoride (Malmberg and Eakin 1962). Although the estimated recharge to the groundwater reservoir resulting from the infiltration of precipitation on the Bullfrog Hills is less than 20 acre-feet per year, a considerable amount of water with low fluoride content may be in storage in the alluvium bordering the hills, according to Malmberg and Eakin (1962). Generally, the groundwater of Oasis Valley may be classified as a sodium-bicarbonate type. This type of groundwater is commonly found in areas of Nevada underlain by Tertiary tuffaceous deposits (Malmberg and Eakin 1962).

The principal area of discharge in Oasis Valley is along the flood plain of the Amargosa River. Most of the discharge by evaporation and transpiration occurs in the floodplain in Oasis Valley. Most of the precipitation on the valley floor is discharged by evaporation. A considerable amount of recharge to Sarcobatus Flat and Oasis Valley may be derived from underflow through the Tertiary or Paleozoic bedrock beneath the topographic divide at the north and northeast sides of the two valleys (Malmberg and Eakin 1962).

Crater Flat immediately adjacent to the project area is part of the Oasis Valley-Fortymile Canyon Groundwater system (Rush 1970; Blankennagel and Weir 1973). In Crater Flat, the minimum depth to water beneath the valley floors was estimated to be 250 to 600 feet (Rush 1970). The approximate altitude of the water surface is 2,300-2,400 feet asl. Winograd and Thordarson (1975) estimated the annual average groundwater recharge for Crater Flat to be approximately 220 acre-feet.

According to Rush (1970), the average annual recharge for the Pahute Mesa (Oasis Valley-Fortymile Canyon) regional system is estimated to be 11,000 acre feet. The estimated average annual discharge from the Pahute Mesa groundwater system is 9,000 acre-feet (Rush 1970, Winograd and Thordarson 1975). Of this amount, 2,200 acre-feet is discharged in Oasis Valley according to Malmberg and Eakin (1962); the remainder, about 7,000 acre-feet, is discharged west of the Ash Meadows fault (Winograd and Thordarson 1975).

Rush (1970) suggested that because the Ash Meadows and the Pahute Mesa groundwater systems converge in the Amargosa Desert, they may actually be part of one large regional groundwater basin that could extend southward to and include much of Death Valley.

Winograd and Thordarson (1975) asserted, however, that there is a north-trending boundary between the Ash Meadows and Oasis Valley-Fortymile Canyon groundwater systems. This boundary is largely based on the great difference in water levels of at least 2,000 feet near the central part of the area. Southward, the disparity is less pronounced, amounting to less than 100 feet in the Amargosa Desert. Northward, the disparity also seems to decrease, but water level data are lacking to define the amount. Moreover, the northern extent of the boundary has not been defined (Winograd and Thordarson 1975).

Ash Meadows and Devils Hole. The Ash Meadows area, at the southern tip of the Amargosa Desert in southern Nevada, is located approximately 40 miles southeast of the project. The Ash Meadows area discharges groundwater collected over several thousand square miles of a regional flow system developed in Paleozoic carbonate rocks (Dudley and Larson 1976).

A small pool in Devils Hole, which is a collapse depression in Cambrian limestone, and numerous springs in the adjacent desert valley contain rare fish species of the genus *Cyprinodon*, which are faunal remnants of Pleistocene lakes. The Devils Hole pupfish, *C. diabolis*, is the most endangered of the several surviving species that have evolved since the post-pluvial isolation of their ancestors (Dudley and Larson 1976). This population feeds and reproduces on a slightly submerged rock ledge. Irrigation pumping in the early 1970's nearly exposed this ledge (Dudley and Larson 1976).

According to Rush (1970), at Ash Meadows in the Amargosa Desert, one or more faults form a barrier to groundwater flow, probably causing water from the system to be discharged as springs. However, the effectiveness of the barrier to groundwater flow is not known. Leakage across the barrier may occur (Rush 1970).

According to Winograd and Thordarson (1975), Walker and Eakin (1963), and Rush (1970), for the Ash Meadows and Oasis Valley-Fortymile Canyon systems, the estimated average annual discharge as measured in Amargosa desert totals at least 24,000 acre feet. The estimated average annual recharge to the two systems totals about 45,000 acre feet. The imbalance between recharge and total discharge is seemingly an excess of 19,000 acre-feet per year. Although the excess may reflect error in the estimates, a substantial part may be accounted for by subsurface flow to Death Valley (Rush 1970; Winograd and Thordarson 1975).

Interbasin Movement. Three major hydrogeologic units in the region - the lower clastic aquitard, the lower carbonate aquifer, and the tuff aquitard, control the regional movement of groundwater (Winograd and Thordarson 1975). Winograd and Thordarson (1975) found that a synthesis of hydrogeologic, hydrochemcial, and isotopic data suggests that an area of at least 4,500 square miles (including 10 intermontane valleys) is hydraulically integrated into one groundwater basin, the Ash Meadows basin, by interbasin movement of groundwater through the widespread carbonate aquifer. The Ash Meadow groundwater basin extends to the east of Ash Meadows and includes Mercury Valley area. Discharge from this basin - a minimum of about 17,000 acre-feet annually - occurs along a fault-controlled spring line at Ash Meadows in east-central Amargosa Desert.

Interbasin movement of water between Cenozoic aquifers and the lower carbonate aquifer is controlled by the tuff aquitard, the basal Cenozoic hydrogeologic unit (Winograd and Thordarson 1975). Such movement significantly influences the chemistry of water in the carbonate aquifer. Groundwater velocity through the lower carbonate aquifer ranges from an estimated 0.02 to 200 ft/d, depending on geographic position within the flow system (Winograd and Thordarson 1975).

Regional movement of groundwater through the lower carbonate aquifer flanking and underlying the valleys is not significantly influenced by the topographic boundaries of the individual valleys. One of the major controls of such movement is the disposition of the lower carbonate aquifer and of the lower and upper clastic aquitards (Winograd and Thordarson 1975). The lateral movement of groundwater through the carbonate aquifer integrates several intermontane valleys into a single large groundwater basin, the Ash Meadows groundwater basin (Winograd and Thordarson 1975).

Interbasin movement of groundwater within the lower carbonate aquifer is greatly influenced by major geologic structures, particularly by folds that bring the lower clastic aquitard close to the surface, or by faults that juxtapose the lower or upper clastic aquitards and the lower carbonate aquifer (Winograd and Thordarson 1975). The most striking example of structural control of groundwater movement within the lower carbonate aquifer is the spring line at Ash Meadows in east-central Amargosa Desert.

According to Winograd and Thordarson (1975) and Blankennagel and Weir (1973), groundwater beneath the Pahute-Mesa-Timber Mountain area is not tributary to the Ash Meadows groundwater basin. This groundwater, predominantly in Tertiary tuff and rhyolite, moves southwestward toward discharge areas in Oasis Valley and probably also moves southward toward the Amargosa Desert through western Jackass Flats. This area is considered part of a single groundwater basin, informally designated the Oasis Valley-Fortymile Canyon basin, which is tributary to the central and northwestern Amargosa Desert (see previous discussion).

Winograd and Thordarson (1975) summarized hydrochemical evidence on regional movement of groundwater in the area:

1. Groundwater beneath the Nevada Test Site moves towards the Ash Meadows area.

2. Chemical quality of the water within the lower carbonate aquifer may not change markedly with depth. Potable water may be present to depths as great as 10,000 feet in the Ash Meadows groundwater basin.

3. Sulfate and sodium contents in groundwater in the tuff aquitard beneath the Nevada Test Site increase with depth, at least locally.

4. Groundwater within the tuff aquitard drains into the underlying lower carbonate aquifer beneath the Nevada Test Site and possibly also beneath the valleys east and northeast of the Nevada Test Site.

5. Leakage of water from the tuff aquitard into the lower carbonate aquifer is probably less than 5 percent of the water discharged at Ash Meadows.

6. Groundwater may move into Ash Meadows basin from Pahranagat Valley and, if so, may constitute as much as 35 percent of the spring discharge at Ash Meadows.

7. Groundwater movement from Pahrump or Steward Valleys into the Ash Meadows area is minor.

8. Groundwater within the central Amargosa Desert comes from the east, the north, and the northwest.

9. Flow from the central Amargosa Desert into Death Valley is the most likely source of the major spring discharge in east-central Death Valley.

Rush (1970) recognized three regional interbasin groundwater flow systems: the Ash Meadows system, the Pahute Mesa system (Oasis Valley-Fortymile Canyon) and the Sarcobatus Flat system (west of the project area and including Cactus Flat). Rush (1970) summarized the regional groundwater movement as follows:

1. Groundwater in the Ash Meadows system flows generally southward to Ash Meadows to discharge at springs, by evapotranspiration, and possibly by subsurface outflow across a fault barrier to the south end of the Pahute Mesa system in Amargosa Desert.

2. The Pahute Mesa (Oasis Valley-Fortymile Canyon) system flows generally southward to discharge largely by evapotranspiration in Amargosa Desert.

3. Groundwater is believed to flow southwestward from Cactus Flat to Sarcobatus Flat where it is largely discharged by evapotranspiration.

4. Some of the water in the first two systems may move southwestward as underflow to Death Valley through the carbonate rocks of the Funeral Range.

In summary, there are apparently still some uncertainties with regard to regional groundwater movement in the area. It appears, based on the available information, that groundwater movement occurs in 3 different systems in the region:

1. Oasis Valley-Fortymile Canyon system. Water moves from the north to the south, southwest and southeast along Fortymile Canyon and through Crater Flat.

2. Ash Meadows system. Water discharged at Ash Meadows is derived to the east of the Ash Meadows Fault in the Mercury Valley area.

3. Amargosa Desert. Flow in the Amargosa Desert moves generally southward with contributions from Oasis Valley and Crater Flat (part of the Oasis Valley/Fortymile Canyon system). There may be a connection between the Amargosa Desert system and Death Valley National Monument via the deep carbonate aquifer.

Local Groundwater Flow. The project area is located within the Oasis Valley-Fortymile Canyon flow system. Groundwater is considered to be recharged in the Timber Mountain-Pahute Mesa area to the north (Blankennagel and Weir 1973; Winograd and Thordarson 1975). In general, water moves from the recharge area southward down through Crater Flat. This is referred to as the Crater Flat groundwater flow system (Sharp 1989). Crater Flat water moves south and combines with the Amargosa Desert groundwater system. Groundwater also moves from the north Timber Mountain-Pahute Mesa area to the southeast, then south along Fortymile Wash through Lathrop Wells (Blankennagel and Weir 1973; Sharp 1989). Groundwater is also considered to move to the southwest and west of Timber Mountain Caldera and the Pahute Mesa area towards a discharge point in the Oasis Valley (Blankennagel and Weir 1973; Sharp 1989, Figure 1).

Bare Mountain essentially acts as an impervious block sitting in the midst of the groundwater flow paths. Groundwater recharged to the north, seeking to move southward and ultimately discharge, is diverted around Bare Mountain. Water does not flow through Bare Mountain. Bare Mountain essentially divides the groundwater flow into three different components (Sharp 1989). First, further to the north, water moves to the southwest and west of Timber Mountain Cadera and the Pahute Mesa area being diverted by Bare Mountain towards Oasis Valley. Second, water flows south into the

Crater Flat flow system which continues to move southward into the Amargosa Desert. Third, groundwater moves from the north to the southeast through Fortymile Wash and the Lathrop Wells area (Figure 1 and Table 2).

In general, it is considered that there is regional discharge from the Amargosa Desert flow system in the Franklin Lake playa to the south (Winograd and Thordarson 1975, Sharp 1989). It has also been suggested that some of the water may flow to the northwest towards Furnace Creek to discharge at the springs near Park Headquarters (Sharp 1989).

There is a major regional boundary between two flow systems in the southeastern part of the area (Figure 1, Sharp 1989). This boundary is between the flow system which is moving down through Mercury and areas in that vicinity and discharging water in the vicinity of Ash Meadows, and is the source of water for Devils Hole (the Ash Meadows groundwater basin delineated by Winograd and Thordarson 1975). The boundary is formed by a major regional fault. The fault has juxtaposed different geologic materials, which prevents the two areas from being in hydraulic continuity. This is supported in part by the fact that the water level on the east side of the fault at Devils Hole is 2,359 feet. Immediately to the west of the fault the water level is 2,225 feet. That is, there is 134 feet of elevation difference in water level in less than one mile (Sharp 1989). Activities which could impede or impact the Devils Hole and Ash Meadows area would have to be to the north and east of the fault, rather than to the west and northwest (Sharp 1989). Therefore, the project area is hydraulically separated from Devils Hole (Sharp 1989; Winograd and Thordarson 1975; Blankennagel and Weir 1973). The flow system in which the project area is located (the Oasis Valley-Fortymile Canyon flow system) flows into the Amargosa Desert flow system to the west of the fault line (Sharp 1989, Winograd and Thordarson 1975).

The interpretation (Sharp 1989) of groundwater flow is based on the potentiometric surface of the groundwater (Figure 1, Table 2). For example, the USNGS exploration hole drilled at the north end of Crater Flat (Figure 1, MW-4) encountered groundwater at 3,252 feet. Further south at USGS holes VH-2 and VH-1 (Figure 1) the water level drops to 2,662 feet and 2,576 feet, respectively. Similar decreases occur in water levels southward through the Amargosa Desert. At the south end of Crater Flat at Highway 95, the water level elevation is 2,330 feet. The

TABLE 2

WELLS IN THE CRATER FLAT AREA AND VICINITY

MOTHER LODE PROJECT USNGS

DOCUMENTATION FOR FIGURE 1

Site Number	Site Location	Surface Elevation (ft)	Depth to Water (ft)	Date Measured	Owner
1	S16 E48 15DADD1	2364	93.4	01/08/87	Spear, I.
2	S16 E48 23AAAA1	2358	108.6	01/10/87	Gillespie
3	S16 E48 36AAAA1	2324	83.2	01/10/87	Bettles
4	S16 E48 18CDC1	2360	98.9	01/10/87	Tharp, E.
5	S17 E49 09AAAA1	2280	76.1	01/12/87	Amargosa, F.
6	S17 E49 20BCAC2	2270	51.6	01/11/87	USGS
7	S17 E49 15BC	2257	66.9	03/21/86	Steelman, J.
8	S17 E49 28BC	2260	51.2	01/15/87	IMV
9	S17 E49 11BCAA	2275	65.0	01/19/84	Bettlo, G.
10	S17 E50 19AAB	2180	14.2	03/17/87	Trenary, P.
11	S17 E50 33CAAB	2165	7.61	03/17/87	?
12	S18 E50 13CCCD	2215	5.4	03/17/87	Hale, D.
13	S18 E51 30DD	2270	12.7	01/14/87	USGS
14	N2616 E05 08	2165	30.2	01/13/87	?
15	N26 E05 21C	2188	74.9	01/13/87	USGS
16	N27 E04 27B	2242	36.6	01/13/87	Morris
17	S18 E50 11AA	2245	20.2	03/17/87	Spr. Melin.
18	S18 E49 11BB	2170	60	11/30/81	?
19	S16 E50 07AAA	2478	129.9	03/16/87	Cook, L.
20	S16 E50 29ACD	2380	100.5	03/15/87	?
21	S16 E49 20AABB	2384	128.6	01/13/87	Travis, M.
22	S16 E49 36BBAA	2338	122.3	01/15/87	Mills, J.

TABLE 2 (CONTINUED)

Site Number	Site Location	Surface Elevation (ft)	Depth to Water (ft)	Date Measured	Owner
23	S16 E49 05CDDD1	2430	159.0	01/12/87	Ruclela
24	S15 E49 22AABA	2612	295.6	01/15/87	Shaw, J.
25	S14 E50 06A	3128	731	10/27/87	?
26	S13 [illegible] 35BAD1	2788	281.9	01/07/87	U.S. Ecology
27	S14 E46 25AA1	2705	304.5	01/11/87	USGS
28	S14 E46 26AA1	2710	303.3	01/11/87	USGS
29	S14 E46 26BA1	2720	281.7	01/11/87	[illegible]
30	S14 E47 32DA	2625	271.2	09/22/88	USGS
31	S14 E48 32ABBB1	2542	212	?	Rose's Station

Source: Hydro-Search

decreasing trend southward in water level elevation indicates that water is flowing towards the south (Figure 1, Table 2, Sharp 1989, Hydro-Search Inc., 1989).

2.3.2 Local Groundwater Quantity

USNGS conducted subsurface drilling work to better characterize the water bearing characteristics of the rock. Initially, three holes were drilled (Figure 1). Two sites, drilled to 740 and 1,000 feet, showed low primary permeability. The third site, MW-3, shows some permeability and indicates that a portion of the water supply could perhaps be developed from the northernmost site (Hydro-Search Inc. 1989). Static water level was found to be approximately 200 feet below the surface.

The drilling program was moved to the east into Crater Flat where volcanic rocks and alluvial materials were thought to be present. Subsequent drilling to approximately 1,540 feet has confirmed this, and also that this material is water bearing with the potential for water supply development (Hydro-Search Inc. 1989).

The southern two holes (MW-2 and MW-18) drilled by Hydro-Search Inc. are on the northern edge of what is mapped by the USGS as aquifer material (Sharp 1989). One hole was drilled to 700 feet, and one was drilled to 1,000 feet; and no water was found. It was concluded that these holes were basically in aquitard material. This lends some support to the concept that even though aquifer materials are mapped in this area, there are aquitard materials at depth in this area. This would tend to extend the area of impervious Bare Mountain rocks further to the north than presently mapped (Sharp 1989).

<u>Transmissivity and Storage</u>. Czarnecki and Waddel (1984) modeled the Oasis Valley-Fortymile Canyon flow system. Based on their computer simulation results, Sharp (1989) calculated that the amount of water moving through Crater Flat was 5,700 acre-feet per year. Similar calculations indicate that a reasonable number for the average velocity of the groundwater would be approximately 160 feet per year (Sharp 1989). This would give a travel time down Crater Flat of about 400 years.

Based on Czarnecki and Waddel's (1984) findings, the transmissivity of the groundwater in this area is approximately 7,500 gallons per day per foot (Sharp 1989). The storage coefficient was estimated by Sharp (1989) to be 0.0048, assuming that the aquifer material is about 4,000 feet thick. Rush (1970) indicates calculated amounts of 220 acre-feet per year recharge to Crater Flat. The source of this recharge primarily would be from snowmelt and runoff in Crater Flat, in addition to some runoff from Yucca Mountain (Sharp 1989).

2.3.3 Local Groundwater Quality

The northernmost site drilled for the Mother Lode Project (MW-3) was sampled for water quality (Hydro-Search Inc. 1989). The hole was drilled to a depth of approximately 1,000 feet and the casing extended to about 700 feet. A pump was set at approximately 500 feet. The static water level is approximately 3,907 feet asl, i.e., the water level is about 200 feet below the surface (Fox 1989; Hydro-Search Inc. 1989).

The results of the analyses are shown in Table 3. Concentrations of the major cations and anions indicate the water to be of a calcium-magnesium-sulfate type. This type of water is common in volcanic rocks where oxidation of sulfide minerals can produce relatively high concentrations of sulfate and iron. Four constituents were found to exceed drinking water standards: iron, manganese, sulfate, and total dissolved solids. All other constituents are within drinking water standards (Table 3).

Water in the vicinity of water permit site 11850C in Oasis Valley (Figure 2) is a sodium-potasium-bicarbonate type (Malmberg and Eakin 1962). At well USW VH-1 in southern Crater Flat (Figures 1 and 2), the water is a sodium-bicrabonate type (Benson, et al., 1983).

2.3.4 Water Rights

Local Water Rights. With the exception of the project water rights applied for from the State Engineer, there are no other water rights in the immediate vicinity of the proposed applicant's wells. Seven water rights applications have been filed (Nos. 51555, 51556, 51557, and 52847, 52848, 52849, 52850), and are intended to be in combination with each other. The rate at which water is being requested is a maximum of 250 cubic feet per second (cfs). The volume over the expected 7-year project life is approximately 3,200 acre-feet.

TABLE 3

WATER CHEMISTRY DATA

MOTHER LODE PROJECT USNGS

	EPA-Nevada Drinking Water Standards[1]	Well MW-3
<u>12/14/88 1200 hrs.</u>		
Discharge, gpm		70
Temperature, °C (°F)		29 (84)
pH (field)	6.5 - 8.5	8.1
pH (lab)		7.3
Total Dissolved Solids (evap. @ 180°C)	500s (1000)	1315 (3)
Total Dissolved Solids (calc.)		1214 (3)
Electrical Conductivity (lab)		1580
Electrical Conductivity (field)		1700
<u>Constituent</u>		
HCO_3		305
CO_3		—
Cl	250s (400)	76
SO_4	250s (500)	599 (3)
F	1.4 - 2.4p (2)	0.3
B		0.4
NO_3 (as NO_3)	45.0 p	<0.1
Na		88
K		6
Ca		170
Mg	125s (150)	93
SiO_2		29
As	0.05p	0.01
Cu	1.0s	<0.02
Fe	0.3s (0.6)	1.57 (3)
Mn	0.05s (0.10)	0.11 (3)
Zn	5.0s	1.01
Ba	1.0p	<0.4
Cd	0.010p	<0.01
Cr	0.05p	<0.02

TABLE 3 (CONTINUED)

	EPA-Nevada Drinking Water Standards[1]	Well MW-3
Pb	0.05p	<0.05
Hg	0.002p	<0.0005
Se	0.01p	<0.005
Ag	0.05p	<0.01
P (total)		<0.01
CN (total)		<0.005
Hardness (mg/l equivalent $CaCO_3$)		806

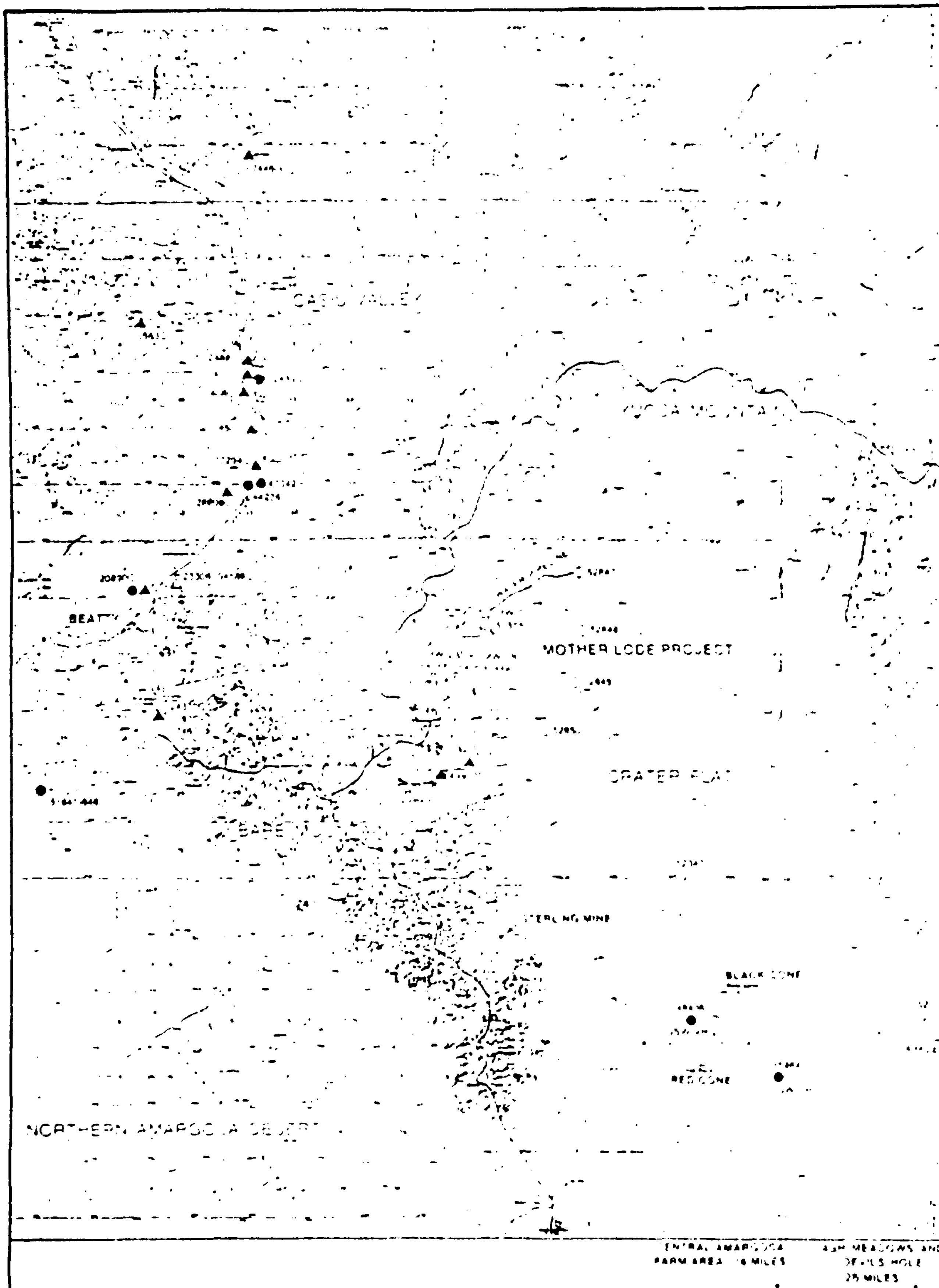
Source: Hydro-Search Inc. 1989

Chemical concentrations are in mg/l, pH is in standard pH units, and electrical conductivity is in micromhos/cm @ 25°C.

[1] Nevada and EPA mandatory primary standards for public water are noted with "p". Nevada and EPA recommended secondary standards for public water systems are noted with "s". The secondary standard for magnesium is Nevada only. Nevada mandatory standards for public water systems are shown in parentheses.

[2] Dependent on annual average maximum daily air temperature.

[3] Exceeds a mandatory standard.



EXPLANATION

▲ SURFACE WATER PERMIT OR CERTIFICATE

PENDING GROUNDWATER WELL APPLICATION

● GROUNDWATER PERMIT OR CERTIFICATE

BOUNDARY OF HYDROGRAPHIC BASINS 227A, 228, 229 AND 230

N

SCALE IN MILES

MOTHER LODE PROJECT

APPENDIX A FIGURE 2
WATER RIGHTS IN THE VICINITY OF THE MOTHER LODE PROJECT

Water rights on file with the State Engineer for the general area are listed in Table 4 and shown on Figure 2. As previously stated, there are no water rights in the immediate vicinity of the project site.

There are two spring permits in the vicinity of the project area. These are Specie Spring and an unnamed spring in the Bare Mountain area, approximately 2.5 miles south of the USNGS applications. These springs are at a much higher elevation than the water encountered at the test wells. Specie Spring is at approximately 4,600 feet asl. The water level elevation at the aplications that are on file are approximately 3,900 feet asl. That is, the springs are some 700 feet higher than the project test hole water levels.

Further south there is a water right near Black Cone, probably for the Sterling Mine, and also a water right near Red Cone which is a DOE permit. The closest well to the project site is approximately 7 miles west of the project (Figure 2).

Regional Water Rights. There are several sensitive areas of concern in the region of the Mother Lode Project. These areas include Long Spring and Crystal Spring to the north and northeast of the project areas, respectively; Death Valley National Monument; Ash Meadows and Devils Hole; and the Amargosa Farms in the southern Amargosa Desert.

Death Valley National Monument has Federal Water Rights. These water rights essentially require the State to guarantee a continued water supply to the Death Valley National Monument and to Devils Hole. Death Valley National Monument, Devils Hole, and Ash Meadows hydrogeology have been discussed previously.

Long Spring is located approximately 9 miles north of the project site in Oasis Valley, upgradient from the project activities. Crystal Spring is also located in Oasis Valley 8 miles to the northwest of the project site and is also upgradient of the project site.

TABLE 4

WATER RIGHTS IN THE VICINITY OF THE MOTHER LODE PROJECT

USNGS NEAR BEATTY, NEVADA

Application Number	Certificate Number	Owner of Record	Status	Source	Point of Diversion	Type of Use	Diversion Rate (CFS)	Annual Duty
1197	420	Martin, Lotta M. Childress, Mildred A.	Certificate	Spring	SE 1/4 SE 1/4 Sec. 6 T12S, R47E	Irrigation & Domestic	0.08	Use: 4/1 - 10/1
01408		Carrara Portland Cement Co	Vested	Spring	SW 1/4 NE 1/4 Sec. 21 T11S, R47E	Irrigation, Domestic & Stock	not adjudicated	
1746 (2501)	368	American Carrara Marble Co	Certificate	Spring	NW 1/4 NW 1/4 Sec. 20 T12S, R47E	Mining	0.3	
2411	316	Carrara Portland Cement Co	Certificate	Spring	NW 1/4 NE 1/4 Sec. 21 T11S, R47E	Irrigation & Domestic	0.40	Use: 3/1 - 10/1
4586		A. Revert Trust	Vested	Spring	SE 1/4 SW 1/4 Sec. 5 T12S, R47E	Irrigation, Domestic Stock & Municipal	Amount not specified (past use - 5.0 cfs)	
6011	852	Williams, Charles W.	Certificate	Spring	SW 1/4 SE 1/4 Sec. 19 T12S, R48E	Stock	0.006	
10563	2750	Harlan, Shirley J. Neal, Elizabeth	Certificate	Spring	NE 1/4 NE 1/4 Sec. 18 T11S, R47E	Domestic	0.0375	
11850	3117	Ohlen, Ronald D	Certificate	Spring	NE 1/4 NE 1/4 Sec. 28 T11S, R47E	Irrigation & Domestic	0.75	300 AFA
12488	3700	Gray, Arthur E Leinsteiner, Agnes	Certificate	Spring	SW 1/4 SE 1/4 Sec. 16 T11S, R47E	Irrigation & Domestic	1.0	
12489	3701	Gray, Arthur E Leinsteiner, Agnes	Certificate	Underground	NE 1/4 NE 1/4 Sec. 21 T11S, R47E	Irrigation & Domestic	0.22	
20352	5764	Watson, Helen Orr	Certificate	Underground	Lot 10, Sec. 36 T16S, R48E	Irrigation	3.5	1169.5 AFS
20890	6728	Beatty Water & Sanitation District	Certificate	Underground	SW 1/4 SE 1/4 Sec. 6 T12S, R47E	Municipal	0.17	
23106		A. Revert Trust	Application	Spring	SE 1/4 SW 1/4 Sec. 5 T12S, R47E	Irrigation & Domestic	4.0	
24370	6851	B. K. R. Co. of Nevada, Inc	Certificate	Spring	NW 1/4 NW 1/4 Sec. 20 T12S, R47E	Irrigation & Domestic	2.546	459.6 AFA

TABLE 4 (CONTINUED)

Application Number	Certificate Number	Owner of Record	Status	Source	Point of Diversion	Type of Use	Diversion Rate (CFS)	Annual Duty
24460	7015	Younghans, George E. & La Rene M.	Certificate	Spring	NE 1/4 NE 1/4 Sec. 33 T10S, R47E	Irrigation & Domestic	0.53	212.5 AFA
28808	9820	Gravelle, Fred L.	Certificate	Spring	NE 1/4 NW 1/4 Sec. 33 T11S, R47E	Irrigation & Domestic	0.04	12.5 AFA
30294	10705	Manley, Everett L. & Patricia J.	Certificate	Spring	NE 1/4 SE 1/4 Sec. 28 T11S, R47E	Irrigation & Domestic	0.12	34.5 AFA
44236		N B Layne, Inc.	Permit	Underground	NW 1/4 NE 1/4 Sec. 33 T11S, R47E	Milling	0.25	10.0 MGA
45984		U.S.D.O.E.	Permit	Underground	NE 1/4 SW 1/4 Sec. 22 T11S, R48E	"Site Characterization" Yucca Mountain	1.00	20.0 MGA
47342		Wahlen, William A. & Edna M.	Permit	Underground	SE 1/4 SE 1/4 Sec. 28 T11S, R47E	Commercial	0.02	2.28 MGA
48436		Saga Exploration Co.	Permit	Underground	NE 1/4 SE 1/4 Sec. 20 T13S, R48E	Mining & Milling	3.50	825.66 MGA
49901	12034	Coffer, Glenn L.	Certificate	Spring	NW 1/4 NW 1/4 Sec. 10 T12S, R48E	Stock	0.006	Sufficient for 200 head of cattle
51555		GEXA Gold Corp.	Application	Underground	SE 1/4 NE 1/4 Sec. 7 T12S, R48E	Mining & Milling	2.0	
51556		GEXA Gold Corp.	Application	Underground	SW 1/4 SE 1/4 Sec. 7 T12S, R48E	Mining & Milling	2.0	
51557		GEXA Gold Corp.	Application	Underground	SE 1/4 SW 1/4 Sec. 7 T12S, R48E	Mining & Milling	2.0	
51841-48		Bond Gold Bullfrog, Inc.	Permit	Underground	Sec. 26,27,33,35,36 T12S, R46E, Sec. 31 T12S, R47E, Sec. 2,3 T13S, R46E	Mining & Milling	4.46	3200 AFA
52338		U.S.D.O.E.	Application	Underground	NE 1/4 SW 1/4 Sec. 19 T13S, R50E	"Site Characterization" Yucca Mountain	0.2	
52347		Saga Exploration Co.	Application	Underground	SE 1/4 SW 1/4 Sec. 35 T12S, R48E	Mining & Milling	1.0	

3.0 IMPACT ASSESSMENT

3.1 Surface Water Impacts

The potential surface water impacts of the Mother Lode project include:

- the potential for changes in surface water quality and flow;
- the risk of failure of access roads and flooding at the mine site; and
- the potential for drainage diversion and increase in soil erosion and sediment loading to streams.

Impacts to the surface water resources from the proposed project are expected to be minimal as a result of the semi-arid climate and the absence of significant surface water. No perennial or intermittent streams are located in the immediate area. Furthermore, the confluence of the ephemeral drainage through the project area (Tates Wash and Joshua Hollow) with the nearest intermittent stream (the Amargosa River) is approximately 35 miles downstream to the southeast of the Mother Lode Project.

Mean annual flow for the ephemeral drainage is expected to be negligible with flow expected only in response to high precipitation events, mainly as flash floods. These existing conditions are not expected to be altered significantly by the proposed diversions. Therefore, the proposed development is not expected to significantly affect the quality of surface flow through the area. The risk of failure of access roads and flooding of the mine site from flash flooding is low because peak discharges and volumes should be relatively small.

Minor bank and channel erosion may occur in the diversion channels. Significant bank erosion could result in some lateral migration of the diversion channel and streambed scour under flood flow conditions. This on-site impact could be mitigated by incorporating engineered channel armoring in the diversion design. Any eroded materials from either above or through the mine site should be deposited a short distance downstream. Therefore, there should not be any significant loading impacts downstream. The Amargosa River should not be affected.

Pond systems are designed in excess of a 25-year rainfall event. The ponds are designed to handle a total of over 3,000,000 gallons of water. A 24-hour, 25-year event would produce, including the operating inventory of water, a total of 2,300,000 gallons of water. The ponds are not anticipated to breach as a result of expected rainfall events. Furthermore, all liquid systems, including all piping and ponds, will be tested for leaks prior to startup. This should minimize the potential for leaks from the piping and the ponds.

3.2 Groundwater Impacts

Based on drill logs, the shallow alluvium in Crater Flat appears to be unsaturated (Hydro-Search Inc., 1989). Therefore, groundwater impacts will be limited to confined aquifers and aquitards at depth such as welded and non-welded tuffs and possibly carbonate rocks.

3.2.1 Drawdown

No pump tests have been performed in the Crater Flat area to assess drawdown and calculate the aquifer parameters of transmissivity and storage coefficient. The Cooper-Jacob modification of the Theis equation was used by Hydro-Search Inc. (1989) to estimate values of transmissivity (7,650 gallons per day per foot) and storage coefficient (4 x 10-3). The value for transmissivity was taken from Czarnecki and Waddell (1984). It was assumed that the volcanic aquifer materials have the characteristics of Crater Flat and that these volcanic materials extend uninterrupted in all directions. It was determined that after pumping for seven years at 500 gpm (twice the expected rate of use), the drawdown at a 5 mile radius would be approximately 4.2 feet (Hydro-Search Inc., 1989). This estimate assumes that no hydraulic barriers to the drawdown cone will be intercepted during the mine life (the seven years of water production).

In reality, the geologic materials exposed at the surface, interpretations of the subsurface geology, and drilling results by USGS lead to the conclusion that relatively impervious barriers will be encountered to the west of the proposed wellfield which includes well numbers 5155, and 52847 through 52850 (Hydro-Search Inc. 1989). This will result in greater than projected drawdown in the immediate vicinity of the wellfield and corresponding reduction in waterlevel drawdown to the west (Hydro-Search Inc. 1989).

Dudley and Larson (1976) examined the possibility of pumping (about 20,000 acre-feet) at the Nevada Test Site approximately 6 miles east of the project site and found that water levels remained stable beneath the Nevada Test site. This indicates some stability in the lower carbonate aquifer.

The r overy time of the aquifer is probably on the order of one to two times the duration of pumping (Sharp 19789). That is, it may take 7 to 14 years for the aquifer to recover to prepumping levels.

Since no pump tests have been performed in the area, there are some questions remaining as to the real impacts to the groundwater aquifer from the Mother Lode project. It is recommended that monitoring be conducted to verify the expected dra down in the area and identify such impacts should any occur.

3.2.2 Elevated Springs

Within the general area there are a number of springs that discharge at relatively high elevation e.g., there are several springs in the Black Mountains at 2,000 to 3,000 feet above sea level and Specie Spring on Bare Mountain at approximately 4,350 feet above sea level. The source of water for these springs is very localized recharge on the mountains (Sharp 1989). These water sources are essentially perched water tables high up in the mountains not connected to the general flow systems. Any pumping from the general flow systems in the area, such as the proposed pumping for the Mother Lode project, would not be expected to have any effect on these springs.

3.2.3 Springs North of the Mother Lode Project

The Mother Lode project wells are approximately 9 miles south of Long Spring and approximately 8 miles southeast of Crystal Spring.

As discussed previously, Bare Mountain has a major effect on the flow system in this area. Essentially Bare Mountain diverts groundwater flow such that two local flow systems are evident: the Crater Flat flow system and the Oasis Valley flow system moving through the Amargosa Narrows.

The Oasis Valley flow system is the source of the water for both Long Spring and Crystal Spring (Sharp 1989). The effect of pumping the project wells would be non-detectable over the period of time in the amount that would be used by the project. Furthermore, both Long Spring and Crystal Spring are upgradient from the project area. The springs (Long Spring and Crystal Spring) derive their water from an entirely different local groundwater flow system. Water developed from the project wells would not intercept water that would otherwise flow to the springs (Sharp 1989).

Perhaps the only possible effect would be a slight bending to the south of the flow lines northwest of the site. This would be very difficult to either document, or prove or disprove (Sharp 1989).

3.2.4 Death Valley National Monument

Sharp (1989) reported that there would be no discernible effect on the water levels at the Park Headquarters (Furnace Creek). The Park Headquarters may be part of the Amargosa Desert flow system (Winograd and Thordarson 1975, Sharp 1989), but this connection has not been verified. There is, however, some new evidence from the USGS that there is a hydraulic boundary east of the Park Headquarters and west of Death Valley Junction (Sharp 1989). Water may not move from the Amargosa Desert towards the Park Headquarters. If this is the case, recharge for the Park Headquarters primarily would be from the Funeral Mountains or alternatively from some very obscure deep source that is unknown or unsuspected at this time (Sharp 1989). In any event, the park is 10 miles from the project area outside of the zone of anticipated drawdown.

3.2.5 Ash Meadows and Devils Hole

Sharp (1989) indicated pumping of project wells would not have any effect on water levels at Devils Hole. This is because there are two different flow systems (Ash Meadows and Oasis Valley-Fortymile Canyon) separated by the Ash Meadows fault (Winograd and Thordarson 1975, Sharp 1989). Drawdown effects could not occur across the hydraulic boundary between the Ash Meadows flow system and the Oasis Valley-Fortymile Canyon flow system (Sharp 1989).

Dudley and Larson (1976) suggested that the stability of water levels in the lower carbonate aquifer cited above also discounts long-term reductions of recharge as a possible cause of the reduced water levels at Ash Meadows in the early 1970's. This is further evidence that there is probably little connection between the Ash Meadows flow system and that of the Nevada Test Site and vicinity, i.e., between the Oasis Valley-Fortymile Wash system and the Ash Meadows system.

3.2.6 Groundwater Quality

There are a number of potential groundwater contamination sources associated with the project. No adverse impacts to groundwater quality are anticipated from any of these sources, as discussed in the following section.

Open Pit. One open pit is planned for the Mother Lode project. Due to the apparent lack of groundwater within the proposed pit, combined with the limited watershed area and proposed surface water diversion, the proposed project is not expected to result in groundwater discharge to the pit floor.

The probability of water accumulating within the pit is minimal. Impacts to groundwater quality from the mine pit should be negligible.

Waste Rock Dump. Waste rock remaining after ore separation would be hauled to a separate dump near the mine pit. Potential impacts associated with the waste rock disposal are the generation of acid mine drainage and subsequent recharge of such water to the local groundwater aquifer. Potential impacts caused by the waste rock dumps are not considered to be significant because: 1) adequate surface water diversion is provided for the waste rock areas; 2) groundwater is at a considerable depth below the dump sites in a low permeability, fractured bedrock, aquifer; and 3) the arid climatic setting precludes the generation of significant seepage through the waste materials.

Leaching Operations. Gold bearing ore would be leached on a contained leach pad with a dilute cyanide solution. The leaching system is designed to be self-contained and intrinsically tight in order to prevent the release of toxic cyanide into the environment and to obtain all available gold from the leach solutions. No adverse impacts to groundwater quality from the leaching facility are expected. In addition, the hydrogeologic conditions afford a moderate degree of hydrologic isolation. With the intervening silts and adequate depth (at least 200 feet) to groundwater, in addition to the attenuative capacity of the soils, the potential for groundwater quality degradation is limited.

The proposed handling of the reagents used in the ore processing should not result in any adverse impacts to groundwater quality. This is due in part to the inherent necessity to fully contain the solids and liquid slurries and reagents involved in the ore processing.

Sanitary Sewage. Sanitary sewage from the mine would be disposed of via a septic tank and leach field system. The geologic materials beneath the project area should provide adequate renovative capacity for sanitary wastewaters discharged to this system.

Solid Waste (Non-Hazardous). Solid waste generated by the mine and facilities is to be disposed of at a nearby landfill. No adverse impacts to the groundwater are anticipated from this activity.

4.0 MITIGATION MEASURES

4.1 Surface Water

Some bank and channel erosion may occur in high-impact flow areas in the diversion channel. Significant erosion could result in some lateral migration of the diversion channel and streambed scour under flood flow conditions. This on-site impact could be mitigated by incorporating engineered channel armoring in the diversion design.

4.2 Groundwater

Pump tests have not been conducted in the area to quantify drawdown estimates. In order to verify the estimates and to ensure that if an impact occurs it can be identified, a groundwater monitoring system is recommended. It is recommended that at least one on-site well completed in the ore zone be monitored. Additional wells already completed by other agencies (e.g., U.S. Geological Survey) should also be monitored if possible. It is recommended that if available, three additional wells should be selected: between the project site and Beatty; to the north of the project site; and to the south of the project site in Crater Flat (e.g., well VH-1 as indicated on Figure 1 may be a possibility).

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APPENDIX B

SOIL PROFILE DESCRIPTIONS
(In Numerical Order)

and

SOIL LABORATORY DATA

APPENDIX B

SOIL PROFILE DESCRIPTIONS

Sample No.* Soil Series, (Lux), & Soil Classification	Horizon and Depth[1] Inches	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Moist	Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-1, Zalda Variant		Loamy-skeletal, mixed, thermic			Typic Durorthid								
A1	0-4	GR SL	10YR 5/4	10YR 3/3	W M&F GR	SO	VFR	NS/SP	Com, F, VF	15%	EM	CS	
AC	4-7	GR SL	10YR 6/4	10YR 4/4	M M PL	SH	FR	NS/NP	Com M, F, VF	15%	EM	CW	
C1	7-16	GR SL	10YR 6/4	10YR 4/4	W. Massive	SO	VFR	NS/NP	Com M, F, VF	30%	EM	CW	
C2	16-22	CB & GR SL	10YR 6/4	10YR 4/4	W. Massive	SO	VFR	NS/NP	Com M, F, VF	45%	ES	CW	
2Bkqm	22-31+	White, hard duripan							Few F, VF between plates of duripan		EV		
GX-2, Tapco	Clayey, montmorillontic, thermic, shallow				Typic Durargid								
A	0-4	GR SL	10YR 5/4	10YR 3/3	W M GR	SO	VFR	NS/NP	Few F, VF	15%	EO	CS	
BA	4-8	SL	7.5YR 5/4	7.5YR 4/4	M M SBK	SO	VFR	SS/SP	Many F, VF, Com CO, M	<10%	EO	GW	
Btq	8-16	GR Clay	7.5YR 5/6	7.5YR 5/8	M M PR	H	FR	S/P	Com M, F, VF, Few CO	20%	EO	GW	
Cr	16-20	Weathered, brown tuff											

Sample No.* Soil Series, (Luz), & Soil Classification	Horizon and Depth, Inches[1]	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Consistency[5] Moist	Consistency[5] Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-3, "Unnamed" Argid	Fine-loamy, mixed, thermic				Typic Durargid								
A	0-3	SL	10YR 5/4	10YR 4/4	W M GR	SO	VFR	NS/NP	Few F, VF	10%	EO	CS	
BA	3-15	CB SL	10YR 5/4	10YR 4/4	W M PL W M GR	SH	FR	SS/NP	Com M, F, VF	20%	EO	GW	
Bt1	15-28	CB Loam	7.5YR 5/4	7.5YR 4/4	M M SBK	VH	FR	S/P	Few CO, M, F, VF	30%	EO	GW	
Bt2	28-35	CB Loam	7.5YR 5/4	7.5YR 4/4	Massive	H	FR	S/P	Few CO, M, F, VF	30%	EO	—	
GX-4, Dodas	Loamy-skeletal, mixed, thermic, shallow				Typic Durargid								
A	0-3	GR SL	10YR 6/3	10YR 4/3	W M GR	SO	VFR	NS/NP	Few F, VF	20%	SE	CS	
BA	3-8	GR & CB SL	10YR 6/4	10YR 4/4	M CO PL/ M M SBK	SH	FR	NS/NP	Com M, F, VF	35%	EM	CW	
Btq	8-13	GR & CB CL	7.5YR 5/4	7.5YR 4/4	M M SBK	H	FR	S/P	Com M, F, VF	35%	EM	CW	
Bkqm	13+	White, hard duripan										EV	

Sample No.*, Soil Series, (Last), & Soil Classification	Horizon and Depth; Inches	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Moist	Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-5, Tapco	Clayey, montmorillonitic, thermic, shallow				Typic Durargid								
A	0-3	GR SL	10YR 5/4	7.5YR 4/4	W M GR	SO	VFR	SS/SP	Com F, VF	21%	EO	CS	
BA	3-8	CL	7.5YR 5/4	7.5YR 4/4	W M SBK	SH-H	FR	S/P	Com F, VF, Few CO, M	7%	EO	GW	
Btq	8-20	CL	7.5YR 5/4	7.5YR 4/4	S M PR	H-VH	FI	S/P	Com F, VF Few CO	5%	EO EM	CW	
Bkqm	20+	White, hard durigan			Massive PL								
GX-6, "Unnamed" Argid		Fine-loamy, mixed, thermic			Typic Haplargid								
A	0-3	GR L-SL	7.5YR 5/4	7.5YR 4/4	W M GR	SO	VFR	SS/SP	Many F, VF, Few CO, M	20%	EO	CS	
BA	3-10	GR Loam	7.5YR 5/4	7.5YR 4/4	W M SBK	SH	FR	S/P	Many F, VF, Com M, Few CO	15%	SE	GW	
Btk	10-22	GR SICL	5YR 5/6	5YR 4/6	M M PR	H	FI	S/SP	Com CO, M, F, VF	15%	EM	CW	
Bk	22-30	Loam	7.5YR 8/4	7.5YR 7/6	W. Massive	SH	FR	SS/SP		<35%	ES	GW	
Cr	30-43+	White, red, and yellow older weath tuff			W. Massive								

APPENDIX B (CONTINUED)

Sample No.* Soil Series, (Unit), & Soil Classification	Horizon and Depth, Inches[1]	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Consistency[5] Moist	Consistency[5] Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-7, Tapco	Clayey, montmorillonitic, thermic, shallow				Typic Durargid								
A	0-3	GR SL	7.5YR 5/4	7.5YR 4/4	W M&F GR	SO	VFR	SS/SP	Few F, VF	18%	LO	CS	
BA	3-8	GR & CB Loam	7.5YR 5/4	7.5YR 4/4	W M SBK	SH	FR	SS/P	Com M, F, VF, Few CO	20%	EO	CW	
Btq	8-14	GR & CB Clay	7.5YR 5/4	7.5YR 4/4	M M ABK	H	FR	S/VP	Com CO, M, F, VF	20%	EO, EM	CW	
Btkq	(Thin, not sampled)										ES		
Bkqm	14+	White, hard duripan									EV		
GX-8, Zalda	Loamy, mixed, thermic			Typic Durorthid									
A	0-3	GR SL	10YR 6/4	10YR 4/4	W M GR	SO	VFR	NS/NP	Few F, VF	15%	SE	CS	
Bw	3-8	Loam	10YR 6/4	10YR 4/4	M M SBK	SH-H	FR	SS/P	Com CO, M, F, VF	10%	ES	CW	
Bkqm	8-15+	White, hard duripan							Few CO, M, F, VF along cracks and between plates of duripan		EV		

Sample No.* Soil Series, (Luz), & Soil Classification	Horizon and Depth, Inches	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Moist	Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-11, Zalda Variant		Loamy-skeletal, mixed, thermic			Typic Durorthid								
A	0-4	GR SL	10YR 5/4	10YR 3/3	W CO PL/ W M GR	SH	VFR	SS/SP	Few F, VF	20%	EM	CS	
BA	4-11	VGR SL	7.5YR 6/4	7.5YR 4/4, 4/6	Massive/ W M SBK	SH	FR	SS/SP	Com CO, M, F, VF	45%	ES	GW	
Bw	11-16	VGR SL	7.5YR 6/4	7.5YR 4/4	Massive/ W M SBK	SH	FR	SS/SP	Com CO, M, F, VF	45%	ES	CW	
Bkqm	16-30+	White, hard duripan									EV		
GX-12, Lealandic		Clayey-skeletal, montmorillonitic, thermic				Typic Durargid							
A1	0-2.5	GR SL	10YR 5/4	10YR 3/3	W M GR	SO	VFR	NS/NP	Few F, VF	20%	EO	CS	
A2	2.5-5	GR SL	10YR 6/4	10YR 3/3	W M PL	SH	FR	NS/NP	Few F, VF	15%	EO	GW	
BA	5-10	GR Loam	10YR 5/4	10YR 4/4	W M SBK	SH	FR	S/SP	Many M, F, VF, Com CO	15%	EO	GW	
Btq1	10-18	GR CL	7.5YR 5/6	7.5YR 4/4	M M PR	H	FR	S/P	Many M, F, VF, Com CO	20%	EO	GW	
Btq2	18-24	GR & CB CL	7.5YR 5/6	7.5YR 4/4	M M PR	H	FR	S/P	Com M, F, VF, Few CO	45%	EO	GW	
Btkq	24-27	GR SCL	7.5YR	7.5YR 4/6	Massive	H	FR	S/P	Few M, F, VF	40%	ES	GW	
Bkqm	27-38	White, indurated duripan			Massive/ Platy				Few F, VF between plates in duripan				

Sample No.* Soil Series, (Fuz), & Soil Classification	Horizon and Depth, Inches[1]	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Moist	Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-13, Tapco	Clayey, montmorillonitic, thermic, shallow				Typic Durargid								
A	0-4	GR Loam	10YR 5/4	10YR 4/3	W M PL/ W M&F GR	SO	VFR	SS/SP	Few M, F, VF		EO	CS	
BA	4-9	GR Loam	7.5YR 6/4	7.5YR 4/4	W M PL/ W M SBK	SH	FR	SS/SP	Com M, F, VF, Few CO		EM	GW	
Btq	9-17	GR Clay	7.5YR 5/6	7.5YR 4/6	M M PR/ M M SBK	H	FI	S/P	Com F, VF, Few CO, M		EM	CW	
Bkqm	17-29+	White, strongly indurated duripan with laminae							Few F, VF between plates of duripan				
GX-14, Lealandic		Clayey-skeletal, montmorillonitic, thermic				Typic Durargid							
A	0-4	GR SL	10YR 5/4	10YR 3/4	W M GR	SO	VFR	NS/NP	Com F, VF	18%	EO	CS	
BA	4-16	GR Loam	10YR 5/4 7.5YR 5/4	10YR 4/4	M M SBK	SH	FR	SS/SP	Com CO, M, F, VF	30%	EO	GW	
Btq	16-30	VGR CL	7.5YR 5/6	7.5YR 4/4	M M PR	VH	FI	S/P	Few F, VF	40%	EO-SE	CW	
Btkq	(Thin, not sampled)										ES	CW	
Bkqm	30-48+	Hard, indurated duripan									EV		

Sample No.* Soil Series (Lux), & Soil Classification	Horizon and Depth, Inches[1]	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Moist	Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-15, Longjim		Loamy-skeletal, mixed, thermic, shallow				Typic Durorthid							
A	0-3	GR & CB SL	10YR 6/4	10YR 4/4	M M PL/ M M&F GR	SH	FR	NS/NP	Few F, VF	35%	EM	CS	
Bw	3-8	GR & CB Loam	10YR 6/4	10YR 4/4	M M PL	SH	FR	SS/SP	Com to many CO, M, F, VF	35%	ES	CW	
Bkqm	8-31+	White, hard duripan							Few M, F, VF between plates of duripan		EV		
GX-16, "Unnamed" Argid		Fine, montmorillonitic, thermic			Xerollic Paleargid								
A1	0-2.5	GR Loam	7.5YR 5/4	7.5YR 4/4	W M PL	SO	VFR	SS/SP	Few F, VF	23%	EO	CS	
A2	2.5-6	GR Loam	7.5YR 5/4	7.5YR 4/4	W M GR	SH	VFR	SS/SP	Com F, VF, Few M	.9%	EO	GS	
BA1	6-16	GR Loam	7.5YR 5/4	7.5YR 4/4	W M SBK	SH	FR	S/SP	Many M, F, VF	22%	EO	GS	
BA2	16-20	VGR Loam	7.5YR 5/4	7.5YR 4/4	Massive	H	FR	S/SP	Com F, VF, Few M, 16-25"	35%	EO	AW	
Bt	20-30	GR Clay	5YR 5/6	5YR 4/6	S M PR/ S M&F ABK	H	FI	S/P	Few M, F, VF, 25-30"	15%	EO	GW	Many thick clay skins on ped faces - pore walls
Bk	30-42	VGR Loam	5YR 6/6	5YR 4/6	Massive	H	FR	SS/NP	Few VF	35%	ES	GW	
C	42-72	VGR LS	5YR 7/4	5YR 5/4	Massive	H	FR	NS/NP	Very Few VF	47%	ES		

APPENDIX B (CONTINUED)

Sample No.,[*] Soil Series, (Late), & Soil Classification	Horizon and Depth, Inches	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Consistency[5] Moist	Consistency[5] Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX 20, Pineval	Loamy-skeletal, mixed, mesic			Durixerollic Haplargid									
A	0-3.5	GR Loam	10YR 5/4	10YR 3/3	W CO PL/ W M&F GR	SH	VFR	SS/P	Com F, VF, Few M	27%	SE	GS	
BA	3.5-13	VGR L-SL	10YR 5/4	10YR 4/4	W M SBK	SH	FR	SS/SP	Many F, VF, Com M, Few CO	35%	EM	GW	
Btkq	13-23	VGR SICL	10YR 4/4	10YR 4/3	M M SBK	H	FR	S/SP	Com F, VF, Few CO, M	45%	ES	CW	
R	23+	White, somewhat weathered volcanic rock											
GX-21, Zalda	Loamy, mixed, thermic			Typic Durorthid									
A	0-3	GR SL	10YR 6/4	10YR 4/4	W M&F GR	SO	VFR	SS/SP	Few F, VF	26%	SE	CS	
B2	3-8	GR Loam	10YR 6/4	10YR 4/4	W M SBK	SH	FR	SS/P	Com M, F, VF	10%	EM	CW	
Bkqm	8-17+	White, hard duripan							Few M, F, VF along cracks and between plates in the duripan		ES		

Sample No.* Soil Series, (Lux), & Soil Classification	Horizon and Depth, Inches[1]	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Moist	Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-22, Tapco Variant		Fine, montmorillonitic, thermic			Typic Durargid								
A	0-4	SL	10YR 5/4	10YR 3/3	W F GR	SO	VFR	SS/SP		10%	EO	CS	
E	4-9	GR & CB SL	10YR 5/4 7.5YR 5/4	7.5YR 4/4	M M SBK	SH-H	FR	S/SP		30%	EO	CS	
Btq	9-24	GR Clay	7.5YR 5/6	7.5YR 4/6	S CO PR	VH	FI-FR	S/VP		15%	EO, EM	GW	
Btkq	24-33	GR CL	7.5YR 6/6	7.5YR 4/6	Massive	H	FR	S/P		15%	ES	CW	
Bkqm	33-40+	White, Hard duripan									EV		
GX-23, Tapco Variant		Fine, montmorillonitic, thermic			Typic Durargid								
A	0-3	GR SL	10YR 5/4	10YR 4/4	W F GR	SO	VFR	NS/NP	Many F, VF, Few M, 0-5"	15%	EO	CS	
BA	3-10	VGR Loam	10YR 5/4	7.5YR 4/4	M M SBK	SH	FR	S/SP	Com M, F, VF, Few CO, 5-22"	38%	EO	GW	
Btq	10-22	GR Clay	7.5YR 5/6	7.5YR 4/6	M M PR	VH	FR	S/P	Com M, F, VF, Few CO	25%	EO	GW	
Btkq	(Thin, not sampled)										ES	CW	
Bkqm	22-27+	White, hard duripan									EV		

Sample No., Soil Series (Lux), & Soil Classification	Horizon and Depth, Inches	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Moist	Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-24, Dodas Variant		Loamy-skeletal, mixed, thermic			Typic Durargid								
A	0-4	VGR SL	10YR 5/4	10YR 3/3	W F GR	SO	VFR	NS/NP	Many F, VF	38%	ES	CS	
C	4-28	VGR SL	10YR 6/4	10YR 4/4	W. Massive	SO LO	VFR	NS/NP	Com F, VF, Few M	42%	ES	GW	
2Btkq	28-34	VGR SL	7.5YR 6/4	7.5YR 4/4	Massive/ W M SBK	SH	FR	SS/SP	Few M, F, VF	35%	ES	CW	
2Bkqm	34-38+	White duripan							Few F between plates in duripan				
GX-25, Dodas Variant		Loamy-skeletal, mixed, thermic			Typic Durargid								
A	0-4	GR SL	10YR 5/4	10YR 4/3	W M GR	SO	VFR	NS/NP	Com F, VF	30%	ES	CS	
C	4-18	VGR SL	7.5YR 6/4	7.5YR 4/4	W. Massive	SO	VFR	NS/NP	Com F, VF, Few CO	35%	ES	CW	
Bw	18-21	VGR SL	7.5YR 6/4	7.5YR 4/4	Massive	SH	FR	SS/NP	Com F, VF, Few CO	35%	EV	CW	
2Bkqm	21-27+	White, hard duripan									EV		

Sample No.*, Soil Series, (Lux), & Soil Classification	Horizon and Depth, Inches[1]	Texture[2]	Color Dry[3]	Color Moist[3]	Structure[4]	Consistency[5] Dry	Moist	Wet	Roots[6]	Coarse Fragments[7]	Reaction[8]	Boundary[9]	Additional Features and Comments
GX-26, Tecopa	Loamy-skeletal, mixed (calcareous), thermic				Lithic Torriorthent								
AC	0-4	VGR Loam	10YR 5/4	10YR 4/4	M M SBK	SH	FR	SS/SP	Com F, VF, Few M	40%	ES	CW	
R	4+	Hard carbonate bedrock											
GX-27, Tecopa	Laomy-skeletal, mixed (calcareous), thermic				Lithic Torriorthent								
AC	0-5	Loam	7.5YR 5/4	7.5YR 4/4	M M SBK	SH	FR	SS/SP	Com F, VF, Few M	41%	ES	GW	
R	5+	Somewhat hard, quartzite bedrock											

* Sample Numbers 9, 10, 17, 18, and 19 are not described in this table. These samples represent soil units similar to other samples described in this Table (see Table 2-2). For example, Sample Number 9 is comparable to 24 and 25 of Dedas Variant.

[1] Soil Profile Description abbreviations are listed and described in USDA-SCS, April 1974. West Technical Service Center. "Definitions and abbreviations for soil descriptions." The new designations for soil horizons and layers (Soil Survey Manual, Agriculture Handbook No. 18, revised Chapter 4, "Examination and Description of Soils in the Field, May 1981, pp. 39-51) are used in this report.

[2] Texture and texture modifier abbreviations:

S	Sand	SCL	Sandy Clay Loam	CB	Cobbly	GR	Gravely
LS	Loamy Sand	CL	Clay Loam	CBV	Very Cobbly	GRV	Very Gravely
SL	Sandy Loam	SICL	Silty Clay Loam	CBX	Extremely Cobbly	GPX	Extremely Gravely
L	Loam	SIC	Silty Clay	CN	Channery	SH	Shaley
SIL	Silt Loam	C	Clay	CNV	Very Channery	SR	Stratified
SI	Silt			CNX	Extremely Channery		

[3] Color, Dry and Moist: Munsell Soil Color Chart, 1975 Edition.

4 Structure:

Grade		Size		Type	
W	Weak	VF	Very Fine	PL	Platy
M	Moderate	F	Fine	GR	Granular
S	Strong	M	Medium	SBK	Subangular Blocky
		CO	Coarse	ABK	Angular Blocky
		VCO	Very Coarse	PR	Prismatic
				W Massive	Weak Massive
				Massive	
				S Massive	Strong Massive
				SG	Single Grained
				Cloddy	

5 Consistency:

Dry		Moist		Wet	
LO	Loose	LO	Loose	NS	Non Sticky
SO	Soft	VFR	Very Friable	SS	Slightly Sticky
SH	Slightly Hard	FR	Friable	S	Sticky
H	Hard	FI	Firm	VS	Very Sticky
VH	Very Hard	VFI	Very Firm	NP	Non Plastic
EH	Extremely Hard	EFI	Extremely Firm	SP	Slightly Plastic
				P	Plastic
				VP	Very Plastic

6 Roots:

Number	Type	
Very Few	VF	Very Fine
Few	F	Fine
Com (Common)	M	Medium
Many	CO	Coarse

Roots are described in terms of a specified size (type) and quantity (number). The size classes are:

Very Fine: Less than 1 mm in diameter

Fine: 1 to 2 mm in diameter

Medium: 2 to 5 mm in diameter

Coarse: 5 mm or larger in diameter

Roots larger than 10 mm in diameter may be described seperately

Quantity classes or roots are defined in terms of numbers of each size per unit area--1 square centimeter for very fine and fine roots, and 1 square decimeter for medium and coarse roots. All roots smaller than 10 mm in diameter are described in terms of the following quantity classes:

Few: Less than 1 per unit area of the specified size
Common: 1 to 5 per unit area of the specified size
Many: More than 5 per unit area of the specified size

Roots are described as to number first, and type second.

7 Coarse Fragments: All coarse fragment percentages (% by weight) are taken from Soil Laboratory Data. Numbers are rounded to the nearest whole number. Lithologic modifier types (gravely, channery, etc.) are taken from the "232" field soil profile description form for each sampled profile.

8 Reaction:

Effervescence		Reaction		pH
		Str. Acid	Strongly Acid	5.1 - 5.5
		Mod. Acid	Moderately Acid	5.6 - 6.0
EO	Non-Effervescent	Sl. Acid	Slightly Acid	6.1 - 6.5
SE	Slightly Effervescent	Neutral	Neutral	6.6 - 7.3
EM	Moderately Effervescent	Mild. Alk.	Mildly Alkaline	7.4 - 7.8
ES	Strongly Effervescent	Mod. Alk.	Moderately Alkaline	7.9 - 8.4
EV	Violently Effervescent	Strong Alk.	Strongly Alkaline	8.5 - 9.0
		Very Strong Alk.	Very Strongly Alkaline	>9.0

9 Horizon Boundaries:

Distinctness
A Abrupt (<2 cm thick)
C Clear (2 to 5 cm thick)
G Gradual (5 to 15 cm thick)
D Diffuse (>15 cm thick)

Topography
S Smooth (the boundary is a plane with few or no irregularities)
W Wavy (the boundary has undulations in which depressions are wider than they are deep)
I Irregular (the boundary has pockets that are deeper than they are wide)
B Broken (at least one of the horizons or layers separated by the boundary is discontinuous and the boundary is interrupted).

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Project: GEXA GOLD

May 11, 1988

Lab No.	Location	Depths	pH	EC mmhos/cm @ 25°C	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR
22452	GX 5	0.0 3.0	7.4	1.21	26.6	7.29	2.74	0.81	0.36
22453		3.0 8.0	7.8	0.61	35.6	3.26	0.97	0.56	0.39
22454		8.0 20.0	7.2	0.55	56.8	2.91	0.74	0.91	0.67
22455	GX 7	0.0 3.0	7.2	0.74	29.1	4.62	1.51	0.78	0.45
22456		3.0 8.0	7.4	0.58	33.8	3.15	0.81	0.82	0.58
22457		8.0 14.0	7.5	0.45	50.7	2.40	0.46	0.95	0.79
22458	GX 8	0.0 3.0	7.8	0.82	24.8	6.85	2.09	0.51	0.24
22459		3.0 8.0	7.6	0.45	22.3	4.30	1.01	0.65	0.40
22460	GX 13	0.0 4.0	7.1	1.06	27.5	8.97	2.37	0.52	0.22
22461		4.0 9.0	7.2	0.89	35.5	6.12	1.28	0.75	0.39
22462		9.0 17.0	7.6	0.35	63.7	2.16	0.43	0.66	0.58
22463	GX 14	16.0-30.0	7.3	0.61	52.7	2.91	1.11	1.00	0.70
22464	GX 15	0.0 3.0	7.4	0.93	24.8	7.59	1.66	0.70	0.33
22465		3.0 8.0	7.6	0.51	22.4	3.52	0.69	0.62	0.43
22466	GX 16	0.0 6.0	7.3	1.54	28.7	11.4	5.52	0.79	0.27
22467		6.0 16.0	7.1	0.43	30.2	2.02	0.85	0.86	0.72
22468		16.0 20.0	7.3	0.47	25.1	2.01	0.74	1.56	1.33
22469		20.0 30.0	7.8	0.44	80.3	2.60	0.72	1.36	1.06
22470		30.0 42.0	7.6	0.55	44.4	1.73	0.61	2.94	2.72
22471		42.0 72.0	7.9	0.57	44.6	1.46	0.50	3.60	3.64

Miscellaneous Abbreviations: SAR- Sodium Adsorption Ratio, CEC Cation Exchange Capacity, ESP- Exchangeable Sodium Percentage, Exch- Exchangeable, Avail Available

inl

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Project: GEXA GOLD

May 11, 1988

Lab No.	Location	Depths	pH	EC mmhos/cm @ 25°C	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR
22472	GX 20	0.0 3.5	7.7	0.90	35.0	6.41	2.33	0.38	0.18
22473		3.5 13.0	7.8	0.57	45.8	3.22	1.46	0.36	0.24
22474		13.0 23.8	7.8	0.45	49.9	2.31	1.39	0.44	0.32
22475	GX 21	0.0 3.0	7.7	0.69	26.2	5.29	0.95	0.33	0.19
22476		3.0 8.0	7.7	0.47	18.8	3.07	0.84	0.89	0.64
22477	GX 22	0.0 4.0	7.1	1.70	28.5	6.42	2.83	0.47	0.22
22478		4.0 9.0	7.5	0.59	29.1	3.29	1.12	0.63	0.42
22479		9.0 24.0	7.6	0.44	26.7	2.04	0.57	1.31	1.15
22480		24.0 33.0	7.7	0.47	64.6	1.82	0.54	1.71	1.57
22481	GX 23	10.0 22.0	7.3	0.49	66.2	2.36	0.84	1.04	0.82
22482	GX 24	0.0 4.0	7.4	1.14	36.8	9.34	2.50	0.42	0.17
22483		4.0 28.0	7.7	0.42	29.1	2.11	1.10	0.54	0.43
22484		28.0-34.0	7.8	0.44	51.3	1.11	0.95	2.07	2.04
22485	GX-26	0.0 4.0	7.4	1.01	34.6	7.49	3.64	0.49	0.21
22486	GX-27	0.0 5.0	7.8	0.56	32.9	4.24	0.61	0.41	0.26

Miscellaneous Abbreviations: SAR- Sodium Absorption Ratio, CEC- Cation Exchange Capacity, ESP- Exchangeable Sodium Percentage, Exch Exchangeable, Avail Available

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Lab No.	Location	Depths	Coarse Fragments %	Very Fine Sand %	Clay 2Hr %	Sand %	Silt %	Clay %	Texture	Organic Matter %	Carbonate %	Selenium ppm
22452	GX 5	0.0-3.0	20.7	15.8	12.4	63.3	29.1	7.6	SANDY LOAM	0.4	0.7	
22453		3.0-8.0	6.7	16.2	21.5	56.9	27.3	15.8	SANDY LOAM	0.2	0.7	
22454		8.0-20.0	5.2	12.8	38.7	38.5	29.5	32.0	CLAY LOAM	0.3	0.9	
22455	GX 7	0.0-3.0	17.9	20.8	10.4	65.1	28.2	6.7	SANDY LOAM	0.3	0.7	<0.02
22456		3.0-8.0	20.8	21.3	16.7	56.9	30.9	12.2	SANDY LOAM	0.3	0.7	<0.02
22457		8.0-14.0	20.8	13.4	41.5	33.1	33.1	33.8	CLAY LOAM	0.4	0.7	<0.02
22458	GX 8	0.0-3.0	15.3	18.3	12.2	58.7	34.6	6.7	SANDY LOAM	0.6	1.6	
22459		3.0-8.0	18.3	20.3	14.9	57.8	30.0	12.2	SANDY LOAM	0.3	2.2	
22460	GX-13	0.0-4.0	16.3	12.6	13.1	63.3	28.2	8.5	SANDY LOAM	0.8	0.9	<0.02
22461		4.0-9.0	30.8	20.8	16.7	54.2	31.8	14.0	SANDY LOAM	0.4	1.8	<0.02
22462		9.0-17.0	18.0	18.5	36.0	36.5	36.0	27.5	CLAY LOAM	0.5	1.8	<0.02
22463	GX 14	16.0-30.0	40.0	14.2	33.1	46.9	23.6	29.5	SANDY CLAY LOAM	0.3	0.7	
22464	GX-15	0.0-3.0	35.0	14.3	14.0	49.6	41.9	8.5	LOAM	0.6	6.9	
22465		3.0-8.0	35.0	14.8	21.3	46.9	39.1	14.0	LOAM	0.4	5.5	
22466	GX-16	0.0-6.0	29.1	17.1	13.1	57.8	35.5	6.7	SANDY LOAM	1.2	1.0	
22467		6.0-16.0	22.4	19.0	14.9	53.3	36.3	10.4	SANDY LOAM	0.4	0.6	
22468		16.0-20.0	35.4	18.0	14.9	54.2	35.4	10.4	SANDY LOAM	0.2	0.4	
22469		20.0-30.0	15.0	12.7	51.6	30.9	26.2	42.9	CLAY	0.4	0.8	
22470		30.0-42.0	34.8	14.2	11.3	71.5	20.9	7.6	SANDY LOAM	0.2	1.3	
22471		42.0-72.0	47.1	7.4	6.7	78.7	18.2	3.1	LOAMY SAND	0.3	11.8	

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Lab No.	Location	Depths	pH	EC mmhos/cm @ 25°C	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR
22471		42.0 72.0	7.9	0.57	44.6	1.46	0.50	3.60	3.64
22488	22471(DUP)	42.0 72.0	7.9	0.54	42.6	1.28	0.48	3.80	4.05
22467		6.0 16.0	7.1	0.43	30.2	2.02	0.85	0.86	0.72
22489	22467(DUP)	6.0 16.0	7.0	0.43	30.1	2.03	0.88	0.92	0.76
22452	GX 5	0.0 3.0	7.4	1.23	26.6	7.29	2.74	0.81	0.36
22490	22452(DUP)	0.0 3.0	7.3	1.26	28.0	8.47	3.22	0.71	0.29

Miscellaneous Abbreviations: SAR Sodium Adsorption Ratio, CEC Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage, Exch Exchangeable, Avail- Available

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Lab No.	Location	Depths	Coarse Fragments %	Very Fine Sand %	Clay Min %	Sand %	Silt %	Clay %	Texture	Organic Matter %	Carbonate %	Selenium ppm
22472	GX 20	0.0-3.5	27.1	26.1	7.6	53.3	42.3	4.4	SANDY LOAM	1.2	9.6	
22473		3.5-13.0	35.0	23.9	7.6	49.5	45.2	5.3	SANDY LOAM	0.7	6.5	
22474		13.0-23.0	45.0	23.2	13.3	43.3	46.9	9.8	LOAM	0.8	9.2	
22475	GX 21	0.0-3.0	26.4	25.0	6.7	68.7	26.0	5.3	SANDY LOAM	0.5	3.8	
22476		3.0-8.0	9.8	23.3	23.3	50.5	34.2	15.3	LOAM	0.2	3.7	
22477	GX 22	0.0-4.0	10.0	24.2	11.3	57.8	34.2	8.0	SANDY LOAM	0.7	0.8	<0.02
22478		4.0-9.0	30.0	23.7	14.9	55.0	32.4	11.6	SANDY LOAM	0.4	0.8	<0.02
22479		9.0-24.0	15.0	12.7	52.5	27.3	28.0	44.7	CLAY	0.3	2.5	<0.02
22480		24.0-33.0	15.0	35.6	9.5	59.6	38.8	1.6	SANDY LOAM	0.2	2.9	<0.02
22481	GX 23	10.0-22.0	25.0	12.1	45.3	35.5	27.0	37.5	CLAY LOAM	0.3	0.9	<0.02
22482	GX 24	0.0-4.0	37.7	23.2	5.8	60.5	35.1	4.4	SANDY LOAM	1.2	10.2	
22483		4.0-20.0	42.3	17.3	6.7	66.0	27.8	6.2	SANDY LOAM	0.3	14.7	
22484		20.0-34.0	35.0	34.9	9.5	63.3	29.6	7.1	SANDY LOAM	0.3	3.6	
22485	GX 26	0.0-4.0	39.5	23.6	7.6	52.4	43.2	4.4	SANDY LOAM	1.0	17.3	
22486	GX 27	0.0-5.0	61.0	20.4	13.3	57.8	32.4	9.8	SANDY LOAM	0.6	2.9	

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Lab No.	Location	Depths	Coarse Fragments %	Very Fine Sand %	Clay 2u %	Sand %	Silt %	Clay %	Texture	Organic Matter %	Carbonate %	Selenium ppm
22471		42.0 72.0	47.1	7.4	6.7	78.7	18.2	3.1	LOAMY SAND	0.3	11.0	
22488	22471(DUP)	42.0 72.0		13.2	4.0	86.0	11.5	2.5	LOAMY SAND	0.2	10.7	
22467		6.0 16.0	22.4	19.8	14.9	53.3	36.3	10.4	SANDY LOAM	0.4	0.6	
22489	22467(DUP)	6.0-16.0		22.0	15.8	56.9	32.4	10.7	SANDY LOAM	0.3	0.6	
22452	GX 5	0.0 3.0	20.7	15.8	12.4	63.3	29.1	7.6	SANDY LOAM	0.4	0.7	
22490	22452(DUP)	0.0-3.0		23.8	10.4	63.3	30.5	6.2	SANDY LOAM	0.5	0.7	

PARAMETERS AND ANALYTICAL PROCEDURES FOR TOPSOIL ANALYSIS

Taken from Wyoming Department of Environmental Quality, Land Quality Division, Guideline No. 1 "Topsoil and Overburden," 10/25/84, and Inter-Mountain Laboratories, Inc., standard method procedures

Parameter	Reported As	Recommended Procedures
Preparation of soil samples for analysis		Air dry samples at ≤35 C. Break up clods for grinding and sieving of sample. Pick out large coarse fragments. Sieve sample material. Pick out remaining rock coarse fragments left on the 10 mesh (2 mm) sieve. Grind remaining soil clods left on the 10 mesh screen until it just passes the screen (avoid grinding coarse fragments). During the entire sample preparation procedure excess grinding of sample material must be avoided.
Subsampling of sieved (<2 mm) soil materials for analysis		USDA Handbook 60, 1954 - Diagnosis and Improvement of Saline and Alkali Soils. pp. 83-84. U.S. Salinity Laboratory Staff.
Coarse fragment	Percent by weight	USDA Handbook 436, App. I, page 472; Soil Survey Laboratory Methods & Procedures for Collecting Soil Samples, pages 9 and 12-13.
pH	Hydrogen ion activity at saturation (paste)	USDA Handbook 60, Method (21a), page 102, and page 84, Method (2).
Conductivity	mmhos/cm @ 25 C	USDA Handbook 60, Method (3a), page 84, and Method pages 89-90.
Preparation of saturation extract and saturation percent determination	Percent	USDA Handbook 60, Methods 2 and 3a, pages 84 and 88, and 27a and b, page 107.
Particle-size Analysis	Percent clay, silt, sand and very fine sand (vfs = 0.05-0.1 mm)	Hydrometer Method. ASA Mono. No. 9, Part 1, Method 43-5, pages 562-566. An 8-hour settling time is required. Sieve analysis for vfs (140-270) mesh. ASA Mono. No. 9, Part 1, pages 554-556. Black 1965 and 1982.
Texture	USDA textural class	USDA Handbook 18, pages 205-223.
Soluble Ca, Mg, and Na	meq/l	Extraction of Ca, Mg, and Na by USDA Handbook 60, Method (3a), page 84. Analysis by atomic adsorption spectrophotometry.
Sodium-adsorption ratio	SAR calculated from soluble Ca, Mg, Na concentrations	USDA Handbook 60, page 26.
Carbonates	Percent	USDA Handbook 60, Method (23c), page 105
Organic Matter	Percent	ASA Mono. No. 9, 1982, Part 2, Method 29-3.5.2, page