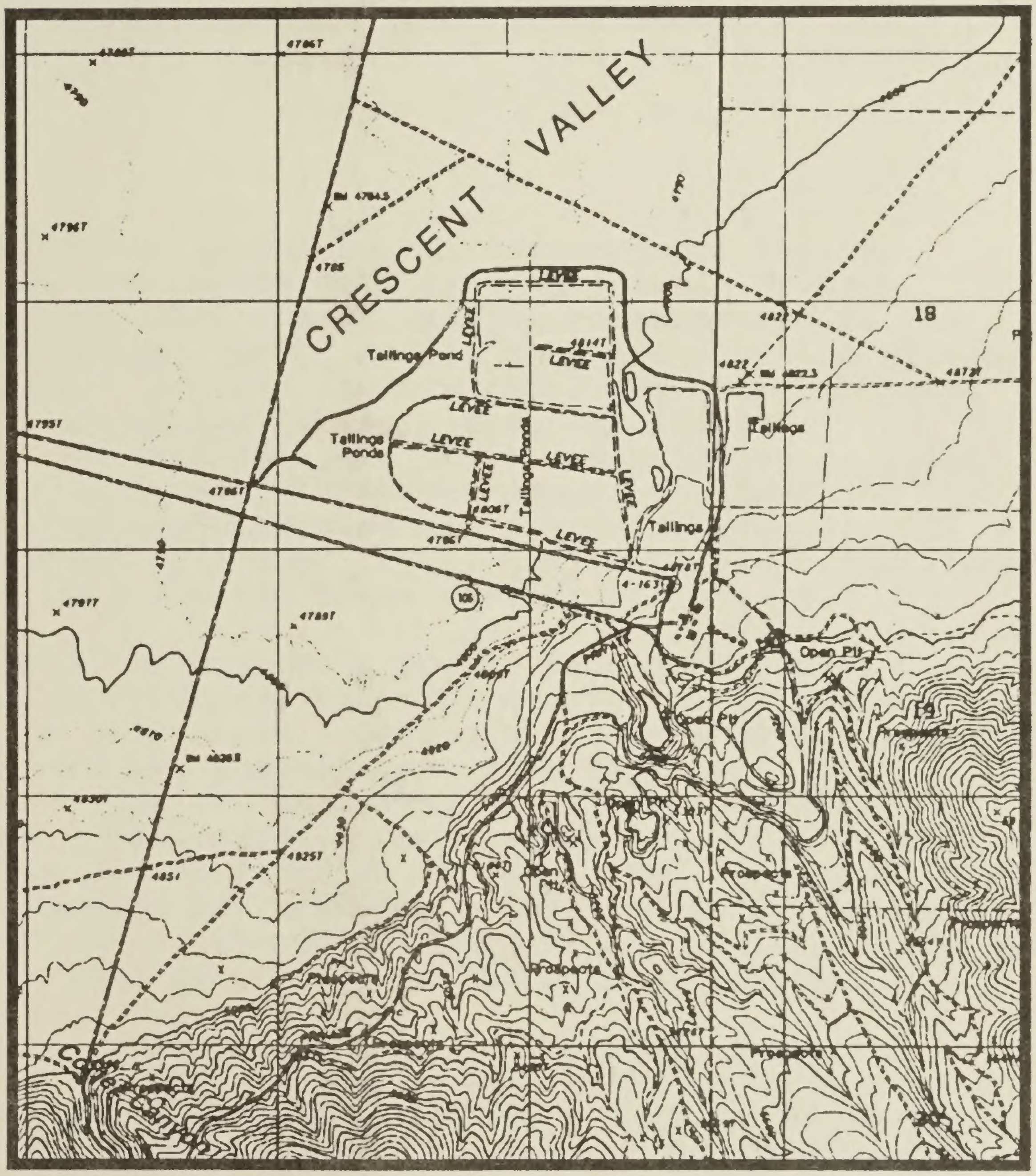
U.S. DEPARTMENT OF THE INTERIOR

Bureau of Land Management

Battle Mountain District Office, Battle Mountain, Nevada **December 1992**

CORTEZ GOLD MINE EXPANSION PROJECT
Draft Environmental Impact Statement



COOPERATING AGENCIES:

NEVADA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
CARSON CITY, NEVADA

MISSION STATEMENT

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based upon the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation, rangelands, timber, minerals, watershed, fish and wildlife, wilderness, air and scenic, scientific and cultural values.

BLM-BM-PT-004-1610

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Nevada State Office
850 Harvard Way
P.O. Box 12000
Reno, Nevada 89520-0006

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

N64-87-010P
1792/3809
(NV-064.03)

Dear Reader:

Enclosed for your review is the Draft Environmental Impact Statement (EIS) for the Cortez Gold Mines Expansion Project. This document analyzes the Plan of Operations submitted to the Bureau of Land Management (BLM), Battle Mountain District Office, Nevada. The analysis includes impacts resulting from continued operations and the expansion of facilities, including: construction of a new tailings pond cell; expanding an existing open pit mine and associated overburden dumps; constructing new heap leach facilities; constructing new overburden dumps; and continuing exploration drilling. Total new disturbance resulting from the proposal is estimated to be 428 acres.

You will notice that the current proposal is significantly reduced (in total disturbance) from the original June 1990, Cortez submittal of 1630 acres. During the course of performing condemnation drilling and geotechnical work to locate an appropriate site for the new heap leach facility, Cortez discovered another gold deposit. Cortez identifies the deposit and its development as the Pipeline Project. The finding of the Pipeline Project changed the economic direction of further mining and mining development at the Cortez Gold Mines. This in turn, resulted in a reduction in acreage of the current proposal.

The Pipeline Project is outlined in the cumulative impacts chapter of the current EIS. A complete analysis of this project will be forthcoming in the "Pipeline Project Environmental Impact Statement." The Draft of this document is expected to be available to the public in mid 1993.

The current document analyzes the Proposed Action (Plan of Operations submitted by Cortez), as well as the "No Action" alternative. Other alternatives were considered but not analyzed in detail.

BLM has selected the Proposed Action as its Preferred Alternative.

Public meetings to accept verbal and written comments on the Draft EIS are scheduled for the following dates, places, and times:

a. January 19, 1993, in Elko, NV at the Elko District Office of the Bureau of Land Management at 3900 East Idaho Street. 7:00-9:00 p.m.

b. January 20, 1993, in Reno, NV at the Airport Plaza Inn at 1981 Terminal Way. 7:00-9:00 p.m.

Written comments should be submitted to the address below before close of business on March 1, 1993.

Bureau of Land Management
Battle Mountain District Office
Attn: Dave Davis, Team Leader
P.O. Box 1420
Battle Mountain, NV 89820

Following the public review and comment period, a final EIS will be prepared considering the public comments received through the review process. An abbreviated format may be used to present this information; therefore, it is suggested that this copy be retained for reference purposes.

Sincerely,

Billy R. Templeton
State Director, Nevada

1 Enclosure
1 - Cortez Expansion Draft EIS

SUMMARY

Cortez Gold Mines (Cortez) proposes to continue and to expand its existing gold mining and processing operations at the Cortez Gold Mine in north-central Nevada. The proposed expansion is described in a 1990 Plan of Operations (Proposed Project) that has been submitted by Cortez Gold Mines (Cortez) to the Battle Mountain and Elko District offices of the Bureau of Land Management (BLM) in compliance with the BLM Surface Management of Public Lands Regulations 43 CFR 3809. The Proposed Project is located within Crescent Valley, south of Battle Mountain. Expansion activities would occur at two nearby locations known as the Cortez and Gold Acres areas. These areas are located about 6 miles apart on opposite sides of Crescent Valley and together represent the Proposed Project expansion area. Several other mining operations (mining primarily precious metals) are located in the general vicinity. The Proposed Project includes expanding an existing open-pit mine and waste rock dumps; constructing new heap leach facilities, tailings disposal facilities, and waste rock dumps; and continuing exploration drilling. Mining activities are proposed in Lander County, Nevada, on both patented and unpatented lands; exploration activities are proposed in Lander and Eureka counties. A total of approximately 428 acres would be affected by the Proposed Project.

The reserves to be mined include both mill-grade and heap leach-grade ore. Portions of the ore would be hauled to the existing Cortez mill for processing, and portions of the ore would be processed at the proposed heap leach facilities. Overburden from the pit areas would be hauled to waste rock dumps near each pit. Exploration activities would generally consist of limited road building and exploration drilling.

PURPOSE AND NEED TO WHICH THE BLM IS RESPONDING

The Proposed Project would provide sufficient ore to allow for the continued operation of the existing milling facilities currently operated by Cortez. The Proposed Project does not represent a significant change in the annual mining and production rates, nor does it represent an increase in project workforce or equipment needs. The proposed project would allow Cortez to continue to employ the existing workforce and to optimize use of the existing

equipment and mineral processing facilities. Without the Proposed Project, Cortez's mining and mineral processing operations would cease sometime during the period 1994-1996.

The BLM has reviewed the Proposed Project and has determined that preparation of an Environmental Impact Statement (EIS) is necessary. The BLM is serving as the lead agency for preparation of an EIS in compliance with the National Environmental Policy Act (NEPA). This EIS has been prepared in compliance with NEPA and BLM Handbook H-1790-1. The EIS describes the Proposed Project components, reasonable alternatives, potential environmental consequences of the project and alternatives, and design measures or mitigation measures capable of eliminating or reducing potential significant impacts.

DESCRIPTION OF THE PROPOSED ACTION

The Proposed Project includes new heap leach facilities and expansion of an existing open-pit mine in the Gold Acres area, expansion of existing heap leach facilities and construction of tailings disposal facilities in the Cortez area, and ongoing exploration drilling. Waste rock dumps for overburden disposal would be expanded in the Gold Acres and Cortez areas. In addition, one new waste rock dump would be constructed in the Gold Acres area. Surface disturbance would result primarily from expansion of an existing pit (1 acre), waste rock dumps (196 acres), heap leach pads (54 acres), and tailings impoundment (81 acres). The additional tailings impoundment is proposed to provide storage capacity of about 2,700 acre-feet. At the current level of tailings production, the proposed impoundment would provide storage of tailings for approximately 7 years. The proposed site for the tailings facility is located directly north of the existing heap leach pads in the Cortez area. The tailings produced during the first 2 years of activity for the Proposed Project would be disposed of in the existing Tailings Pond No. 6. The embankment of Tailings Pond No. 6 would be raised approximately 8 feet to accommodate the additional tailings. This construction would not disturb any additional acreage.

The Proposed Project would not involve any expansion or major changes in the existing ore processing facilities (e.g., the crushing and grinding circuits, the roaster circuit [oxidation of ore], and the carbon in-leach processing). The ore mined by the Proposed Project would allow for continued operation of the existing facilities, but would not significantly change the daily or annual throughput of these facilities.

The Proposed Project includes reclamation of all proposed disturbance in accordance with BLM surface management regulations and Nevada Department of Environmental Protection regulations. Reclamation would result in an additional 77 acres of disturbance and would be designed to provide a post-mining condition that would support land uses identified in the Shoshone/Eureka and Elko Resource Management Plans.

ALTERNATIVES

Feasible alternatives for facility locations are limited, because existing processing facilities and open pits are in place. The range of alternatives considered in this EIS therefore consists primarily of operational alternatives and alternative components of the project rather than location alternatives for the entire project. In the alternatives evaluation, the following factors were considered: public or agency issues/concerns, technical and economic feasibility, potential environmental advantage, and ability to meet the purpose and need stated by the applicant.

Based on the screening of operational alternatives, no feasible alternatives were retained for detailed analysis. The EIS contains summaries of the reasons that various alternatives considered were eliminated from detailed analysis.

In accordance with the National Environmental Policy Act, the No Action Alternative is addressed in the EIS. Under the No Project Alternative, Cortez would not expand the existing Gold Acres pit or construct the new processing facilities. Instead, it would continue to mine ore from the various existing pits as authorized by existing approvals. However, Cortez' mining and mineral processing operations would run out of ore sometime in 1994-1996, resulting in a closure of operations.

For purposes of this EIS, the No Project Alternative would result from the BLM's disapproval of Cortez' 1990 Plan of Operations. However, other circumstances, such as a drop in gold prices or the application of some future legislation, could also potentially result in mine closure. The objective of the No Project Alternative is to describe the environmental consequences that would result if the proposed project is not implemented in order to assist EIS readers with the evaluation of consequences from the proposed project.

SUMMARY OF IMPACTS

A comparison and summary of the impacts associated with the implementation of the Proposed Project and No Action Alternative is provided in Section 2.5 of the EIS. Detailed information on project impacts is provided in Chapter 4.0; cumulative impacts are discussed in Chapter 5.0. The summary below highlights potential impacts from the Proposed Project. Impacts associated with the No Action Alternative are only discussed if they would be greater or substantially different from the Proposed Project. In most cases, the No Action Alternative would not result in additional impacts beyond those anticipated by the Proposed Project.

Air Quality

The Proposed Project would continue point source emissions associated with ore processing and would result in fugitive dust emissions from open pit expansion, operation of haul roads, and exploration. There would not be significant increases to maximum 24-hour or annual sulfur dioxide concentrations or total suspended particulates. Estimates for fugitive dust emissions would not violate state or federal ambient standards. There would not be significant contributions to cumulative 24-hour or annual emissions in the Crescent Valley Air Basin.

Geology, Minerals, Paleontology

Leach pads, ponds, pit walls, and waste rock dumps would be designed to prevent significant structural damage or sediment transport caused by seismic or storm events. No paleontological resources have been identified within the project area.

Soils and Topography

Approximately 428 acres of soil disturbance would result from expansion of facilities and reclamation activities including grown medium stockpiles and roads. Sedimentation in perennial water courses is not expected. A shortfall in topsoil necessary for reclamation is probable. Reclamation should be carefully monitored to determine if additional measures need to be taken to provide reclamation success. The proposed project contributes less than

5 percent of the total soils disturbance estimated for the projects considered in the cumulative analysis.

Water Resources

There would be only local dewatering with no effect to other nearby groundwater users. No impacts to surrounding springs, seeps, or other surface waters would occur.

No impacts to groundwater or surface water quality are anticipated. The existing plume near the Cortez processing facilities would not enlarge and will continue to be remediated under direction of the Nevada Department of Environmental Protection. Remediation of the plume will proceed under the same procedures, with or without the Proposed Project.

Accidental releases of hazardous materials to surface or groundwater could occur but would be limited by the spill prevention and containment plan included in the project design.

Vegetation

No impacts are anticipated to wetlands, riparian communities, or threatened and endangered species. Cumulative impacts to common vegetation types would be insignificant.

Wildlife

Removal of moderate to low quality wildlife habitat and indirect impacts due to traffic, noise, and human presence are not considered significant. Contribution to cumulative impacts would be less than 5 percent of the total cumulative impact. No critical wildlife habitat or species would be affected.

Acute toxicity in tailings ponds is not likely. Chronic toxicity could be significant at the Cortez tailings facility or could be cumulatively significant due to multiple exposures from other projects in the region.

Recreation and Wilderness

No impacts are anticipated.

Visual Resources

Short-term impacts would occur consistent with BLM objectives for the project landscape. Long-term impacts after reclamation would not be significant.

Social and Economic

There would be no increase in demand on schools and infrastructure in affected communities. In a cumulative sense, the expansion project would continue to contribute to a significant regional impact on schools and infrastructure, particularly in Elko, Nevada.

Additional revenues for Lander County would be generated because of an increase in assessed valuation.

Land Use/Livestock Grazing

No significant impacts are anticipated.

Cultural Resources

No sites eligible for the National Register of Historic Places would be affected. The Proposed Action would not significantly contribute to cumulative losses of historic or prehistoric resources.

The continued presence of mining in the viewshed of Mt. Tenabo is considered an indirect impact to Native American tradition and/or religious values associated with Mt. Tenabo.

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INTRODUCTION AND PURPOSE AND NEED

1.1 INTRODUCTION

A 1990 Plan of Operations (Proposed Project) has been submitted by Cortez Gold Mines (Cortez) to the Battle Mountain and Elko District offices of the Bureau of Land Management (BLM) in compliance with the BLM Surface Management of Public Lands Regulations 43 CFR 3809. In this Plan, Cortez proposes to continue and to expand its existing gold mining and processing operation. The Proposed Project is located in north-central Nevada, within Crescent Valley, south of Battle Mountain (Figures 1.1-1 and 1.1-2). Several other mining operations (mining primarily precious metals) are located in the general vicinity. The Proposed Project includes: expanding existing open-pit mines and waste rock dumps; constructing new heap leach facilities, tailings disposal facilities and waste rock dumps; and, continuing exploration drilling. Mining and exploration activities are proposed in Lander and Eureka counties, Nevada on both patented and unpatented lands. The total number of acres that would be affected by the Proposed Project is approximately 428 acres.

The reserves to be mined include both mill-grade and heap leach-grade ore. Portions of the ore would be hauled to the existing Cortez mill for processing, and portions of the ore would be processed at the proposed heap leach facilities. Overburden from the pit areas would be hauled to waste rock dumps near each pit. Exploration activities would generally consist of limited road building and exploration drilling.

1.2 PURPOSE AND NEED TO WHICH THE BLM IS RESPONDING

The Proposed Project would provide sufficient ore to allow for the continued operation of the existing milling facilities currently operated by Cortez. The Proposed Project does not represent a significant change in the annual mining and production rates, nor does it represent an increase in project workforce or equipment needs. The proposed project would allow Cortez to continue to employ the existing workforce and to optimize use of the existing equipment and mineral processing facilities. Without the Proposed Project, Cortez's mining and mineral processing operations would cease sometime during the period 1994-1996.

The BLM has reviewed the Proposed Project and has determined that preparation of an Environmental Impact Statement (EIS) is necessary. The BLM is serving as the lead agency for preparation of an EIS in compliance with the National Environment Policy Act (NEPA). This EIS has been prepared in compliance with NEPA and BLM Handbook H-1790-1. The EIS describes the Proposed Project components, reasonable alternatives, potential environmental consequences of the project and alternatives, and design measures or mitigation measures capable of eliminating or reducing potential significant impacts.

1.3 PUBLIC PARTICIPATION

Federal regulations mandate an early and open process for determining the scope of issues to be addressed and significant issues related to the proposed action. To begin this process, a scoping announcement was developed, letters and news releases were mailed, a Federal Register notice was published, and scoping meetings were held in Elko, Nevada, on July 10, 1990 and Reno, Nevada, on July 11, 1990.

The scope of this EIS reflects input received from the public during the scoping process. Key issue areas identified by the BLM and the public during this process include:

- Potential secondary and indirect impacts to the Cortez Historic District, ethnographic issues related to Native American traditional or sacred areas, and disturbance to historic or prehistoric resources in a cumulative impact area
- Potential and known groundwater contamination resulting from heap leaching and tailings disposal areas
- Potential air quality cumulative impacts from the roasting facility as they pertain to impacts on Class II airsheds
- Cumulative impacts to various resources as a result of mining activities, grazing, and other land uses; especially mining activities that occurred prior to the implementation of the Bureau's "Surface Management Regulations" 43 CFR 3809, as well as after the January 1, 1984, implementation of those regulations.

The Draft EIS has been sent to governmental agencies and several designated groups and individuals for formal review and comment. Two public hearings, announced in the Federal Register and by news release, will be held. All comments received will be carefully considered as revisions are made for the Final EIS.

Public involvement techniques to be employed include news releases to the mass media; publication of notices in the Federal Register; letters to governmental agencies, organizations, and individuals; individual or small group meetings; briefings; and distribution of the EIS and technical appendices to public libraries and BLM offices.

1.4 AUTHORIZING ACTIONS

In addition to this EIS, approval of the Proposed Project would require authorizing actions from other federal, state or local agencies with jurisdiction over the project. Authorizing actions include land use and environmental permits, licenses and approvals. In conjunction with past and ongoing mining and mineral processing activities in the Cortez-Gold Acres district, Cortez has already obtained several permits and approvals. Table 1.4-1 summarizes the principal authorizing actions required for the Proposed Project including those already obtained.

TABLE 1.4-1

SUMMARY OF PERMITS AND APPROVALS
REQUIRED FOR A MINING PROJECT IN NEVADA

(Page 1 of 4)

Agency	Permit/Approval	Facet of Project	Time Requirements	Comments
FEDERAL				
U.S. Bureau of Land Management (BLM)	1. Approval of Plan of Operations (Requires EA or EIS).	All activities on unpatented mining claims or involving right-of-way on Federal land.	120-180 days	If EIS required, could take 365 days or longer. Public notice required.
	2. Right-of-Way Permits	Road and Powerline access on Federal land.	30-180 days	Data in Plan of Operations and EA can be used for this application.
U.S. Environmental Protection Agency (EPA)	Review of State Water and Air Permits	Surface and groundwater discharge permits; Air Quality Permit.	30-60 days review	Review capacity.
U.S. Army Corps of Engineers	Section 404 permit	Any filling or dredging of wetland/riparian areas.	90 days	If nationwide permit required, could take 365 days or longer.
STATE				
Nevada Division of Environmental Protection (NDEP)	Air Quality Permits			
	1. Air Quality Permit to Construct (ATC).	All aspects, including construction, that produce air contaminants, i.e., particulates, hydrocarbons, sulfur dioxide, etc.	Up to 95 days	Requires plans and specifications for air pollution control facility. Public notice/hearing required.

TABLE 1.4-1

SUMMARY OF PERMITS AND APPROVALS REQUIRED FOR A MINING PROJECT IN NEVADA

(Page 2 of 4)

Agency	Permit/Approval	Facet of Project	Time Requirements	Comments
	2. Air Quality Permit to Operate (ATO).	All aspects, including construction, that produce air contaminants, i.e., particulates, hydrocarbons, sulfur dioxide, etc.	180 days to demonstrate compliance after start-up.	No public notice required.
	Water Quality Permits			
	1. Water Pollution Control Discharge Permit.	Mine, tailings, heap leach operation; review discharge and seepage potential.	Minimum of 165 days.	Review of geotechnical design criteria to verify zero-discharge operation. Public notice required.
	2. National Pollution Discharge Elimination System (NPDES).	Any discharge of wastewater to surface water (i.e., sediment control facilities).	180 days	Review of geotechnical design; Public notice required.
	3. National Pollution Discharge Elimination System (NPDES) - Storm water.	Coverage by general mining storm water permit at each site.	30 days	Review of site plan. No public notice required.
	Solid Waste Disposal	Disposal of solid, non-toxic waste, i.e., garbage, construction waste, etc.	14-90 days; prior to construction	Site location, design and operation plan.
	Reclamation Permit for a Mining Operation	Any surface-disturbing aspect of the project.		

TABLE 1.4-1

SUMMARY OF PERMITS AND APPROVALS REQUIRED FOR A MINING PROJECT IN NEVADA

(Page 3 of 4)

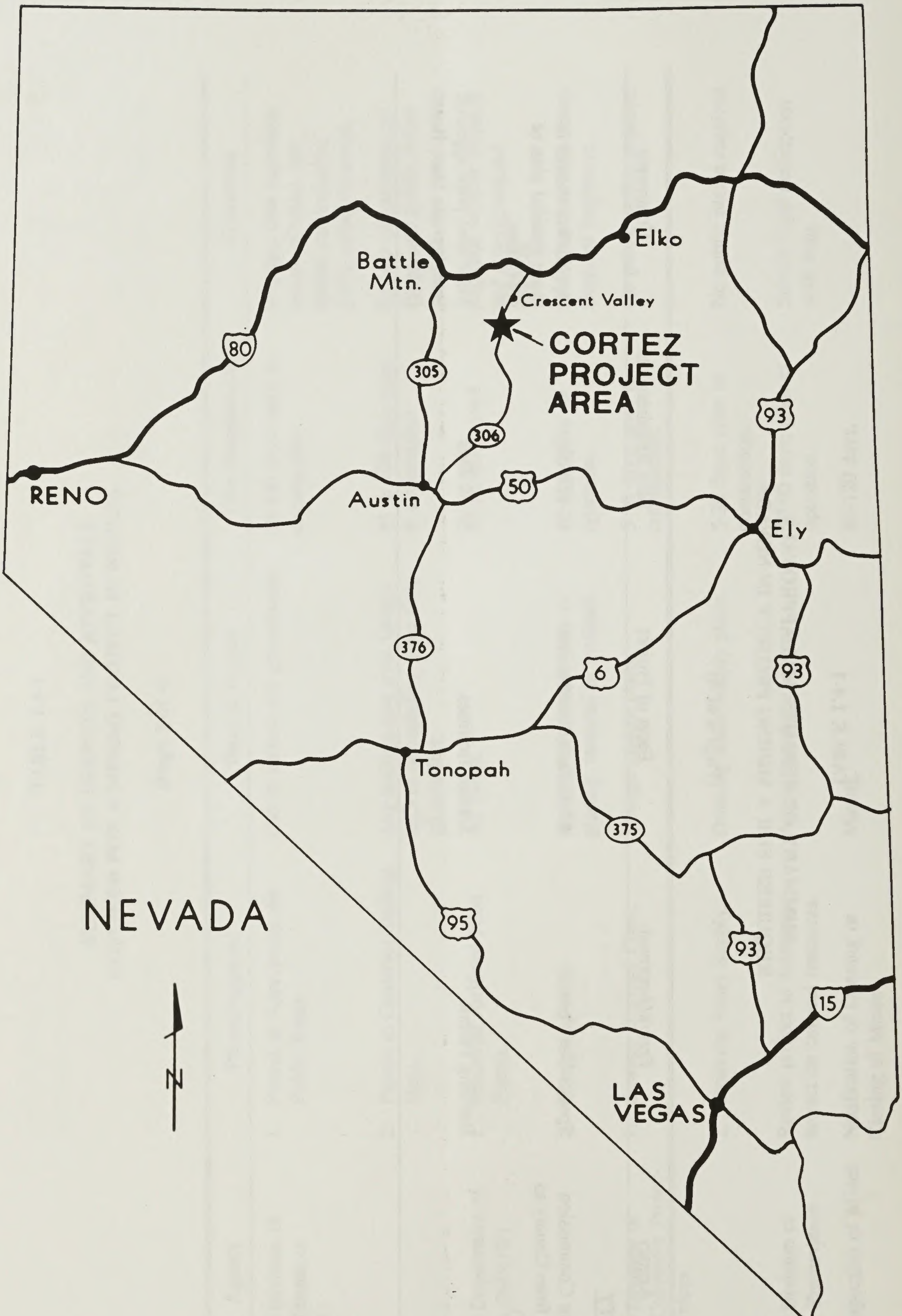
Agency	Permit/Approval	Facet of Project	Time Requirements	Comments
Nevada Division of Water Resources (NDWR)	1. Permit to Appropriate the Public Water.	Use of surface and groundwater.	90-180 days; prior to construction	Requires data regarding source of water and annual consumption; public notice required.
	2. Permit to Construct Tailings Dam.	Any tailings dam over 10-feet high or impounding more than 10 acre-feet.	45 to 120 days; prior to construction	Review of geotechnical design; no public notice required.
Nevada Department of Wildlife (NDOW)	1. Industrial Artificial Pond Permit.	All facets.	To be determined	Regulate wildlife impacts and cyanide-related impacts.
	2. Dredging Permit.	Removal of material from or placing material in wetlands.	10 days; prior to operation.	In conjunction with Army Corps of Engineers.
Nevada Division of Health/Consumer Protection Services	1. Sewage Disposal Plans.	Sewage system plans.	5-30 days; prior to construction.	No public notice required.
	2. Drinking Water Supply.	Drinking water supply plans.	5-30 days; prior to construction.	No public notice required.
Nevada Division of Historic Preservation	Review project to determine impact on cultural resources.	All surface disturbances.	30-90 days; prior to operation.	Submit legal description with map.
State Inspection of Mines	Notification of Opening or Closing of Mines	Mining.	60-120 days.	

TABLE 1.4-1

**SUMMARY OF PERMITS AND APPROVALS
REQUIRED FOR A MINING PROJECT IN NEVADA**

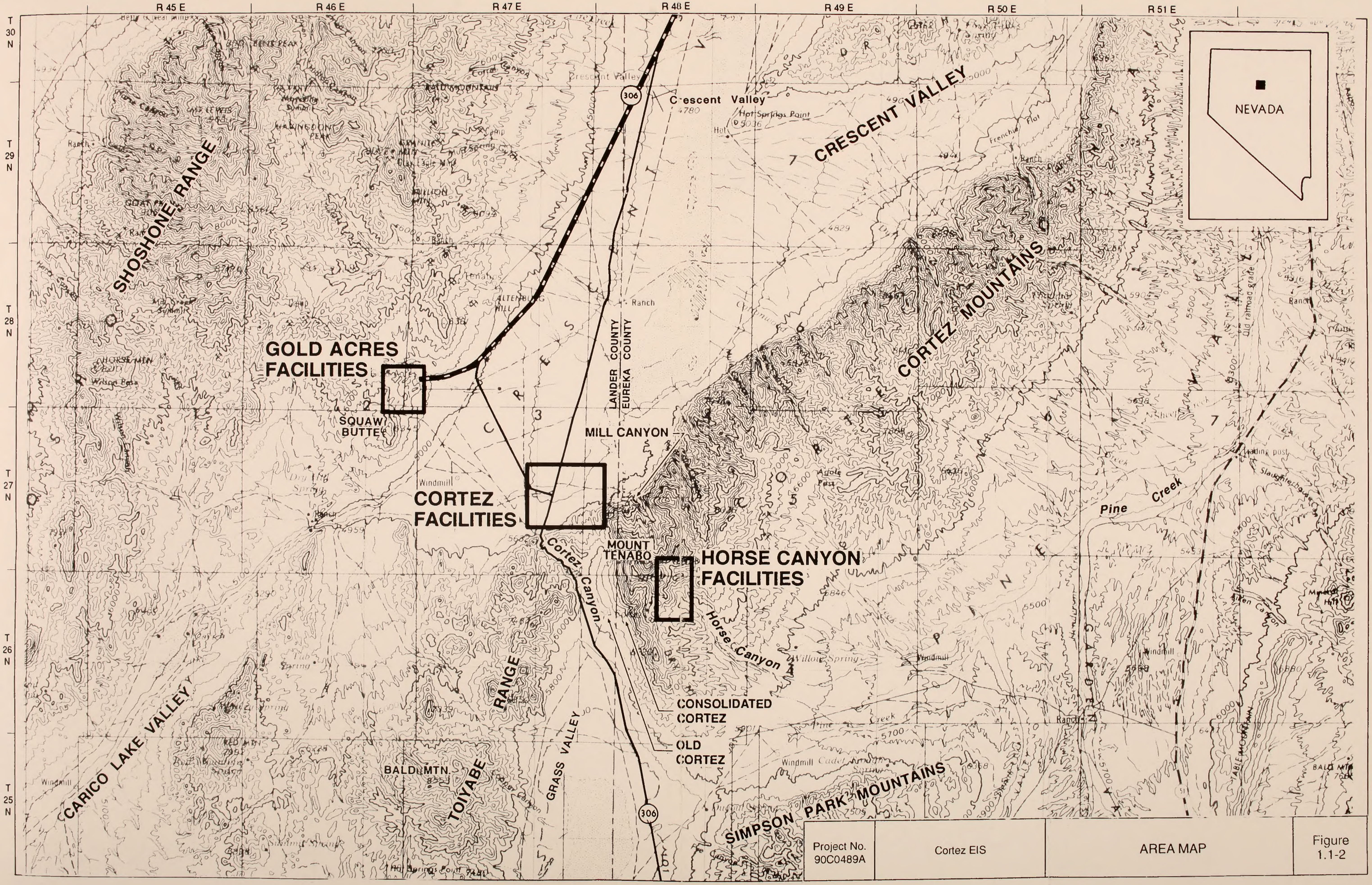
(Page 4 of 4)

Agency	Permit/Approval	Facet of Project	Time Requirements	Comments
COUNTY				
Planning Commission (varies from County to County)	Special Use Permit	All surface disturbances.	60-120 days	Application should include detailed plan of operations.
	Building Permit	Surface facilities.	30-60 days	Must have prior approval from Nevada State Health Division



Project No. 90C0489A	Cortez EIS	LOCATION MAP	Figure 1.1-1

90C0489A-9010/071392



Project No. 90C0489A	Cortez EIS	AREA MAP	Figure 1.1-2

2.0
ALTERNATIVES INCLUDING THE PROPOSED ACTION

The action proposed by Cortez in its 1990 Plan of Operations and the range of alternatives evaluated for this EIS are described in this section. Input from the public scoping process as well as from affected agencies and the BLM has been considered in order to identify alternatives to the proposed project. As required by NEPA the No Action alternative is also evaluated. The applicant's existing facilities and operations are described to establish the context for the description of the Proposed Project. Section 2.0 concludes with a summary and comparison of impacts associated with the proposed action and alternatives.

Activities associated with existing operations and already approved under existing Plans of Operations are not the subject of this EIS except for their consideration as part of the cumulative impact assessment. Reasonably foreseeable mining projects (proposed by the applicant or other interests) considered in the cumulative impact analysis are identified and evaluated in Section 5.0.

Cortez's 1990 Plan of Operations, and the technology associated with modern gold mining is very complex and sometimes difficult to understand. A glossary of mining terminology is included to assist the reader/reviewer of this EIS (see Section 7.0). Terms or processes used for the first time in the EIS will be in **bold type**, to direct the reader to the glossary for a definition of that term or process. Refer to Figure 2.0-1 for a simplified diagram showing steps involved in the mining, milling and heap leach processes.

2.1 EXISTING FACILITIES AND OPERATIONS

2.1.1 Location of Existing Facilities and Land Ownership

Cortez's existing gold mining operations are located in north central Nevada in Eureka and Lander counties, approximately 78 miles southwest of Elko, Nevada (Figure 1.1-1). The mining operations are reached from Elko by traveling approximately 40 miles west on Interstate 80, and then approximately 38 miles south on Nevada State Route 306 (Figure 1.1-1). The Cortez Gold Mines company is based in Cortez, Nevada in Lander County where the administrative offices, mill site, and ancillary facilities are situated. A landing strip for small aircraft is located in Crescent Valley, approximately 2.5 miles west of the mill site and is usually serviceable all year.

Existing mining and processing facilities are located in three main areas, Cortez, Gold Acres and Horse Canyon (Figures 2.1-1, 2.1-2, and 2.1-3). The Cortez area lies on the east side of Crescent Valley on the western flank of the Cortez Mountains in Lander County approximately 6 miles west of Horse Canyon. The Gold Acres area lies on the southwest side of Crescent Valley in the Shoshone Range in Lander County, approximately 8 miles northwest of the Cortez area. It contains the Gold Acres and London Extension open-pit mines. The Horse Canyon area is approximately 2 miles east of Mt. Tenabo in the Cortez Mountains in Eureka County. It encompasses the Horse Canyon open-pit mine and an associated deposit to the south, the South Silicified Zone. No new facilities or mining operations are proposed in the Horse Canyon area.

The applicant controls approximately 44,000 acres of **unpatented mining claims** and 3,200 acres of **patented mining claims** in the vicinity of existing mining operations.

2.1.2 History of Mining in the Project Area

Mining in the Cortez-Gold Acres district began with the discovery of mineralization in 1862 when high-grade silver ores were exploited from underground mines located approximately 4.5 miles southeast of the present Cortez mill site. An 8-**stamp mill** was erected in Mill Canyon in the 1860s to process the silver ore. The Garrison and Arctic tunnels provided the bulk of this silver production between 1864 and 1895, with a lower level of mining and milling activity continuing throughout the Cortez-Mill Canyon area until 1930. A small **cyanidation** process was operated for a short time in lower Mill Canyon, and a portion of this structure remains today.

Gold mining in the Gold Acres area began in 1935. It was the largest gold producer in the Bullion mining district. Underground methods were used initially, with open-pit methods introduced later on. A mill using cyanidation processing techniques was constructed in the area. Gold Acres was one of the few U.S. gold mines which operated through World War II, and was one of the largest gold producers in Nevada in the 1950s.

Regional geochemical studies undertaken by the U.S. Geological Survey in the Cortez Canyon area during the early 1960's indicated gold mineralization which eventually led to the discovery of the Cortez gold deposit by Placer Amex (now Placer Dome U.S.).

2.1.3 History of Cortez's Mining Operations

Since the discovery of the Cortez deposit, Cortez and the Cortez Joint Venture have developed several mines in the project area. Cortez operated a **cyanide leach countercurrent decantation** (CCD) recovery mill from January 1969 to February 1976. The mill ran initially from 1969 to 1973, processing 1,700 tons per day of **oxidized ore** from the Cortez ore body. Starting in 1973, the mill was operated at 2,300 tons per day on softer, less oxidized, high-clay ore from Gold Acres. At the same time, **heap leaching** of the lower grade portion of the ore was practiced at both Cortez and Gold Acres to supplement the milling operation. In February 1976, the oxidized portion of the ore body at Gold Acres was depleted, the mobile equipment was auctioned off, and the mill ceased operation. Leaching of the ore heaps continued through 1979. In early 1980, heap leaching was started on low-grade oxidized dump material left from the earlier Cortez operation. The mill was converted from CCD, a process using zinc to recover gold, to one using activated carbon (charcoal) to recover gold, called **Carbon-in-Leach** or CIL. Modifications were completed in February, 1981, and at that time, processing of the Gold Acres London Extension dump material commenced. The Horse Canyon Project commenced in early 1983 supplying the mill with ore for another four years. This project was permitted under case file N64-81-001P by the BLM.

Following operations at Horse Canyon, mining of the first stage of the Gold Acres London Extension pit area began in 1988 (Plan of Operations N64-86-001P). This stage was designed to recover the remaining oxide reserves in order to sustain the 2,000 ton per day mill until a **circulating fluid bed roaster** (CFB) modification could be completed. The CFB roaster was necessary because the mill was able to treat oxide or easily treatable ore only and was unable to extract gold from the remaining ores containing carbon and sulfide minerals. The carbon and sulfide minerals have an affinity for the gold that does not allow separation by chemicals in the CIL mill. The CFB roaster breaks down the bond between the gold and carbon/sulfide minerals by an oxidation process of raising temperatures to over 700°C or

1,300°F. The CFB process does not increase mill throughput. The roaster and mill are located on privately owned lands.

2.1.4 Existing Mining Operations

To sustain the current mill production, oxide ore is being mined from the East Pit at Cortez and the London Extension Pit at Gold Acres. Low-grade oxide ore is also produced at the East Pit and stacked on pads for heap leaching. Operations at the East Pit are approved under permit N64-81-001P. Feed is supplied to the roaster from stockpiles located at Horse Canyon and Gold Acres. In addition to these operations, Cortez is continuing to remove waste rock with uneconomic gold content from three of four stages at the Gold Acres London Extension Pit in order to uncover mixed **carbonaceous/oxide** ore.

Minable reserves in the Northwest Pit (above the water table), adjacent to the Cortez East Pit, are being developed to supply oxidized ore for processing at Cortez.

A portion of the current oxide stockpiles located at Gold Acres are in consideration for processing at the Cortez heap leach pads provided the economics are favorable.

2.1.5 Summary of Existing Plans of Operation and Rights-of-Way

Existing Plans of Operations and Rights-of-Way approved by the BLM for previous Cortez development and exploration in the project area are summarized in Table 2.1-1.

2.1.6 Existing Processing Facilities

Existing mill processing facilities include: ore processing facilities (i.e., the crushing and grinding circuits, the CFB roaster, the CIL mill and a tailings impoundment). Refer to Figure 2.0-1 for a diagram showing the steps involved in these processes. Heap leaching facilities are also used to recover gold from mined ore. These existing facilities are located on patented land primarily in the Cortez area. Brief descriptions of the existing activities and processing facilities are given below.

2.1.6.1 Crushing

Ore is fed to a jaw crusher from an ore bin. The crushed material passes over a vibrating screen. Crushed ore smaller than the screen size is conveyed to fine ore storage while the oversize is further reduced by a cone crusher before reaching the fine ore stockpile. The fine ore stockpile has a storage capacity of 34,000 tons which represents 17 days of mill operation. The fine ore is conveyed to the grinding area of the mill where it is processed for gold extraction.

2.1.6.2 Roasting Circuit

As mining and development progressed in the Cortez-Gold Acres district, ore bodies with increasing amounts of carbon and sulfide minerals were encountered. Gold recoveries from these ores is very poor by the existing CIL process scheme. The CFB roaster has the capability to raise the temperature of the ore and thereby oxidize the difficult minerals and free the gold for extraction by subsequent chemical means.

Ore is crushed with the existing jaw crusher and fed to a semi-autogenous dry grinding **(SAG) mill** prior to the roaster. The SAG mill is a large rotating drum that contains steel balls. The tumbling action of the balls and the ore particles causes the ore to grind to a fine powder.

Ore is roasted at temperatures near 700 °C or 1,300°F. Exhaust gases from the roaster flow through a gas cleaning plant where dust, sulfur dioxide, and mercury are removed prior to discharge from a stack. The cooled roasted ore is slurried (ore mixed with water) and pumped to the **ball mill circuit** for processing through the existing CIL mill.

2.1.6.3 Carbon-in-Leach Processing Facility

Crushed ore is fed to the grinding circuit. Slurried ore from the grinding circuit is piped to two conventional thickeners which are large tanks that allow the ore to settle from the slurry. Settled ore is pumped to the eight carbon-in-leach (CIL) tanks where the gold is dissolved by cyanide solution and adsorbed onto carbon (charcoal) granules. Some gold is also dissolved in the thickeners and the solution overflowing the thickener tanks is run through a series of carbon (charcoal) tanks or columns where gold is removed from the solution and onto carbon granules. Activated carbon is used to extract the gold from a cyanide solution. The gold free solution from these columns is recirculated to the grinding circuit.

Gold-bearing carbon granules are screened from the slurry in the CIL tanks and sent to the carbon stripping circuit which is designed to remove gold from the carbon granules. In the stripping circuit the gold-bearing carbon is placed in a pressurized tank and a hot chemical solution containing sodium cyanide and sodium hydrochloride is circulated through the carbon. The gold is dissolved into this solution and this solution is cooled and then passed through an electrical unit that causes the gold to precipitate onto steel wool. The now gold free carbon is reactivated to an efficient state by thermal means and then reused in the circuit. The steel wool containing the gold is mixed with fluxes and melted in a small furnace to produce gold ingots. Several ingots are combined in a second melting furnace and poured into a bar mold. The bar is removed from the mold and prepared for shipment.

2.1.6.4 Tailings Disposal Facilities

Once slurried ore from the mill has been treated and the gold recovered, the remaining slurried material called tailings, is transported through a pipeline and discharged into Tailings Pond No. 6. The solid portion of the tailings settle in the pond while the liquid portion of the tailings rise to the top. Once at the surface of the pond, the liquid clarifies as solids settle to the bottom of the pond and the clear liquid is allowed to drain to a pipe system that transports the solution back to the mill for reuse.

As the tailings slurry is discharged, the level of solids rises requiring the discharge pipe to be moved around the pond perimeter to evenly deposit the solids. Solution in the pond is maintained at least 2 feet below the dam crest at all times by either removing solution or moving the discharge point of the tailings slurry. When solids build up throughout the entire tailings pond, the pond dikes are raised.

Solution is reclaimed from the dam at two locations. As the water level changes, the structures used to reclaim water, called decant towers, are adjusted up or down to maintain the required flow.

Concentrations of **weak acid dissociable (WAD) cyanide** in the tailings impoundment are maintained well below 50 ppm, and generally below 20 ppm. These low concentrations are maintained as a result of the low cyanide requirements in leaching circuit and by washing the tailings with a solution which is much lower in cyanide concentration prior to discharge to the tailings impoundment.

2.1.6.5 Existing Heap Leaching Facilities

In addition to the milling processes discussed in previous sections, an ore processing technique called heap leaching is practiced to recover gold from low grade ores. The following section describes heap leaching as practiced at Cortez Gold Mines.

Heap leaching involves placing ore grade material on a prepared pad using mine haulage trucks. Ore is placed in **lifts** 15 to 20 feet in height. Once a lift is completed, an array of sprinkler pipe is moved onto the lift. Through the sprinkler system a dilute solution of sodium cyanide is sprayed on the ore. Due to the chemical reaction that takes place between the cyanide solution and the gold in the ore, the gold is put into the solution and flows to collection ponds along the surface of the prepared pad. Solution is then run through a **carbon adsorption circuit** which recovers the gold from solution.

Each lift that is placed on the heap is typically sprayed with cyanide solution for 90 days; however, this time may be extended with releaching for additional gold recovery. Following the completion of heap construction and leaching, the heap is allowed to drain, and then, sprayed with fresh water. Rinsing the heaps with fresh water will usually remove residual cyanide left in the heap to standards set by the Nevada Division of Environmental Protection. If rinsing of the heaps with fresh water does not reduce residual cyanide levels to acceptable standards, a solution of cyanide destroying chemicals can be applied to the heap until neutralization standards are met.

Concentrations of WAD cyanide in the existing heap leach circuits are below 20 ppm due to the low concentration of cyanide required to achieve the desired gold recovery from these process circuits. The most recently constructed heap leach solution ponds have been covered with wildlife protection netting and solution flow to these ponds is piped to eliminate open ditches. The concentrations of the WAD cyanide in the older heap leach solution ponds and ditches is below 10 ppm.

Heap leach ore is not expected to contain clays or fines in sufficient quantities to cause pooling or ponding of cyanide solution on the tops of heaps. Were ponding to occur, ore underlying ponded areas would be scarified (broken or loosened) to enhance infiltration.

2.1.7 Ancillary Facilities, Equipment, and Workforce

2.1.7.1 Power

Sierra Pacific Power Company provides electrical service to the minesite through a 60-kV line from the Battle Mountain area. Cortez owns the transformer substation located at the mill.

2.1.7.2 Water Source and Supply

The primary consumptive use of water occurs in the Cortez plantsite area due to evaporative losses. Water used for mining and milling purposes at Cortez is supplied by groundwater wells in the Gold Acres area, Horse Canyon area and Cortez plantsite area (Figure 2.1-1, 2.1-2, and 2.1-3).

Cortez is currently conducting groundwater remediation under the direction of the NDEP to remove cyanide from a localized area of shallow groundwater. A system of pollution control wells recovers shallow groundwater and provides makeup for the process solution circuit. By using shallow, poor quality groundwater for the process solution makeup, the consumptive use of higher quality fresh water is minimized.

Two production wells are available at the Cortez plantsite to supply the small demand for fresh water. Gold Acres area and Horse Canyon area are served by one production well each. Water from these areas is primarily used for dust control purposes.

2.1.7.3 Access Roads and Internal Mine Roads

The Cortez-Gold Acres mine area is accessed via Nevada State Highway 306, which extends southward off U.S. Interstate 80, both of which are paved. The last few miles of road to the plantsite is a Lander county road. Internal mine roads consist of a 14-mile haul road from Horse Canyon to the millsite, an 8-mile haul road from Gold Acres to the millsite, and a 1-mile haul road from Cortez to the millsite.

2.1.7.4 Surface Water Diversions and Drainage Control

The areas surrounding existing facilities contain numerous channels and washes that flow only during times of intense precipitation and snowmelt. These facilities are protected from surface runoff and storm events by berms and diversion ditches. Use of natural drainage courses are maximized as much as possible to reroute runoff. Springs and surface flow are controlled by channelling flow around the facilities. Diversion ditches protect project facilities from being inundated by surface runoff.

2.1.7.5 Fuel Storage

Diesel fuel for mine equipment and power generators are transported to the project site by commercial tanker trucks. Average use is approximately 100,000 gallons of fuel per month.

Fuel is stored in existing tanks located in the Horse Canyon, Cortez, and Gold Acres areas. Above ground tanks are surrounded by berms sized to contain the contents of the largest tank in case of spillage or tank rupture.

2.1.7.6 Sanitary and Solid Waste Disposal

All sanitary wastes are disposed of in the existing on-site, state-approved leach field. All trash and refuse is hauled to an approved landfill facility. All refuse is handled in accordance with applicable federal, state, and county laws.

2.1.7.7 Fencing and Security

To prevent trespass by the general public, the pad, pond, and process areas are surrounded by a 5-foot-high fence. Appropriate warning signs are placed on this fence at 200-foot intervals. All access roads to these areas have gates with locking capability to provide vehicular access control. In addition, the mine security department makes routine inspections to ensure that the access gates are properly maintained and that trespass does not occur.

2.1.7.8 Support Facilities

Support facilities include an administrative office, assay lab, and first aid station located in buildings in the Cortez mill area. There is also an office and maintenance facility located in each of the Horse Canyon and the Gold Acres areas.

Other mine site facilities consist of the existing mobile equipment ready line, maintenance shop, explosives magazine, mine office and fuel and lube-oil storage facilities. In addition to the facilities located in the Cortez mine area, both the Horse Canyon and Gold Acres mine areas have subordinate maintenance-related facilities.

2.1.7.9 Fire Protection

Adequate fire protection equipment and a fire protection plan have already been established for the existing operations at the project site. These procedures comply with all regulations imposed by the Mine Safety and Health Administration (MSHA) and applicable state and county building codes and regulations.

2.1.7.10 Chemical Reagent Requirements and Storage

Reagents required for the milling and heap leach operations are listed in Table 2.1-2. Currently, sodium cyanide is received as a liquid. Caustic is obtained in commercially available forms when needed. Lime is stored onsite in a silo as a solid and added either as a solid or as milk-of-lime for pH control in the mill. The working inventory of reagents is kept as low as feasible.

The following safety measures are currently followed and would be continued for the proposed project:

- All chemicals are stored within fenced or restricted access areas. Sodium cyanide and acid are stored separately.

- Sufficient calcium hypochlorite and/or hydrogen peroxide are maintained onsite to neutralize any unforeseen spills.

- Sodium cyanide is typically received as a liquid solution containing 30 percent sodium cyanide. The solution is buffered with caustic to a pH of 13 to prevent the formation of hydrogen cyanide gas. Liquid cyanide is stored in a tank which is surrounded by a concrete containment berm sufficient to contain 110 percent of the tank's capacity.

  An inventory of sodium cyanide briquettes is also maintained in reserve should liquid cyanide shipments be interrupted. Sodium cyanide briquettes are received in drums. When emptied, drums are triple-rinsed and disposed of in accordance with applicable regulations.

- All employees are indoctrinated in the safe use of chemicals. Proper safety training is given to those employees involved in handling chemicals. Adequate personal protection equipment is worn by all employees during the handling of chemicals. State-certified trained first responders provide emergency medical treatment.

- Face shields or goggles, rubber aprons, rubber gloves, and respirators are worn when handling chemicals. This safety equipment, plus earplugs, are used at all appropriate times and meet MSHA requirements.

- Hard hats, safety glasses, and steel-toed boots are worn by all personnel on site as appropriate to the work area.

- Cyanide antidote kits, oxygen bottles, first aid kits, fresh water showers, and eye wash stations are located in the mill area. An additional cyanide antidote kit, oxygen bottle, first aid kit, and trauma kit are located in the office or at the security gate. All employees are instructed in their use.

- At least two people are present when sodium cyanide is being mixed.

- At least one person is onsite continuously during operational shutdowns.

- Cortez has developed a detailed sodium cyanide spill prevention and response plan to mitigate potential impact of such spills in the project area. This plan requires immediate control of the source of the spill and immediate notification of the shift foreman. The shift foreman would immediately investigate the spill and take those actions which are both appropriate and safe to stop the discharge at source and contain the spill to minimize its impact. The shift foreman would notify the mill superintendent and/or other company official as soon as possible, who would in turn notify the appropriate agencies as required. Spilled product would be retrieved for reuse as practical. Spilled sodium cyanide solution not suitable for reuse would be neutralized with calcium hypochlorite. Contaminated materials not suitable for reuse would be excavated to the depth of apparent contamination and placed in the lined heap leach pad and reclaimed as part of this facility. The excavated area would be sampled and tested for total cyanide concentration. Areas where the total cyanide concentration exceeds 10 mg/kg of soil would be further excavated until the entire impacted area is remedied.

2.1.7.11 <u>**Mine Equipment**</u>

Major existing mining equipment is listed in Table 2.1-3. This equipment is used at the different mining operations depending upon the production required in a specific area. The equipment schedule is dictated each week by the balance of ore at the crusher stockpile and millfeed requirements.

2.1.7.12 <u>Workforce</u>

The present operation employs 175 people. Approximately 75 employees work in ore processing which includes the CFB roaster, CIL mill, and heap leach facilities. About 50 employees are involved with mining operations, and about 50 people are employed for administrative work.

2.1.8 Existing Reclamation

Reclamation practices on the Cortez Joint Venture property have evolved over the years. Waste rock dump sloping was started in the mid 1970s at the Cortez and Gold Acres areas. These dumps remained inactive until 1980 at which time an investigation revealed some of the dumps located at Cortez could be heap leached economically. In addition to this, plans were made to convert the mill which made milling of low grade dumps at Gold Acres feasible. The converted mill was commissioned in 1981 and operated on these low grade dumps until 1983.

Mining activities in these areas redisturbed much of the reclaimed land. However, remnants of the reclaimed areas do remain and are indicative of what reshaping dumps can do in assisting reclamation.

Natural revegetation was successful to some degree at both areas but more so at Gold Acres. The reason for this is that the waste rock at Gold Acres contains more fines and holds moisture better than some of the waste rock at Cortez.

In the 1980s, an emphasis was placed on establishing reclamation procedures. This resulted in several test programs which were intended to evaluate seed mixtures for different areas, particularly for the Horse Canyon area. Seeding was attempted around the Horse Canyon pit based on mixtures recommended from the BLM, Soil Conservation Service, consulting services and other mining companies. These areas are being monitored today in order to establish a successful program for the future.

A test plot area selected at both the Cortez and Gold Acres areas in the spring of 1989 intends to evaluate other revegetation parameters including mulching, fertilizing and spreading of topsoil.

More recently, emphasis has been placed on the reclamation of exploration roads while simultaneously monitoring the reclaimed dump areas. Current procedures for reclaiming exploration roads start with replacing the cut area with the fill portion of the road. The last part of the fill placed on the road is typically topsoil, the first part of the road excavated. Again, the seeding placed on the road is dependent on the area. The BLM has recently prescribed a mixture for the different areas. Recent reclamation of two dumps at the Cortez area included reshaping, application of topsoil and seeding. Over 100 acres of roads and dumps have been reclaimed by Cortez.

The waste rock dumps at Cortez and Gold Acres are built with reclamation in mind. The tier design is used wherever feasible to minimize the amount of fill to be rehandled and to provide more breaks in the slope. Where practical, soil is stockpiled for future spreading.

The BLM has provided guidelines for prevention of unnecessary and undue degradation of public lands. In general, these include proper location and construction of roads (i.e., water bars, percent grade, water course approach, and topsoil stockpiling), plugging of exploration drill holes and construction and location of waste rock dumps (north facing slopes, tier design, etc.).

Current mine practices reflect the requirements of the Environmental Assessments for the existing Plans of Operations per the BLM specifications.

2.2 PROPOSED PROJECT

The Proposed Project includes: new heap leach facilities and expansion of an existing open-pit mine in Gold Acres area; expansion of existing heap leach facilities and construction of tailings disposal facilities in the Cortez area; and, ongoing exploration drilling. Waste rock dumps for overburden disposal would be expanded in the Gold Acres and Cortez areas. In addition, one new waste rock dump would be constructed in the Gold Acres area. The Proposed Project would disturb 336 acres of public land and 92 acres of private land.

The Proposed Project would provide sufficient ore to allow for the continued operation of the existing milling facilities currently operated by Cortez. The Proposed Project would not represent a significant change in the annual mining and production rates, nor would it represent an increase in project workforce or equipment needs. The Proposed Project would allow Cortez to continue to employ the existing workforce and to optimize use of the existing equipment and mineral processing facilities.

2.2.1 Surface Disturbance in Each of the Proposed Mining Areas

The surface disturbance that would result from mining and processing of ore is summarized below and shown in Table 2.2-1. Surface disturbance would result primarily from expansion and/or construction of open-pits, waste rock dumps, heap leach pads, tailings impoundment, and haul roads. A discussion of proposed mining operations and processing facilities is presented in Section 2.2.2.

2.2.1.1 Cortez Area

No new pit development beyond that currently permitted is proposed in the Cortez area. Expansion of an existing waste rock dump would disturb 1 additional acre. The waste rock dump would increase in area by 27 acres; however, most of this area (26 acres) has already been disturbed by mining activities. Expansion of the existing heap leach pad at Cortez is also proposed. This expansion would disturb 49 acres. Construction of a new tailings disposal facility (Tailings Pond No. 7) would disturb 81 acres including perimeter access. Proposed as-built disturbances prior to reclamation for this area would be 130 acres. The location of these proposed disturbances are shown in Figure 2.2-1.

2.2.1.2 Gold Acres Area

The proposed project includes: the expansion of an existing pit mined in the mid-1970s, road construction, waste rock dump expansion and construction, and a heap leach facility. The proposed pit expansion is located south of the London Extension Pit (Figure 2.1-2) and would disturb 1 additional acre. Pit expansion would increase the area of open pit to 85 acres; however, most of this area (84 acres) has already been disturbed by mining activities. A portion of the existing Gold Acres haul road would be routed around the proposed heap leach pad and a section of new haul road would be required to access the proposed waste rock dump to the south of the pit. Proposed road construction would disturb an estimated 9 acres. Proposed waste rock dump construction would disturb an estimated 196 acres. Proposed heap leach facilities would disturb an estimated 6 acres. Proposed final/as-built disturbance prior to reclamation for this area would total 212 acres.

Low grade ore stockpiles from previous and current operations at Gold Acres are also planned for heap leaching at either the proposed Gold Acres heap leach facilities or the existing or proposed Cortez heap leach facilities. This ore would be hauled via existing roads. No acreage allowance is made for disturbance since this ore would be taken from stockpiles located on top of existing waste rock dumps.

2.2.1.3 Horse Canyon Area

No new mine development activities are proposed in the Horse Canyon area.

2.2.2 Proposed Mining Operations

The following sections describe the construction and operation procedures necessary to expand and/or construct the facilities discussed above.

2.2.2.1 Pit Configuration and Stability

Pit high wall configuration would be controlled by several parameters, some of which are geologic and geotechnical controls, equipment constraints or safe operating practices. Pit bench heights and widths would be designed according to sound engineering practice. Bench heights are determined by the mining equipment limitations and the characteristics of the gold mineralization. High wall slopes are a function of the geometry of the ore body and are based on slope stability analyses, similar to that described below for waste rock dumps.

As mining progressed, an ongoing geotechnical program would confirm the assumptions made and the validity of the slope design. The geologic and geotechnical characteristics of the materials exposed during mining would be monitored regularly. Geologic structure mapping and interpretation, groundwater monitoring, and slope stability analyses would be the basic elements of this geotechnical program. Slope movement monitoring would be instituted to evaluate the safety of pit high walls. In addition, operational procedures for controlling blasting and bench scaling would be instituted to facilitate mining of stable pit walls. Initial engineering indicates that the pits would have maximum pit wall slopes of approximately 45 degrees overall. Walls would be 50 to 100 feet high with 10 to 40 foot wide safety benches to contain minor rock sloughing and to allow for safe operating conditions and a stable postmining configuration.

2.2.2.2 Drilling and Blasting

Ore would be mined by conventional open-pit methods involving drilling, blasting, loading and hauling. Most of the overburden and ore would require drilling and blasting. Blasting would be performed only during daylight hours and under strict safety procedures as required by the Mine Safety and Health Administration (MSHA). Explosives would be delivered by licensed haulers and stored onsite in approved storage facilities. Scaled distance formulas would be used to establish safe seismic disturbances and air blast limits.

After blasting, both overburden rock and run of pit ore would be loaded with front-end loaders or hydraulic shovels into end dump trucks and hauled to the appropriate area. The ore would be hauled either to the mill or heap leach facilities, and the overburden would be hauled to the waste rock dump areas.

2.2.2.3 Waste Rock Dump Facilities

The proposed waste rock dump areas would cover a total of approximately 196 acres, and would have a final capacity of approximately 25 million tons. The waste rock dump areas would be located as close as possible to the pits in order to minimize haulage distance (Figures 2.1-1 and 2.1-2). In addition to the unmineralized rock that overlies the ore bodies, non-mineralized material (interburden) is locally interspersed within the ore and would be hauled to the waste rock dump areas. The overburden and interburden rock would be hauled by haul trucks to the waste rock dump areas.

Waste rock dump areas would be developed by end dumping at an angle of approximately 38°. Wherever feasible, waste rock dump facilities would be designed and built as terraced structures in order to facilitate recontouring and reclamation. A 30 percent swell factor is assumed in the conceptual facility designs. The upslope portion of each disposal area would be sloped back into the hill to prevent runoff down the face of the disposal area. Engineered diversions would be installed as necessary to protect the waste rock dump areas from being inundated by surface runoff. It is anticipated that material segregation during dumping would promote natural drainage of the disposal facility. No seeps or springs of importance for wildlife use have been identified in waste rock dump areas. However, if seeps or springs that are used by wildlife are identified, they will be diverted by engineered french drains.

2.2.2.4 Haul Roads

For the most part the Proposed Project would use existing haul roads to transport the ore and overburden mined from the pits to the appropriate areas. A new section of haul road would be constructed to access the expanded Gold Acres pit. This road would be approximately 5,600 feet in length. This road would be designed with a 62- to 70-foot-wide running surface to accommodate the 50 to 85 ton capacity haul trucks. The overall width of this road would be at least 62 feet to allow for a minimum 50-foot-wide running surface plus 12 feet for safety berms and internal ditches. Maximum road grades would be on the order of 10 percent. Internal pit roads would be approximately 50 to 70 feet wide, and sufficient for two-way haul vehicle traffic. No acreage allowance is made for disturbances since the proposed road would be constructed over areas of existing disturbance, or over the area proposed for waste rock dump disturbance. A second haul road will be constructed around the proposed Gold Acres heap leach facility. The new construction will amount to 2,500 feet of road with a width of 75 feet. The new road will reroute the existing Gold Acres haul road and will run along side the new heap leach pad. A total of 9 acres will be disturbed to construct the new road.

Cortez would use a dust suppressant to control fugitive dust on haul roads as needed to supplement routine use of water trucks. Magnesium chloride has been used in the past, and proved to be very effective in suppressing dust emissions from the Gold Acres haul road.

2.2.2.5 Ore Stockpiles

At times, ore mining rates or the need to blend ore types could require construction of temporary ore stockpiles. One or more temporary stockpiles with a planned storage capacity of up to 50,000 tons of ore could be located near or within the proposed pit. Additionally, ore stockpiles would be located at the crusher and could also be located near or within other components of the ore processing and roaster facilities. Blended ores or ore sufficiently close to the design mill feed composition would be dumped into stockpiles sized at about 100,000 tons, or about 50 days surge at the nominal 2,000 tons per day mill capacity.

2.2.3 Description of Proposed Processing Facilities

The Proposed Project would not involve any expansion or major changes in the existing ore processing facilities (e.g., the crushing and grinding circuits, the CFB roaster, and the CIL mill) described in Section 2.1.6. These existing facilities are located on patented land. The ore mined by the Proposed Project would allow for continued operation of the existing facilities, but would not significantly change the daily or annual throughput of these facilities.

2.2.3.1 Tailings Disposal Facilities

The tailings produced during the first 2 years of activity for the Proposed Project would be disposed of in the existing Tailings Pond No. 6. The embankment of Tailings Pond No. 6 would be raised approximately 8 feet to accommodate the additional tailings. This construction would not disturb any additional acreage.

An additional tailings impoundment (Tailings Pond No. 7) is proposed to provide storage capacity of about 2,700 acre-feet. At the current level of tailings production, the proposed impoundment would provide storage of tailings for approximately 7 years. The proposed site for the tailings facility is located directly north of the existing heap leach pads as shown in Figure 2.1-1. A portion of the proposed tailings facility would be located on patented ground. The tailings facility would disturb approximately 81 acres.

The design of the tailings disposal facility is still in the conceptual stage. However, the site assessment studies and geotechnical and groundwater investigations have been performed.

This facility would consist of a tailings embankment; a lined, impervious impoundment area; and tailings slurry and water return pipelines.

The tailings disposal facility would be designed as a zero-discharge or closed system, and would not discharge process solutions to surface water or ground water resources in the project area. The milling of the gold ore would produce a slurry of suspended, finely ground rock mixed with mill waste water. These mill tailings would be transported via a pipeline from the mill to the tailings disposal facility. The tailings pipeline would be located underground. The tailings would either be pumped or would travel by gravity flow to the tailings disposal facility. The tailings pipeline would contain suitable instrumentation that would immediately indicate pipeline operational malfunctions.

Concentrations of WAD cyanide in the proposed tailings impoundment would be maintained below the level toxic to wildlife in the same manner as is currently accomplished in Tailings Pond No. 6 (Section 2.1.6.4).

2.2.3.2 <u>Heap Leach Facilities</u>

Expansion of existing heap leach facilities at Cortez and new heap leach facilities at Gold Acres are proposed as part of the Proposed Project. The installation of upgraded heap leaching facilities would allow the existing heaps to be rinsed and decommissioned without affecting the schedule of operations. Site assessment and geotechnical/groundwater investigations have been completed, and full design of the facilities is proceeding for this area.

The heap leach facilities would be designed so that they could be built in phases. The size would accommodate presently proven and anticipated minable and geologic reserves as based upon Cortez's geologic model for the area and their experience in identifying and developing mineral resources in the district. The new heap leach facilities would also be used to process proven reserves of leach grade ore which have been authorized by the BLM for mining in previously approved Plans of Operation. The first stage of the heap leach facilities would accommodate proven minable reserves. Development of all subsequent phases of the heap leach area would be contingent upon the results of future exploration, definition drilling, and feasibility studies. It is anticipated that future reserves would be located upon both patented and unpatented land.

The proposed heap leach facilities would be single lined on a prepared native soil material base. Pad design criteria would be determined from the geotechnical investigations. Construction of the first phase would be in stages, with each stage consisting of an area adequate to contain the scheduled minable reserve. Ore would consist of crushed or agglomerated leach-grade material placed on the pad utilizing end dump haul trucks. Ore placement would be by end dumping from haulage vehicles to an initial height of 20 feet. Additional ore would be placed on the preceding material in lifts on the order of 10 to 20 feet in height. A dilute sodium cyanide solution would be sprayed on each lift until the leachable gold was extracted. After percolating through the heap, the leach solution would be collected from the pad and routed to a lined pond system for containment. Leach solution containing gold would then be pumped for processing. Weather permitting, leaching is planned to operate on a year-round basis.

The preferred sites for the leach pads at Cortez and Gold Acres were selected in order to integrate with the existing facilities.

The proposed heap leaching facilities are designed as a closed-circuit, zero-discharge system both in terms of potential leakage and in terms of overflow. The solution collection ponds are designed to store process solutions and to contain runoff from a 100-year 24-hour storm event. The proposed heap leach facilities would be surrounded by containment berms. The berms would prevent surface runoff from entering the facility and causing erosion of structures or dilution of the leach solution. The berms would also prevent any possible escape of process solutions from the facility. The operation of the heap leach facilities is designed for zero discharge of leach solutions to the environment.

Proposed leach solution ponds would be covered with netting, and fences would be constructed to exclude avian and terrestrial wildlife from these ponds. Leach solution collection and conveyance ditches would also be covered with netting to exclude wildlife.

Ponding and pooling of process solution on the tops of heaps would be prevented by scarifying the areas where it occurred or by using a drip line system instead of sprinklers to disburse leach solution.

2.2.4 Exploration Activity

The Proposed Project includes exploration drilling and trenching, primarily in the Cortez and Gold Acres areas. Generally, exploration activities would take place during hours of daylight, although some nighttime drilling could occur if necessary to accommodate drilling contractor scheduling constraints. Drilling activities would take place any time of the year when weather and site conditions are suitable, but would be primarily scheduled during the drier periods of the year.

2.2.4.1 Cortez Area Exploration Drilling

The proposed exploration disturbance in the Cortez area would result from access roads, sites for 40 drill holes (approximately 2 acres of new disturbance) and improving approximately 2 miles of existing drill road (approximately 4 acres of disturbance).

2.2.4.2 Gold Acres Exploration Drilling

Exploration activities on federal land in the Gold Acres area would occur in the old Gold Acres pit, the Golden Zone and the Billie claims. Approval for proposed disturbance on the Billie claims already exists. Additional disturbance would consist of 1 acre required for constructing new access roads and sites for 19 drill holes. In addition, approximately 1 mile of existing access road would be improved (approximately 2.0 acres).

2.2.5 Ancillary Facilities, Equipment, and Workforce

The proposed project does not require any significant changes or additions to ancillary or support facilities, equipment or workforce. Refer to Section 2.1.7 for a discussion of current facilities, equipment, and workforce.

2.2.6 Mine Production Schedule

The ore reserve for the Proposed Project would be exhausted by April 1999. A simplified timeline of production events is shown in Figure 2.2-1. Detailed yearly mine production schedules are available in the Plan of Operation.

2.2.7 Proposed Reclamation Plan

The BLM surface management regulations in 43 CFR 3809 as well as the NDEP Bureau of Mining and Regulation/Reclamation regulations require that a mining company using public land for its operations must prevent undue and unnecessary degradation of the land and provide a plan for reclamation of the disturbances. The details of this general requirement have been expanded in various BLM Instruction Memorandums.

The Cortez reclamation plan is intended to comply with the applicable BLM and NDEP regulations and policies and is generally designed to provide a post-mining condition of the affected land which would support the land uses identified in the BLM's Shoshone/Eureka and Elko Resource Management Plans (RMPs). The proposed post-mining land uses include wildlife habitat, livestock grazing, open space, dispersed recreation, and mineral exploration and development. The methods proposed to achieve these land uses are intended to meet Cortez's general reclamation goals including: prevention of slope instability, control of soil erosion and sediment transport, reduction of visual impacts, restoration of surface hydrology patterns, minimization of safety impacts, revegetation of disturbed surfaces, and establishment of diverse and perennial vegetation communities.

The Bureau of Land Management and Cortez have agreed to a bond variance for the 1990 Plan of Operations. All planned surface disturbances proposed (i.e., engineered) in the 1990 Plan of Operations will be bonded per the NDEP/BLM Memorandum of Understanding. The remainder of the mine site (i.e., post-January 1, 1981, disturbance) will be bonded per the NDEP/BLM schedule. Cortez is currently working with the Bureau to identify all disturbance that occurred before January 1, 1981, and disturbance after that date. Cortez, working with the Bureau and the NDEP, is currently preparing a detailed reclamation plan and bond estimation for the post-January 1, 1981 disturbance.

The specific reclamation procedures that would be conducted are described in the following subsections. These procedures are subject to modification by the BLM, in consultation with other applicable state and federal agencies and with Cortez. Areas disturbed to accomplish reclamation of proposed activities are shown on Figures 2.2-2 and 2.2-3. Cross sections of the proposed reclamation are shown in Figures 2.2-4 and 2.2-5.

2.2.7.1 Topsoil Removal and Stockpiling

An Order II Soil Survey has been conducted in areas proposed for disturbance to identify the topsoil resource potentially available for salvage prior to disturbance. The quality and depths of these soils vary from place to place. The existing vegetation and topsoil would be removed with conventional mining equipment prior to disturbance for mining operations and stockpiled in designated locations for future use during reclamation. Table 2.2-2 indicates the anticipated topsoil volume that would be stockpiled during topsoil stripping operations. The topsoil resource that is currently anticipated to be available in the areas proposed for new disturbance is approximately 650,323 cubic yards. The actual amount available would be determined during topsoil stripping operations and would be controlled by the depth of the topsoil horizons and the practicality and safety limitations of removing the topsoil with normal mining equipment.

Topsoil stockpiles would be located away from active mining operations and would be protected from disturbance or erosion. All stockpiles would be marked with signs to prevent their disturbance by mining operations. The surfaces of the stockpiles would be constructed to slopes no steeper than 3.0 horizontal to 1 vertical to reduce erosion. A cover crop of Ephraim crested wheatgrass and cereal rye would be seeded in the fall following construction of the stockpiles to stabilize their surfaces from wind and water erosion. Diversion channels and/or berms would be constructed around the stockpiles as needed to prevent erosion from overland runoff.

2.2.7.2 Demolition of Facilities

At the completion of all operations, the mining, milling, and leaching facilities would be dismantled and salvaged. This demolition would be done in an organized fashion to reduce additional disturbance; eliminate long-term health, safety and environmental impacts; and maximize the salvage value of the facilities and equipment.

Mobile mining equipment would be removed from the site by Cortez. Salvageable equipment such as crushers, conveyors, silos, roasters, mills, tanks, pumps, switchgear, transformers, classifiers, filters, kilns, retorts, furnaces, laboratory equipment, and office equipment and furnishings would be sold in place and removed from the site. After salvageable equipment was removed from the site, recyclable metal materials in the facilities would be removed by the demolition contractor, temporarily stored, and removed from the site.

Prior to demolition, all fuels, reagents, and chemicals in storage or use at the facilities would be treated onsite or safely packaged and handled according to the applicable regulations. Residues of cyanide or other toxic chemicals in equipment or on surfaces would be treated prior to demolition.

2.2.7.3 Heap Leach Facility Decommissioning

Heap leach facilities consisting of leach pads, solution ponds, and associated equipment are located at all three Cortez operations areas. A 61-acre expansion of the Cortez Area leach facilities and a new 50-acre leach facility at the Gold Acres area is included in the proposed project. These would be decommissioned when operations were terminated to minimize the potential for long-term health or environmental impacts due to cyanide or dissolved metals. Final decommissioning plans would be prepared prior to termination of operations and presented to the NDEP for approval. The specific decommissioning methods for a typical Cortez leach facility are conceptually described below.

As the termination of operations for the leach facility was approached, the amount of leach solution in the system would be gradually reduced through evaporation until the point of termination was reached. The active heap leach would then be allowed to drain to the connected solution ponds and all leach solutions containing gold would either be evaporated, treated in the ponds with a cyanide destroying reagent, or pumped out and used in an active leach facility or the mill where the solutions can be used for continued leaching. The leach system would then be allowed to rest undisturbed for about 4 months to allow the WAD and **free cyanide** compounds to degrade naturally.

After the initial rest period, the solution system of the leach pad would be used to circulate fresh water through the heap. As the water was evaporated through spraying, additional fresh water would be added to the system. This would continue as long as the concentrations of free and WAD cyanide in the returns from the heap were still decreasing. The goal would be to achieve the standards contained in the NDEP permits for the leach facilities. If these standards could not be met after a reasonable amount of rinsing, the water volume in the circulation system would be reduced by evaporation or use in another heap and the heap would be allowed to rest again for a few months. Rinsing with fresh water would be re-initiated after this second rest period and rinsing would proceed until the applicable NDEP rinsate standards were met. If the results of the second rinsing indicated that the NDEP standards could not be met, alternate decommissioning procedures would be discussed with the NDEP.

When the returns from the heap met the appropriate NDEP standards, the volume of water in the system would be reduced through evaporation on the heap or use in another leach system. The final amount of water in each of the solution ponds would be evaporated in the pond or transferred to another active leach facility, or the Cortez tailings pond. All equipment and piping would be removed, and buildings and structures would be salvaged or demolished. The sludge in the bottoms of the solution ponds would be allowed to dry out and representative samples would be obtained to determine the chemical characteristics of the sludges. The sludges would be handled according to the NDEP permits for the leach pads, and in conformance with NDEP regulations for solid waste handling. Depending on the characteristics of the sludges, they would either be left in the ponds and buried in place, removed and placed on top of the leach facilities, or removed and placed in a permitted landfill.

Following appropriate testing according to NDEP requirements, the rinsed, heap leach ore on the slopes of the heap would be pushed down to slopes ranging from 2.0 to 3.0 horizontal to 1 vertical. The actual slope of reclaimed heaps would be dependent upon the results of the stability analysis. Slopes steeper than 3.0 horizontal to 1 vertical would only be constructed if satisfactory mass stability, erosion, and revegetation could be demonstrated as required by BLM and NDEP. The areas affected to accomplish heap reclamation depicted on Table 2.2-1 represent slopes at 3.0 horizontal to 1 vertical. Steeper slopes would result in a reduction in the area affected to accomplish reclamation. Typical cross sections are provided in Figures 2.2-4 and 2.2-5, with locations of the cross sections indicated in Figures 2.2-2 and 2.2-3.

The pond liners would either be removed and disposed of in a permitted landfill or they would be removed from the sides of the ponds and folded into the pond bottoms. The ponds would then either be filled with earth and/or breached in a controlled manner to prevent accumulation of water. The surface of the regraded ponds would blend in with the surrounding terrain.

After all regrading was completed, the available topsoil would be placed over the regraded surfaces and revegetated. Runoff from upgradient sources would be rerouted around the reclaimed leach facility in stable open channels. Maintenance of erosion control and sediment control facilities as required would be conducted until the reclamation of the leach facility was considered to be complete. The final construction/as-built for heap leach facilities would be 49 and 6 acres respectively. The final regraded acreage, at a 3.0 horizontal to 1 vertical slope, is estimated to be 61 acres at Cortez. Reclamation of the disturbance associated with the Gold Acres heap leach expansion would be accomplished within the proposed haul road disturbance area adjacent to the leach pad.

2.2.7.4 Tailings Pond Decommissioning

Tailings from the Cortez mill have been placed in a number of tailings ponds near the mill. Tailings produced for the first two years of the proposed action would be disposed of in the existing Tailings Pond No. 6 after which a new tailings pond would be built. The new tailings pond included in this proposed action would disturb 81 acres to the east of the existing pond. Reclamation of the tailings pond would have the objective of eliminating any continued direct contact with solutions containing potentially harmful amounts of cyanide, preventing release of fugitive tailings dust, and providing a land use in concert with the stated post-mining land use objectives. The specific reclamation methods that would be utilized are described below.

The open tailings solutions remaining in the pond upon termination of operations would be allowed to evaporate. As the surface of the tailings solids became strong enough to support construction equipment, the available topsoil would be spread over the tailings. If insufficient amounts of topsoil were available to cover the tailings, a topsoil substitute material such as alluvial material would be used to cover the tailings. The topsoil or cover material would then be revegetated.

Pipelines, pumps, valves and other equipment related to operation of the tailings pond would be removed.

Tailings dam reclamation would depend on the chemical stability of the tailings and the ability of the tailings and dam construction materials to support plant growth. Tailings would be characterized according to procedures set forth by the Nevada Division of Environmental Protection prior to defining a reclamation scheme; however, the following two schemes are envisioned based on the tailings characterization.

Option 1 - Tailings Chemically Stable. If the tailings were shown to be chemically stable, the tailings surface would be graded to minimize the ponding of water from precipitation. The freeboard created by the pond perimeter dike would be dozed level with the pond surface and the perimeter dike side slope cut down to a slope of 3.0 horizontal to 1 vertical or less. The slopes and pond surface would be revegetated. If either the dike construction materials or the tailings would not support vegetation, efforts would be made to place suitable material on top of the tailings if available. Embankment slope reduction resulting from this reclamation plan is shown in Figure 2.2-4.

Option 2 - Tailings Not Chemically Stable. If the tailings were not shown to be chemically stable, the surface of the tailings would be covered with a low permeability material, and the surface would be cut to a slope that would not expose tailings material to precipitation. The slopes and pond surface would be revegetated. If either the dike construction materials or the capping material would not support vegetation, efforts would be made to place suitable material on top of the material if available.

Monitoring wells around the tailings pond would be maintained until Cortez was released of this requirement by the NDEP. These wells would then be plugged and abandoned according to the requirements of the State Engineer.

2.2.7.5 Waste Rock Dumps Reclamation

The waste rock dumps would be constructed by end-dumping the waste rock from the outer face of the dumps which would produce a slope of about 1.3 horizontal to 1 vertical. The tops of the dumps would be constructed with a slight slope from the outer edge to the back so that runoff from the tops of the dumps would not drain onto the outer slopes.

When operations on a waste rock dump were terminated, it would be reclaimed to meet certain general objectives including: stable slopes, reduced slope erosion, **mass stability**, rounded edges, revegetated surfaces, and control of sediment. The specific reclamation methods proposed to meet these objectives are described below for a typical Cortez waste rock dump. Waste dump reclamation at Cortez and Gold Acres would disturb an additional 1 acre and 64 acres, respectively (Table 2.2-1). Additional disturbance would result from slope reductions depicted on Figures 2.2-4 and 2.2-5. Cross section locations are shown on Figures 2.2-2 and 2.2-3.

The outer slopes would be contoured to achieve overall slopes ranging from 2.0 to 3.0 horizontal to 1 vertical with a rounded crest to produce a more natural appearance. The actual slope of reclaimed waste rock dumps would be dependent upon results of stability analyses. The upper level surfaces of the dumps would be scarified to break up compaction but would not be regraded. Waste rock dump slopes steeper than 3.0 horizontal to 1 vertical would only be constructed if satisfactory mass stability, erosion, and revegetation could be demonstrated as required by the BLM and the NDEP. The areas affected to accomplish reclamation depicted in Table 2.2-1 are based on the reclamation of 3.0 horizontal to 1 vertical. Steeper slopes would result in a reduction in the area affected to accomplish reclamation.

The long term stability of waste rock dumps are analyzed from an engineering standpoint to determine if they will be stable over time and under seismic activity. Waste rock dump designs are also compared with similar facilities that have been stable over a long period of time.

When waste rock dumps are engineered, a factor of safety is determined which indicates how stable they will be under a given set of conditions. A factor of safety of less than 1.0 is considered potentially unstable while a factor of safety greater than 1.0 is considered stable. The engineering condition under which a waste rock dump is analyzed will vary from site to site due to such factors as soil conditions underneath the proposed facility and the earthquake (seismic) potential of the area.

As waste rock dumps are constructed, the rock and soil is allowed to stand at its natural angle or approximately 38°. Waste rock dumps constructed at the natural angle will typically have safety factors of 1.1 under normal conditions and 0.9 if seismic conditions occur. This means that the outer surfaces under normal conditions will be stable; however, earthquake activity would cause outer surfaces to become unstable. Such instability would produce small failures or slides of material along the outer edges.

Upon reclamation of the waste rock dumps, outer slopes would be flattened to a 3.0 horizontal to 1 vertical or less. This reduction in the slope would have the effect of increasing slope stability from a factor of safety of 0.9 under seismic conditions to a safety factor of 1.8, a stable slope.

Waste rock in the waste rock dumps to be reclaimed under this proposed action are not expected to produce acid in amounts exceeding the **neutralizing potential** of the waste rock. This determination is based on the lack of evidence of acid generation in any of the existing waste rock dumps in the areas of proposed mining. The **acid generating potential** of waste rock generated as a result of the proposed action would be monitored during mining. Waste rock would be characterized according to final closure procedures set forth by the NDEP.

As part of the reclamation process, the top surfaces of the waste rock dumps would be uniformly covered with the available topsoil and revegetated.

Runoff from uphill areas to waste rock dumps would be collected with the natural slope and directed laterally to the facility margins. This water would drain down the contact of the waste rock dump slope with the natural slope. Runoff from uphill areas would not be able to discharge onto the outer slope. Sediment control as necessary would be installed beneath the waste rock dump.

2.2.7.6 Road Reclamation

There are many existing roads used in the Cortez operations for general access, haulage, and exploration. The reclamation of these roads has been discussed in previous Notices and Plans of Operations. The only haul roads addressed in the proposed project are a new haul road to service the proposed waste rock dump at the Gold Acres area and the rerouting of the Gold Acres haul road around the proposed Gold Acres leach pad. At the end of their service lives, the roads would be reclaimed in conjunction with the reclamation of the existing disturbance or in conjunction with the waste rock dump and heap leach pad reclamation described in Section 2.2.7.5 above.

The side berms would be regraded to blend with the general shape of the road. Where the road was located on fill, the side slopes would be rounded and regraded to 3.0 horizontal to 1 vertical. Where the road was built on a side hill cut and fill, the fill material would be pulled back against the cut to produce a more natural appearance. Compacted surfaces of the road would then be scarified and the available topsoil would be uniformly spread over the regraded surfaces. The regraded and topsoiled areas would then be revegetated.

During regrading, any culverts would be removed and stream crossings would be opened to restore their natural flow capacities. Dikes and ditches that would no longer be required would be regraded. Runoff on the road surface would be controlled with waterbars and turnouts to reduce erosion. The spacing of these features would be as follows: 2-5%:100′; 6-10%:75′; +10%:50′.

2.2.7.7 Open Pit Reclamation

The proposed action includes an 85-acre expansion of the Old Gold Acres Pit at the Gold Acres area. This pit would be constructed with high walls and safety benches engineered for general mine economics and according to applicable MSHA regulations. The final configuration of the pit slopes would vary as the mining progressed but initial engineering indicates that the maximum overall pit slopes would be 45°. The maximum overall high wall height at the Old Gold Acres Pit would be 550 feet. The bottom of this pit would be below natural grade so there would be no discharge of runoff from the pit. The ground water table would not be intercepted by the pit.

Access to the proposed expanded pit high wall would be restricted by berms constructed of available surface materials and BLM standard specified fences. Access into the pit would be blocked with a large earthen berm and BLM standard specified fences. Signs warning of possible hazard would be posted appropriately around the perimeters of the pit.

The pit walls have been designed to be stable during the mining period for the safety of the personnel and equipment that would work at the base of the slopes. However, the safe and economic design of the pit walls for mining operations does not guarantee the long-term stability of the pit slopes following the cessation of mining. Large scale mass failures of the pit walls are not expected to be common following mining but it is expected that the walls between the benches would gradually deposit rocks on the benches. These rock falls would be infrequent and localized.

Runoff into the pit from uphill areas would be controlled with ditches or berms. Runoff collected in the pit would not be discharged due to the fact that the pit bottoms would be lower than the surrounding terrain. Sediment control for the pit would not be necessary.

2.2.7.8 <u>Surface Water Control</u>

The reclamation of the Cortez facilities would include attention to natural drainage patterns and long-term stability of any permanent drainage alterations.

Smaller drainages that would be altered with road fills or other small facilities would be restored to a through-draining condition similar to their natural configuration. Culverts would be removed and drainage alterations no longer required for the post-mining condition would be regraded. Where drainages had been altered with large facilities like open pits, dumps, leach pads, or tailings ponds, the drainages would remain permanently impacted.

Permanent drainage alterations constructed during operations and consisting of open channels or berms would be reclaimed with vegetation or rock lining to be stable under long-term conditions without maintenance. The quantities of flow and the flow velocities that would need to be handled by each such diversion would be calculated for the post-mining configuration of the uphill watersheds. Vegetation stabilization of the channel bottoms and sides would be used where velocities were 4 feet per second (fps) or less. Rock rip-rap of the appropriate gradation, according to standard engineering practice, would be used where flow velocities were higher than 4 fps. Depth of permanent diversions would be sufficient to handle the flow resulting from a 100-year, 24-hour storm event in the uphill watershed without overtopping the diversion.

Solution ponds and other operational ponds no longer required after termination of operations would be filled or contoured to prevent the long-term collection of runoff. This would not apply to the tailings pond which would be reclaimed with sufficient freeboard to contain the design storm runoff from the tailings pond area itself and any uphill watershed that was not permanently diverted. Any permanent sediment ponds or traps would be constructed with stable overflows to prevent these features from washing out.

The uphill margins of the pits would be surrounded with berms placed during initial mining activities to divert uphill runoff from entering the pits. Any runoff collected within the pits is expected to infiltrate into the ground or evaporate. There should be no permanent bodies of standing water in the pits due to the fractured nature of the bedrock. There should be no discharge of water from the pits because they would not have any outlets to the surrounding terrain.

2.2.7.9 Erosion and Sediment Control

The goals of erosion and sediment control efforts during reclamation would be to prevent topsoil from being lost offsite through erosion, to store available water in the form of soil moisture thereby enhancing revegetation efforts, and to prevent degradation of downstream water quality.

The precipitation regime in the Cortez operations areas results in little annual runoff. Most runoff would be expected to occur as a result of short, intense and isolated thunderstorms that occur in the summer months. Runoff also occurs from spring snowmelt, although peak flows, and therefore potential for erosion and sediment transport, would normally be lower than for the thunderstorm events.

Runoff from the reclaimed waste rock dumps, tailing dam, heap leach, and other slopes would occur only as a result of direct precipitation on them; there would be no upstream contributing areas. The slopes would generate minimal or negligible runoff due to the increased water-holding capacity of the regraded and topsoiled surfaces, and their gentler slopes. Any runoff that did occur on the slopes has the potential to erode the surface and carry this material to the base of the slopes. Most of the eroded material would be deposited near the base of the slopes on the more gradual natural terrain. Some of the runoff from the slopes would be collected in the ephemeral drainage channels below the toes of the slopes where silt fences or hay bale sediment traps would be constructed to collect any sediment. These would be maintained in operating condition after reclamation construction until the reclamation of the slopes was considered by the BLM to be completed.

Erosion of the flatter surfaces like the tops of the dumps and the reclaimed tailings pond surface should be minimal due to the flat slopes and vegetation cover. During the time that the vegetation was becoming established on these surfaces, inspections of the property would determine if any erosion or sediment control methods should be employed.

2.2.7.10 Topsoiling and Surface Preparation

At the time of reclamation the topsoil would be sampled and analyzed for soil fertility characteristics including pH, conductivity, phosphorous, potassium, iron, zinc, and nitrogen. The test results would be used to determine the types and addition rates of fertilizers, if necessary. Fertilization methods and rates would be in accordance with BLM standards. These standards will be determined by NDEP and BLM and will be available by summer 1993.

During grading operations, the graded surfaces would be left in a loose, uncompacted state. Compacted surfaces not requiring regrading would be scarified to a minimum depth of 8 inches to loosen compacted materials. Any scarifying or ripping operations would be conducted along the contour whenever possible.

During reclamation, the topsoil would be hauled to the graded and scarified areas scheduled for topsoiling. It would then be spread to a uniform thickness with bulldozers. Spreading the anticipated volume of available topsoil to a depth of 12 inches would allow coverage of approximately 353 acres, or about 67 percent of the dump, heap leach, road, and tailings pond areas included in this proposed action. The depth of topsoil spread over certain areas could be less than 12 inches which would increase the area topsoiled. Based on the limited amount of topsoil available for reclamation, it is Cortez's and BLM's intent to concentrate the re-topsoiling efforts on areas where past experience has shown the most promise for successful reclamation. The actual limits of topsoil spreading would be determined following the topsoil salvaging operations. The areas that would be topsoiled during reclamation and the topsoil depths for these areas would be approved by BLM.

The topsoil spreading would be done in such a manner as to leave the finished surface in a rough, irregular configuration. Contour furrowing, discing, pitting, or dozer basins would be used as appropriate to increase moisture retention and reduce soil erosion. This would result in a hummocky surface which would create small microslopes and depressions with numerous aspects. This micro-topography would enhance the storage of runoff, provide for numerous microclimates to help establish colonies of plants, and encourage repopulation of the reclaimed areas by small mammals and reptiles.

2.2.7.11 <u>Revegetation</u>

All of the reclaimed surfaces would be revegetated to control runoff, reduce erosion, provide feed for wildlife and livestock, and reduce the visual impacts. Reclaimed surfaces would be fertilized prior to seeding with a dry diammonium phosphate fertilizer, should site specific soil tests indicate the need.

Seed would be spread with either a rangeland drill or with a broadcaster, depending upon accessibility. Seeding rate would be approximately 14 lbs pure live seed (PLS)/acre where drilled and approximately 28 lbs PLS/acre where broadcast methods were used. Seedbed preparation and seeding would take place in the fall after grading and topsoiling of reclaimed areas.

The seed mixture that would be applied upon reclamation is shown in Table 2.2-3. It reflects the goals of the post-mining land uses of grazing and wildlife habitat by providing forage and cover species similar to the pre-disturbance conditions. In addition, the vegetation's effectiveness in providing erosion protection; the ability to grow within the constraints of the low annual precipitation experienced in the region; its suitability for site aspect; and the elevation and soil type have also been considered in determination of the seed mix.

Revegetation would be considered a success based on establishment of seedlings in accordance with BLM and NDEP revegetation success criteria to be established by summer 1993. The revegetation success would be assessed by the BLM Authorized Officer prior to release of the bond.

Boundary fences (3- or 4-strand barbed wire), built to BLM standard specifications, would be erected around reclaimed areas to exclude livestock grazing on the reclaimed areas until vegetation was re-established and approved by the BLM.

2.2.7.12 Exploration Activities

There have been many drill holes installed in the Cortez area of operations during the course of exploring for and developing the ore bodies, environmental monitoring of leach pads and tailings pond cells, and water supply wells. Upon termination of all operations, and release from monitoring obligations by the NDEP, all drill holes and wells would be plugged in accordance with State regulations, NRS 534.420 to 534.428.

Exploration roads and pads involving cut and fill construction would be contoured by placing fill material into the cuts. The last part of the replaced fill typically would be topsoil material. Where cuts for road construction would be over three feet deep, the topsoil materials would be salvaged prior to cuttings. The salvaged topsoil materials would be placed on the regraded fills during reclamation. Reseeding with the specified seed mix would follow contouring.

All water wells would be plugged by a licensed well driller. Drill holes that were not wells would be plugged by a qualified driller. Plugging would consist of introducing drill cuttings, bentonite or cement as required by the regulations. Any casings protruding above the ground would be cut off below the ground surface and surface caps would be placed in the tops of the holes.

2.2.7.13 Reclamation Surety

Cortez has prepared a detailed estimate for the reclamation work included in this proposed action. The cost estimate reflects the potential contractor costs for each of the components of the reclamation as well as supervisory and administrative costs for the BLM and its engineering contractor. The total amount of the cost estimate is $1,780,852.

The surety to be posted by Cortez would be in a form acceptable to NDEP and BLM and will be held by the BLM.

2.2.8 Applicant Committed Practices

2.2.8.1 Control of Fugitive Dust from Roads and Disturbed Surfaces

Roads and disturbed surfaces within the mining and processing areas would be watered and if necessary treated with a dust suppression chemical. Magnesium chloride has been used effectively in the past by Cortez, and similar measures would be taken to control fugitive dust from the proposed project.

2.2.8.2 Sediment Control

Temporary sediment traps would be installed as necessary in the drainages in the project area to limit sediment movement. Flow dissipation and sediment control structures would be constructed in the diversion ditches at appropriate locations. Small sediment dams, designed for catching runoff and storing sediment from exposed and erodible surfaces, would be built prior to construction start-up in each area where they are deemed necessary. These structures would be maintained and cleaned out as often as necessary for as long as erodible surfaces were exposed. Small check dams and hay bale dams would be placed below slopes as temporary erosion control measure until revegetation was sufficiently established to provide a stabilized slope condition. In addition to the use of check dams, hay-bale dams, silt fences, and matting could be installed at strategic locations to limit sediment migration.

2.2.8.3 Spill Prevention and Containment Plan

Cortez has developed a detailed spill prevention plan as required by the NDEP to mitigate the potential impact of fuel and chemical spillage in the project area. Containments to prevent migration of spills and physical methods of neutralization and control would be used in the event of a spill. The plant site is designed to have secondary containment structures in the areas where potentially hazardous materials are stored or used. Heap leach process areas would also be lined and graded to drain into the pregnant solution pond.

In the unlikely event of a spill escaping the containment facilities, the following steps would be taken:

- The source of the spill would be immediately controlled and the shift foreman would be immediately notified;

- The shift foreman would investigate the spill, take those actions which are both appropriate and safe to stop the discharge at source and contain the spill, and report the conditions to the mill superintendent and/or other designated company officials as soon as possible, who would notify the appropriate agencies of a reportable spill;

- The facility would be repaired and returned to operation as soon as possible;

- The contaminated material would be excavated to the extent practical and tested for the level of contamination, and disposed of in accordance with State and federal requirements;

- The area would then be contoured and reclaimed;

- Remediation of a reportable spill would be reviewed for approval prior to and upon completion by all appropriate agencies.

2.2.8.4 Monitoring

The heap leach and tailings disposal facilities would be monitored as required by the NDEP. A leak detection system would be installed at the heap leach facility and a ground water monitoring network would be established for the tailings facility. A monitoring schedule would be established with the appropriate regulatory agencies prior to operation. The response and action levels to be implemented for various volumes of any leakage detected would conform to Nevada state regulations.

2.2.8.5 Ground Water Monitoring Program

The current monitoring network at Cortez consists of 47 permanent ground water monitor wells and 15 temporary monitor wells, located at various points around the existing tailings and heap leach facilities. Well water samples and ground water elevations of monitor wells are taken once a month by Cortez. The well samples are analyzed for total alkalinity, pH, free cyanide, and gold. Well water samples are sent to an outside laboratory on a quarterly basis for WAD cyanide analysis. These quarterly analytical results are reported to the NDEP.

2.3 REASONABLY FORESEEABLE PROJECTS

Certain additional mine development activities are anticipated but are not scheduled for development under the Proposed Project. These are presented in Section 5.0 in order to describe reasonably foreseeable projects which need to be considered as potential contributors to cumulative impacts.

2.4 PROJECT ALTERNATIVES

The Proposed Project includes expanding existing open pit mines, constructing new heap leach waste rock dumps and tailings facilities, and exploration. Some changes are also proposed to existing processing facilities, including raising of Tailings Pond No. 6 and heap leach facilities expansion. As a result, feasible alternatives for facility locations are limited, because existing processing facilities and open pits are in place and new open pit locations are determined by ownership and location of ore bodies.

The range of alternatives considered in this EIS therefore consists primarily of operational alternatives and alternative components of the project rather than location alternatives for the entire project. In this alternatives evaluation the following factors were considered: public or agency issues/concerns; technical and economic feasibility; potential environmental advantage and, ability to meet the purpose and need stated by the applicant.

Based on the initial screening of alternatives no feasible alternatives were retained for detailed analysis. The sections below discuss the reasons that various alternatives considered were eliminated from detailed analysis. The no action alternative is also addressed.

2.4.1 Alternatives Considered in Detail

2.4.1.2 No Project Alternative

Under the No Project Alternative, Cortez would not expand the existing Gold Acres pit or construct the new processing facilities. Instead it would continue to mine ore from the various existing pits as authorized by existing approvals. However, Cortez' mining and mineral processing operations would run out of ore sometime in 1994, resulting in a closure of operations.

For purposes of this EIS, the No Project Alternative would result from the BLM's disapproval of Cortez' 1990 Plan of Operations. However, other circumstances such as a drop in gold prices or the application of some future legislation could also potentially result in mine closure. The objective of the No Project Alternative is to describe the environmental consequences that would result if the proposed project is not implemented, in order to assist EIS readers to evaluate the consequences from the proposed project.

2.4.2 Alternatives Eliminated From Detailed Consideration

2.4.2.1 Alternative Locations for Project Facilities

Two waste rock dump areas were eliminated at Gold Acres after condemnation drilling results indicated the presence of gold mineralization. This would prevent feasible mining at this location. The waste rock dump was moved to its presently proposed location south of the Old Gold Acres Pit.

The location for the Gold Acres heap leach facility was moved from its original proposed location, near the existing facility, due west. This was the third area selected, the prior two were eliminated once again due to the presence of gold mineralization.

Two sites were considered for the placement of Tailings Pond No. 7. The initial site was located to the east of the existing leach pads at the Cortez Mill Site. The initial site was rejected for the presently proposed site adjacent to the east side of Tailing Pond No. 6. The second site was chosen due to the fact that groundwater is very shallow in the Cortez area and existing tailings facilities have impacted the shallow groundwater acquifer; hence, the decision was made to keep all tailings facilities in the same area, which should minimize future groundwater impacts. Construction of Tailings Pond No. 7 adjacent to Tailings Pond No. 6 also appears to be less costly.

2.4.2.2 Operational Alternatives

Several alternatives involving alternative operational techniques have been suggested during the scoping and review process. These are discussed below with the reasons for their elimination from further analysis.

- One suggestion was to decrease the high wall pit angle in order to end up with a shallower slope. Pit slopes are determined by slope stability, configuration of the ore body and accessibility. They are designed reasonably steep in order to minimize the overburden removal required to uncover the ore. A shallower slope would reduce the amount of minable ore and increase the cost to mine the ore body. The net effect would be a larger waste volume (more to reclaim) for fewer tons of ore and more acres of disturbance.

  Each open pit would have to be evaluated independently in order to measure the economic impact of a slope change. However, the cost to reduce the slope significantly would be detrimental to the economics of most open pit operations. For ease of calculations consider an open pit the shape of a right circular cone. If this pit is 300 feet deep with a base radius of 100 feet, a 10 degree change in the pit wall angle would double the volume of the waste generated. Only the highest grade ore bodies would withstand such an impact.

- Another suggestion was for Cortez to construct fences around the perimeter of the open pits. Presently, berms are constructed around the open pits to prevent access to the high wall crests.

- A suggestion to use explosives to blast high walls in order to reduce the slope angle and create a talus slope would have similar economic effects of mining at a shallower slope. Other draw backs include safety and technology available to accomplish the expected result.

2.4.2.3 Sequential Filling of Existing Open Pits with Waste Rock

Regrading or backfilling of the pit was not considered as a feasible alternative for the following reasons. The limited working area of the proposed expanded pit would preclude partial backfilling during mining. Proposed mining would recover that resource which is currently economical to mine under current and forecasted market conditions. Additional resources which cannot currently be economically mined will remain in existing nearby pits and in the proposed expanded pit. It is not unreasonable to expect that these resources could be economically mined in the future with improved market conditions or advances in mining technology which would significantly reduce mining costs. Backfilling pits, in whole or in part would further limit future resource recovery and is not proposed.

2.5 SUMMARY AND COMPARISON OF IMPACTS FROM PROPOSED PROJECT AND ALTERNATIVES

A summary of the impacts associated with the implementation of the Proposed Action and the No Action Alternative is provided in Table 2.5-1. This summary includes project specific impacts and the contribution of project impacts to the total cumulative impact estimated for the cumulative study area. Detailed evaluation and discussion of project impacts are contained in Section 4.0 of this document. Evaluation and discussion of cumulative impacts are presented in Section 5.0.

TABLE 2.1-1

SUMMARY OF PLANS OF OPERATIONS AND ENVIRONMENTAL ANALYSIS DOCUMENTS FOR CORTEZ GOLD MINES 1981-PRESENT

(Page 1 of 3)

Plan date	Plan Case File No. General Location BLM Administration	Description of Operation	Prop. Acres	Environ. Assessment No./ROD	Plan Approval date	Comments and Remarks
3-30-81	N64-81-001P Cortez Mine/Cortez Canyon BLM-Battle Mtn	East pit, Horse Canyon pit, waste dumps, heap leach pad, leach ponds, mill, tailings disposal, lab, shop, 17 mile haul road + other ancillary facilities.	1857	N64-EA1-47 by Neal Brecheisen, BLM Geologist	8-11-1981 Letter of Authorization on post 1981 disturbance.	Existing operation when 3809 regulations became effective. Cortez submitted a plan of operation as required by regulations.
5-10-84	N64-81-001P Amendment #1 Cortez Mine/Cortez Canyon BLM-Battle Mtn	Construction of additional tailings cell/pond and surrounding access roads, monitoring wells.	105	Undocumented	10-22-86	Phone conversation records in case file indicate Area Manager verbal approval 10-22-86
8-86	N14-81-001P Horse Canyon/Mt Tenabo BLM-Elko	South Extension pit, South Silicified pit, waste dumps.	55.8	Undocumented	10-16-86 Letter of Authorization	
3-19-87	N14-81-001P Amendment #1 Horse Canyon/Mt Tenabo BLM-Elko	Access and drill road construction and drilling.	5			
8-12-87	N64-87-010P Cortez Canyon/Pixie area BLM-Battle Mtn	construction and drilling.	10	N64-EA7-46 by Ahmed Mohsen, BLM Geologist	10-26-87 Letter of Authorization	Exploration activities were conducted under Notices up to then. An exploration Plan was required for Cortez' exploration and assessment work on unpatented mining claims.
8-17-87	N64-87-010P Amendment #1 Gold Acres area/N.Shoshone BLM-Battle Mtn	Exploration:Access and drill road construction and drilling	5	N64-EA7-57 by Ahmed Mohsen, BLM Geologist	9-28-87 Letter of Authorization	Additional exploration activities on claims held by Cortez.
11-9-87	N64-87-010P Amendment #2 Gold Acres area/N. Shoshone BLM-Battle Mtn	Exploration:Access and drill road construction and drilling	1	N64-EA8-13 by Ahmed Mohsen, BLM Geologist	12-3-87 Letter of Authorization	Additional exploration activities on claims held by Cortez.
11-19-87	N64-87-010P Amendment #3 Cortez Canyon area BLM-Battle Mtn	Exploration:Access and drill road construction and drilling	1	N64-EA8-16 by Ahmed Mohsen, BLM Geologist	12-14-87 Letter of Authorization	

TABLE 2.1-1

SUMMARY OF PLANS OF OPERATIONS AND ENVIRONMENTAL ANALYSIS DOCUMENTS
FOR CORTEZ GOLD MINES 1981-PRESENT
(Page 2 of 3)

Plan date	Plan Case File No. General Location BLM Administration	Description of Operation	Prop. Acres	Environ. Assessment No./ROD	Plan Approval date	Comments and Remarks
5-10-88	N14-81-001P Horse Canyon/Mt Tenabo Amendment #1 BLM-Elko	Exploration:Access and drill road construction and drilling	1	Undocumented		Additional exploration activities on claims held by Cortez
5-17-88	N64-87-010P Amendment #4 Cortez Canyon area BLM-Battle Mtn	Exploration:Access and drill road construction and drilling	1	N64-EA8-65 by Ahmed Mohsen, BLM Geologist	6-13-88 Letter of Authorization.	Additional exploration activities on claims held by Cortez
6-13-88	N64-87-010P Amendment #5 Cortez Canyon area BLM-Battle Mtn	Exploration:Access and drill road construction and drilling	1	N64-EA8-83 by Ahmed Mohsen, BLM Geologist	8-16-88 Letter of Authorization	Additional exploration
6-29-88	N14-81-001P Amendment #2 Four Mile area/Mt Tenabo BLM-Elko	Exploration:Access and drill road construction and drilling	1.32	Undocumented	Letter of approval	
7-12-88	N14-81-001P Amendment #3 Upper Mill Cy/Mt Tenabo BLM-Elko	Exploration:Access and drill road construction and drilling	1	Undocumented	8-2-88 Letter of approval	
7-18-88	N64-87-010P Amendment #6 Cortez Canyon/Pixie area BLM-Battle mtn	Access and drill road construction and drilling	12	N64-EA8-91 by Ahmed Mohsen, BLM Geologist	10-3-88 Letter of Authorization	
10-6-88	N64-86-001P Amendment # 2 Gold Acres Mine/N. Shoshone BLM-Battle Mtn	Expansion of waste dumps and processing of old leached ore piles.	Undocumented	N64-EA9-11 by Ahmed Mohsen, BLM Geologist	11-25-88 Letter of Authorization	Extension of waste dumps and remaining of old ore stockpiles
1-23-89	N64-81-001P Amendment #2 Cortez Mine/Cortez Canyon BLM-Battle Mtn	Development of the ADA 52 deposit and pit and waste dump expansion.	75	N64-EA9-34 by Ahmed Mohsen, BLM Geologist		

TABLE 2.1-1

SUMMARY OF PLANS OF OPERATIONS AND ENVIRONMENTAL ANALYSIS DOCUMENTS FOR CORTEZ GOLD MINES 1981-PRESENT
(Page 3 of 3)

Plan date	Plan Case File No. General Location BLM Administration	Description of Operation	Prop. Acres	Environ. Assessment No./ROD	Plan Approval date	Comments and Remarks
Plan date	Plan Case File No. General Location BLM Administration	Description of Operation	Prop. Acres	Environ. Assessment No./ROD	Plan Approval date	Comments and Remarks
4-19-89	N64-87-010P Amendment #7 Cortez Canyon/Pixie area BLM-Battle Mtn	Access and drill road construction and drilling.	5	N64-EA8-91 by Ahmed Mohsen, BLM Geologist	5-2-89 Letter of Authorization	Previous plan proposed 12 acres only 7 were conducted. Cortez shifted remaining acreage to an adjacent location that is of similar affected environment.
4-27-89	N64-81-001P Amendment #3 Cortez Mine area F-Canyon project BLM-Battle Mtn	Mining F-Canyon pit and waste dumps.	60	N64-EA0-17 by Ahmed Mohsen, BLM Geologist	2-8-90 Letter of Authorization	Development of the F-Canyon pit to increase amount of oxide ore to mill until roaster comes on line.
11-29-88	N64-87-010P Amendment #8 Cortez Canyon area BLM-Battle Mtn	Access and drill road construction and drilling	10	N64-EA9-25 by Ahmed Mohsen, BLM Geologist	3-14-89 Record of Decision	A 1500 acre exploration target under Cortez' control was identified. Programmatic EA to cover exploration activities as submitted by Cortez and approved by BLM.
5-3-90	N64-87-010P Amendment #9 Cortez Canyon+Gold Acres area BLM-Battle Mtn	Access and drill road construction and drilling	5	Tiering on existing EA for the project area	9-17-90 Record of Decision	Administratively determined to be within the scope of previously prepared EAs for the project area.

TABLE 2.1-2

CHEMICAL REAGENTS USED FOR MILLING AND HEAP LEACH OPERATION

Reagent	Form
Sodium Cyanide	briquette
Lime	pebble
Baroid S35 Antiscalant	liquid
Diatomite FW18	granule
Caustic Soda	granule
Muriatic Acid	liquid
Sodium Hypochlorite	liquid
Hydrogen Peroxide	liquid
Sulfuric Acid	liquid
Sodium Carbonate	pebble
Flocculant[1]	powder
Hydrochloric Acid	liquid
Sodium Hydroxide	liquid

[1] Flocculants used include Thatcher Polymer T-Floc, A-830, Nalco Nuclear 9708, DULV Flocculant D8D.

Note: Sodium hypochlorite, hydrogen peroxide, and sulfuric acid are used as neutralizers and are kept onsite in cases of emergencies.

TABLE 2.1-3

1990 PROJECT MAJOR EQUIPMENT LIST

Unit	Number
13.5 cy loader	2
7.5 cy loader	1
5.3 cy loader	2
11.0 cy shovel	1
85 ton truck	6
50 ton truck	4
40 ton truck	3
50 ton tractor/trailer	2
10,000 gal. water truck	1
12,000 gal. water truck	1
40,000 lb blasthole drill	3
air track drill/compressor	1
ANFO blasting truck	2
track dozer	4
rubber tie dozer	1
motor grader	3

TABLE 2.2-1

SUMMARY OF PROPOSED DISTURBANCES (ACRES)

Area	Pit	Waste Rock	Other	Reclamation*	Total
Cortez					
Waste Rock Dump Expansion	--	--	--	1	1
Tailing Pond No. 7	--	--	81	--	81
Heap Leach Facilities	--	--	49	12	61
Gold Acres					
Pit Expansion	1	--	--	--	1
Waste Rock Dumps	--	196	--	64	260
Heap Leach Facilities	--	--	6	--	6
Roads	--	--	9	--	9
Exploration					
Cortez	--	--	6	--	6
Gold Acres	--	--	3	--	3
Totals	1	196	154	77	428

* Reclamation area is area disturbed to accomplish reclamation.

TABLE 2.2-2

PROPOSED TOPSOIL REMOVAL AREAS AND VOLUMES

Component	New Disturbance[a] (Acres)	Mined Land Disturbance	Soil Depth (Inches)	Topsoil Volume (Cubic Yards)
Gold Acres Pit	1	84	0	807
Gold Acres Waste Rock Dumps	260	39	0-14	450,695
Gold Acres Haul Road	0	9	0	0
Gold Acres Exploration	3	0	4	1,600
Gold Acres Heap Leach Facilities	6	45	15	12,101
Cortez Tailing Pond No. 7	81	29	0-21	261,273
Cortez Heap Leach Pad	61	0	0-11	196,936
Cortez Waste Rock Dump	1	32	3	3,227
Cortez Exploration	6	0	0-6	2,400
TOTAL	419	238		929,039[b]

[a] This amount varies from the amount on Table 2.2-1 because of the lack of top soil that would be removed from the Gold Acres Haul Road.

[b] 30 percent loss due to equipment capability to recover material on steep and rocky terrain = 929,039 x 0.70 = 650,327

TABLE 2.2-3

RECOMMENDED REVEGETATION SEED MIXTURE

Species	Common Name	PLS lbs/acre
Agropyron trichophorum	pubescent wheatgrass	1
Agropyron cristatum	ephraim crested wheatgrass	2
Elymus cinereus	basin wildrye	2
Sitanion hystrix	bottlebrush squirreltail	1
Oryzopsis hymenoides	indian ricegrass	1
Atriplex canescens	fourwing saltbush	2
Medicago sativa	Ladak alfalfa	2
Purshia tridentata	bitterbrush	1
Onobrychis viciaefolia	sainfoin	2
	Total	14

TABLE 2.5-1

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND NO ACTION ALTERNATIVES

(Page 1 of 7)

Resource/ Potential Impact	Mitigation	Proposed Action: Project Impacts	Proposed Action: Contribution to Cumulative Impacts	No Action
Air Quality				
Point Source Emissions from ore processing.	None required beyond controls included in project design.	No violations of ambient 24-hour or annual SO_2 standards. No violations of ambient 24-hour or annual PM_{10} standards. No significant impact.	No significant contributions to 24-hour or annual Total Suspended Particulates in the Crescent Valley Air Basin.	Continued mining and processing for 2-3 years. No additional impact.
Fugitive Dust Emissions (PM_{10}) from open pit expansion, and exploration.	None required beyond control measures included in project design.	No violations of state or federal ambient PM_{10} standards. No significant impact.	No significant contribution to cumulative PM_{10} levels resulting from reasonably foreseeable future activities.	Continued mining and processing for 2-3 years. No additional impact.
Geology, Minerals, and Paleontology				
Structural damage from geologic hazards or storm events.	None required beyond design and reclamation measures included in project design.	Leach pads, ponds, pit walls, and waste rock dumps would be designed to prevent significant structural damage and increased sediment transport caused by seismic or storm events.	Insignificant.	No additional impacts.
Impact to Future Mineral Exploration.		No long-term impacts to mineral exploration.	Insignificant.	No additional impact.
Impact to Paleontological Resources.		No resources identified.	No resources identified.	No resources identified.

TABLE 2.5-1

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND NO ACTION ALTERNATIVES

Resource/ Potential Impact	Mitigation	Proposed Action: Project Impacts	Proposed Action: Contribution to Cumulative Impacts	No Action
Soils and Topography				
Soil Disturbance and Loss	None beyond topsoil salvage and reclamation proposed in project design.	Additional 428 acres of soil disturbance from disturbed areas including growth medium stockpiles and roads. No sedimentation of perennial waters and no significant impacts.	About 8,500 of disturbed soils are expected from all projects in cumulative analysis. The proposed project contributes about 5% of cumulative impact. This is considered insignificant.	No additional impact.
Areas to be reclaimed	Reclamation efforts should be monitored longer than 3 years specified in standard reclamation procedures. Based on monitoring, additional seedbed preparation and reseeding may be implemented.	Shortfall in topsoil available from salvaging. About 25 acres would not be topsoiled. Failure of reclamation due to lack of topsoil considered a significant impact.	Shortfall of topsoil is also a significant cumulative impact because topsoil in the cumulative study area is also very limited.	Areas disturbed by approved operations would be reclaimed.
Water Resources				
Sedimentation of perennial and ephemeral streams.	None beyond erosion control and reclamation procedures in project design.	Additional sedimentation in ephemeral drainages considered insignificant.	Project impacts are localized and do not impact surface water or groundwater associated with projects considered in the cumulative analysis.	No additional impact.

TABLE 2.5-1

SUMMARY AND COMPARISON OF IMPACTS FROM
THE PROPOSED ACTION AND NO ACTION ALTERNATIVES

(Page 3 of 7)

Resource/ Potential Impact	Mitigation	Proposed Action: Project Impacts	Proposed Action: Contribution to Cumulative Impacts	No Action
Change in surface water or groundwater quality.	None required beyond zero-discharge requirements and design measures included in the project.	No decreases in water quality or increases in extent of existing plume are anticipated.	Same as above.	Existing groundwater plume will be remediated under direction of the Nevada Department of Environmental Protection.
Accidental release of hazardous materials to surface or groundwater.	None beyond implementation of spill prevention and containment plan included in project design and plan of operations.		Same as above.	Risk of release same as proposed action until 1994 when operations would cease.
Depletion of aquifers that supply domestic or agricultural water.	None.	Dewatering is local with no effect to other groundwater users.	Same as above.	No additional impact.
Vegetation				
Disturbance to common vegetation types.	None required beyond reclamation measures included in project design.	Additional 428 acres of disturbance to common types such as shadescale/sagebrush and sagebrush/grass.	About 8,500 acres of disturbance are expected from other projects in the cumulative analysis. The proposed project contributes 5% of the cumulative impact. This is considered insignificant.	No additional disturbance beyond that already approved. Reclamation would proceed as specified in approved plans of operations.
Disturbance to sensitive communities or special status species.	None required.	No impacts to wetlands, riparian communities, or threatened or endangered species.		

TABLE 2.5-1

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND NO ACTION ALTERNATIVES

(Page 4 of 7)

Resource/ Potential Impact	Mitigation	Proposed Action: Project Impacts	Proposed Action: Contribution to Cumulative Impacts	No Action
Wildlife Resources				
Removal of moderate to low quality wildlife habitat.	None required beyond reclamation measures included in project design.	Additional disturbance to 428 acres of wildlife habitat represents a loss of about 100 mule deer AUMs and about 125 antelope AUMs. This is considered insignificant.	Project disturbance contributes less than 5% of total cumulative impact. No significant impact.	No additional impacts.
Indirect impacts due to traffic, noise, and human presence.		Approximately 1,487 acres would be indirectly impacted by mining activities in a zone of disturbance surrounding project features. Approximately 1,197 acres would be indirectly disturbed by exploration activities. Neither impact is considered significant.	Project disturbance contributes less than 5% of total cumulative impact. No significant impact.	No additional impacts.
Disturbance to critical wildlife habitat or special status species.	None required.	No critical habitat or special status species would be affected.	No contribution to cumulative impacts.	No additional impacts.

TABLE 2.5-1

SUMMARY AND COMPARISON OF IMPACTS FROM
THE PROPOSED ACTION AND NO ACTION ALTERNATIVES

(Page 5 of 7)

Resource/ Potential Impact	Mitigation	Proposed Action: Project Impacts	Proposed Action: Contribution to Cumulative Impacts	No Action
Cyanide toxicity in surface waters and tailings pond.	Monitoring and other permit conditions for Industrial Pond System Permit.	Acute toxicity in tailings pond not likely because cyanide levels will be kept below acute toxicity levels. Chronic toxicity in tailings pond is a potential significant impact because chronic effects are not easily monitored. No significant impacts from accidental release to surface waters are expected.	Contribution to chronic toxicity could be significant for species such as waterbirds, which may contact cyanide containing water at other nearby facilities.	No additional impacts.
Recreation and Wilderness				
No impacts are anticipated.	None required.	No impacts anticipated.	No significant contribution to cumulative impacts, although other cumulative projects will generate impacts.	No additional impact.
Visual Resources				
Contrast to existing landscape.	None required beyond recontouring and revegetation included in reclamation procedures.	Short-term impacts from waste dumps, heap leach pads, and haul roads. These would be consistent with VRM Class IV objectives. Long-term impacts not significant after reclamation.	Other projects in the cumulative study area are outside the Cortez viewshed. No significant cumulative impacts.	No additional impacts.

TABLE 2.5-1

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND NO ACTION ALTERNATIVES

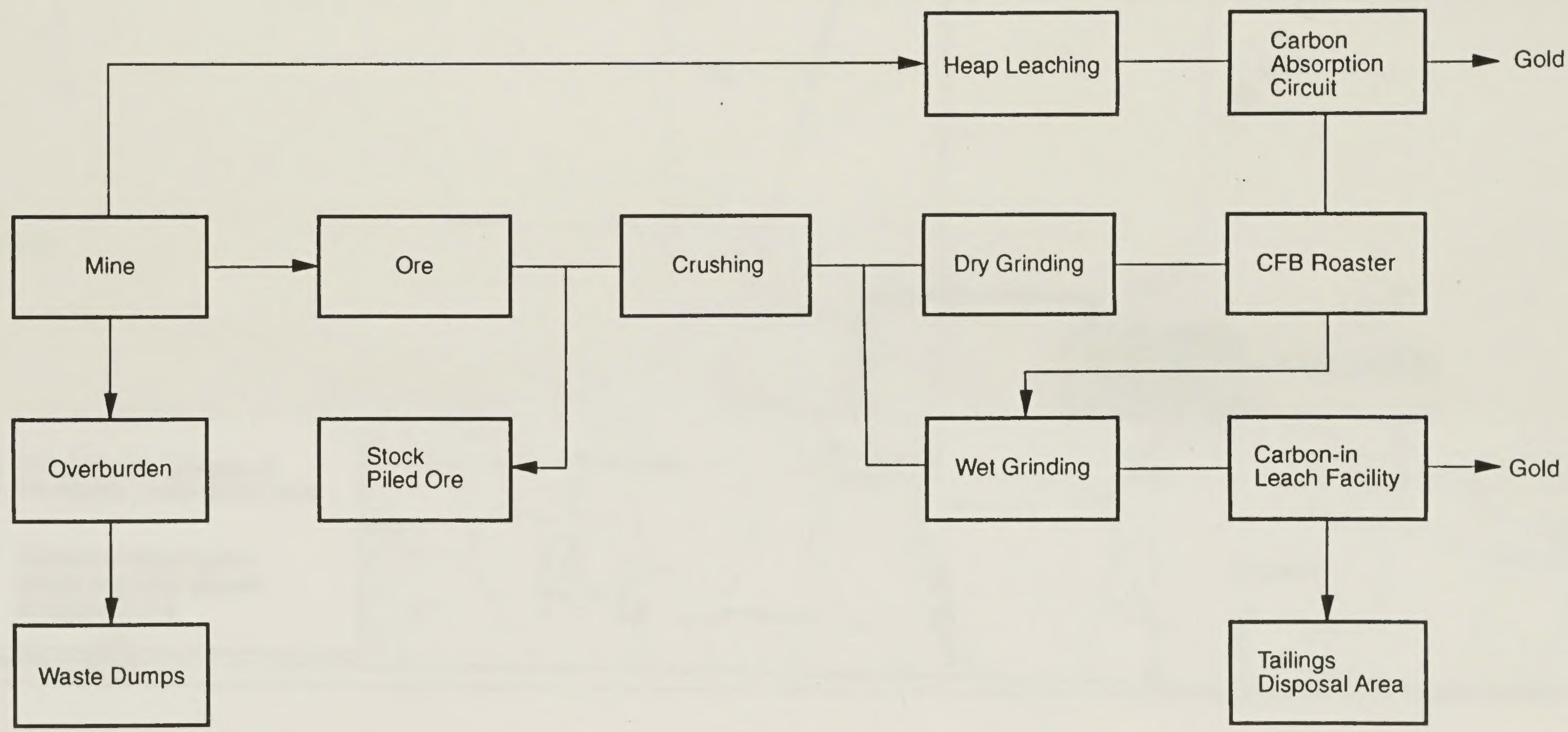
(Page 6 of 7)

Resource/ Potential Impact	Mitigation	Proposed Action: Project Impacts	Proposed Action: Contribution to Cumulative Impacts	No Action
Social and Economic				
Demand on schools and other public services and facilities.	None required beyond any voluntary agreements between the applicant and counties affected.	No change in the number of people employed by applicant. Therefore no increase in demand on schools and other infrastructure.	Project would continue to contribute to a significant regional cumulative impact resulting from demand on schools and infrastructure in Elko that is not balanced by distribution of revenues generated by mining activities outside of Elko County.	Demand on schools and infrastructure would continue until current operations cease.
Tax revenues to local counties of Elko, Eureka, and Lander.	None required.	Additional revenues for Eureka and Lander counties would be generated because of increase in assessed valuation.		Additional revenues would not be generated and current revenues would cease in 2-3 years as current operations end.
Land Use/Livestock Grazing				
Loss of grazing lands.	None required.	Approximately 20 AUMs lost during mining activity. No significant impact.	Less than 5% of total cumulative loss of AUMs. No significant impact.	No additional impact.

TABLE 2.5-1

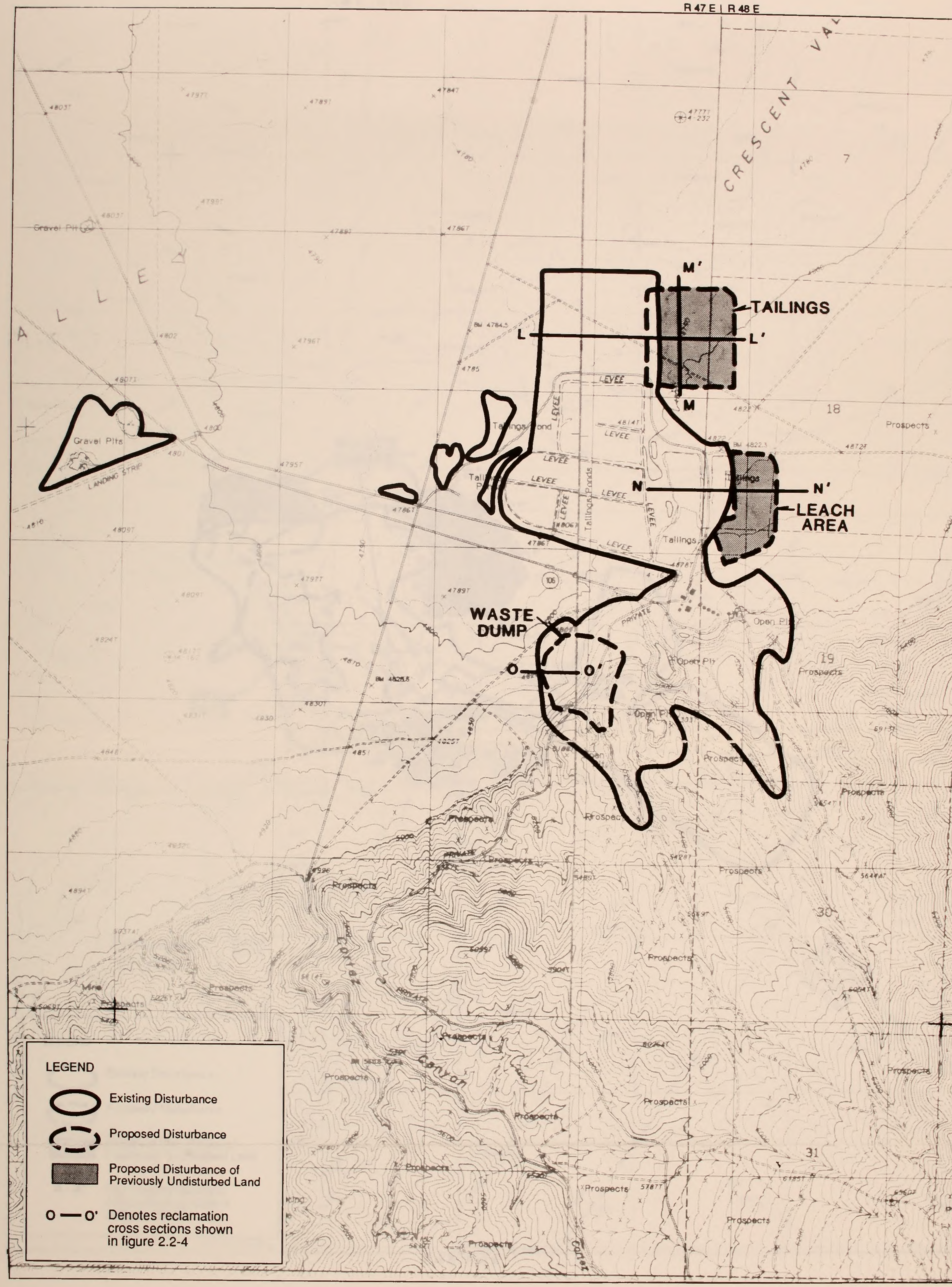
SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND NO ACTION ALTERNATIVES

Resource/ Potential Impact	Mitigation	Proposed Action: Project Impacts	Proposed Action: Contribution to Cumulative Impacts	No Action
Cultural Resources				
Sites eligible for National Register of Historic Places.	None required. BLM has satisfied requirements of Section 106 requirements of NHPA.	Two historic and three prehistoric sites affected. No significant impacts because none of the five sites are eligible for NRHP.	Proposed action contributes less than 2% of total cumulative non-significant prehistoric cultural resources and no loss of significant prehistoric resources. Loss of non-significant historic resources is less than 13% of total cumulative and there would be no loss of significant historic resources.	No additional impact.
Impacts to Native American traditional or religious features or values.		No significant direct impacts. Continued presence of mining in viewshed of Mt. Tenabo considered an indirect impact.	The proposed action represents a significant portion of the total cumulative presence in the viewshed of Mt. Tenabo.	No additional impact.



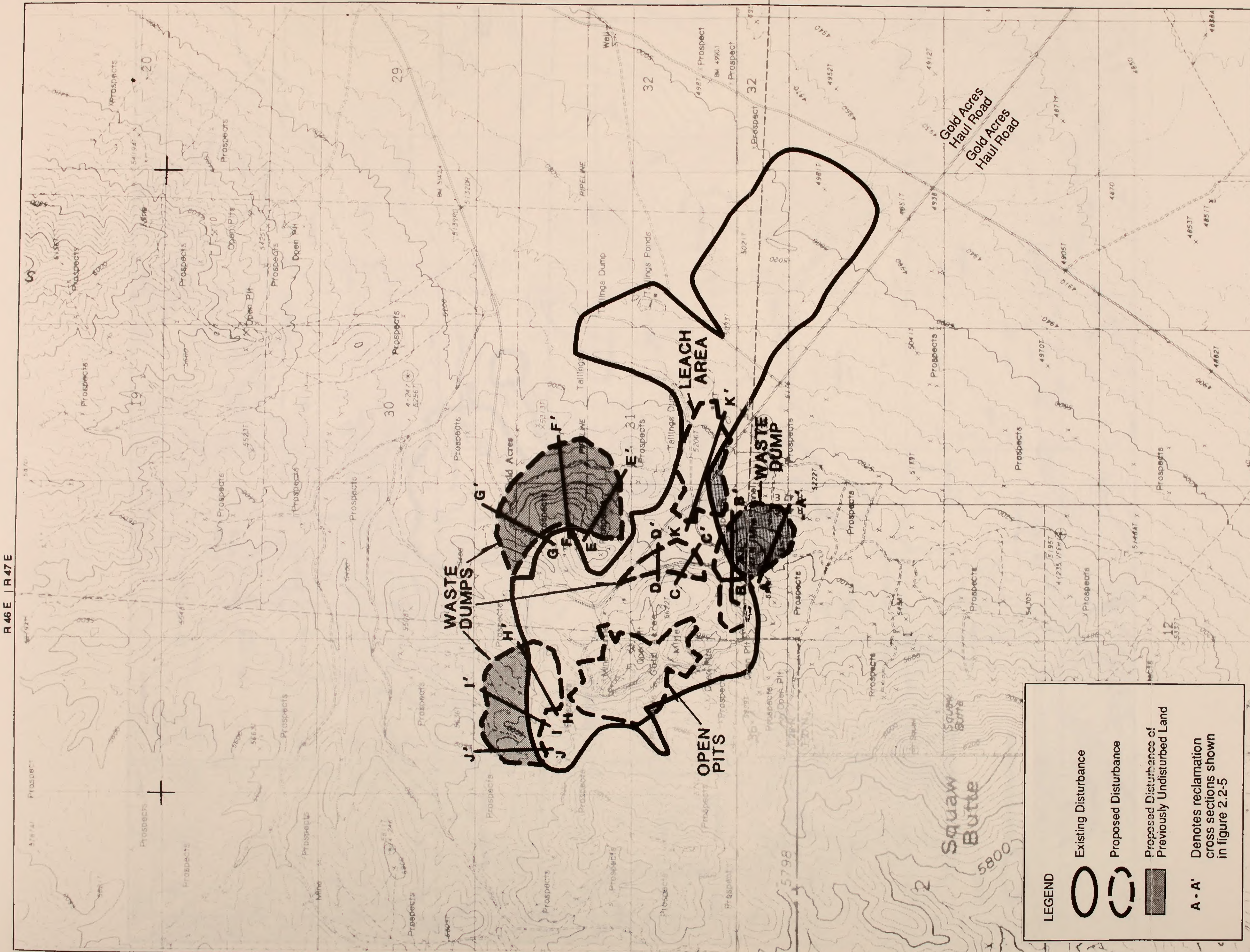
Project No. 90C0489A	Cortez EIS	SIMPLIFIED GOLD PRODUCTION PROCESS	Figure 2.0-1

90C0489A-9010/071392



Project No. 90C0489A	Cortez EIS	EXISTING AND PROPOSED DISTURBANCE, CORTEZ	Figure 2.1-1

90C0489A-3000/090492



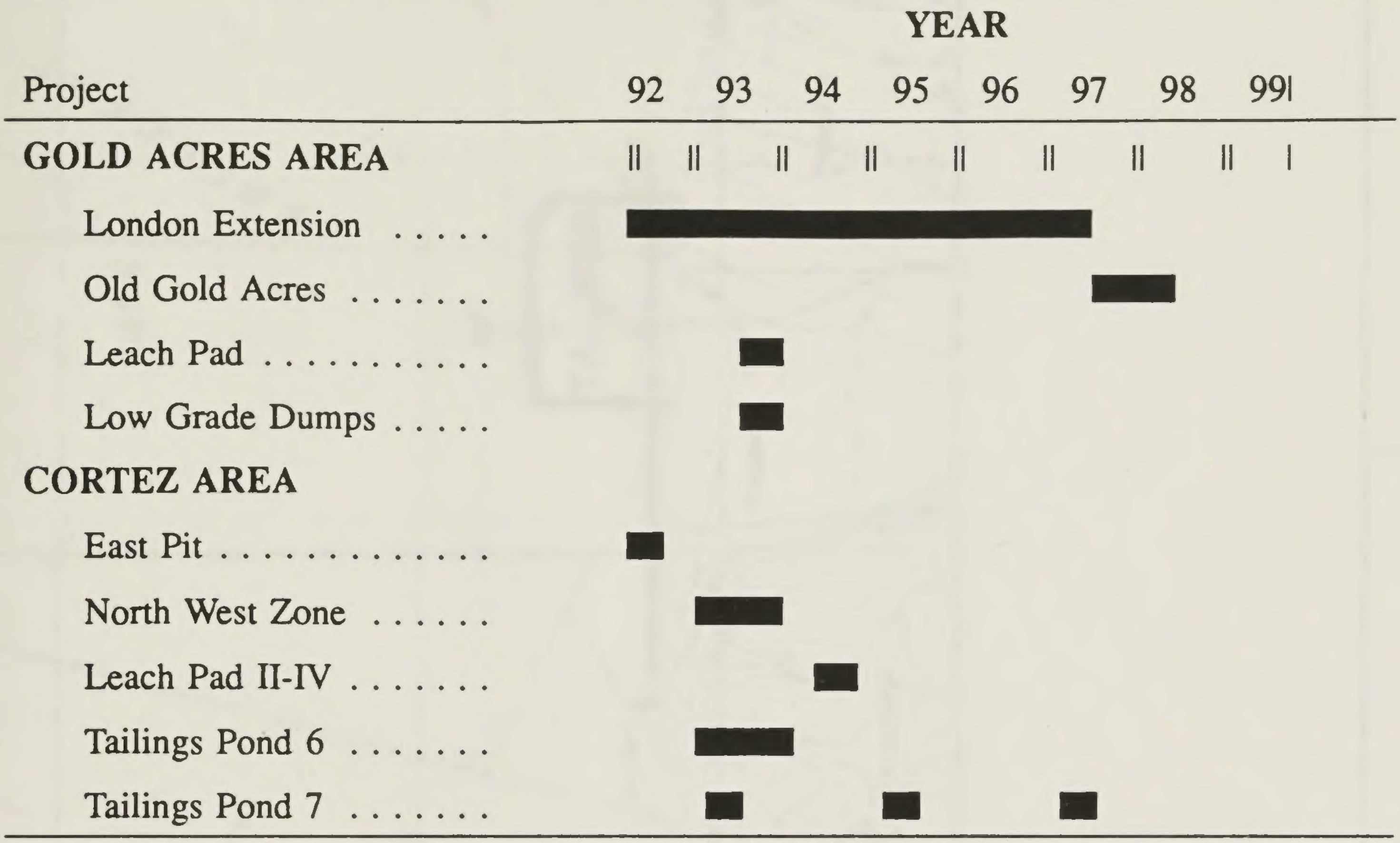
Project No. 90C0489A | Cortez EIS | EXISTING AND PROPOSED DISTURBANCE, GOLD ACRES | Figure 2.1-2

90C0489A-3000/090492

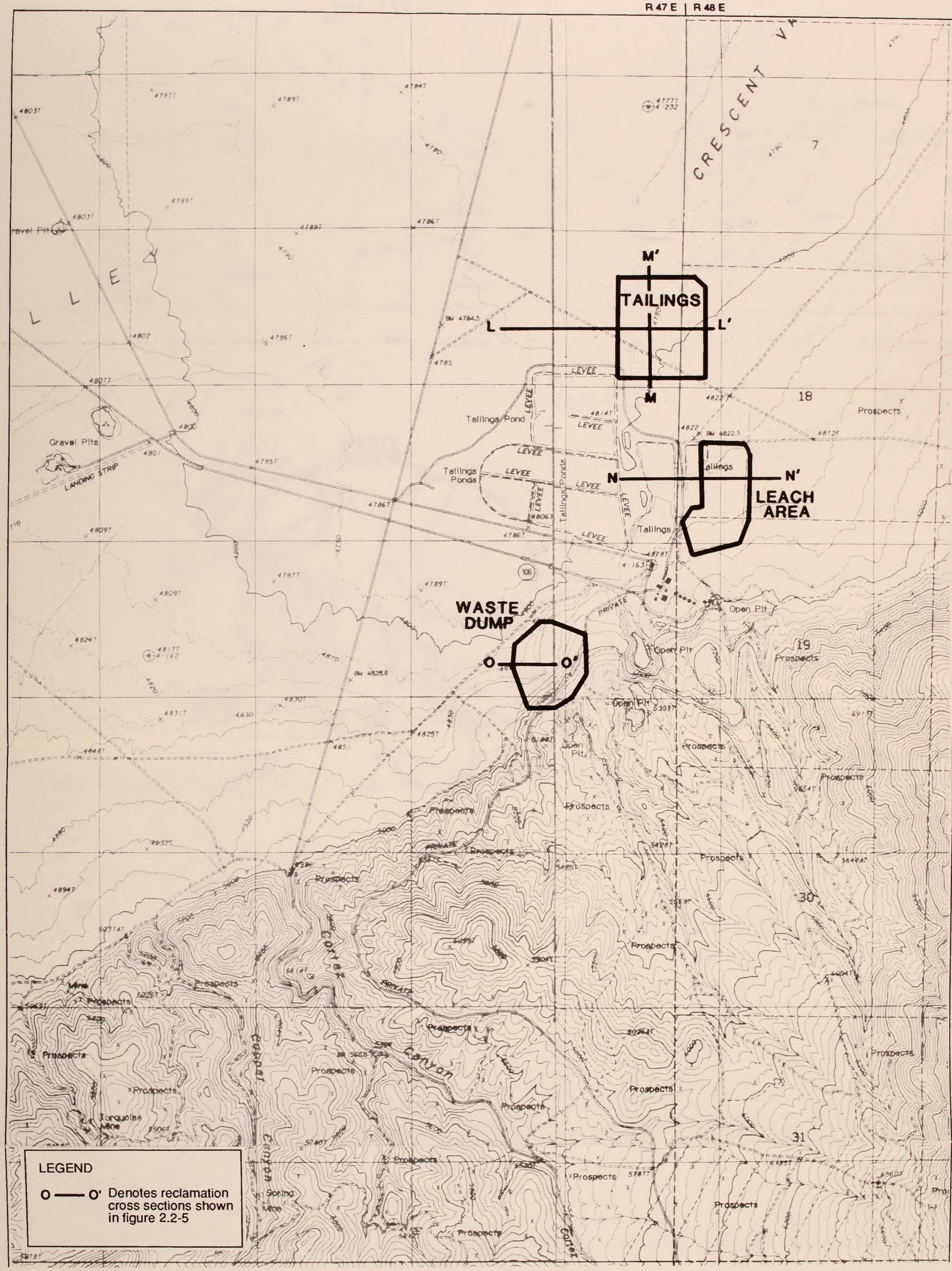
Project No. 90C0489A	Cortez EIS	EXISTING DISTURBANCE, HORSE CANYON	Figure 2.1-3

Figure 2.2-1

PRODUCTION AND CONSTRUCTION TIMELINE

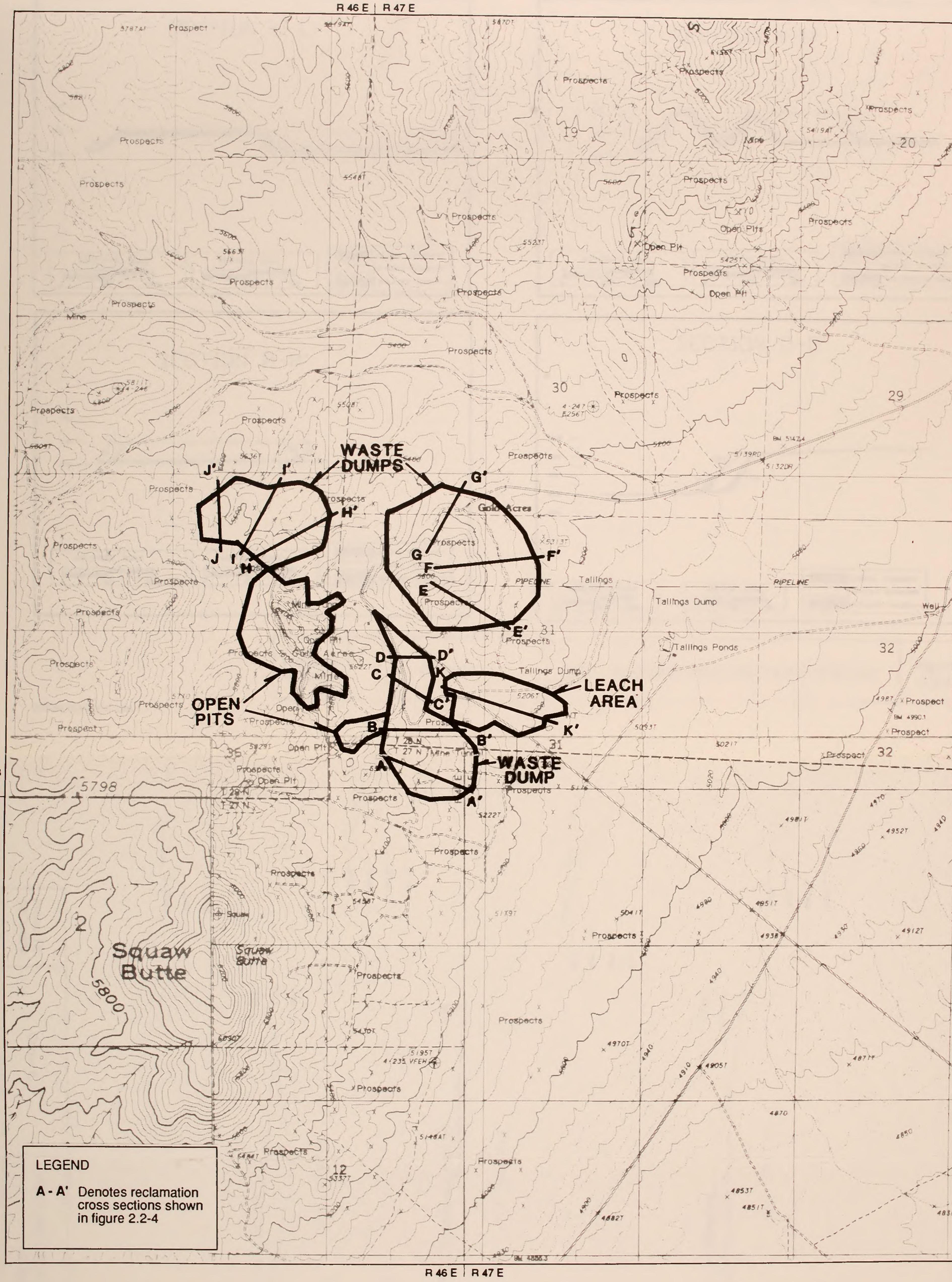


Note: Activities shown for 1992 are activities that have already been approved.



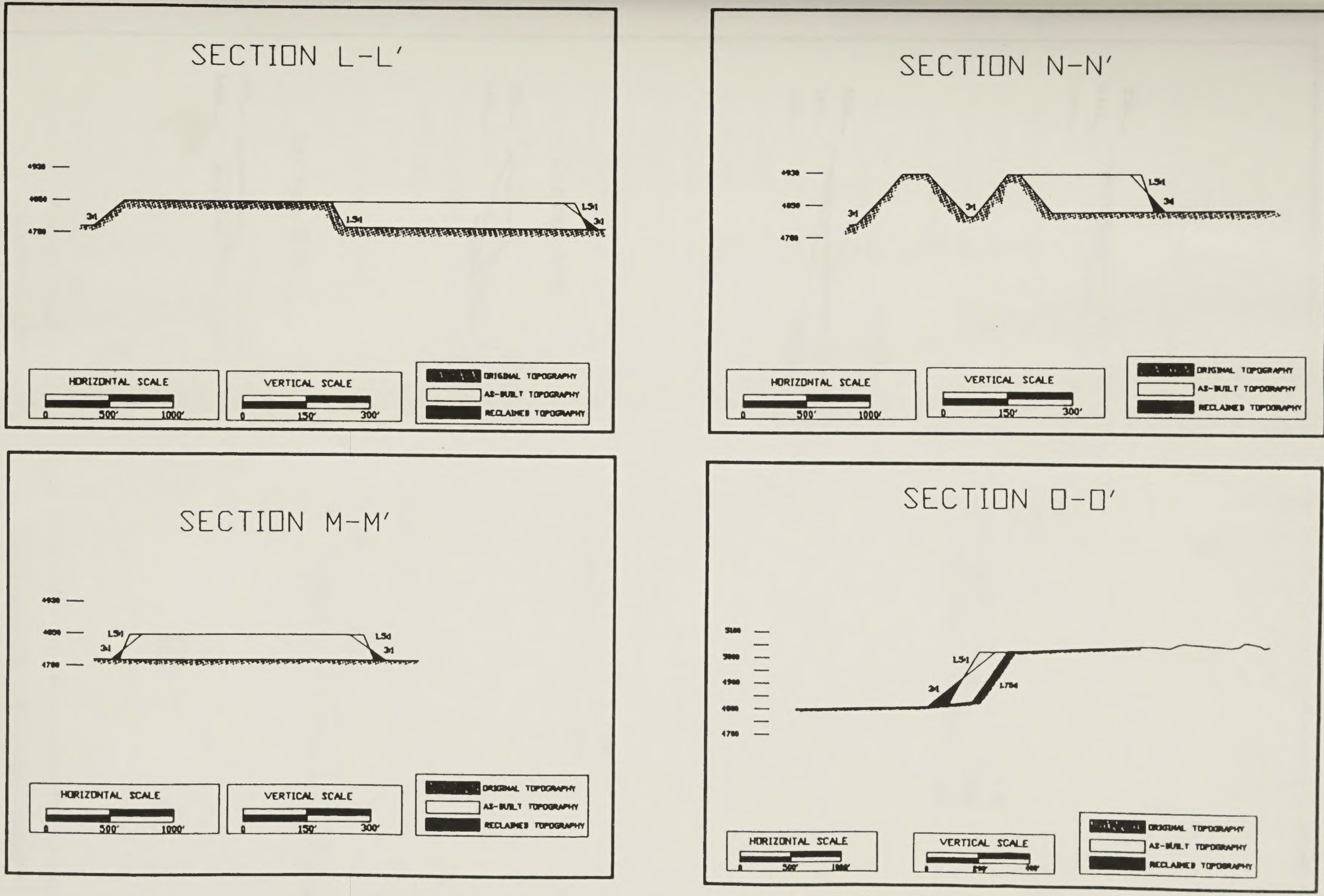
Project No. 90C0489A	Cortez EIS	RECLAMATION AREAS, CORTEZ	Figure 2.2-2

90C0489A-3000/090492



Project No. 90C0489A	Cortez EIS	RECLAMATION AREAS, GOLD ACRES	Figure 2.2-3

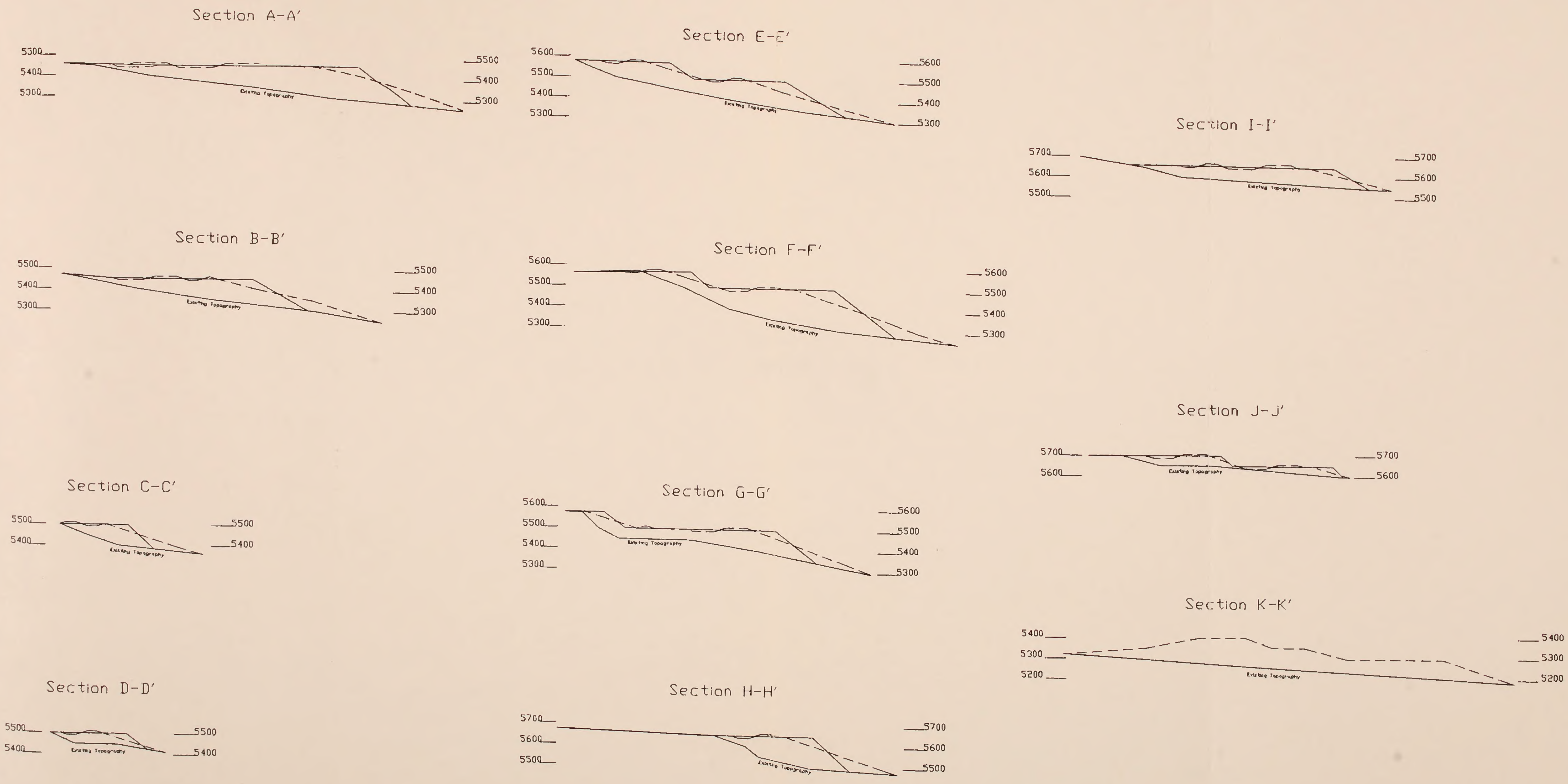
90C0489A-3000/090492



Project No. 90C0489A	Cortez EIS	RECLAMATION CROSS SECTIONS, CORTEZ	Figure 2.2-4

90C0489A-9010/071392

RESTORATION CROSS SECTIONS (CONT.)



Key:
_ _Reclaimed Dump
___As-Built Dump

Note: Reclaimed Slopes are at 3:1

Scale: 1"=500'

Project No. 90C0489A	Cortez EIS	RECLAMATION CROSS SECTIONS, GOLD ACRES	Figure 2.2-5

3.0
AFFECTED ENVIRONMENT

This section describes the existing environmental conditions and present trends in the general vicinity of the proposed action. The affected environment has been described for each of the resources to encompass the area affected by the construction of the proposed expansion facilities and the operation of those facilities.

The extent of the affected environment evaluated (study area) differs between resources depending on the locations where impacts would be expected. The areas of proposed disturbance and disturbance of previously mined land are included in the study area for all resources. In addition to these areas, a larger surrounding region was evaluated as the defined study area to adequately evaluate the potential effects from secondary or indirect impacts. The evaluation of this surrounding region also allows an evaluation of cumulative, i.e., incremental effects that could result from the combination of project-related impacts with impacts from other mining or related projects that would affect the same resources. For example, the study area for water resources was defined by watershed boundaries; the study area for air quality impacts was defined by the regional air basin; the study area for livestock grazing was defined by contiguous grazing allotments; and the socioeconomic study area was defined by those communities where workers would reside and place demands on the infrastructure. The description of the baseline conditions for each resource area includes a description of the study area considered.

3.1 AIR QUALITY

3.1.1 Study Area

The project site is located in north-central Nevada in Eureka and Lander counties. Development and exploration activities proposed in the 1990 Plan of Operations would occur in two main areas: Cortez and Gold Acres (Figure 1.1-2). The Cortez area lies on the east side of Crescent Valley on the west flank of the Cortez Mountains in Lander county approximately 6 miles west of Horse Canyon. The Gold Acres area lies on the northwest side of Crescent Valley in the Shoshone Range in Lander County, approximately 8 miles northwest of the Cortez area. Elevations at project sites vary from about 5000 to 8000 feet.

The air quality study area used for evaluation of potential impacts is defined as the Crescent Valley Air Basin, which includes the area bounded by the Shoshone Range and Tuscarora Mountains to the north and west and the Cortez mountains to the south and east. Air basins are defined as areas over which airflow is unimpeded by major topographical barriers.

3.1.2 Climate

The climate of the project region is characterized by arid-to-semiarid conditions, with bright sunshine, low annual precipitation, and large daily ranges of temperatures. The climate is controlled primarily by rugged and varied topography to the west; in particular, the Sierra Nevada Range. The prevailing westerlies move warm, moist Pacific air over the western slopes of the Sierra Nevada Range where the air cools, condensation takes place, and most of the moisture falls as precipitation. As the air descends the eastern slope, compressional warming takes place and very little precipitation falls.

The closest sources of long-term meteorological data are National Weather Service stations located in Winnemucca and Elko, Nevada. Winnemucca Station is located approximately 70 miles northwest of the project site, while the Elko Station is about 55 miles northeast of the project site. Based on a review of long-term data from these two stations (USDC 1987), which cover a 30-year period (1958-1987), there do not appear to be significant differences in annual climatological data between the two stations (Table 3.1-1). Therefore, the closer Elko Station was selected as being representative of the project region.

Located in the Humboldt River Valley of northeastern Nevada, the Elko Station is at the Municipal Airport, 1 mile west of town, at an elevation just above 5,000 feet. Several mountain ranges with many peaks near or exceeding 10,000 feet dominate the landscape, but the immediate terrain consists of sagebrush-covered valleys and low foothills, the highest of which are approximately 2,500 feet above station elevation.

Temperature

Owing to the high elevation and proximity of the mountains, there is a wide temperature range. High night-time radiation makes cool nights the rule even in mid-summer. At Elko Station, the annual average temperature is 46 degrees Fahrenheit (F). The annual average maximum temperature is 63°F, and the annual average minimum temperature is 30°F. The hottest month is July, with an average temperature of 70°F. The coldest month is January, with an average temperature of 24°F. The average first occurrence of 32°F in the fall is in early September and the average last occurrence is in early June (USCD 1987).

Precipitation

The project area is effectively cut off by the Sierra Nevada Mountains from the moisture source of the Pacific Ocean. At the Elko Station, precipitation is light, with the highest amounts falling during the winter months as snow. Summer precipitation occurs mostly as showers. Summer is typically dry, with an average relative humidity of 25 percent during the day, and 51 percent during the night. Annual average rainfall at Elko and Winnemucca is 9 inches and 8 inches, respectively. At the project area, the annual precipitation is estimated to be about 8 inches (USDC 1987).

Winds

On an annual basis, the prevailing wind at Elko Station is from the southwest. The annual average wind speed is 6 mph. The month-to-month variation of average wind speed is small, with a lowest average value of 5 mph in October and December, and highest average value of 7 mph in April (USDC 1987).

Dispersion Conditions

Atmospheric dispersion is influenced by several parameters, including wind speed, temperature inversions (mixing height), and atmospheric stability. Mixing height provides an indication of the potential vertical extent of pollutant diffusion. It is a measure of the thickness of the layer of the lower atmosphere in which pollutants may freely disperse. Inversions restrict vertical movement of the air in the lower atmosphere, thereby preventing atmospheric pollutants from mixing with the air above the inversion. Lower mixing heights can be expected to produce high pollutant concentrations since the volume of air with which pollutants can be mixed is limited. Pollutant mixing in regions of lower elevations can be greatly restricted when an inversion limits the vertical mixing and surrounding terrain limits horizontal mixing. Spatial variations in mixing depth are complex depending upon local elevations and ground surface properties. Mixing heights normally increase during the day and decrease during the night.

As is typical for the weather pattern of "cold night/hot day" and sharp temperature change, the mixing height can be quite high during the afternoon due to strong convective activity mixing the air vertically throughout the lower levels of the atmosphere. Conversely, mixing heights can be quite low at night and in the morning because of night time radiational cooling, which causes surface-based or low-level inversions to form. At the project site, the mean annual morning mixing height is estimated to be 250 feet and the mean annual afternoon mixing height is about 2400 feet (Holzworth 1972).

Another factor that can be used to assess the ability of the atmosphere to disperse pollutants is atmospheric stability. Atmospheric stability is usually expressed in terms of Pasquill-Gifford categories, ranging from Class A (very unstable) to Class F (very stable), and is a measure of the degree of atmospheric turbulence. Stable conditions will suppress atmospheric turbulence, resulting in decreased pollutant dispersion; unstable conditions will enhance atmospheric turbulence, increasing pollutant dispersion. Based on measurements taken at the Elko Station during 1986, good dispersion conditions (Classes A through D) occurred 54 percent of the time. Poor dispersion conditions (Classes E and F) occurred 46 percent of the time.

3.1.3 Air Quality

Regulatory Background

Several State and Federal air quality regulations potentially apply to the type of facility at the Cortez Gold Mine. These include Prevention of Significant Deterioration/New Source Review (PSD/NSR), New Source Performance Standards (NSPS), National Emission

Standards for Hazardous Air Pollutants (NESHAPS), Standards for Permits to Construct, State air toxics regulations, and National and State Ambient Air Quality Standards (AAQS).

National and State AAQS. National ambient air quality standards for ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), total suspended particulates (TSP), and lead (Pb) were established by the U.S. Environmental Protection Agency (EPA) after the passage of the Clean Air Act of 1970. A national standard for particulate matter of less than 10 micrometers in aerodynamic diameter (PM_{10}) was established in 1987, and a state standard for PM_{10} was established in 1991. One micrometer is equal to one one-millionth of a meter.

State ambient air quality standards for Nevada are equal to or more stringent than the national standards. The state is responsible for developing a State Implementation Plan (SIP), which details how the state intends to reduce pollutant levels and bring nonattainment areas into compliance with the National AAQS. National and state air quality standards, both primary and secondary, are listed in Table 3.1-2. The primary standards are designed to protect public health, while secondary standards are intended to prevent other adverse air quality effects, such as reduced visibility and property damage.

Air basins are classified as being in attainment of the national or state air quality standards for a particular pollutant if air quality monitoring data show ambient pollutant concentrations to be below the standard. Air basins are classified as nonattainment of national or state standards for a particular pollutant if monitoring shows ambient concentrations to be above the air quality standard. If there is no air quality monitoring for a particular pollutant, the air basin is unclassified for that pollutant, in terms of air quality standards.

PSD/NSR. In an area where air quality meets the National AAQS, a source that would emit more than 250 tons per year of those pollutants that have established AAQS (criteria pollutants) would be subject to PSD regulations. These regulations are intended to prevent degradation of good ambient air quality. The PSD regulations also protect Class I areas from pollutant impacts. Class I areas are generally of pristine air quality, such as national parks, monuments, and wildlife refuges. The only Class I area in Nevada is the Jarbidge Wilderness Area, which is approximately 118 miles away from the project site. The Cortez facility is not subject to PSD review, because its emissions are less than the PSD threshold.

A source of air pollution is regulated under NSR if it is to be constructed in a nonattainment area and would emit more than 100 tons per year of the nonattainment pollutant or, if located near a nonattainment area it would significantly affect the air quality of the nonattainment area. The Cortez facility is not subject to NSR, because it is located in an area that is not classified as nonattainment for any of the regulated air pollutants, and would not significantly affect any nearby nonattainment areas.

NSPS. Standards of performance for stationary sources were established by the Clean Air Act of 1970. These are standards for new or modified stationary sources to achieve the best demonstrated emissions control technology. The NSPS apply to specific processes, of which the metallic minerals processing industry is one. NSPS that apply to Cortez are for crushing, screening, and grinding processes (40 CFR Part 60, Subpart LL).

NESHAPS. NESHAPS are standards of emission for seven substances: mercury, arsenic, beryllium, vinyl chloride, asbestos, benzene, and radionuclides. Although the Cortez facility has sources of mercury and arsenic, it is not subject to NESHAPS regulations, as they apply to different types of specific sources (e.g., mercury ore processing). Instead, mercury and arsenic sources at Cortez are subject to Nevada's air toxics regulations, discussed below.

Permits to Construct. Before a potential source of air pollution is constructed, an air quality application for potential sources must be submitted to the Nevada Division of Environmental Protection (NDEP), in order to obtain a Permit to Construct. The NDEP is the air quality permitting authority for all of Eureka and Lander Counties. Cortez currently has air quality permits for the sources listed in Table 3.1-3. The proposed action does not require any additional permits.

Air Toxics Regulations. Nevada state regulations contain criteria for evaluating emissions of toxic or hazardous air contaminants from stationary sources. An air contaminant is defined as toxic or hazardous under one of two conditions: it has been assigned a Threshold Limit Value (TLV) by the American Conference of Governmental Industrial Hygienists, based on its toxic properties in humans; or it has been determined by the Director of the Nevada State Department of Conservation and Natural Resources to cause or contribute to air pollution such that exposure may result in increased mortality or irreversible morbidity.

The State has defined acceptable concentrations for toxic or hazardous air contaminants for the quality of ambient air (ACQAA) that are based on Threshold Limit Values (TLVs), or other toxic factors determined by the NDEP, divided by a safety factor. Compliance with ACQAAs must be demonstrated through ambient air monitoring and/or emission sampling and/or dispersion modeling techniques. For the proposed project, toxic air emissions of mercury and arsenic have already been addressed as part of the State's air quality permitting process and were found to be below ACQAA levels. Toxic air emissions of crystalline silica (quartz silica) could also occur from sources at the mill facility. These are addressed in Section 4.1.

<u>Existing Air Quality</u>

Air quality in the project region is governed by several factors: pollutant emissions and meteorological conditions. Meteorological factors such as wind speed, mixing heights, and atmospheric stability all affect the dilution rate of emitted pollutants, and solar radiation affects photochemical oxidant production. Frequent short-term variations of air quality usually result from changes in atmospheric conditions. Long-term variations typically result from changes in pollutants emission amounts.

The study area defined for evaluation of air quality impacts, the Crescent Valley Air Basin, is currently unclassified for all pollutants having an air quality standard. This is because there has been no ambient air quality monitoring in the Crescent Valley Air Basin. It is also classified as a Class II area by EPA for purposes of PSD air quality regulations. The Battle Mountain Air Basin, which is adjacent to the Crescent Valley Air Basin, is a federal nonattainment area for particulate matter less than 10 μm (PM_{10}). The Battle Mountain Air Basin is approximately 15 miles northwest of the proposed project site and is separated from the Crescent Valley Air Basin by the Shoshone Range. Modeling results from the NDEP for permitting of sources at Cortez shows no pollutant impacts to the adjacent (Battle Mountain) Air Basin. It is therefore assumed that Cortez would not have an effect on the air quality of the Battle Mountain Air Basin.

For the proposed Cortez project, the primary pollutants of concern are SO_2 and particulates (TSP and PM_{10}). Sulfur dioxide monitoring sites are no longer operated by the State of Nevada, but data received by the NDEP from industrial sources indicate that the SO_2 standard has not been violated in the last five years (NDEP 1989). No TSP or PM_{10} monitoring data exist for the Crescent Valley Air Basin.

An emissions inventory of TSP and SO_2, provided by the NDEP for the Cortez facility and other sources in the Crescent Valley Air Basin are summarized in Table 4.1-4 in Section 4.1. These data are for current permitted sources, and are discussed further in Section 4.1.3.

3.2 GEOLOGY, MINERALS, AND PALEONTOLOGY

3.2.1 Study Area

The study area includes the sites where mine expansion activities would take place, i.e., Cortez Mill and Gold Acres, as well as a larger surrounding area bounded by the town of Crescent Valley to the north, Garden Gate pass to the south, the Shoshone Range to the west, and the Cortez Mountains to the east. This study area was selected in order to consider the resource base that could sustain cumulative impacts due to other nearby mining projects affecting the same resources. This general discussion for each resource is then followed by description of baseline conditions for each of the specific mine expansion areas.

3.2.2 Geological Baseline Conditions

Rocks in the study area can be categorized into three groupings. Limestone with minor amounts of shale and quartzite were deposited in the east part of the study area and are referred to collectively as the eastern carbonate assemblage (Roberts et al. 1958, Gilluly and Gates, 1965). Clastic sedimentary rocks such as sandstone and volcanic rocks were deposited in the western portion of the study area and are collectively referred to as the western siliceous and volcanic assemblage. Rocks transitional between the eastern and western assemblages are referred to as the transitional assemblage. These three groupings underlie the large majority of the study area.

Quaternary (0 to 2 million years ago) deposits consist primarily of valley alluvium, alluvial fans that flank the mountains, and lesser playa, talus and landslide deposits. Some older alluvial gravel and sand deposits are of late Tertiary (2 to 24 million years ago).

In addition to the many flat-lying thrust faults exposed throughout the area, there are numerous high angle faults striking north, northeast, and northwest. These faults have been determined to have formed from at least 360 million years ago (Gilluly and Gates, 1965) with the most recent activity during Basin and Range development 12 to 15 million years ago.

3.2.3 Seismic Baseline Conditions

The study area is located in a section of the Basin and Range Province that has remained relatively quiet, seismically, during recent time.

Although the seismic zone map in the Uniform Building Code shows the area as zone three on a scale ranging from one (indicating less damage expected) to four (indicating the most damage expected), there have been no major historical earthquakes reported within the study area through December of 1990 (Slemmons et al. 1964, Mackay School of Mines 1991).

Slemmons et al. (1964) have reported only two earthquakes with epicenters within 20 miles of the study area prior to 1960. One measured 4.0 to 4.9 on the Richter Scale and was located approximately 10 miles south of the study area in the central Toiyabe Range. This event took place between 1932 and 1960. The other event also took place between 1932 and 1960 and was centered near the community of Beowawe, approximately 12 miles north of the study area. This larger earthquake had a Richter magnitude of 5.0 to 5.9.

3.2.4 Mineral Baseline Conditions

The study area has been, and continues to be, the site of substantial mineral exploration and production in both metallic and industrial minerals. It has been an historic producer of gold, silver, barite and turquoise and lesser amounts of copper, lead and arsenic. Gravel deposits in valley alluvial fill have been worked intermittently to construct and maintain local roads and highways. To date, most of the region's mineral production comes from gold mining and barite operations.

There are three recognized mining districts located within the study area. They are the Bullion district located on the eastern slope of the Shoshone range, the Cortez-Mill Canyon district at the south end of the Cortez Mountains, and the Buckhorn district on the eastern slope of the southern Cortez Mountains. The largest historic producing mines of each district are gold mines: the Gold Acres Mine, the Cortez Gold Mine, and the Buckhorn Mine, respectively.

The various deposits within the study area occur within the Battle Mountain-Eureka or Cortez Trend which trends roughly north-northwest through the study area. While the explanation for the location and extent of this mineral trend is uncertain, the trend may be spatially related to crystalline rocks at depth (Bagby and Berger 1985).

Gold Mining and Exploration

Recent mining and exploration activity in the study area has been considerable with the majority of the activity centered around the search for, and operation of, bulk minable gold deposits.

Currently, operating gold mines include: Cortez Gold Mine's Cortez and Horse Canyon Mines in the Cortez-Mill Canyon district; the Gold Acres Mine (Cortez Gold Mines), and the Fire Creek Mine (processing only) in the Bullion district; Cominco American's Buckhorn Mine (processing only) in the Buckhorn mining district; and Inland Gold and Silver Corporation's Toiyabe Mine at the south end of the study area in the Toiyabe Range. Elder Creek Mine is not active but is not yet reclaimed.

Significant mining and/or exploration activities have been conducted on five other properties in the area. Coral Resource's Robertson and Triplet Gulch properties, Newmont Gold's Indian Creek exploration drilling property and S/L Corporation's Grey Eagle Mine at Granite Mountain are all located in the Bullion district. Cominco American's Cottonwood/Brock Canyon exploration drilling project is located in the Buckhorn mining district. A listing of the above properties and their important characteristics, excluding the Gold Acres, Cortez and Horse Canyon Mines, is given in Table 3.2-1. Figure 3.2-1 shows the locations of the mines and exploration projects within the study area.

Barite

Two barite properties are located in the study area. Dresser Mineral's Greystone Mine and IMCO Service's Clipper Mine, both located in the Bullion mining district, continue to supply barite from stockpiles which were mined during the last decade. The Greystone Mine is one of the largest barite mines in Nevada.

3.2.5 Paleontology Baseline Conditions

The paleontological resources of the study area were assessed by reviewing the paleontological inventories prepared by the Bureau of Land Management and by literature search. The full results of this study, including an annotated bibliography are presented in Appendix A.

The study area is the site of numerous invertebrate fossil occurrences. No vertebrate sites have been identified within the study area. Of the known invertebrate fossil localities, all occur in rocks of Paleozoic Age and are of low to moderate sensitivity. The sensitivity of a site is based on a ratings scheme employed in the BLM inventory series which rates the most sensitive sites as S-1 and the least sensitive sites as S-3.

Paleontological sites of relatively high sensitivity, including two vertebrate sites, lie several miles to the south of the study area. These occurrences are described in Appendix A. Despite these occurrences, the potential for the occurrence of vertebrate fossils in the study area, although real, is considered low.

There are no known paleontological localities directly within the expansion areas. A low-sensitivity graphtolite site is located adjacent to the Horse Canyon mine area, as described in Appendix A.

3.2.6 Baseline Conditions for Mine Expansion Areas

Cortez Facilities

The Cortez area is located at the southwestern tip of the Cortez Mountains in Section 1 and 2 of T.26N., R.47E.; Sections 23, 24, 25, 26, 35, and 36 of T.27N., R.47E.; and Sections 18 and 19 of T.27N., R.48E. The mine is located within the Cortez-Mill Canyon mining district and is the largest historic producer of gold in the district. Gold operations, consisting of open pit mining, and milling of oxidized ore began in 1969 and continued until 1976. Heap leaching began in 1973 and has continued to the present while mill operations were suspended in 1976 through 1981.

Folding and faulting are common in rocks of the mine area. Thrusting, which resulted in development of the Roberts Mountains thrust fault, was followed by several periods of additional faulting. The primary host of gold mineralization at Cortez is the Roberts Mountains Formation. Quartz and pyrite are common minerals in the ore zone. Gold is also associated with arsenic, antimony, mercury, barium, and silver.

The proposed heap leach and tailings pond facilities would be located on alluvial valley fill. The precise depth to bedrock under these facilities has not been determined; however, alluvium is likely to exceed several hundred feet, and may be several thousand feet in thickness (Sergent, Hauskins, and Beckwith 1991). Extensions of the Crescent fault system, which is one of two major Basin and Range fault systems occurring in the area, may be present on site (Sergent, Hauskins, and Beckwith 1991).

Gold Acres Mine

The Gold Acres area is located on the eastern flank of the Shoshone Range in Section 1, T.27N., R.46E.; Section 6, T.27N., R.47E.; Sections 35 and 36 T.28N., R.46E.; and Section 31 T.28N., R.47E. This property, the largest historic producer of gold in the Bullion District, began operations in 1935 and has continued intermittently to the present. The mine is currently extracting gold ores using open pit mining methods. Underground and open pit mining were employed during the early days.

The proposed heap leach facilities and process ponds are located in an area where shallow soils cover bedrock. The subsurface materials in the vicinity of the proposed facilities at Gold Acres include (in descending order) old mill tailings, soil, and limestone bedrock (Welsh Engineering 1992). The results from drilling of test holes within the footprint of the proposed facilities show that a lightly to highly fractured limestone (dolomite) bedrock, occasionally highly weathered at depths greater than 10 feet, was found under the entire area. Test borings further indicate that in addition to fracturing, the limestone formation may be characterized by karst conditions (i.e., presence of caverns). In addition, geologic data (Welsh Engineering 1992) show three faults extending under the footprint of the proposed facilities.

3.3 SOILS AND TOPOGRAPHY

3.3.1 Study Area

The study area for soils and vegetation resources extends from the town of Crescent Valley southeast through the Little Cottonwood Creek drainage, along Pine Valley west through Horse Creek Valley to Garden Gate Pass, then west to Bald Mountain in the Toiyabe Range, northwest to Mount Lewis in the Shoshone Range, and east back to Crescent Valley. Figure 3.3-1 depicts the general outline of the study area.

3.3.2 Soils Baseline Conditions

The topography in the study area is typical of that found in the Basin and Range Physiographic Province. North to northeast trending mountain ranges are separated by alluvial valley floors. In the study area, the Shoshone Range, with Mount Lewis at 9,680 feet above mean sea level (amsl) the highest point, borders the northwest corner. The mountains slope southeast to Crescent Valley, the lowest elevation in the study area at approximately 4,725 feet. At the southeast edge of Crescent Valley, the Cortez Mountains rise sharply then gradually slope down into Pine Valley and Horse Creek Valley. Mount Tenabo, at 9,153 feet, is the highest point in the Cortez Mountains. Cortez Canyon, a narrow winding canyon, separates the Cortez Mountains from the Toiyabe Range. Bald Mountain in the Toiyabe Range is at an elevation of 8,543 feet. Rocky Pass at the southwest end of Crescent Valley separates the Toiyabe Range from the Shoshone Range.

The soil descriptions and mapping for the study area are based on the Soil Conservation Service Order III soil surveys. Order III Survey is a level of mapping where associated soils occupying similar terrains are included in a mapped association. Thus, the mapped soil association may include two or three soils and one to two smaller units usually regarded as inclusions. For the purposes of this analysis, soils were grouped according to landform. Appendix B outlines characteristics of the specific series and associations that have been mapped in each landform type in this area, as depicted in Figure 3.3-1.

As can be seen in the table, there is not much variation between soils on the same landform in different locations; i.e., the soils found on mountains throughout the study area (the Toiyabe Range, the Cortez Mountains and the Shoshone Range) all have very similar characteristics.

Playa soils on the valley floors are barren of vegetation and are frequently flooded. These soils in Map Unit 2 are generally very fine textured with relatively slow permeability. Soils are generally moderately or strongly alkaline and deep. Hazard of erosion is generally slight. All of these soils are derived from alluvium (water-transported materials).

Soils on the valley slopes (Map Unit 3) may vary in texture from stony to silt loams. Permeability of these soils is also quite varied, and may vary between soils in an association. Hazard of erosion by water is generally higher than by wind; all of these soils have a slight erosion hazard by wind. Valley slope soils may be alkaline to neutral pH. These soils are primarily derived from alluvium, but a few are derived from weathering of residual bedrock materials (residuum).

Soils found on higher elevations tend to be slightly alkaline to neutral, shallow, and coarse textured. Soils on the foothills are usually coarser in texture than soils on flats and valley slopes. Hazard of erosion is greater, especially by water, for these soils. The slopes are generally steeper. Most of these soils are derived from residuum; others may be derived from alluvium or colluvium (gravity transported materials). Mountain soils tend to have the coarsest textures, ranging from gravelly to extremely stony loams. Permeability of higher-elevation soils is generally slow, and depth to bedrock is quite shallow. Hazard of erosion by water ranges from moderate to severe. Mountain soils are derived from colluvium and residuum.

Inset fans (the alluvium deposits of side channels) are found along stream channels in the mountains, and on the valley floors. Inset fan soils vary considerably as a result of elevation. Those inset fans at higher elevations have slower permeability and coarser textures than those found on the valley floors. The erosion hazard for inset fans is generally slight for both water and wind.

Baseline Conditions for Cortez and Gold Acres Areas

Soils within the areas of proposed disturbance at Cortez and Gold Acres were mapped in spring of 1991 during the course of an Order II soil survey (Summerfield 1991). An Order II survey does separate the soil associations and map the large soil units as individual units. Smaller units may still be defined as inclusions and mapped with the large soil unit or closely associated soils with undefinable boundaries may be mapped as complexes. Figures 3.3-2 and 3.3-3 depict the results of this mapping for the Cortez and Gold Acres areas. Tables 3.3-1, 3.3-2, and 3.3-3 provide a summary of soil characters for each mapping unit. Descriptions of map units and soil families corresponding to these tables and figures are provided in Appendix B.

Most soils in the Cortez area are highly alkaline and are derived from limestone. Valley slope and bottom soils are generally fine grained (mostly silt loam). Soils in the valley bottom are generally deep, while soils on bordering hills are generally shallow.

In general, the soils in the Gold Acres area are gravelly loams in the hills and upper valley slopes, shallow to moderately deep to bedrock or cemented layers. The soils of the lower pediments are gravelly silt loams and moderately deep to bedrock or hardpans. The soils in this area are derived from a variety of parent material; volcanics, limestone, sedimentary rock and mixed alluvium.

A portion of the Gold Acres area was not mapped at an Order II level; however, these soils have been mapped at an Order III level. These areas are depicted on Figure 3.3-3 and are distinguishable from the Order II map units by the numbering system used. Order II map units are given a number and a letter symbol; Order III map units consist of four numbers. Two Order III soil map units occur within the Gold Acres area.

3.3.3 Topography Baseline Conditions

The study area is located in the Basin and Range Physiographic Province between 116 to 117 degrees east longitude and from 40 degrees to 40 degrees 30 minutes north latitude. The study area comprises an area totalling approximately 600 square miles with altitudes ranging from under 4,800 feet in the valleys to over 9,600 feet on the crests of the mountain ranges. Portions of three different basins are included in the area: Crescent Valley, Pine Valley and the northern end of Grass Valley. The elevation of the Crescent Valley basin at the town of Crescent Valley is 4,780 feet. Grass and Pine Valleys average 5,700 feet in the area. The three valleys drain to the north. Grass Valley drains into Crescent Valley, and Crescent and Pine Valleys drain into the Humboldt River.

In this area of the Basin and Range, mountain ranges trend north-northeast. Parts of three different ranges are included in the study area. These are the central Shoshone Range, the southern half of the Cortez Mountains and the northern tip of the Toiyabe Range. There are several peaks which exceed 8,000 feet in elevation. These include: Mount Lewis in the Shoshone Range at the northwest corner of the project area, 9,680 feet; Mount Tenabo at the southern end of the Cortez Mountains, 9,153 feet; and Bald Mountain at the southwest corner of the study area in the Toiyabe Mountains, 8,553 feet.

3.4 WATER RESOURCES

The description of existing water resources was prepared based on a review of published and unpublished information. The following companies and agencies were contacted for information pertinent to the preparation of this section:

- Cortez Gold Mines
- U.S. Bureau of Land Management, Battle Mountain and Elko District Offices
- U.S. Geological Survey, Division of Water Resources
- Nevada Division of Water Resources

- Nevada Department of Conservation and Natural Resources, Division of Environmental Protection

The U.S. Geological Survey has produced a report pertaining to hydrogeologic aspects of the study area (Zones 1961). This report evaluated the hydrology of Crescent Valley with an emphasis on the occurrence and potential development of its groundwater resources including estimates of aquifer characteristics and a water balance. A study conducted by the State of Nevada Department of Conservation and Natural Resources entitled "Hydrogeology of the Lower Humboldt River Basin, Nevada" (Bredehoeft 1963), marginally includes Crescent Valley but does not provide information beyond that published by Zones (1961). Geology of the Cortez Quadrangle was described by Gilluly and Masursky (1965). Selected hydrologic data for Crescent Valley were published in Eakin et al. (1966).

Consultants for the applicant have prepared several reports describing tailings pond design (Dames & Moore 1980; Sergent, Hauskins & Beckwith (SHB) 1981; and Harding Lawson Associates 1984). These reports contain geologic boring logs and estimates of seepage from the tailings ponds. The focus of the consultants' later reports shifted from engineering design to contaminant control (SHB 1988, 1990a, 1990b, Hydro-Search, Inc. [HSI] 1990).

Surface water and groundwater hydrology are discussed below for the two areas where expansion activities would occur: Cortez and Gold Acres. These discussions are preceded by a discussion of regional hydrology and hydrogeology.

3.4.1 Study Area

The water resources study areas for both surface water and groundwater are described below.

Surface Water

The surface water study area was initially selected in a workshop attended by the management team from Nevada State Office and Battle Mountain District BLM offices, the applicant, and Woodward-Clyde Consultants. The area selected was intended to include the watershed in which the existing and proposed mining activities are located and any downstream areas that could potentially be affected by mining activities. The area selected is described as follows: Town of Crescent Valley south to Little Cottonwood Creek; Pine Creek from Horse Creek Valley south to Garden Gate Pass; Garden Gate Pass to Bald Mountain; Bald Mountain to Rocky Pass; Rocky Pass north to Crescent Valley, including the Gold Acres and Gold Quartz areas of Crescent Valley Watershed.

<u>Groundwater</u>

The groundwater study areas were selected based on the same criteria used for delineating the surface water study area. As such, these areas encompass the existing and proposed mining facilities, in both assumed or known upgradient and downgradient directions. Groundwater quality data collected to date do not show any impacts outside of these areas. The areas selected include the Cortez and Gold Acres areas within the Crescent Valley Groundwater Basin.

3.4.2 Regional Hydrology

The surface water study area spans the southern half of Crescent Valley, the western half of Horse Creek Valley, and the northern portion of Grass Valley. These valleys are within the Humboldt River Basin, which is in the Great Basin section of the Basin and Range physiographic province. The Great Basin Region is characterized by alternating valleys and mountain ranges that are generally aligned north to south. Within the Humboldt River Basin, stream courses drain into other tributaries or into the Humboldt River.

Rainfall in the Crescent Valley watershed typically evaporates or infiltrates. Many of the streams draining snowmelt or rainfall from the mountains surrounding Crescent Valley do not reach the dry lake beds on the valley floor; instead, they branch into smaller channels and eventually dry up. Runoff from Crescent Valley flows into the Humboldt River only after large storms. Alternatively, streams in Horse Creek Valley flow into Pine Creek, which in turn flows into the Humboldt River.

There are three land forms of hydrologic significance within the study area: mountains, valley uplands, and valley floors. The crests of the mountains within the Shoshone Range and Cortez Mountains rise as high as 5,000 feet above the valley floors to elevations exceeding 8,000 feet. The crests of the mountain ranges form surface water drainage divides.

Valley uplands are the areas of intermediate slope between the mountains and the valley floors. In areas where the valley uplands are underlain by hard rocks, the streams do not lose much water to infiltration. In other areas where the streams are not underlain with hard rock, such as in Crescent Valley, the streams quickly lose water by infiltration through the stream bottoms. In these latter areas, runoff only reaches the valley floors during high flows. Within the study area, most of the streams do not flow year-round; however, a few of the larger streams, such as Indian Creek and Pine Creek, do flow year-round. The Valley bottoms of Crescent, Grass, and Horse Creek valleys usually consist of dry lake beds.

In general, the valley floors receive the least rainfall and the higher elevations receive the most. Annual rainfall is estimated to average about 6 inches on the valley floors (Zones 1961). According to Hardeman (1936), the highest peaks above Crescent Valley receive more than 20 inches of precipitation annually. Weather data collected from the weather station in Beowawe, located about 26 miles northeast of Gold Acres, indicate an annual average rainfall of 7.9 inches at an elevation of 4,684 feet. Most rainfall occurs during the winter and spring with the least from July to September. About 60 percent of the total rainfall in the Humboldt River Basin occurs in the mountains. In the Humboldt River Valley about 90 percent of the total rainfall is lost to evaporation and uptake by plants. Therefore, only the remaining 10 percent is available for streamflow and groundwater recharge (Eakin 1966).

Most of the annual runoff within the study area is from snowmelt water. A large percentage of the annual precipitation falls as snow and is stored as snow pack in the higher elevations during the winter months. In the spring months, typically April through early June, snowmelt water produces significant runoff. In many of the high mountain drainages, this snowmelt runoff produces the highest annual flows. Occasionally, spring season rainfall coincides with the snowmelt runoff, resulting in extremely high runoff flows. The hot, dry weather in mid to late summer produces the lowest annual flows due to little or no rain and high evaporation rates.

Winter and spring floods occur in the Humboldt River Basin (Eakin 1966). Winter floods are caused primarily by large rainstorms falling on low-lying snow or frozen ground. Winter floods are generally high volume but short duration events. Spring floods occur as warming temperatures melt the snow packs that accumulate over the winter and spring months. Heavy rains during the spring can rapidly accelerate the generation of snowmelt runoff. Summer floods also occur as the result of localized high-intensity rainfall from thunderstorms. However, large-volume, short-duration storms that cause flash flooding can exceed the snowmelt peak in magnitude. Flash floods, caused by thunderstorms originating in the mountains, deposit large volumes of debris and sediment in the valley uplands or valley floor.

Surface water flow in the region is used for grazing and mining, and by wildlife. There is no historic or existing use of surface water for domestic purposes within the mine expansion areas, i.e., Cortez and Gold Acres.

3.4.3 Regional Hydrogeology

The regional hydrogeology of Crescent Valley and to a much smaller degree, the Cortez Mountains and Shoshone Range surrounding Crescent Valley, has been studied by the U.S. Geological Survey and reported in Water-Supply Paper 1581 (Zones 1961). Much of the following section is derived from Zones (1961) and SHB (1981).

Groundwater in the Cortez Mountains and Shoshone Range surrounding Crescent Valley occurs mainly in fractures within the bedrock. Most precipitation falling on the mountains travels across the valley uplands in streams toward the valley floor. Before reaching the valley floor, most or all of the surface water infiltrates through the stream bed and recharges groundwater. Groundwater moves through the sediments of the valley uplands to the valley floor where large quantities of groundwater are stored. There has not been enough deep drilling performed in the valley to accurately estimate the thickness of the sediments. From experience in other intermountain basins in central Nevada, the sediments are likely to exceed several hundred feet, and may be up to several thousand feet in thickness (Zones 1961).

Groundwater in Crescent Valley generally flows very slowly to the north and northeast. Only a small amount of groundwater leaves the valley by subsurface outflow. There are several irrigation, stock, and domestic water wells in use within 2 to 5 miles of the Cortez mine. Wells installed in the valley uplands generally yield more water than wells installed in the valley floor.

Aquifer testing performed during research for a U.S. Geological Survey report (Zones 1961) has shown that wells located on or near the alluvial fans of the valley uplands were significantly higher in transmissivity (ability of an aquifer to transmit groundwater) than those wells completed on the valley floor. Within the valley, finer-grained material is reflected by the results of pumping tests. Four tests were performed with results for transmissivity ranging from 6,500 to 61,000 gallons per day per foot (gpd/ft). The specific capacities (yield of a well per unit of drawdown) ranged from 5 to about 25 gallons per minute per foot of drawdown, which also indicates the presence of fine-grained alluvium beneath the valley floor.

3.4.4 Cortez Area

<u>Surface Water</u>

The Cortez mine is located on the northwestern flank of the Cortez Mountains between Cortez Canyon and Mill Canyon. In this area, several small streams including Cortez Creek and Mill Creek, and several unnamed drainages, flow in a northerly direction towards Crescent Valley. These creeks and unnamed drainages originate on the slopes of Mt. Tenabo, located about 3 miles southeast of the existing mine facilities. These streams and drainages branch into many smaller channels as they approach the valley floor.

The streams and drainages located in the vicinity of the mine site typically carry water only after storms or during the snowmelt. Mill Creek, located about 1.5 miles northeast of the mining area, is an exception and flows year-round, although the flow diminishes considerably in the fall (Zones 1961). Springs are common in the upper parts of these drainages and likely contribute to surface runoff in these areas.

No known water quality data exist for these drainages based on a review of existing literature and telephone contacts with the following state and federal agencies: Nevada Division of Environmental Protection (NDEP), Nevada Division of Water Resources, Bureau of Land Management in Elko, Nevada Division of Water Resources, and the U.S. Geological Survey Division of Water Resources in Carson City, Nevada. Limited water quality data were collected in 1991 to 1992 from Mill Creek. A streamflow of 2.2 cubic feet per second in Mill Creek was measured on June 9, 1948 (Zones 1961). This is the only quantitative streamflow information found in the literature.

The Cortez site is located on the valley upland. As such, the flow of surface runoff is largely naturally diverted around the facility. Drainages located on the property have been diverted around the existing tailings impoundment and leach pad by berms or diversion channels (SHB 1990b). No surface water is used by Cortez Gold Mines.

The Federal Emergency Management Agency (FEMA) flood plain maps for the Cortez area were reviewed for identification of flood plains in the vicinity of the mining site. The mining site is located in an area identified as being outside the 500-year flood plain. The nearest mapped flood hazard area is the 100-year flood plain located about 1,000 feet to the northwest (FEMA 1988).

Groundwater

Groundwater beneath the Cortez Facility occurs at depths ranging from about 11 to 59 feet below existing grade (SHB 1990a). Geologic materials encountered during well drilling at the facility vary from silty clay to sandy and clayey gravel with cobbles. Using water level data obtained from wells at the facility, it is apparent that groundwater flows to the north and northeast, closely following the topographic contours.

In general, groundwater elevations tend to be highest during the winter and spring months and likely reflect groundwater recharge from rainfall and snowmelt. A water level decline ranging from about 2 feet to 10 feet has been observed in wells monitored at the facility from 1984 to 1990. This well exhibited a 10-foot drop in water level from 1984 to 1986. This decline appears to be explained by the well's close proximity to the pollution control wells. These wells were installed in 1984 and began pumping and locally lowering the water table. From 1986 to 1990, the groundwater elevation in well MW-15 declined an additional 6 feet. While certain wells are influenced by pollution control activities (discussed further below), the overall trend in declining water levels from 1984 to 1990 probably reflects the ongoing drought. The applicant maintains a spreadsheet with all available water level data recorded from their wells.

The ability of the aquifer to transmit groundwater varies significantly across the mine area due to the high variability of the geologic materials. The sandier or coarser-grained materials result in higher groundwater flow velocities and, depending on the thickness of the aquifer, the transmission of greater volumes of groundwater per unit time (i.e., gallons per day). Groundwater flow velocities are calculated to range from about 0.05 to 30 feet/day. For additional details on the groundwater resource, see Appendix C.

The mining history of the Southern Crescent Valley and the potential impact on soil and groundwater contamination is briefly summarized by SHB (1990a). Properties of cyanide, including biological toxicity, transport in groundwater, and monitoring, are discussed in SHB (1981).

Water quality in wells within Crescent Valley was found to be acceptable for domestic use, with no elements present that exceeded acceptable limits based on standards in effect in 1961 (Zones 1961). The quality of groundwater near the mountains is generally better, in terms of total dissolved solids, than groundwater beneath the valley floor.

Cortez Gold Mines, Inc., in cooperation with the Nevada Division of Environmental Protection (NDEP), identified measurable groundwater contamination at their tailings pond facility during routine groundwater monitoring late in 1980. It is important to note that this contamination consists of low-level concentrations of cyanide and other trace metals. Table C-3 in Appendix C provides water quality data thought to be representative of groundwater beneath the Cortez Facility.

The area of contamination occurs near the northwest corner of the tailings ponds. It is suspected that the majority of the contamination is coming from these ponds. There is evidence that some additional contamination may be coming from an adjacent cyanide heap leach facility. It is also suspected that some minor level of contamination may have and may continue to be leaching from a historic tailings area located at the mouth of Mill Canyon (Figure 1.1-2).

The area of contamination (called a plume) is very localized. This plume has been well defined through ongoing studies conducted by Cortez under the direction of the NDEP. Cortez has submitted a formal remediation plan (a clean-up plan) to deal with this contamination to the NDEP for approval and has initiated actions recommended in the plan.

The remediation plan consists of operating 18 groundwater recovery wells. Six of these wells were installed in June 1992, in accordance with the remediation plan. The recovery wells are operated in a cyclic manner such that pumping rates are increased during the period of May through November and decreased from November through May.

To monitor the depth to groundwater, groundwater quality, and remediation response, Cortez has installed 63 monitoring wells located around and within the remediation site. The water levels in all 63 wells are measured monthly to evaluate groundwater movement. Forty wells are sampled quarterly for measuring water quality. Results of the monitoring program are reported to the NDEP on a quarterly basis. An annual review and report on the remediation plan is submitted to the NDEP each November.

The goals of the groundwater monitoring program and remediation plan are to prevent further migration of impacted groundwater and provide a timely and effective cleanup of groundwater.

The Bureau wishes to make known the presence of two other areas of potential contamination related to historic mining operations in the area. A portion of the first area is located on some of Cortez's patented (private) property in the historic mining town of Cortez (Figure 1.1-2). This area consists of approximately 6 acres of tailings of undetermined thickness and composition. This material originated from ore processing operations conducted in the early 1900s. This processing is known to have involved the use of cyanide.

The second area's origin begins at the old Consolidated Cortez Mine (a portion of this area is owned by Cortez). A 1985 high-intensity thunderstorm washed historic mine tailings downslope nearly 2,000 feet over public lands administered by the Battle Mountain District of the BLM (Figure 1.1-2).

It is important to note several issues related to these areas. First, cyanide readily breaks down upon exposure to air and sunlight. Although unknown at this time, it is unlikely that these areas currently contain measurable levels of cyanide. Second, although some analysis of the tailings in the town of Cortez has occurred, the chemical content of these tailings areas is unknown at this time. Third, it is unknown whether these areas have contributed to or are currently contributing to any further contamination or degradation of the groundwater.

Existing laws and regulations ensure that new mining projects will protect the State of Nevada's water resources.

Cortez, the BLM, and the NDEP will be working together in the future to identify any problems related to these historic tailings. Should there be any problems found related to these areas, the NDEP, working under various State and Federal statutes, will work with the BLM and Cortez to remediate them. For additional information on groundwater quality at the Cortez Facility, see Appendix C.

Groundwater at the Cortez Facility is presently pumped from two production wells and used for the following purposes: process water, domestic supply, dust control, and as part of the pollution control wells for groundwater remediation. Shallow groundwater extracted from the 14 pollution control wells is used as makeup water for the process solution circuit. The primary consumptive use of water at the Cortez Facility is due to evaporative losses. The use of shallow, poor quality groundwater for the process solution makeup minimizes the consumptive use of higher quality fresh water.

Table C-5 in Appendix C summarizes well permit numbers, groundwater pumping information, and dates for proof of completion and beneficial use for all wells owned and operated by Cortez Gold Mines. Table C-6 in Appendix C summarizes the current or planned groundwater consumptive use for each of the mine sites. Total usage as reported by Cortez Gold Mines in April 1991 is 665 gpm, or 1,072 acre-feet per year at the Cortez Facility. Total groundwater usage reported by Cortez Gold Mines in June 1992 for this Facility is about 1,300 to 1,400 gpm, which is less than their certified amount.

3.4.5 Gold Acres

Surface Water

The Gold Acres mine is located in the unnamed drainage north of Squaw Butte on the eastern flank of the Shoshone Range. The streams that drain the eastern side of the Shoshone Range are longer and have a more gradual slope than those that drain the western slopes of the Cortez Mountains on the opposite side of Crescent Valley. Only Indian Creek, located about 4.5 miles north of the mine, is known to flow year-round. All of these streams, including

Indian Creek, dry up and disappear as they cross the valley upland and flow towards the valley floor. No known streamflow or water quality data exist for these drainages based on the existing literature reviewed and agencies contacted. No surface water is used by Cortez Gold Mines.

The FEMA flood plain maps for the Gold Acres mine were reviewed for identification of flood plains in the vicinity of the mine site. The mine site is located in an area identified as being outside the 500-year flood plain. The nearest mapped flood hazard area is the 100-year flood plain located about 3 miles to the southeast (FEMA 1988).

Groundwater

Groundwater data for the Gold Acres study area is presently limited to pump test information for a water supply well. According to Cortez Gold Mines, two wells are known to exist in the mine area but no soil or rock descriptions or well completion logs are available. The wells were completed in the 1930s by the previous land owner. Water is currently pumped from one of the two wells and used primarily for dust control. According to Cortez Gold Mines, the well is presently pumped at 62 gpm or about 100 acre-feet/year.

Groundwater in the Gold Acres study area is expected to occur in fractures within the bedrock. Groundwater flow directions are expected to generally follow surface water flow routes. No groundwater quality data are presently available for this area.

The Bureau wishes to make known that there is an area located near the current Gold Acres Mine that is a potential source of contamination due to historic mining operations in the area (Figure 1.1-2). Tailings in this area are the result of mining that occurred in the 1960s. These tailings were dumped into a small drainage. They cover an area of approximately 202 acres and range in thickness from a few inches to more than 15 feet.

As discussed in Section 3.4.4 (Groundwater for the Cortez Area), it is important to note that cyanide readily breaks down upon exposure to the air and sunlight. Although unknown at this time, it is unlikely that this area currently contains measurable levels of cyanide. It is also unknown whether this area has contributed to or is currently contributing to any groundwater contamination.

Cortez proposes to remove all or portions of the tailings as part of their Pipeline Project (see Cumulative Impacts, Section 5.0). The proposed action will in no way contribute to any further contamination or degradation of the groundwater.

3.5 VEGETATION

3.5.1 Study Area

The study area for vegetation is the same as for other natural resources, e.g. soils, water, and wildlife.

3.5.2 Vegetation Baseline Conditions

The following discussion on vegetative communities in the study area is based on site visits, information from both published and unpublished reports by the USDA Soil Conservation Service, and other sources, referenced where applicable. The study area includes diverse community types. Wetlands and riparian areas are scattered throughout the study area near springs and along streams. Upland community types include shadscale/black greasewood, shadscale/bud sagebrush, sagebrush/grass, pinyon-juniper/sagebrush, and mountain mahogany. Each of these community types are described below along with typical vegetation associated with them. Not all listed species occur throughout each community.

<u>Wetlands</u>

Wetlands are represented in the study area as either seeps, springs, saline flats or wet meadows. These are often associated with thickets of willows and/or dogwood. Jurisdictional wetlands are protected by the U.S. Army Corps of Engineers (Corps) and defined by the Corps (U.S. Department of the Army 1987) and the Environmental Protection Agency (EPA) as:

> Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (EPA, 40 CFR 230.3 and CE, 33 CFR 328.3).

In the study area two kinds of wetlands are predominant. Wet meadows are created either by seeps and springs or exist along the floodplain of creeks. Saline flats in Crescent Valley are formed by streams and creeks which have no outflow. Typical species associated with these wetlands are listed in Table 3.5-1.

Throughout the study area there are approximately 585 acres of wetlands in at least 90 separate sites in the form of hillside or streamside seeps and springs. Generally these areas have been severely trampled and overgrazed by livestock. A few have corrals or holding pens constructed on them.

Large wet meadows are located along Pine Creek. These are under private ownership and are used for pastures and hay fields. Wet meadows along Pine Creek encompass approximately 1,100 acres. A large saline flat is located in the Crescent Valley. It encompasses approximately 8,400 acres.

In the vicinity of Cortez facilities there are approximately 9.9 acres of wetlands in four separate locations. These are associated with a hillside on the northwest facing slopes of the Cortez Mountains.

Three riparian areas along streams and the three small wet meadows occupy approximately 6,400 feet of the channel bank along Copper Creek and another unnamed creek which drains into Cortez Canyon.

Riparian Areas

Riparian areas are defined as areas where vegetation is the product of the presence of perennial or intermittent surface water, associated high water tables or soils which exhibit some wetness characteristics (Thomas et al. 1979).

While riparian areas exhibit some of the characteristics of wetlands, not all riparian areas meet all three of the criteria of hydrophytic vegetation, hydric soils and wetland hydrology, which would technically classify them as Jurisdictional wetlands under protection of the Corps. However, many of these riparian areas in the study area are within stream channels, below the ordinary high water mark (OHWM), and thus are regulated by the Corps as part of the Waters of the United States.

Riparian areas are typically located along perennial or intermittent streams. Many are in steep canyons with occasional heavy livestock use. Riparian areas are located in at least 220 locations along approximately 50 miles of various perennial and intermittent streams and channels in the study area. Most riparian areas are in poor condition due to cattle grazing and trampling. However, some areas in steep canyons are in good to fair condition where they are less accessible to livestock.

Surveys conducted by the BLM in 1991 in the Cortez Range found that "almost without exception, stream and riparian habitat conditions were found to be poor. Streambanks are cut and eroding, riparian vegetation is lacking, sedimentation levels are excessive and stream channels are wide and narrow. . . . Poor livestock grazing practices resulting in overuse of the riparian zone are the primary cause of poor habitat conditions along streams in the cumulative effects study area." Table 3.5-2 summarizes the results of these 1991 surveys.

Vegetation species commonly associated with these riparian areas are listed in Table 3.5-3.

<u>**Upland Communities**</u>

A vegetation map is provided in Figure 3.5-1.

<u>Shadscale/Black Greasewood Community</u>. Shadscale/black greasewood communities are found in the valley bottoms, including Crescent Valley, Grass Valley and Pine Valley. Understory vegetation consists of salt/sodium tolerant grass species. Elevation of these valley floors is approximately 5,000 feet above mean sea level (amsl). Precipitation in these areas is approximately 7 inches per year. Soils are strongly alkaline and sodium affected. When disturbed, invader species in this community type include Russian thistle, annual mustards and halogeton. The shadscale/black greasewood community encompasses approximately 40,000 acres within the study area. Vegetation species commonly found in the shadscale/black greasewood communities are listed in Table 3.5-4.

Shadscale/Bud Sagebrush Community. Shadscale/bud sagebrush communities are found around the edges of the valleys and on the alluvial fans. Grasses are the predominant understory vegetation. Soils may be neutral to strongly alkaline. Indurated duripans (strongly cemented silica hardpans), are commonly found in many soils of this community type. Annual average precipitation is approximately 7 inches. The community may be found at elevations up to 6,000 feet. Common invader species on disturbed sites in this community include cheatgrass, tansymustard, and halogeton. The shadscale/bud sagebrush community encompasses approximately 70,000 acres within the study area. Vegetation species commonly found in the shadscale/bud sagebrush communities are listed in Table 3.5-4.

Sagebrush/Grass Community. Sagebrush/grass communities are found throughout the study area, on fans and in the mountains and foothills. The understory vegetation is composed of grasses and forbs. Arrowleaf balsamroot may be a predominant understory forb. Elevations range from above 5,000 to 8,500 feet. Cheatgrass, Russian thistle and halogeton may invade these sites if excessively utilized by livestock. Average annual precipitation may range from 8 to 10 inches. Because this community type occurs over an extensive area, soil types are quite variable. Soils may be neutral to alkaline, shallow to deep, and may or may not be affected by hardpan. This is the most common community type within the study area, encompassing approximately 200,000 acres. Vegetation species commonly found in the sagebrush/grass communities are listed in Table 3.5-4.

Pinyon-Juniper Community. Pinyon-juniper communities occur in the Cortez Mountains, the Toiyabe Range and in the Granite/Bullion Mountains of the Shoshone Range. In the Granite/Bullion Mountains, black sagebrush is an important understory plant. In the Cortez Mountains and the Toiyabe Range, big sagebrush or black sagebrush may be found in the understory. Low sagebrush may also be an understory plant in the Cortez Mountains. Precipitation in areas dominated by this community ranges from about 10 to 13 inches per year. This community type is managed for forest products by both the Elko and Shoshone-Eureka Resource Areas. The pinyon-juniper community encompasses approximately 40,000 acres within the study area. Vegetation species commonly found in the pinyon-juniper community are listed in Table 3.5-4.

Mountain Mahogany Community. Mountain mahogany is found on Granzan Variant soils in the Cortez Mountains, surrounding Mount Tenabo on the east and south. The elevation is approximately 9,000 feet. Annual mean precipitation is approximately 16 inches. Slopes are steep, ranging from 30 to 75 percent. Soils are moderately alkaline, and range from 26 to 40 inches depth to bedrock. Mountain big sagebrush is the principal understory shrub. These communities may be invaded by cheatgrass if heavily impacted by livestock. Heavy livestock use can negatively impact the reproduction of the mountain mahogany. The mountain mahogany community is found on approximately 2,500 acres within the study area. Vegetation species commonly found in the mountain mahogany community are listed in Table 3.5-4.

Forestry

Management of forested lands varies slightly depending on the particular Resource Area objectives. The pinyon-juniper woodlands in the Battle Mountain BLM District portion of the study area include the areas in the vicinity of Bald Mountain in the Toiyabe Range, in the Mount Tenabo area of the Cortez Mountains, and in the Granite/Bullion Mountains of the Shoshone Range. All three of these areas are managed for noncommercial harvest of pine nuts, and for other harvest on a rotating basis with the remainder of the forested areas in the resource area (BLM 1986). The woodlands in the Elko District section of the study area are those pinyon-juniper and mountain mahogany stands found in the Mount Tenabo area of the Cortez Mountains. The Elko Resource Area manages these woodlands as harvest areas for Christmas trees, fuel and posts. Commercial pine nut sales may be allowed during years when pine nuts are abundant (BLM 1987). Figure 3.5-1 delineates the woodland areas in the study area.

Threatened and Endangered Plants

A search of the Nevada Natural Heritage Program records in Carson City indicated two Class 3C plants occur in the area. These are Eriogonum beatleyae (T26N R48E) and Lomatium ravenii (T28N R45E). A Class 3C species is one no longer being considered for listing as threatened or endangered, based upon evidence that the species has been found to be more abundant or widespread than originally thought. No additional records of threatened, endangered or candidate species were found within the study area during a search of the Elko and Shoshone-Eureka Resource Areas' files.

Vegetation in Area of Proposed Disturbance

The vegetation in the Cortez and Gold Acres expansion areas is dominated by two community tyoes: sagebrush/grass and shadscale/bud sagebrush. Descriptions of these two community types are provided below. No wetlands, riparian areas, forested lands, or other sensitive communities occur in the areas proposed for expansion.

Cortez Area. The Cortez area includes four distinct community types: Greasewood, shadscale/bud sagebrush, sagebrush, sagebrush/grass, and juniper (Figure 3.5-2). The greasewood community is found on the lower valley floor of the Crescent Valley. On lower fans, the shadscale/bud sagebrush community is found. Sagebrush/grass communities are located on alluvial fans, foothills, and mountains. A pocket of juniper/sagebrush is located south of the Cortez mine area.

Heavy livestock use and the current drought conditions have resulted in degradation of the vegetation in the Cortez project area. The communities within the Cortez area include the vegetation species outlined in Table 3.5-5.

Gold Acres Area. The Gold Acres Area consists of two community types: sagebrush/grass and shadscale/bud sagebrush. The sagebrush/grass community is located on the hills and higher fans within the project area. Shadscale/bud sagebrush is generally found on the lower fans sloping into Crescent Valley. Figure 3.5-3 depicts the vegetation communities within the Gold Acres area.

The composition of the Gold Acres sagebrush/grass community is like that of similar community types found throughout the study area. Table 3.5-6 outlines the species that occur within this community type within the Gold Acres project area.

The shadscale/bud sagebrush community type is also similar in composition to that mapped within the study area along the edges of the Crescent Valley. Those species which occur in this community within the Gold Acres project area are listed in Table 3.5-6.

Drought conditions and livestock grazing have contributed to degradation of the vegetation communities in this area.

3.6 WILDLIFE RESOURCES

3.6.1 Study Area

The study area for wildlife resources is the same as identified for soils and vegetation. This study area includes the two locations where mining activities would be expanded (Cortez and Gold Acres). It also includes additional surrounding acreage in order to adequately evaluate the potential effects from secondary or indirect disturbances to mobile species such as big game. The size of the study area also allows an evaluation of cumulative, i.e., incremental, impacts that could result from the combination of impacts from the Cortez project with impacts from other nearby mining projects affecting the same wildlife populations and/or wildlife habitat.

3.6.2 Wildlife Resources Baseline Conditions

The general vegetation types found throughout the study area are described in Section 3.5. Wildlife found in the area reflects this diversity of vegetation and habitat types, and includes both game and nongame species.

The game species known to inhabit the study area include mule deer, antelope, mountain lion, chukar, sage grouse, mourning dove, cottontail rabbit, California quail, and Wilson's snipe. A few Hungarian (gray) partridge occur in the area. A wide variety of nongame species and limited aquatic habitat also occurs in the area. A general description of these wildlife resources is provided below. Following this general description, more specific discussions are provided for wildlife resources in the specific areas of mine expansion.

<u>Mule Deer</u>

Mule deer occur throughout the mountains and foothills of the study area. Summer range is generally located above 7,500 feet in most ranges, while year-long and winter range is found at the lower elevations. In the western mountain ranges of the Bureau of Land Management Shoshone-Eureka and Elko Resource Areas, including the Shoshone Range, mule deer seasonal movement is generally elevational, with movement largely occurring on individual mountain ranges. In the eastern part of the area, many deer move greater distances to the south in winter, returning to the more northern mountain ranges with the onset of spring (BLM 1983). The Elko district of the BLM identifies most of the Cortez Range as year-long mule deer range with the higher elevations being utilized in summer and lower elevations used as winter range (BLM 1985).

A part of the northern Toiyabe Range is identified as mule deer year-long range. The western slopes of the extreme northern end of the Toiyabe Range are identified as mule deer winter range, as shown in Figure 3.6-1 (BLM 1983).

Much of the Shoshone Range is utilized as year-long range, with summer range again generally found at the higher elevations. As noted above, deer seasonal movement tends to be primarily altitudinal in this range, though some deer may move south and east into southern Carico Lake Valley and perhaps into the Toiyabe Range (NDOW 1982). Reasonable numbers are estimated at 1,231 mule deer on the year-long range.

Antelope

Few antelope currently occur in the study area. Antelope were introduced into Pine Valley in the 1950s. By the late 1950s, this herd had increased to as high as 200 animals. Subsequently, the size of this herd has dropped, with approximately 50 to 75 animals present in the early 1980s (NDOW 1983). A lack of forbs and grasses is suspected to be at least partially responsible for this population decline. The Elko District of the BLM identifies a part of the southeastern Cortez Mountains, from north of Agate Pass to south of Horse Canyon, at elevations generally below 7,000 feet as critical antelope summer range (Figure 3.6-1) (BLM 1983). The Pine Valley area is utilized year-round by antelope, while the Rocky Hills area of the northern Simpson Park Range is identified as antelope winter range (BLM 1983). The Buckhorn area of the Cortez Mountains has been identified as a high priority augmentation site (NDOW 1983). NDOW released 30 antelope in this area in December of 1984.

Mountain Lion

Mountain lions occur in low numbers in the mountain ranges of the study area, including the Cortez Mountains. The NDOW has estimated that the Cortez Mountains support a resident population of six adult animals (NDOW 1983), while an average of eight lions may be present in the Simpson Park Range and somewhat higher numbers may occur in the Shoshone and Toiyabe ranges (NDOW 1982). Lion tracks were discovered on an exploration road east of Mount Tenabo in early April, 1991. The BLM notes lion numbers in the Cortez Range may now be lower, reflecting the decrease in deer numbers in the range (Sherwood 1991). However, the NDOW notes lions may be able to supplement the prey base by preying upon weakened wild horses (Teske 1991).

Sage Grouse

Sage grouse utilize mountainous areas of the study area as both winter and brood rearing areas, with the Simpson Park Range, south of the study area, supporting a large population. Sage grouse utilize traditional strutting grounds, or leks, for courtship in spring. These strutting grounds are generally located on valley benches and in mountain foothills (BLM 1983). Within and near the study area, the greatest concentrations of strutting grounds are found in Grass and Carico Lake valleys. Nesting usually occurs within 2 miles of a strutting ground. Wet meadow and riparian areas are utilized as brood rearing habitats, and provide a crucial source of insects and succulent forage for young birds. Together, the strutting grounds, nesting and brood rearing areas form a sage grouse habitat complex which may encompass areas from valley floors or benches up into the mountains, to include mountain meadow habitats. An extensive sage grouse habitat complex is located in northern Grass Valley, including parts of the southern Cortez Mountains. Another complex is centered in the southeastern foothills of the range, between Horse Canyon and Willow Creek. A third complex is found on and above upper Pine Creek.

In Crescent Valley, strutting grounds are known or formerly occurred near Tenabo, north of Indian Creek and near Mud Spring Gulch, again with nesting usually occurring within two miles of the lek and with streamside and mountain meadow habitats utilized for brood rearing.

The Shoshone-Eureka Resource Management Plan (RMP) notes that trampling by livestock and wild horses, and over-utilization of forage have resulted in damage to much of the spring, wet meadow and riparian habitat in the resource area (BLM 1983). Similar damage was noted in the Elko Resource Area during a site visit. This and other human-related disturbance, including mine development, have resulted in a generally downward trend in the sage grouse population in the area (NDOW 1982).

Chukar

Chukar occur throughout the lower elevations of the study area, with a concentration found in the northern Toiyabe Range south of Cortez Canyon. Battle Mountain BLM wildlife biologists identified this area as one of the best chukar habitats in the Shoshone-Eureka Resource area (Sherwood 1991). The steeper, western slopes above southern Crescent Valley are particularly favored. These high density areas support 30 to 50 birds per square mile.

Like sage grouse, chukar are dependent on riparian and wet meadow habitats for brood rearing, and on water sources as a necessary component of their habitat in general. Management practices that result in impacts to these habitats would adversely affect chukar populations.

Other Game and Furbearers

Hungarian partridge occur in low numbers in the project area. A population high was recorded in the early 1970s, but subsequently populations have declined (NDOW 1983). Mourning doves are usually one of the more common game species found in the project area during spring, summer and early fall. Mourning doves require water sources as well as seeds and insects.

Other game species found in the area include scattered California (valley) quail populations, pigmy and cottontail rabbits, white-tailed jackrabbits, and Wilson's snipe. California quail are dependent on riparian habitats, many of which have been impacted by grazing. Severe winters can be very detrimental to quail populations. Rabbit and hare populations are cyclical and can vary considerably. Snipe utilize wetland and wet meadow habitats.

Furbearers occurring in the study area include kit fox at lower elevation, gray fox in mountainous areas, coyote, bobcat, badger, and other mustelids throughout the study area. The NDOW emphasizes the importance of streamside riparian habitats for many furbearer species (NDOW 1982, 1983).

Birds

Waterfowl and shorebird habitats in the study area are limited. Ranch ponds and fields and larger streams, primarily Pine Creek in Pine Valley, attract migrating water and shore birds. Perennial water in the study area may support a few nest pairs of mallards.

Raptor species occurring in the study area include resident golden eagles and red-tailed hawks, wintering rough-legged hawks, and nesting spring and summer residents including Cooper's and sharp-shinned hawks, Swainson's and ferruginous hawks, turkey vultures, northern harriers, prairie falcons, and American kestrels. Great-horned owls may occur throughout the area. Long-eared owls have been observed in the Shoshone Range, and Crescent and Pine valleys support concentrations of burrowing owls (Herron et al. 1985). During spring surveys in 1991, a goshawk was observed in the northern Toiyabe Range. Most raptors utilize cliffs, outcrops and larger trees as nest sites. Some, including the burrowing owl, are ground nesters.

Three pairs of Swainson's hawks and a single pair of ferruginous hawks have been recorded in the northern Toiyabe Range, in the vicinity and south of Cortez Canyon (Sherwood 1991). Both of these raptors are species of concern, having declined over most or all of their range. The ferruginous hawk is a Candidate 2 species, a species for which listing as threatened or endangered may be warranted, but which requires further study before this determination is made.

Non-Game Species

Nongame species found in the study area reflect the diverse habitats found within the study area, which range from desert valleys to mountain habitats reaching elevations of over 9,000 feet. The greatest diversities of nongame wildlife occur in spring and summer, when a variety of migratory birds breed throughout the area. These and resident avian species and small mammal species support the area's raptor populations and several mammalian predators. Within the general study area, wetland and riparian habitats support the greatest diversity of wildlife. The BLM's Shoshone-Eureka RMP notes that during a 1980 wildlife habitat inventory, "106 of 129 species observed in the field were associated with wetland or riparian habitat" (BLM 1983). Both Battle Mountain and Elko BLM Districts indicate that over 300 species of wildlife occur in the two districts (BLM 1983, 1985).

Fisheries

Fisheries in the study area include Indian Creek, in the Shoshone Mountains, which supports a nongame fishery of dace and shiners (Sherwood 1991). The BLM Shoshone-Eureka RMP identifies as a long-term goal the improvement to good condition of 2.0 miles of riparian/aquatic habitat on Indian Creek. No streams in the area currently support Lahontan cutthroat trout or any other game fish. A pond which has formed in an abandoned pit at the Cortez Mine has been stocked with bass (Erickson 1991).

Important Wildlife Habitat

Several habitat types are particularly important to wildlife species, as noted in the above discussion. Habitats of particular importance to wildlife include the limited aquatic and wetland areas, the similarly scarce riparian areas, including aspen and willow stands, and other meadows. Many aquatic, wetland and riparian areas within the study area have been degraded by past land use practices. Bitterbrush, serviceberry, mountain mahogany and to a lesser extent big sagebrush stands provide important winter forage sources for mule deer. Pinyon-juniper forest, mountain mahogany stands and areas of dense brush provide thermal and hiding cover for deer and other species. Larger, deciduous tree species are also limited but important, providing elevated nest sites and habitat for cavity nesting birds including kestrels, woodpeckers and mountain bluebirds. Sage grouse utilize low dense sagebrush stands as nesting sites. Land use practices and range fires have decreased the amount of this habitat type present in the area. Pinyon pine nuts form a valuable forage item for many species, including pinyon jays, mountain chickadees and several small mammals.

Threatened and Endangered Wildlife

Bald eagles and peregrine falcons may pass through the area, but habitat conditions are not conducive to either species, and neither species nests or makes use of critical habitat in the study area.

Several Candidate, Category 2 species (species for which listing as threatened or endangered may by warranted, but which require further study before such a determination is made) occur within the study area. These include the western big-eared bat, the spotted bat, pigmy rabbit, the northern goshawk, ferruginous hawk, the long-billed curlew, the loggerhead shrike and, possibly, the western snowy plover.

The western big-eared bat and spotted bat are generally cave dwellers, though the big-eared bat may roost in buildings. Both occur throughout the state. The spotted bat occurs in a variety of elevations and habitats, while the western big-eared bat is generally found in desert scrub and pinyon-juniper habitats (Jameson and Peeters 1988).

Pigmy rabbits occur throughout the Great Basin, particularly in rocky habitats dominated by sagebrush. Pigmy rabbits often remain near dense cover (Jameson and Peeters 1988).

Within the Great Basin, northern goshawks generally nest in aspen groves, usually very near creeks (Herron 1991). A single bird was seen in the northern Toiyabe Range during spring, 1991 surveys, and a bird was reported from Cottonwood Canyon, in an aspen grove, in the fall of 1981 (Podborny 1991). Little suitable goshawk nesting habitat occurs in the study area, however.

Ferruginous hawks have been reported from pinyon-juniper habitats in the northern Toiyabe Range, and are believed to nest in the area (Sherwood 1991). This species often nests in junipers located on alluvial fans or foothills at the extreme edge of juniper stands.

The long-billed curlew, currently classified as a C-3 species, nests in a variety of habitats, including in and near wetland areas and in agricultural and meadow habitats. Concentration areas occur along the Humboldt River. Within the Great Basin, territorial long-billed curlews have been recorded in greasewood habitats located near wetlands. This species may be reclassified as a C-2 species in the future (Hamblin 1992).

Loggerhead shrikes are often a fairly common species in the Great Basin, though their populations appear to fluctuate considerably. Loggerhead shrikes, a passerine predatory species, occur in a variety of habitats, from greasewood on valley floors to serviceberry habitats in the mountains. Shrikes will often nest in fairly large bushes, including greasewood and serviceberries.

The western snowy plover nests on playas, either on the bare playa itself or in saltgrass habitats on playa borders (Bradly 1991). Such habitats occur within the study area, but not near the area of proposed disturbance.

Cortez

The Cortez area is located in the low-precipitation sagebrush, greasewood, and shadscale shrublands in southeastern Crescent Valley, at the base of the Cortez Mountains. Sagebrush, grassland and pinyon-juniper habitats occur in the foothill areas of the mountain ranges above mining activities at the Cortez Facility. The majority of the project area is moderately to heavily modified by existing mining operations. Several areas of new disturbance are proposed, adjoining existing disturbance and bordering foothill habitats.

This area is located within NDOW mule deer Management Area 14, Unit 141 (the majority of proposed expansion area) and Management Area 15, Unit 154 (Copper Canyon area). BLM identifies the lower elevations of the Cortez Mountains and the western foothills of the northern Toiyabe Range as mule deer winter range. Deer generally migrate altitudinally, leaving the higher elevations of the mountain ranges with the onset of snowy weather.

Antelope generally utilize the valley and foothill habitats east of the crest of the Cortez Mountains, and are seldom seen in the Cortez area. However, these animals appear to be pioneering new areas, and a band of eight animals was observed near the Cortez Mine turnoff in the spring of 1992.

Several raptor species, including Swainson's and ferruginous hawks, utilize pinyon and juniper trees as nest sites. BLM personnel have observed up to three pairs of Swainson's hawks and a single pair of ferruginous hawks in this area (Sherwood 1991). The pinyon-juniper forest also supports several nongame species not found in the more abundant mixed shrubland habitats of the area, including Townsend's solitare, black-tailed gnatcatcher, mountain bluebird and mountain chickadee.

__Gold Acres__

Wildlife habitat in the Gold Acres area includes predominantly sagebrush-grass foothill and fan habitats. Generally, grasses grow under or near the cover of shrubs.

The Gold Acres area lies within NDOW Mule Deer Management Area 15, Unit 152. According to the BLM, the Gold Acres area is located east of identified mule deer yearlong range in the Shoshone Mountains (BLM 1983), though deer do occur in the area, particularly in winter and during migration (Sherwood 1991, Teske 1991). Deer numbers have declined in the Management Area recently, with this Unit and Unit 151 showing reduced buck ratios in 1989-1990 (Teske 1991). The Gold Acres area itself is highly disturbed and contains only low value mule deer habitat.

While the Gold Acres area is not within identified antelope range, antelope in the general area seem to be pioneering new areas, and a band of eight animals was observed near the Cortez Mine turnoff in the Spring of 1992 (Teske 1992, Lamp 1992).

The nearest recorded sage grouse strutting ground is located near the Clipper Mine, approximately 2.5 miles northwest of the project area. No riparian or wet meadow areas occur within the Gold Acres project area.

Chukar and Hungarian partridge may occur in the project area, though the area has been heavily modified by existing mining-related disturbance.

Nongame found in the area includes raptors and ravens, which utilize the area as hunting territory. Horned larks occur in the area year round. Western meadowlarks, sage thrashers, Brewer's and sage sparrows nest in the area in spring and summer.

3.7 RECREATION AND WILDERNESS

3.7.1 Study Area

The objective of the recreational resource study is to identify recreation resources in the vicinity of the project area which could be affected by the proposed development. The study area for recreation resources encompasses portions of Elko, Lander, Eureka, Humboldt, and Pershing counties. This area is included in planning Regions IV, V, and VI of the Nevada Statewide Comprehensive Outdoor Recreation Plan (SCORP) (Nevada Department of Conservation and Natural Resources 1987). Study area definition was based on the fact that some workers at the Cortez Mine live up to 70 miles from the mine, with over 50 percent living in Carlin and Elko (see Section 3.9, Socioeconomics). Because developed recreational opportunities are relatively sparse in this part of Nevada, it is assumed that users would travel to some of the remote areas, especially on weekends, to recreate.

Information was compiled from maps and literature supplied by public and private agencies and from meetings and telephone communications with federal, state, county, and community officials.

3.7.2 Baseline Conditions

Recreational opportunities can consist of dispersed recreation (such as hunting) or use of developed recreational facilities. Recreation opportunities also consist of hiking and camping in nearby WSAs (Roberts and Simpson Park) and photography, especially of the historic Cortez structures. There are limited developed recreational opportunities within the project area. Water-based recreational sites or unusual features that normally attract people are lacking. Primary recreational opportunities consist of hunting, off-road vehicle (ORV) use, and rockhounding.

The 1987 SCORP indicates that the supply and demand of recreational opportunities is somewhat varied across the three planning regions. Generally, the demand for recreational facilities by residents of the regions is projected to exceed the supply between 1990 and 2000. Additionally, residents of the more populated regions of the state and out-of-state residents also use the facilities of these regions. Opportunities that appear to be particularly stressed are lakes and streams, bicycle trails, tennis courts, and ball fields.

For instance, demands for fishing streams are higher than supply in all three planning regions, and the need is projected to increase. The number of tent camping sites in Regions IV and V is projected to be adequate through the year 2000, but the demand currently outstrips the supply in Region VI. While the total number of campsites may be considered adequate, some of the more accessible sites received much heavier use due to their proximity to population centers. The number of tennis courts is inadequate in all three regions, while the number of golf courses is projected to be adequate through 2000.

Some of the numbers used in these projections were based on telephone surveys taken 9 and 14 years ago. Since this was before much of the recent mining activity in the region, the demand figures may be low. Growth projections may have been focused more on urban centers and less on communities within the general study area. The focus of recreational pursuits may also have changed. For instance, while the cumulative miles of bicycle trails is projected to be sufficient in the three regions, the accounting probably did not take into account the recent surge in the popularity of mountain bike use. The SCORP cautions readers to use these numbers as general indicators of the need for additional facilities. Also, these projections included only increased demand and not an increase in the facilities.

The majority of the mine employees live in Elko, Crescent Valley, Carlin, Battle Mountain, and Beowawe. Recreational facilities in Elko include: a golf course, parks, soccer fields, archery range, speedway, firearms range, trap and skeet range, ball fields, swimming pools, wading pool, tennis courts, and gymnasiums. The county fairgrounds include a rodeo arena and horse track. The city of Elko has formed a recreation district and is starting to organize community recreation activities. The parks, ball fields and swimming pools receive heavy use and demand exceeds supply.

Recreational facilities in Crescent Valley are limited. There is a child's playground and a basketball court. A park with a ball field, horseshoe pits, picnic tables, and barbecue pits is planned for construction this year. Additionally, the North Eureka County Fairgrounds is under construction (Manual 1991).

Carlin maintains a city park with a playground, tennis courts, basketball courts, baseball field, concession stand, and bleachers. The town also has a baseball field complex. Long-range plans include a municipal swimming pool, golf course or putting green, an additional ball field, and an additional playground. Land has been donated for the proposed swimming pool, but funding for the other improvements has not been secured (BLM 1991).

Recreational facilities in Battle Mountain include four parks, a golf course, tennis courts, baseball fields, a swimming pool, an auto race track, and a rodeo arena. A sports recreation center is in the planning stages (Mize 1991). Developed recreational facilities in Beowawe are extremely limited, consisting only of the school gymnasium which is occasionally opened for public use (Summers 1991).

In addition to these public facilities, there are some private facilities in Elko and Carlin, which include swimming pools, tennis courts, a campground, fishing pond, and ball fields.

Figure 3.7-1 depicts developed recreation areas in the general region. The majority of these areas are managed by the BLM and the U.S. Forest Service. State or local entities manage a few of them such as the Wild Horse and Chimney Creek reservoirs, and the South Fork State Recreation Area. The U.S. Fish and Wildlife Service manages the Ruby Lake National Wildlife Refuge. Generally speaking, these facilities receive the heaviest use on the weekends and during holiday periods. Some of the campgrounds away from fishing areas and population centers receive lighter use except during hunting season.

3.7.3 Wilderness Study Areas

Due to existing disturbances, the immediate project area was never considered as a WSA. There are 12 WSAs within the general region as depicted on Figure 3.7-1. Of these, six have been recommended as suitable for National Wilderness Area Designation. They include the North Fork of the Little Humboldt River, Roberts, South Fork of the Owyhee River, Owyhee Canyon, Little Humboldt River, and Rough Hills. The Roberts WSA is the closest one to the project area; it is located approximately 18 miles south-southeast of Cortez. The Roberts WSA contains over 15,000 acres and is characterized by narrow, deep forested canyons, barren rock ridges, and isolated stands of mountain mahogany and timber pine. It offers numerous opportunities for secluded primitive and unconfined recreation (BLM 1983). The

U.S. Congress will make the final decision as to which WSAs will become designated wildernesses. BLM will curtail development in all WSAs until that decision is reached.

In addition to the WSAs managed by the BLM, the U.S. Forest Service also has designated wilderness areas in the Humboldt National Forest including the East Humboldt Wilderness Area, the Ruby Mountain Wilderness Area and the Jarbidge Wilderness Area.

3.8 VISUAL RESOURCES

3.8.1 Study Area

The objectives of the visual resources investigation are to identify and describe the visual resources which could be affected by the construction and operation of the proposed action and related facilities. The study area includes those landscapes that viewers could travel through, recreate in, or reside in where existing view could be affected by the proposed action or ancillary facilities. This study area is bounded on the west by the crest of the Shoshone Range; on the east by state highway 27; on the south by Simpson Park and Roberts Mountains; and, on the north several miles north of Crescent Valley where the proposed areas of mine expansion can first be viewed.

Visual resources are described using guidelines in the Visual Resource Inventory Manual (BLM Manual Handbook 8410-1, 1/17/86). Under the Visual Resource Management (VRM) system, the visual resource inventory has three major components: scenic quality, visual sensitivity, and visual distance zones. Based on these three factors, lands are placed into one of four visual resource inventory classes. These inventory classes represent the relative value of the visual resources. The inventory classes provide the bases for considering visual values in the resource management planning (RMP) process. VRM objectives are established for each class. Table 3.8-1 details the VRM class objectives.

Landscape character type is a unit of physiographic area having common characteristics of landforms, rock formations, waterforms, and vegetation patterns. The landscape character by which scenic quality is judged is based upon descriptions in Fenneman (1931).

3.8.2 Baseline Conditions

The study area is located in the northern Great Basin section of the Basin and Range Physiographic Province. The Great Basin is characterized by a rhythmic pattern of isolated mountain ranges and broad basins. Clear skies with broad open vistas characterize this landscape. Vast areas of sagebrush and scattered grasses cover the valley basins. Infrequent linear patterns of riparian willows and cottonwoods outline the larger drainages. At higher elevations, mixed shrubs and scattered pinon-juniper forests cover the mountains.

The mine expansion areas and surrounding area are characteristic of the province: a broad, flat-to-gently rolling landscape with abruptly rising foothills to the west. Project elevation ranges from approximately 4,840 feet (Cortez Operation), 5,170 feet (Gold Acres) to 8,145 feet (Horse Canyon). The Horse Canyon area is primarily located in Cortez Mountain range with Mount Tenabo the highest peak at 9,153 feet. Vegetation is a homogeneous pattern of sagebrush and grasses at lower elevations and pinyon-juniper and mixed shrubs at higher elevations. Mine expansion activities that would occur at each of three locations are all adjacent to existing visually-dominant mine disturbance areas. Vegetation colors include tawny, gray, brown, and dark green. Soils range from beige to a chalky off-white color, which, when exposed, contrast highly with the surrounding vegetation. Rock colors vary from light to dark brown to burnt orange.

The study area contains several recreation locations and travel routes. These include the Roberts Mountains and Simpson Park Wilderness Study Areas, Cortez Historic Mining District, Tonkin Springs Reservoir, State Highway 278 and 306. The community of Crescent Valley is located approximately 14 miles north of the Cortez Mine area.

The BLM has established VRM classes for the study area (Figure 3.8-1). The study area and basin to the east have been designated VRM Class IV. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements. For Class IV lands, the level of visual change to the landscape can be high, dominate the view, and may be a major focus of viewer's attention. To the west of the mine expansion areas is a strip of VRM Class III land. A description of the landscape for each of the proposed mine expansion areas, Cortez and Gold Acres, is provided below.

Cortez. The Cortez area is located at the base of Mount Tenabo, which is a visually prominent land feature in the study area. Steep rugged irregular terrain is characteristic of the area. At the base of the mountain is the existing Cortez mine and milling operation which significantly contrasts with the natural landscape. The landscape is disturbed with pyramidal landforms and blocky manmade structures. The landscape below the existing operations area is a flat valley. A geometrically shaped tailings pond is the only waterform present. The color of the Cortez operation consists of light chalky browns and red-browns which contrast the adjacent vegetation colors of sage green and dull beige. Textures range from fine to medium on the mountain; coarse to medium for the operations area and fine for the valley bottom. The existing haul road is visually evident causing a lighter horizontal line next to darker vegetation patterns. Dust plumes from haul trucks and mill operation are visually evident.

Gold Acres. The Gold Acres area contains smooth, rounded and moderately steep landforms. Vegetation is mottled and fine textured. Color ranges from tawny to sage green. A network of lighter colored chalky beige roads are located on foothill slopes. No waterforms are apparent. A few blocky formed, lighter colored, smooth textured manmade structures are located in the vicinity of the existing mining disturbance. The disturbed area contains waste rock piles of lighter brown to reddish-beige colors which contrast the vegetation colors. Dust plumes from haul truck activity are occasionally noticeable.

3.9 SOCIAL AND ECONOMIC VALUES

3.9.1 Study Area

Social and economic effects of the proposed project would likely occur in communities close to the project site where Cortez employees currently reside, and in the counties where Cortez operations are located. The study area includes Battle Mountain in Lander County, Beowawe and Crescent Valley in Eureka County, and Carlin and Elko in Elko County. This section describes the current demographic characteristics and economic conditions in this three-county project area and the communities listed above. In describing current conditions, the impacts of current Cortez operations are also described to provide a basis for comparison for evaluating effects of the no action alternative.

3.9.2 Population

Table 3.9-1 presents the current and projected population of the communities in the study area. The Elko County population doubled over the period from 1980 to 1990, while the Lander County population grew by about 54 percent over the same period. Eureka County recorded a relatively small growth in population (29 percent) over this period. Most of the growth in the study area population has occurred since 1986, primarily due to immigration of mining workers in response to growth in mining activity. This growth has centered around cities such as Elko, Carlin, and Battle Mountain, (e.g., population growth of 55 percent in the City of Elko, and almost 98 percent in Carlin between 1985 and 1989). Recent growth trends are expected to continue over the next 5 years. According to official Nevada state projections, Elko County population is expected to increase by another 28.9 percent between 1990 and 1995. During the same period, Lander County population is projected to increase by 17.2 percent. However, growth in Eureka County population is expected to be relatively less marked; an increase of 5.2 percent is projected (Nevada Department of Administration 1990).

3.9.3 Economy and Employment

Nevada's economy is dominated by the service industry, primarily by the hotel, gaming and recreation sectors. However, rapid increases in mining sector employment have been recorded in recent years due to the increase in gold mining in many counties. Eureka and Lander counties depend heavily upon mining for employment. As shown in Table 3.9-2, about 83 and 48 percent of the labor force in these counties was employed in mining in 1989. The economy of Elko County depends more on the service industry, and mining accounted for about 8 percent of all jobs in 1989. However, Elko residents also commute to mines in adjacent counties in substantial numbers. Unemployment rates in the project area in 1989 ranged from 5.7 in Lander County to 2.4 in Eureka County (Nevada Department of Administration 1990).

Cortez Gold Mines currently employs a total of 193 personnel. Table 3.9-3 presents information on the distribution of these employees by place of residence. Most of the employees reside in Elko, Crescent Valley and Carlin.

3.9.4 Housing

Recent U.S. Census data indicate that there were 5,817 housing units in Elko in April 1990 (Naroll 1991). This has grown from 3,883 units in April 1988, which included 947 apartments and 736 mobile homes (Lipparelli 1988). Housing stock in Carlin grew from 850 to 888 over 1989-1990. Housing stock in Battle Mountain is reported by the 1990 census to consist of 1,431 units. Breakdown by type of unit is not available for Battle Mountain. However, statistics for Lander County for earlier years reveal that more than half the housing units in Lander County and Battle Mountain are mobile homes. In addition to permanent housing, there are about 200 motel and hotel rooms in Lander County, mostly located in Battle Mountain. Rental housing is generally unavailable in project area communities, although a few homes are for sale and trailer hook-ups are available (Summers 1991; Shangal 1991).

3.9.5 Schools

Schools in the Elko-Carlin area are owned and managed by Elko County School District. Currently there are five elementary schools, a junior high and a high school in the city of Elko, and two elementary schools in Spring Creek, a community near Elko. There is one combined school in Carlin. School capacities and enrollments in 1992 are reported in Table 3.9-4. All schools are at or over capacity. One elementary school is operated entirely out of mobile trailers, and trailers are also used in the other schools, with one-third of all students in trailers. Some of the effects of this overcrowding are classroom loadings above State-mandated levels, very high student-teacher ratios, use of team teaching, inability of the schools to offer all electives or to provide a lunch program, and the elimination of certain special programs. In addition, this overcrowding in Elko-Carlin schools has placed such enormous demands on the District's resources that the District is unable to provide necessary facilities in other schools in Wendover, Jackpot and Owyhee. The District is currently building one school each year. One junior high, high school and permanent elementary school is planned in Spring Creek, and a high school, a junior high and two new elementary schools in Elko. The District's building needs for the next eight years (1991-1999) are projected to be $50 million and the building program is predicated on a $0.5 per $100 assessed value pay-as-you-go tax levy (Billings 1991).

Communities of Beowawe and Crescent Valley are served by an elementary school located in Beowawe. The school enrollment in 1991 was 34 students, although the school has the capacity to accommodate 80 to 100 students (Summers 1991). There are one primary, one elementary, one junior high and one secondary school in Battle Mountain. Total enrollment in the Battle Mountain schools in 1991 was 1,373 students (Smith 1991). All schools in Battle Mountain except the primary school have capacity to accommodate additional students.

3.9.6 Utilities and Services

The City of Elko added two water wells in the summer of 1990 and has the budget to add a 3-million-gallon storage tank. The City has completed Phase I of its sewer treatment modifications, which created a capacity sufficient to serve another 7,000 to 8,000 persons over 1990 population (Klein 1990). The City of Carlin has sufficient water and sewer capacity to accommodate a population of 5,000 (Aiazzi 1990), which is almost 2,500 additional persons over the 1990 population.

Homes and trailers in Crescent Valley and Beowawe are served by septic tanks. The water supply system was recently upgraded by Eureka County (Summers 1991).

Lander County provides water and sewer services to the residents of Battle Mountain. The sewer treatment plant for the town has a capacity of 800,000 gallons per day, and is currently treating 450,000 gallons per day. A sewer pond is planned in the near future to facilitate the disposal of treated wastewater. The water system has a water storage capacity of 2.3 million gallons. Water demand fluctuates between 0.6 to 1 million gallons per day. A new well and storage reservoir with a capacity of 2 million gallons is planned to provide better fire protection to newer areas of the town (Lang 1991).

3.9.7 Public Finance

A large percentage of the State of Nevada's revenues is derived from the tax on gaming winnings. Nongaming tax revenues consist of property tax, sales tax, the statewide gas tax, cigarette and liquor tax, the drug manufacturer's tax, the estate and lodging tax, and the net proceeds-from-mines tax. Nevada has a 6 percent sales tax rate, which includes 2 percent state sales and use tax, 1.5 percent school support tax, 2.25 percent County/City Relief Tax, and an optional 0.25 percent Mass Transit Tax. The sales tax in Elko, Lander and Eureka counties is 5.75 percent.

The ad valorem property tax rate is $2.2212 (1989-90) per $100 of assessed value for Elko County, and $1.6170 (1990-91) per $100 of assessed value for Eureka County. The basic rate is $2.9824 (1990-91) per $100 assessed valuation in Lander County, although the tax rate is higher and varies among the eight taxation districts. In addition, mining operations in the State generate net proceeds-from-mines tax revenues. This tax is assessed on the net proceeds or net profits of mining operations and currently is $5 per $100 for net proceeds in excess of $4 million. The rate is lower for operators with net proceeds less than $4 million. The tax is collected by the State and is shared by the State and the county where the net proceeds were generated. The county receives revenues equal to its ad valorem rate applied to the net proceeds. Annual revenues from property taxes, net proceeds-from-mines taxes and sales tax are reported in Table 3.9-5 for the three counties.

Current Cortez Gold Mines operations generate both property tax and net proceeds-from-mines tax revenues for the counties. Taxes paid by Cortez in 1991 are reported in Table 3.9-6. In addition, $7.3 million were paid in salaries and wages in 1991. Given that about 33 percent of personal income is spent on taxable goods (Bureau of Labor Statistics 1989), this payroll generated an estimated $138,675 in sales tax revenues in the regional economy in 1991. Most of these revenues accrued to the communities where Cortez employees reside.

3.10 LAND USE/LIVESTOCK GRAZING

3.10.1 Land Use

The study area (Figure 3.10-1) is almost equally bisected by the Eureka and Lander County line running in a north-south direction from the town of Crescent Valley to the northern end of Grass Valley. The Elko and Battle Mountain districts of the BLM are also divided by the county boundaries in the study area.

The eastern-most portion of the study area is several miles west of State Highway 278 from Carlin to Eureka. The western boundary of the study area runs from Mt. Lewis in the Northern Shoshone Mountains Range south to Bald Mountain in the northern Toiyabe Range.

3.10.2 Land Status and Land Use Authorizations

Public lands predominate the study area except along the northern tier which comprises the typical "checkerboard" railroad lands wherein alternate sections of private and public ownership exists in association with railroad lands (Figure 3.10-2). Although some private and public lands have been consolidated into larger blocks, the remaining intermingled ownership presents unique land management challenges to both the agencies and the private land owners. In addition, the irregular shape of patented and unpatented mining claims by different claimants throughout the study area presents the land owners and the Bureau of Land Management unique concerns.

The major transportation route in the study area is State Highway 306 traversing Crescent Valley from north to south. The highway is paved from the town of Crescent Valley south about 12 miles. It then becomes a gravel road southward. Other gravel and dirt roads including County and BLM, occur within the study area. The non-BLM roads are not official BLM right-of-way grants except for those roads listed in Table 3.10-1. Cortez Gold Mine has one of the two recorded road rights-of-way in the study area. That right-of-way (N43670) is for a 200 ft. wide mine haul road from Gold Acres to the Cortez millsite. Other existing haul roads for the Cortez Mine have been constructed under approved mining plans of operations. The major haul road is a 14 mile facility from Horse Canyon to the Cortez millsite. The public land use authorizations are shown in Table 3.10-1 and are shown on Figure 3.10-2.

3.10.3 Land Use

The major land uses within the study area are livestock grazing and mining. Generally these uses are compatible although in areas of concentrated mining activity, livestock grazing is affected by the loss of forage on disturbed areas. Historic use patterns and livestock movement are also affected in those areas. Considering the vast expanse of the study area and the isolated areas of mining, direct competition is minimal. There have been no reductions in authorized grazing use due to mining activity.

While public lands predominate in the areas proposed for mine expansion (336 acres), patented mining claims cover an appreciable area in each mine expansion location (92 acres).

Livestock Grazing

Portions of three livestock grazing allotments lie within the study area (Figure 3.10-1). Table 3.10-2 reflects livestock grazing allotment data within the study area. Mine expansion activities included in the proposed action are confined to the Carico Lake Allotment administered by the Battle Mountain District.

The BLM has determined the management of each grazing allotment through a planning process referred to as selective management categorization. The process assigns extent and priorities for activity planning within each allotment including range improvement facilities which would be required to accomplish management objectives. As depicted in Table 3.10-2, the grazing allotments within the study area are classified by the BLM as "Improve" (I) allotments. On category I allotments, the objective is to improve current unsatisfactory conditions.

Livestock grazing is authorized generally on a year-round schedule for the Carico Lake Allotment. Use of the higher elevations by livestock is dictated by seasonal weather patterns. Until 1991 licensed grazing use has not been affected by drought conditions. However, the BLM is evaluating potential reductions in authorized use. Table 3.10-3 lists active grazing preference by livestock operators in the study area, the class of livestock, and the normal grazing season.

Although there is considerable wild horse trespass on public lands, particularly in the South Buckhorn Allotment, a small portion of the Bald Mountain Wild Horse Herd Use Area extends into the study area, but no wild horses are known to occur in this specific area of the Carico Lake Allotment (Figure 3.10-1).

Appendix D contains the summary of resource management decisions for each resource in the Elko and Shoshone-Eureka Resource Areas. The impacts of the Proposed Action to those management decisions will be discussed in the Environmental Consequences chapter.

3.11 CULTURAL RESOURCES

Cultural resources include prehistoric and historic archaeological sites, historic architectural and engineering remains, and sites of traditional value or religious importance to Native Americans or other ethnic groups. A cultural resource is considered significant when it has been determined that it is eligible for inclusion on the National Register of Historic Places. Cultural resources are significant in local, state, or national history, based on their architecture, archaeology, engineering, or culture. They must possess integrity of location, design, setting, materials, workmanship, feeling and association. They must contribute to an understanding of history or prehistory through the variety, quantity, clarity, and research potential of the information present, and must:

A. be associated with events that have made a significant contribution to the broad patterns of our history; or

B. be associated with the lives of persons significant in our past; or

C. embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master or that possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or

D. have yielded, or may be likely to yield, information important in prehistory or history.

3.11.1 Study Area

The area of proposed disturbance for the cultural resources analysis is comprised of 428 acres consisting of two separate areas where proposed mine expansion activities would occur. These new facilities are located in the Cortez and Gold Acres areas (Figure 3.11-1).

An intensive (Class III) cultural resources survey was conducted on lands encompassed within the study area as well as an additional 5,249 acres. The additional 5,249 acres were identified by BLM as buffer areas and other areas where future mine expansion could be anticipated. These areas were not brought forward for detailed analysis. The results of this inventory are provided in a Cultural Resources Technical Report. A summary discussion of prehistory, ethnography, and history for the area of proposed disturbance and surrounding region is provided below. In addition to the Class III survey, a 167,000-acre cultural resources cumulative effects study area was identified by BLM to represent a surrounding area with similar mining and grazing activities. The assessment was designed and conducted in a manner to conform with the requirements of a BLM Class II cultural resource inventory. A technical report which documents the results of this Class II inventory has been prepared and is summarized in this section of the EIS. The results of this study are further analyzed in Section 5.3.11 of this EIS.

3.11.2 Baseline Conditions

<u>Prehistory</u>

The prehistory of the central Great Basin has been summarized by Thomas (1971, 1982, 1983a,b). Relevant overviews focused farther from the study area include Jennings (1978), James (1981) and Madsen (1982) for the eastern Great Basin and Pendleton, McLane and Thomas (1982) and Elston (1986) for the western Great Basin.

The first human occupation of the central Great Basin probably occurred sometime after the end of the Ice Age or Pleistocene, about 10,000 years ago. The project area has yielded little archaeological information for this period. What evidence does exist suggests a pattern that was focused on the hunting of big game by small, highly mobile groups with settlements oriented toward lakeshores and marshes (Davis 1982, Elston 1982). Other researchers have found evidence that people from this period may have also exploited upland areas for plants and animals (Elston 1982, Kelly and Todd 1988, Madsen 1982).

The period following this earliest episode of human activity in the central Great Basin is called the Archaic. This period was a relatively long and stable adaptation when a greater variety of plants and animals were exploited in a broader range of environmental zones. Archaeological remains from this period include large village sites with stratified deposits, small specialized task sites, hunting encampments, quarries, rock art sites, antelope traps, and drift fences for capturing large game.

In nearby Grass Valley, researchers found a pattern of large village sites in association with ancient Ice Age lakeshores and flats along water courses (Clewlow and Pastron 1972, Elston 1980). Smaller, more specialized task-specific sites seem to occur in both upland and lowland settings. The location of springs and streams seems to have particularly influenced the location of task-specific sites in lowland settings (Hardesty and Hattori 1982).

Research at Gatecliff Shelter in the Toquima Mountains to the south of the project area has contributed to establishment of a regional **chronology** for the prehistory of the area (Thomas 1983a). A sequence of time-marker **projectile points** has been firmly dated at this site in the project area when identical **time-marker** artifacts are present. These time-marker projectile points include:

Desert Series: 650-100 B.P. (year before present)
Rosegate: 1250-650 B.P.
Elko Series: 3250-1250 B.P.
Gatecliff: 4250-330 B.P. (sometimes identified as Pinto)
Triple T Concave Base: 5500-3050 B.P.

The late Archaic - Historic period is thought to be related to the movement of Shoshone and Paiute speakers, into the Great Basin from southeast California (Lamb 1958). It is not clear whether there were actual population displacements, competing cultural adaptations, introduction of a new language or a mixture of these phenomena. There are certain archaeological signatures associated with this period including pottery and small triangular projectile points. These time-sensitive artifacts should not, however, be construed as clear evidence that they belong to one group or another (Baumhoff and Bettinger 1982). Because few sites dating only from the late Archaic period exist, their distribution, nature and variability are clouded by their association with earlier archaeological manifestations.

The first reported **Euroamerican** contact with the Western Shoshone was by Jedediah Strong Smith in 1827. These early visitors disparagingly reported this group to be primitive, nontechnological and without horses, using their women as beasts of burden. Apparently little thought was given to the fact that people and horses were competitors for the same resource - grasses (Madsen and O'Connell 1982, Thomas et al. 1986).

Introduction to Native American Concerns

There are several federal laws and policy directives which are applicable to the consideration of Native American values. Of particular importance are:

- American Indian Religious Freedom Act of 1978 (AIRFA): Requires federal agencies to take into account the effect of their actions on Native American traditional belief prior to actions being authorized.

- Native American Graves Protection and Repatriation Act of 1990 (NAGPRA): The intent of this legislation is to ensure that disposition of Native American human remains and associated funerary objects shall be controlled by individuals or groups determined to be most closely associated with the materials.

- Traditional Cultural Properties: National Register (U.S. Department of the Interior) Bulletin 38 discusses properties that can be determined to be eligible for inclusion on the National Register of Historic Places because of their association with beliefs or cultural practices of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community.

Based on this legal mandate, a review of pertinent ethnographic literature was undertaken. This review included, among others, both the pioneering work of Julian Steward, an anthropologist who conducted research on the Western Shoshone in Nevada, and contemporary ethnographic studies in central Nevada. This literature review was then followed by a program to contact Native Americans who might be able to contribute information on traditional use areas and practices in the Cortez area.

Steward's Western Shoshone contacts gave information about the way things had been in the 1800s before the patterns began to change in response to non-Native settlement and use of the land. In conjunction with the proposed project a search was made for Native Americans knowledgeable about the project area. Initially, notification letters about the project and the Native American consultation effort were sent out to a mailing list of BLM-recognized elders, to all Western Shoshone and joint Paiute-Shosone tribes and bands in central and northern Nevada, to the Western Shoshone Elders Council, the Western Shoshone National Council, the Inter-Tribal Council of Nevada, and the Stewart Indian Museum. As a result of followup calls to these parties, additional letters were sent to several additional individuals who were identified as knowledgeable of the Cortez area. Officials at Fallon, South Fork, Ely, Duckwater, and Yomba said that they knew of no residents of those reservations or colonies with ties to the Cortez area. They provided names of people at other colonies. The chairman of Battle Mountain Band and chief of Western Shoshone National Council, who were named as knowledgeable by a number of bands and Western Shoshone National Council members, both declined to consult about the Cortez project and deferred to staff at the Council to identify other informants. As a result of this search, eight people were identified as potentially knowledgeable about the Cortez area. In August, the anthropologist visited the area and spoke with five of the eight. One person was in the hospital, one person was unreachable, and one person deferred to another among the eight to speak for her. Two people explained that they were not from the area around Cortez and had no knowledge of the area. Three people with direct experience in the area provided information. In addition, a Western Shoshone National Council member who had recently been an informant on the Tosawihi Quarry project made general comments. These four people provided the information below. Two of the informants said they had moved away from the area when they were young and know about the area from relatives and an occasional visit. The oldest of the informants stated flatly that all the older people who know about that area are gone. One of the informants still lives in the area and remembered a number of trips on and around Mt. Tenabo with relatives.

Ethnography

The project area includes parts of two Western Shoshone "districts" mapped by the ethnographer Steward (1937, 1938): Crescent Valley and Diamond Valley. Steward does not describe the Crescent Valley district in his text although he does make some references to the Cortez Mountains. He includes Pine Creek in the Diamond Valley district, stating, "These valleys are in the midst of an area about which I have little information" (1938).

Steward shows no winter villages on or around the Cortez Mountains, nor any in Crescent Valley. He says that people who wintered along the Humboldt River in the vicinity of

Beowawe "gathered seeds in Crescent Valley, but preferred not to remain there as winters were too cold. Sometimes they wintered near Cortez in Grass Valley to the south instead of returning to the Humboldt River. Grass Valley was a good place to hunt rabbits in winter" (1938). Steward shows two villages, each at least 20 miles from the project area, on the east side of the valley drained by Horse Creek and Pine Creek (1938). One, known as Todzagadu, consisted of "fifteen or sixteen families (perhaps 90 individuals), scattered along the mountain side" at springs on the west side of the Sulfur Spring Mountains. The other, Bauwiyoi, was a "group of at least six encampments at the foot of the Roberts Mountains where there are four sloughs." As non-Indians settled in the area, some Western Shoshone moved close to their towns to be near wage labor opportunities. Steward (1937) reports that 60 persons under Chief Tukayanna were listed for "Mineral Hill" in the 1870s. He shows the town of "Mineral," presumably the same as Mineral Hill, on lower Horse Creek/upper Pine Creek, at least 15 miles from Horse Canyon portion of the project area (1938).

The Todzagadu and Bauwiyoi regularly joined with people from one village group, from Diamond Valley, for subsistence and festivals. As Steward reconstructs it, primarily with evidence from a single informant, pine nuts were gathered in the fall — most found on the west side of the Roberts and Sulphur Springs Mountains. "A few grow on the Cortez Range" (1938). If local crops were not good, people traveled as far south as Austin to gather nuts and participate in festivals. Pine nuts were stored in winter villages. In the spring, groups of a few families foraged together, moving from place to place until fall. In one of the tributaries of Pine Creek, probably southwest or west of Mineral (possibly Horse Creek) they caught small fish. They went north of Mineral to gather roots, then sometimes west to Cortez (known as Tinaba [tina, a white rock, + pa, water]) to gather roots or to kill small mammals. In the early fall, people went to the southern part of Diamond Valley for a communal antelope drive. Festivals were usually held in early fall, before the pine nut gathering. After the pine nut trips, people stayed together for rabbit drives before disbursing back to their winter encampments.

Contemporary Native American Concerns

Some of the concerns expressed by informants result from the effects of past and ongoing mining activity. Mt. Tenabo was identified as an area that was once important as a place of traditional use, but is no longer used because those qualities that gave it importance have been affected by past or ongoing mining and related activities. Specific informant concerns are discussed below.

One Native American informant asserted that it does not make sense to talk of specific sacred places: everything is sacred. This is consistent with the Western Shoshone perspective reported in consultations about other projects:

> "It is because the Creator provisioned the holy land with useful resources and charged the people with taking care of them that they are so significant. They remain sacred, even though the land upon which they were placed has been removed from Indian control. Despite these losses of land and resources, Native Americans remain in proximity to them and continue to believe that they have a sacred charter to shepherd them" (Stoffle, Evans, Halmo, Niles, O'Farrell 1989).

> "Important from the perspective of religion is the concept of power (puha), an impersonal force which potentially can reside in any natural or living thing (water, geographic sites, plants, animals, person, etc.). This in turn translates into a view of the whole earth as sacred, and the duty of Indian people to protect it. This affects attitudes toward land-altering projects...as potentially harmful to the Earth and all who inhabit it" (Fowler 1990).

Two informants said that Mt. Tenabo was formerly used by Western Shoshone as a place to fast and pray. One of these said that did not mean that the whole mountain was sacred, although he knew that people did go there to pray. Eight years ago, one informant counseled a relative to go elsewhere for her fasting and praying because the mining scars on the mountain and the ongoing mining activity would interfere with the religious activity.

Recent consultations with Western Shoshone by other researchers have also elicited responses regarding the importance of prayer and power places and their association with prominent mountain peaks. Clemmer notes that "Prayers are especially important in connection with places and spirits that live there. Prayers are made to the spirits of plants and animals; to the 'Little Men'; and to the spirits of places that are regarded as power places. . . . Power spots are always on mountains or on the tops of prominent, isolated rock formations or in springs" (Clemmer 1990:67-68,70).

Rusco and Raven in their study of the Tosawihi Quarry north of Battle Mountain note the spiritual significance of certain areas as identified by their informants. They note "Prominent peaks are major sources of power" (Rusco and Raven 1992:13). These researchers also observed that:

> "Two places at *Tosawihi* were specifically mentioned in this context as places where vision quests were undertaken. Big Butte was a place to fast and pray, and people would leave offerings of white chert there. These offerings were said to resemble caches. Another area was identified north of Ivanhoe Creek where the edge of the mountain is especially steep. Both men and women who were gifted went often to many such places during their lifetimes. Often, they were given instructions by another medicine person regarding when to go.
>
> "In addition to using spiritual spots to receive special powers, young men would fast and spend the night on top of a high knob in order to be recognized as strong, brave men" (Rusco and Raven 1992:20).

One informant urged that the natural white marker rock visible when approaching the mountain from Austin should not be disturbed by mining.

The importance of white rock was also noted by Rusco and Raven (1992:19): "Three minerals found at the Tosawihi Quarry were traditionally used in healing. These are the white opalite or chert. . . ." Rusco and Raven also note that at "Big Butte . . . people would leave offerings of white chert there" (Rusco and Raven 1992:20). They go on to state, "People save worked opalite items as powerful heirlooms. . ." (Rusco and Raven 1992:27).

One informant was told by elders about a cave located somewhere on the upper slopes of Tenabo, with the admonition that the cave should not be entered by humans. The cave's significance comes from times before humans lived on the earth. None of the other informants knew about the cave. While the informant did not label the cave as a power place, the admonition to stay away implies this religious value. "Power is also present in caves, particularly deep caves with tunnels and separate chambers, and where water collects" (Rusco and Raven 1992:14).

Two informants spoke of former turquoise mining activity on Tenabo by Indian people. Two mentioned clay resources; one source on the Buckhorn Mine side of the mountain and one source on the alluvial fan in Crescent Valley, about six miles north of the old town of Cortez.

An informant for the background study on the Tosawihi Quarry mentioned some greenish small rocks that come from that quarry and also "the Cortez area, which are tied in a bag and are used to spiritually cleanse springs" (Rusco and Raven 1992:20). Mary Rusco identified the informant as one of the people who was unreachable during consultations for this study. None of the other informants mentioned greenish rocks as a traditional or religious resource in the Cortez area.

One informant referred to the pine nut resources on the mountain, increasingly important because there are fewer and fewer places where Indians have access to harvest pine nuts. Another speculated that the mountain contains other traditionally used resources that are becoming harder to find, and thus may be important in the future as a gathering place for these.

One informant observed that pine trees have been cut under BLM-permitted woodcutting, thus reducing the number of mature trees available for pine nut harvesting.

No informant spoke about grave sites in the project area until asked. No one knew of any specific sites. One person said there may be some graves on the mountain, though probably relatively recent, since Shoshone didn't generally bury their dead before the Euroamericans introduced the practice.

Several informants identified issues that are not solely Native American concerns: potential effects of mining expansion on groundwater quality, erosion of mountain slopes, and deer migration patterns.

Given the legal mandates requiring consideration of Native American values that could be potentially affected by the proposed project, a program was undertaken to contact and interview Native American informants who could provide potentially pertinent information. Several concerns presented above were expressed by Native Americans related to past and present impacts in the general area, such as scarring on Mt. Tenabo from mining activity and loss of access to pine nut harvesting areas. However, no issues of concern were expressed related to the proposed project area.

History

The first Euroamericans in close proximity to the project area were early explorers including Jedediah Smith, Peter Ogden and Joseph Walker who followed the Humboldt River drainage to the north beginning in the late 1820s. By the 1840s, explorers such as J.C. Fremont, J.H. Simpson and others were looking for fast, central transportation routes through Nevada. During his reconnaissance for a transportation route through Nevada, Beckworth crossed through the northern end of Diamond Valley, the Sulphur Springs Range and into Crescent Valley in 1854 (Vlasich 1981). Captain James H. Simpson, accompanied by Major Howard Egan in 1859, led the expedition that established the route through central Nevada that would become the Pony Express Route and the Overland Trail (Bowers and Muessig 1982). The central route was used by stagecoaches through the 1860s until transcontinental railroad service began in 1869.

The dominant theme structuring historic period events within the study area is mining. Ancillary and related to this theme are ranching and transportation. For the most part Nevada was bypassed by the first surge of fortune seekers on their way to California in the 1850s. By the 1860s the human tide had reversed somewhat with heightened interest in the Comstock of western Nevada and the more remote ore bodies of central Nevada (Bowers and Muessig 1982). Cortez and its surrounding environs were no exception to this pattern. Dominating the study area is the Cortez Mining District. Founded in 1863 by Simeon Wenban and others, the District intermittently flourished until the 1930s when activity all but ceased until activity resumed a few years ago spurred by attractive precious metal prices and new mining technologies. Hardesty and Hattori (1982) categorize this temporal range into study units based on the mill in use at the time.

Within, or near, the study area there are other mines and associated settlements whose histories are synchronous with the boom-bust nature of mining in central Nevada. These loci include Buckhorn, Gold Acres, Lander, Mill Canyon, Tenabo and Cortez proper which contained the satellite communities of Shoshone Wells, Upper Cortez, and St. Louis.

Ranching has played an important supporting role in the history of the study area. During the early stages of mining development in the study area it is assumed that ranches produced an array of foodstuffs not normally associated with hay and cattle/sheep operations (Bowers and Muessig 1982). The cyclical nature of mining in part contributed to the evolution of widely spaced ranches with large grazing areas geared to production of a single commodity focused on markets far from central Nevada.

The development of transportation within the study area is directly tied to the advent of mining. Until mining acted as an economic magnet, most travel was through the region to the north in an east-west direction (Bowers and Muessig 1982) The opening of the Central Pacific Railroad to the north of the region precipitated easier access to the general area and provided a ready-made labor pool of unemployed railroad workers (Hardesty and Hattori 1982). Transportation development within the study area was limited to the operation of horse drawn stage and freight lines.

3.11.3 Previous Cultural Resource Investigations Completed in the Study Area

Summary of Sites in Area to be Disturbed

A review of prehistoric and historic site records indicates that five sites have been recorded within the area of proposed disturbance. Two strategies have been employed by archaeologists when recording historic sites and isolates. One strategy has tended to lump finds under the umbrella of a known settlement. The other strategy has been to split out spatially discrete historic loci and give them a separate site number. Recognizing these differences, two historic sites and three prehistoric sites have been recorded in the study area. The following is a brief description of sites within the study area:

Gold Acres

26La071 (Nevada State Museum Site Number): Historic mining community that consists of the remains of more than 35 structural and trash dump features dating from 1935 to 1961. This latter Gold Acres settlement was known as the London Extension Company's Gold Acres. The townsite was dismantled in the 1940s and has since been used for refuse disposal, recreational shooting, scavenging and recent mining activities. The Nevada SHPO (State Historic Preservation Office) has determined this site not eligible for inclusion on the National Register of Historic Places.

CrNV-62-6446 (BLM Site Number): This small historic site is described as a mine adit and associated can scatter. The Nevada SHPO has determined this site is not eligible for inclusion on the National Register of Historic Places.

Cortez

CrNV-62-6407 (BLM Site Number): This small prehistoric site is described as a small diffuse **lithic scatter** of chert, jasper, and basalt **secondary** and **tertiary flakes** and a Rosegate projectile point. The Nevada SHPO has determined this site is not eligible for inclusion on the National Register of Historic Places.

CrNV-62-6410 (BLM Site Number): This small prehistoric site is composed of white chert secondary flakes - widely dispersed. The Nevada SHPO has determined this site is not eligible for inclusion on the National Register of Historic Places.

CrNV-62-6411 (BLM Site Number): This small prehistoric site is composed of one gray chert thinning flake and one red chert secondary flake, 15 meters apart. The Nevada SHPO has determined this site is not eligible for inclusion on the National Register of Historic Places.

Class III and Class II Survey Results

A Class III (intensive) cultural resources inventory for the project area has been completed. This study is reported in a Cultural Resources Technical Report. While the area subjected to an intensive cultural resources survey encompassed 5,677 acres (including a buffer zone), the proposed disturbance (Area of Potential Effect) has been refined and now encompasses 428 acres. It should be noted that this 428 acres referred to as the Area of Potential Effect is synonymous with the study area referred to in this EIS. As part of this effort a literature search identifying prior cultural resource surveys and recorded sites within the study area was conducted. Records maintained by the Battle Mountain and Elko BLM Districts were reviewed to identify previous cultural resources studies conducted in or near the study area. Supplemental information was also obtained from the Nevada State Museum at this time.

The results of the archival review (presented in the Cultural Resources Technical Report) provide the BLM project number, name and affiliation of the researcher, date of the research report, number of acres surveyed, number of sites recorded by survey, and report citation. In some cases the reported project area extends beyond the present study area boundary.

With the exception of the work presented in the Cultural Resources Technical Report, which was undertaken in support of the proposed project, no other cultural resources investigations have been conducted entirely or partially within the project study area. The earliest identified archaeological investigations undertaken in close proximity to the study area were conducted by BLM archaeologist, Roberta McGonagle in the mid 1970s. Subsequent work has been performed in advance of projects proposed by BLM or by others on BLM-administered lands. Such projects have included mining plans of operation, seismic line surveys, transmission line rights-of-way, material pits, and fencelines. The most exhaustive work conducted within and adjacent to the project area has been the historic archaeology program undertaken by Hardesty and Hattori (1982, 1983, 1984).

To understand the nature, distribution and significance of cultural resources within the areas to be disturbed, a statistically defensible assessment of 167,000-acre cultural resources cumulative effects study area was completed (Figure 3.11-1). The assessment was designed and conducted in a manner to satisfy the requirements of a BLM Class II cultural resources inventory. A technical report which documents the results of this Class II inventory has been prepared and has been summarized in this section of the EIS.

The archaeological cumulative effects study area contains approximately 167,000 acres, which was divided into three environmental domains (Basin, Piñon, and Mountain) from which separate random samples were drawn. The sampling domains are defined as follows:

Basin: Areas where vertical relief is less than 410 feet/0.6 mile (excluding areas of little relief in areas surrounded by mountainous conditions - these were considered mountain domain).

Mountain: Areas where vertical relief is greater than 410 feet/0.6 mile.

Piñon: Upland green areas on U.S.G.S. topographic maps supplemented with field verification.

Approximately 6 percent (9,770 acres) of the study area was inventoried resulting in the discovery of 109 sites (1 site in two sampling units counted as 2 sites, 4 sites are multi-component with both historic and prehistoric components, 2 sites found outside sampling units, this equates to a total of 82 prehistoric and 27 historic sites) and 558 isolated finds.

The prehistoric sites (n=82) span the interval from early Holocene (pre-650 B.P.) into late prehistoric and contact period times. Aboriginal adaptations, reflected in the distribution and assemblages of prehistoric sites, suggest limited exploitation of local piñon nuts and at least some changes in land use as indicated by the uneven occurrence of sites across the landscape through time. Several lithic quarries and numerous, related **reduction localities** also document extensive use of locally derived toolstones over the entire period of occupation. The distribution of prehistoric sites within the sample indicates that they are most concentrated in the upper reaches of the Mountain domain and in the lower reaches of the Piñon domain. Comparatively few prehistoric sites were discovered in the Basin, upper reaches of the Piñon, and lower reaches of the Mountain domains.

The 27 sites recorded with historic components range in age from early (1862) mining settlements up to the present era. Beginning with the initial mining operations of the mid-19th century, historical sites reflect increasingly intensive mineral exploitation accelerated by the advent of cyanide-based milling in the early twentieth century and a coincident reduction in the intensity of certain ranching practices. In contrast to the prehistoric sites' distribution, historic sites are only moderately concentrated within the Piñon domain.

In addition to the data developed in the Class II regional study, the data provided in the Class III (intensive) survey to assess cultural resources within the Class III study area contribute to our understanding of the area. The Class III study area covered approximately 5,677 acres including the area of proposed disturbance, a buffer area around the study area, and several parcels upon which mining expansion is planned (Figure 3.11-1). The Class III survey resulted in the recordation of 3 previously recorded sites and 61 new historic and prehistoric sites. Of these, 20 are isolated artifacts, 36 have been determined to not be eligible to the National Register of Historic Places (NRHP) by the Nevada SHPO and 6 have been determined to be eligible to the NRHP. Three of these sites are considered contributing elements to the Cortez Historic District and three others are considered eligible individually based on their potential to yield important data.

In addition to the 5 sites located in the area of proposed disturbance, the Class III survey identified another 50 sites (including 20 isolates) within the Class III study area. The Class II sample survey of approximately 167,000 acres surrounding the project area resulted in the discovery of 109 sites and 558 isolated finds. Tables 3.11-1 and 3.11-2 provide a breakdown of sites within both study areas by type, significance and environmental zone (sampling domain).

For purposes of analysis archaeological sites were defined by specific characteristics. Five classes of stone artifacts/tool types were employed as defining criteria in the technical report utilizing these categories four prehistoric site types were defined. Historic site categories include: isolated finds, ranches/homesteads, ranching/mining affiliated, mining, charcoal production, transportation, dumps, Native American contact, and unknown.

The site classification scheme is derived from that used for the Class II study. The Class III study, conducted by a different group of researchers employs a different classificatory and sampling strategy. To facilitate discussion of both sets of data, the Class III data have been adjusted to conform with the Class II data.

The results of the Class II inventory provide a statistical picture of how sites are distributed in space and time. It also provides information on the frequency of prehistoric and historic sites including those that are determined significant when assessed in terms of the criteria for eligibility for inclusion on the National Register of Historic Places.

TABLE 3.1-1

COMPARISON OF ANNUAL CLIMATOLOGICAL DATA FROM ELKO AND WINNEMUCCA NWS STATIONS

	Elko[a] Station	Winnemucca[a] Station
Mean Daily Maximum Temperature (F)	62.1	65.8
Mean Daily Minimum Temperature (F)	30.2	31.7
Monthly Average (F)	46.2	48.7
Mean Sky Cover	5.3/10	5.3/10
Precipitation (inches)	9.3	7.87
Mean Wind Speed (mph)	6	8
Prevailing Wind Direction	SW	S,W

[a] Source: USDC 1987

TABLE 3.1-2

AMBIENT AIR QUALITY STANDARDS
(micrograms per cubic meter)

		National Ambient Air Quality Standards		Nevada Ambient Air Quality Standards
		Primary	Secondary	
Sulfur Dioxide				
3-hour[a]		---	1,300	1,300
24-hour[a]		365	365	365
Annual Average		80	80	80
Particulate Matter < µm				
24-hour		150	150	150
Annual Average		50	50	50
Nitrogen Dioxide				
Annual Average		100	100	100
Carbon Monoxide				
1-hour[a]		40,000	40,000	40,000
8-hour[a]	< 5,000′ MSL	10,000	10,000	10,000
	= > 5,000′ MSL	10,000	10,000	6,670
Ozone				
1-hour[a]		235	235	235
Lead				
Quarterly Average		1.5	1.5	1.5
Crystalline Silica (quartz)				
8-hour		2.4	2.4	2.4

[a] Short-term national standards and national and Nevada PSD increments (24 hours or less) are not to be exceeded more than once per year, at any location. Short-term Nevada standards are not to be exceeded at any time.

TABLE 3.1-3

PERMITTED AIR EMISSION SOURCES AT CORTEZ GOLD MINES

Cleaver Brooks Boiler

Lime Handling System

Bartlett-Snow Carbon Reactivation Kiln

Roasting Circuit

- Surge Bin
- Fluid Bed Roaster
- Calcine Fluid Bed Cooler
- Quench Tank
- Product Handling System

Ore Storage Silo

Dry Grinding System

Two Wabi Iron Works Furnaces

Hydrastoke Feeder and Jaw Crusher

Symons Shorthead and Cone Crusher

Vibrating Screen and Associated Conveyors

Surface Area Disturbance

TABLE 3.2-1

SUMMARY OF CUMULATIVE AREA — MINING AND RELATED ACTIVITY

	Mine/Prospect	Operator	Location	Mineralization/ District	Operation	Disturbed Acreage
1)	Elder Creek	Alta Gold Inc.	Sec. 1, 12-14, 23, 24, T28N, R45E Sec. 6, 7, 18, 19, T28N, R46E	Gold/Bullion	Open Pit/Leach	143 acres
2)	Indian Creek	Newmont Explor. Limited	Sec. 6, T28N, R47E Sec. 30, 31, T29N, R47E	Gold/Bullion	Exploration Drilling	25.6 acres
3)	Fire Creek	Aurenco	Sec. 14, 15, 22, 23, T30N, R47E	Gold/Bullion	Open Pit/Leach	173 acres (95 public)
4)	Robertson	Coral Resources Inc.	Sec. 8, T28N, R47E	Gold/Bullion	Open Pit/Leach	100 acres[a]
5)	Triplet Gulch	Coral Resources Inc.	Sec. 16, 17, T28N, R47E	Gold/Bullion	(Undeveloped) Open Pit/Leach	129 acres
6)	Grey Eagle	S/L Corporation	Sec. 13, 14, 24, T29N, R46E	Gold-Silver/Bullion	Underground (and Pit?)/Leach	<5 acres (public)[a]
7)	Greystone	MI Drilling	Sec. 23-26, T28N, R45E	Barite/Bullion	Open Pit	500 acres[a]
8)	Clipper	MI Drilling	Sec. 5, 6, T27N, R46E Sec. 31, 32, T28N, R46E	Barite/Bullion	Open Pit	400 acres[a]
9)	Toiyabe	Inland Gold & Silver Corp.	Sec. 13, T25N, R46E Sec. 18, 19, T25N, R47E	Gold/Unorganized	Open Pit/Leach	266 acres
10)	Buckhorn	Cominco American	Sec. 16-21, 28-33, T27N, R49E Sec. 13, 24, 25, T27N, R48E Sec. 4-6, T26N, R49E	Gold/Buckhorn	Open Pit/Leach	260 acres
11)	Cottonwood/ Brock Canyons	Cominco American	Sec. 10-15, 23-25, T27N, R49E Sec. 7, 18, 19, 30, T27N, R50E Sec. 34, T28N, R49E	Gold/Buckhorn	Exploration Drilling	20 acres
12)	Notices of Intent Battle Mtn. District	Misc. (90 notices)	Numerous	--	--	450 acres (max)
13)	Notices of Intent Elko District	Misc. (29 notices)	Numerous	--	--	145 acres (max)
14)	Mill Canyon	Santa Fe Pacific Mining Inc.	Mill Canyon			244 acres

[a] Estimated by U.S. BLM personnel.

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TABLE 3.3-1
SOIL CHARACTERISTICS, CORTEZ

(Page 1 of 2)

Map Unit	Soil Type	Topsoil Suitability - Limiting Factors	Slope (%)	Depth (inches)	Drainage	Runoff	Water Erosion Hazard	Permeability	Hydrologic Group
1 - Xerollic Haplargids									
b	fine-loamy, mixed, frigid	Poor	8-30	23-36	Well	Moderate	Moderate	Moderate	B
4 - Typic Haplargids									
a	fine-loamy, mixed, frigid	Poor - lime content	0-4	>60	Well	Slow or ponded	Slight	Mod. slow	C
b	fine-loamy, mixed, frigid	Fair to Poor - excess lime	0-4	65	Well	Slow	Slight	Mod. slow	C
7 - Typic Calcixerolls									
a	coarse-loamy, mixed, frigid	Fair - alkalinity	0-4	60	Well	Slow	Slight	Moderate	B
8 - Typic Argixerolls									
a	loamy-skeletal, mixed, frigid	Poor - gravel content	4-8	60	Well	Slow	Slight	Moderate over rapid	B
11 - Calcic Cryoborolls									
a (60%)	loamy-skeletal, mixed	Fair to Poor - gravel content, cemented	30-50	68	Well	Rapid	Severe	Moderate	C
a (40%)	loamy-skeletal, mixed	Fair to Poor - gravel content	30-50	50	Well	Rapid	Severe	Moderate to petrocalcic	D
14 - Typic Torriorthents									
a	loamy-skeletal, mixed, frigid	Poor - gravel content, alkalinity	4-8	60	Well	Slow	Slight	Rapid	A
b	silty, mixed, frigid	Fair to Poor - alkalinity	0-4	60	Well	Slow	Slight	Moderate	B

TABLE 3.3-1
SOIL CHARACTERISTICS, CORTEZ

(Page 2 of 2)

Map Unit	Soil Type	Topsoil Suitability - Limiting Factors	Slope (%)	Depth (inches)	Drainage	Runoff	Water Erosion Hazard	Permeability	Hydrologic Group
c	loamy-skeletal, mixed, frigid	Poor - excess lime	8-15	60	Well	Slow	Slight	Rapid	B
15 - Typic Xerorthents									
a	loamy-skeletal, mixed, frigid	Poor - gravel content, alkalinity	30-50	60	Well	Rapid	Severe	Moderate rapid	B
16 - Lithic Xerorthents									
a	loamy-skeletal, mixed, frigid	Poor - gravel content, alkalinity	30-50	4-7	Well	Rapid	Severe	Rapid	D
b	loamy-skeletal, mixed, frigid	Poor - alkalinity	8-15	6-9	Well	Slow to moderate	Moderate	Moderately rapid	D

TABLE 3.3-2

ORDER II SOIL SURVEY DATA, GOLD ACRES

Map Unit	Soil Type	Topsoil Suitability - Limiting Factors	Slope (%)	Depth (inches)	Drainage	Runoff	Water Erosion Hazard	Permeability	Hydrologic Group
1 - Xerollic Haplargids									
a	fine, montmorillonitic, frigid	Poor - clay	8-15	19-24	Well	Moderate	Moderate	Slow	D
2 - Lithic Xerollic Haplargids									
a (65%)	fine-loamy, mixed, frigid, 15-30% slopes	Poor - alkalinity, depth	15-30	7-14	Well	Moderate - slight	Moderate - slight	Mod. slow	D
a (35%)	fine-loamy, mixed, frigid, 8-30% slopes	Poor - depth	8-30	6-10	Well	Slight - moderate	Slight - moderate	Mod. slow	D
b	fine-loamy, mixed, frigid	Poor - depth	30-50	3-9	Well	Rapid	Severe	Mod. slow	D
c	fine, montmorillonitic, frigid	Poor - depth, clay content	15-50	4-9	Well	Rapid	Severe	Very slow	D
3 - Duric Haplargids									
a	fine-loamy, mixed, frigid	Fair - clay content, carbonates	2-8	>55	Well	Slow	Slight	Mod. slow	B
b	fine, montmorillonitic, frigid	Poor - alkalinity	8-30	>54	Well	Moderate	Moderate	Slow	D
5 - Haplic Durargids									
a	fine-loamy, mixed, frigid (shallow)	Poor - alkalinity	2-4	43-48	Well	Slow	Slight	Mod. slow	D
6 - Haplic Nadurargids									
a (80%)	fine, montmorillonitic, frigid (shallow)	Poor - clay content	0-4	26-32	Well	Slow	Slight	Very slow	D
a (20%)	fine, montmorillonitic, frigid	Poor - clay content, alkalinity	2-4	36-60	Well	Slow	Slight	Very slow	D

TABLE 3.3-3

ORDER III SOIL SURVEY DATA, GOLD ACRES

Map Unit	Soil Type	Topsoil Suitability - Limiting Factors	Slope (%)	Depth (inches)	Runoff	Water Erosion Hazard	Permeability	Hydrologic Group
3840	Jung-Norfork-Buffaran Assocation							
	Jung very gravelly loam	Poor- depth, stones, clay content	8-30	19	Rapid	Moderate	Slow	D
	Norfork gravelly loam	Poor - depth, clay content, stones	15-30	17	Medium	Severe	Slow	D
	Buffaran gravelly loam	Poor - depth, stones	4-8	15	Slow	Slight	Slow	D
3843	Jung, steep-Robson-Jung Association							
	Jung very gravelly loam	Poor - depth, stones, clay content	30-50	19	Rapid	Moderate	Slow	D
	Robson cobbly loam	Poor - depth, stones, steepness	30-50	19	Rapid	Severe	Slow	D
	Jung very gravelly loam	Poor - depth, stones, clay content	8-15	19	Rapid	Moderate	Slow	D

TABLE 3.5-1

TYPICAL SPECIES ASSOCIATED WITH WET MEADOWS AND SALINE FLATS

Wet Meadows	
Big rubber rabbitbrush	Chrysothamnus nauseosus
Red-osier dogwood	Cornus sericea
Currant	Ribes sp.
Wild rose	Rosa woodsii
Willow shrubs	Salix sp.
Common yarrow	Achillea millefolium
Buttercup	Ranunculus sp.
Curly dock	Rumex crispus
Clover	Trifolium sp.
Spike bentgrass	Agrostis exarata
Redtop bentgrass	Agrostis stolonifera
Cheatgrass	Bromus tectorum
Elk sedge	Carex geyeri
Nebraska sedge	Carex nebrascensis
Blackcreeper sedge	Carex praegracilis
Russet sedge	Carex saxatilis
Saltgrass	Distichlis spicata
Basin wildrye	Elymus cinereus
Arctic rush	Juncus arcticus
Toad rush	Juncus bufonius
Swordleaf rush	Juncus ensifolius var. montanus
Thread rush	Juncus filiformis
Longstyle rush	Juncus longistylis
Fowl bluegrass	Poa palustris
Kentucky bluegrass	Poa pratensis
Rabbitfoot grass	Polypogon monspeliensis
Deerhair bulrush	Scirpus caespitosus
Panicled bulrush	Scirpus microcarpus
Alkali sacaton	Sporobolus airoides
Saline Flats	
Big rubber rabbitbrush	Chrysothamnus nauseosus
Greasewood	Sarcobatus vermiculatus
Cheatgrass	Bromus tectorum
Saltgrass	Distichlis spicata
Basin wildrye	Elymus cinereus

TABLE 3.5-2

STREAM AND RIPARIAN HABITAT CONDITIONS IN THE CORTEZ RANGE

Creek Name	Percent of Optimum[a]	Riparian Condition Class[a]	Percent Sedimentation[b]	Width to Depth Ratio[c]
Horse Canyon Creek	32.0	25.0	20.0	31.3
Cottonwood Creek	41.4	32.8	55.9	21.0
Brock Creek	25.4	25.0	43.6	29.0
Cottonwood Canyon Creek	39.8	34.4	20.2	29.0

[a] Based on the following scale; 0-49% = Poor; 50-59% = Fair; 60-69% = Good; 70+% = Excellent.

[b] Streambottom sedimentation levels in excess of 54% are generally considered undesirable.

[c] The following scale can be used to evaluate the width to depth ratio: 26+ = Poor; 15-25 = Fair; 8-15 = Good; <7 = Excellent.

TABLE 3.5-3

TYPICAL SPECIES ASSOCIATED WITH RIPARIAN AREAS

Rabbitbrush	Chrysothamnus sp.
Red-osier dogwood	Cornus sericea
Narrowleaf cottonwood	Populus angustifolia
Quaking aspen	Populus tremuloides
Chokecherry	Prunus virginiana
Currant	Ribes sp.
Wild rose	Rosa woodsii
Willow	Salix sp.
Greasewood	Sarcobatus vermiculatus
Bentgrass	Agrostis sp.
Sedges	Carex sp.
Saltgrass	Distichlis spicata
Basin wildrye	Elymus cinereus
Rushes	Juncus sp.
Bluegrass	Poa sp.
Bulrushes	Scirpus sp.
Alkali sacaton	Sporobolus airoides

TABLE 3.5-4

TYPICAL SPECIES ASSOCIATED WITH UPLAND COMMUNITIES
(Page 1 of 3)

Shadscale/Black Greasewood Community

Shadscale	Atriplex confertifolia
Black greasewood	Sarcobatus vermiculatus
Rubber rabbitbrush	Chrysothamnus nauseosus
Nuttal saltbush	Atriplex nuttalii
Basin wildrye	Elymus cinereus
Alkali sacaton	Sporobolus airoides
Inland saltgrass	Distichlis stricta
Bottlebrush squirreltail	Sitanion hystrix
Cheatgrass	Bromus tectorum

Shadscale/Bud Sagebrush Community

Shadscale	Atriplex confertifolia
Bud sagebrush	Artemisia spinescens
Bottlebrush squirreltail	Sitanion hystrix
Indian ricegrass	Oryzopsis hymenoides
Bluegrass	Poa spp.

Sagebrush/Grass Community

Basin big sagebrush	Artemisia tridentata tridentata
Wyoming big sagebrush	A. tridentata wyomingensis
Mountain big sagebrush	A. tridentata vaseyana
Black sagebrush	A. arbuscula nova
Low sagebrush	A. arbuscula arbuscula
Shadscale	Atriplex confertifolia
Douglas rabbitbrush	Chrysothamnus viscidiflorus
Antelope bitterbrush	Purshia tridentata
Phlox	Phlox spp.
Lupine	Lupinus spp.

TABLE 3.5-4

TYPICAL SPECIES ASSOCIATED WITH UPLAND COMMUNITIES
(Page 2 of 3)

Arrowleaf balsamroot	Balsamorhiza sagittata
Indian ricegrass	Oryzopsis hymenoides
Bluebunch wheatgrass	Agropyron spicatum
Bluegrass	Poa spp.
Idaho fescue	Festuca idahoensis
Thurber needlegrass	Stipa thurberiana
Basin wildrye	Elymus cinereus
Cheatgrass	Bromus tectorum
Pinyon-Juniper Community	
Singleleaf pinyon	Pinus monophylla
Utah juniper	Juniperus osteosperma
Mountain big sagebrush	Artemisia tridentata vaseyana
Black sagebrush	A. arbuscula nova
Antelope bitterbrush	Purshia tridentata
Snowberry	Symphoricarpos sp.
Serviceberry	Amelanchier sp.
Indian ricegrass	Oryzopsis hymenoides
Basin wildrye	Elymus cinereus
Needle and thread	Stipa comata
Thurber needlegrass	S. thurberiana
Bluegrass	Poa spp.
Bottlebrush squirreltail	Sitanion hystrix
Bluebunch wheatgrass	Agropyron spicatum
Mountain Mahogany Community	
Curlleaf mountain mahogany	Cercocarpus ledifolius
Singleleaf pinyon	Pinus monophylla
Utah juniper	Juniperus osteosperma
Mountain big sagebrush	Artemisia tridentata vaseyana
Snowberry	Symphoricarpos sp.
Bluebunch wheatgrass	Agropyron spicatum
Indian ricegrass	Oryzopsis hymenoides

TABLE 3.5-4

TYPICAL SPECIES ASSOCIATED WITH UPLAND COMMUNITIES
(Page 3 of 3)

Bluegrass	Poa sp.
Thurber needlegrass	Stipa thurberiana
Basin wildrye	Elymus cinereus
Idaho fescue	Festuca idahoensis

TABLE 3.5-5

VEGETATION COMMUNITIES BY SPECIES, CORTEZ
(Page 1 of 2)

Greasewood Community	
Greasewood	Sarcobatus vermiculatus
Alkali Blite	
Shadscale/Bud Sagebrush Community	
Shadscale	Atriplex confertifolia
Bud Sagebrush	Artemisia spinescens
Squirreltail	Sitanion hystrix
Sandberg Bluegrass	Poa secunda
Cheatgrass	Bromus tectorum
Sagebrush/Grass Community	
Big Sagebrush	Artemisia tridentata
Black Sagebrush	Artemisia nova
Low Sagebrush	Artemisia arbuscula
Pygmy Sagebrush	
Rabbitbrush	Chrysothamnus spp.
Spiny Hopsage	Grayia spinosa
Horsebrush	Tetradymia sp.
Balsamroot	Balsamorhiza sp.
Buckwheat	Eriogonum sp.
Squirreltail	Sitanion hystrix
Thurber Needlegrass	Stipa thurberiana
Sandberg Bluegrass	Poa secunda
Basin Wildrye	Elymus cinereus
Cheatgrass	Bromus tectorum

TABLE 3.5-5

VEGETATION COMMUNITIES BY SPECIES, CORTEZ
(Page 2 of 2)

Juniper Community	
Utah Juniper	Juniperus utahensis
Black Sagebrush	Artemisia nova
Snowberry	Symphoricarpos sp.
Sandberg Bluegrass	Poa secunda

TABLE 3.5-6

VEGETATION COMMUNITIES BY SPECIES, GOLD ACRES

Sagebrush/ Grass Community	
Black Sagebrush	Artemisia nova
Wyoming Big Sagebrush	Artemisia tridentata wyomingensis
Low Sagebrush	Artemisia arbuscula
Shadscale	Atriplex confertifolia
Spiny Hopsage	Grayia spinosa
Rabbitbrush	Chrysothamnus spp.
Halogeton	Halogeton glomeratus
Squirreltail	Sitanion hystrix
Sandberg Bluegrass	Poa secunda
Thurber Needlegrass	Stipa thurberiana
Cheatgrass	Bromus tectorum
Shadscale/Bud Sagebrush Community	
Shadscale	Atriplex confertifolia
Bud Sagebrush	Artemisia spinescens
Sandberg Bluegrass	Poa secunda
Squirreltail	Sitanion hystrix
Cheatgrass	Bromus tectorum

TABLE 3.8-1

VISUAL RESOURCE MANAGEMENT OBJECTIVES

1	Class I. The objective of this class is to preserve the existing character of the landscape. This class 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.
2	Class II. 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.
3	Class III. 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.
4	Class IV. 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.

Source: Bureau of Land Management, 1986.

Table 3.9-1

DEMOGRAPHIC CHARACTERISTICS OF THE PROJECT AREA

Area	Population 1980	1990	1995	Average Household Size 1990	Av. Number of School-Age Children per household 1990
County					
Eureka	1,198	1,547	2,450	2.5	0.47
Elko	17,269	33,530	47,110	2.9	0.64
Lander	4,076	6,266	7,710	2.6	0.69
City					
Battle Mountain	2,749	3,542	--	--	--
Elko	8,758	14,736	--	--	--
Carlin	1,313	2,220	--	--	--
Beowawe Division[a]	NA	440[a]	--	--	--

Source: Bureau of Census, 1980 and 1990
Nevada Department of Administration 1990

[a] Beowawe Division includes approximately the northern half of Eureka County; unofficial estimates of population for Beowawe is about 30 persons, and for Crescent Valley is 200-250 persons (Summers 1991, Shangal 1991)

Table 3.9-2

EMPLOYMENT IN THE PROJECT AREA (1989)

County	Civilian Labor Force	Total Employment	Unemployment Rate	Employment in Mining[a] (%)
Eureka	3,150	3,080	2.4	82.9
Elko	15,430	14,630	5.2	8.1
Lander	3,380	3,190	5.7	48.4

Source: Nevada Department of Administration 1990

[a] Percentage of total employment

Table 3.9-3

DISTRIBUTION OF CORTEZ EMPLOYEES BY PLACE OF RESIDENCE

Community	Number of Employees
Battle Mountain	16
Beowawe	3
Crescent Valley	57
Carlin	35
Elko	70
Spring Creek	12
TOTAL	193

Source: Cortez Gold Mines, Nevada, 1992

Table 3.9-4

ELKO AND CARLIN AREA SCHOOLS
CAPACITIES AND ENROLLMENT, JUNE 1992

School	Capacity	Enrollment
Carlin Combined School, Carlin	500	491
Southside Elementary, Elko	600	714
Northside Elementary, Elko	500	511
Grammar School #2, Elko	500	529
Mountain View Elementary, Elko	600	800
Sage Elementary, Spring Creek	*	389
Spring Creek Elementary, Spring Creek	600	661
Elko Jr. High School, Elko	600	879
Elko High School, Elko	850	1,402

Source: Elko County School District, June 1992

* This school is operated out of mobile trailers, with plans to build permanent facilities when money becomes available. Mobile trailers are used at a number of schools listed above.

Table 3.9-5

TAX REVENUES COLLECTED BY STUDY AREA COUNTIES - 1990-1991

County	Property Tax ($)	Net Proceeds-from-Mines Tax ($)	Sales Tax ($)	Total[a]
Elko	2,309,742	1,331,757	2,235,387	5,876,886
Eureka	1,591,381	1,601,034	1,604,185	4,796,600
Lander	1,318,352	597,396	1,642,413	3,558,161

Source: Counties of Lander, Eureka, and Elko 1991

[a] This gives the sum of three columns, and does not represent total tax revenues received by the counties from all sources.

Table 3.9-6

TAX REVENUES GENERATED BY CORTEZ GOLD MINES - 1991

County	Personal Property Tax ($)	Net Proceeds-from-Mines Tax ($)	Total ($)
Elko	2,166.88	0	2,166.88
Eureka	28,520.32	19,263.14	47,783.46
Lander	367,547.90	135,565.37	503,113.27

Source: Cortez Gold Mines, 1992

Note: In addition to the taxes above, Cortez paid $10,200 to the State in the form of Nevada Business License Tax, and $250,772 as Sales/Use Tax.

TABLE 3.10-1

PUBLIC LAND USE AUTHORIZATIONS

Right-of-Way Number	Type of Facility	Location*
N-48321	Transmission Line, 40' wide	T26 & 27NR48E
N-46805	Road, 30' wide	T26NR48E
N-43670	Road, 25' wide	T27NR48E
N-30650	Telephone Line, 5' wide	T28NR47E
NEV-044669	Road, 200' wide	T28NR47E
NEV-044814	Road & Mat. Site	T28NR47E Sec 2 & 3
N-7348	Transmission Line, 10' wide	T28NR47E Sec 31, 32, 33, etc
N-7803	Transmission Line, 10' wide	T28NR47E Sec 31
N-2616	Transmission Line, 10' wide	T27 & 28NR48E
N-2434	Transmission Line, 20' wide	T28 & 29NR48E
N-2615	Transmission Line, 12 1/2' wide	T29NR48E Sec 8
N-52	Airport Lease	T29NR48E Sec 4
N-39818	Water Line & Tank	T29NR48E Sec 6,N1/2
N-36596	Airport Lease	T27NR47E Sec 15, 22

* Facility may not be confirmed to listed location

TABLE 3.10-2

LIVESTOCK GRAZING DATA FOR THE STUDY AREA

Map Reference Number	Allotment Name	Selective Management Category	Acres of Public Lands	Active Grazing Preference AUMs	Average Licensed Use AUMs[a]	Public/Private Acres in Cumulative Study Area	
						Public	Private
1	Carico Lake	I	574,129	36,958	27,171	113,838	7,057
2	South Buckhorn	I	226,004	20,654	15,852	126,531	23,302
3	Argenta	I	122,370	14,248	12,107	26,458	21,411

[a]Average licensed use for the period 1979 to 1983.

TABLE 3.10-3

1990 GRAZING USE IN THE LIVESTOCK GRAZING STUDY AREA

Allotment	Operator	Livestock[a]	Grazing Period	Percent Public Land	AUMs
CARICO LAKE	Agri-Beef	500 S	04/01 to 06/30	100	299
		300 S	10/11 to 11/30	100	101
	C Ranches, Inc.	1117 C	03/01 to 04/01	100	13,404
		1 C	03/01 to 04/01	100	1
	Alves, M	433 C	03/01 to 03/31	100	441
		755 C	11/01 to 02/28	100	2,979
SO. BUCKHORN	Alves, M				
Frenchie Seeding		1201 C	04/16 to 06/30	69	2,071
Native Seeding		1658 C	07/01 to 10/31	69	4,492
	Lander County	73 C	03/01 to 10/31	100	588
	Development Corp.	7 C	04/01 to 04/30	100	7
Pine Creek Field	Pieretti, D	127 C	04/01 to 05/30	37	93
Pine Creek Field		180 C	11/01 to 11/30	37	66
Pine Valley Seeding		150 C	04/01 to 04/15	68	50
Pine Valley Seeding		50 C	09/16 to 09/30	68	17
Pine Valley Seeding		200 C	10/01 to 10/30	68	134
Native		713 C	04/16 to 11/15	68	3,411
	Russell, D	795 C	04/16 to 09/15	100	3,999
		542 C	09/16 to 11/30	100	1,354
	Slagowski	332 C	05/01 to 05/31	100	338
	Ranches	10 H	04/16 to 11/15	100	70
		150 C	04/16 to 08/15	100	602
		170 C	04/16 to 10/15	100	1,023
		100 C	10/16 to 11/15	100	102
		20 C	11/16 to 12/15	100	20
	Dewey Dann	10 H	04/16 to 11/15	100	70
	Estate	35 C	04/16 to 05/15	100	35
		170 C	05/16 to 09/12	100	671
		90 C	09/13 to 11/15	100	189
ARGENTA	Agri-Beef	4685 S	04/01 to 06/25	23	1,793
	Alves, M	308 C	03/01 to 03/31	100	314
		206 C	11/01 to 02/28	100	813
	Zeda, Inc.	65 C	04/15 to 10/14	100	309

[a] S = Sheep; C = Cattle; H = Horses

TABLE 3.11-1

NUMBER OF SITES RECORDED IN EACH SAMPLING DOMAIN WITHIN THE CLASS II SURVEY AREA****

Site Types	Pinyon (2,540 acres)	Basin (4,494 acres)	Mountain (2,736 acres)
Prehistoric:**			
Isolated Finds	116	82	103
Simple Assemblage[a]	17 (2)*	14 (1)*	12 (1)*
Moderate Assemblage[b]	13 (9)*	2 (2)*	7 (4)*
Complex Assemblage[c]	7 (7)*	2 (2)*	8 (4)*
Historic:***			
Isolated Finds	108	73	76
Ranches/Homesteads	2		
Ranching/Mining Affiliated		1	
Mining	4		2
Charcoal Production	3		
Transportation	1		
Dumps	3	5	2
Native American Contact	1 (1)*	1 (1)*	
Unknown	2		

Source: Class II Sample Survey for the Cortez Cumulative Effects Study Area (revised edition)

a Sites which contain debitage and/or a maximum of two other tool categories
b Sites which contain debitage and/or all other tool categories except milling equipment
c Sites which contain milling equipment as well as any other tool category
* Number in parentheses indicates number of sites eligible for inclusion on the National Register of Historic Places.
** Source: Table 37, Class II Survey Report (revised edition)
*** Source: Tables 25 and 27, Class II Survey Report (revised edition)
**** Total 109 sites; 1 site counted twice, 4 sites multi-component (historic and prehistoric), 2 sites outside sampling unit; this equates to a total of 82 prehistoric sites and 27 historic sites.

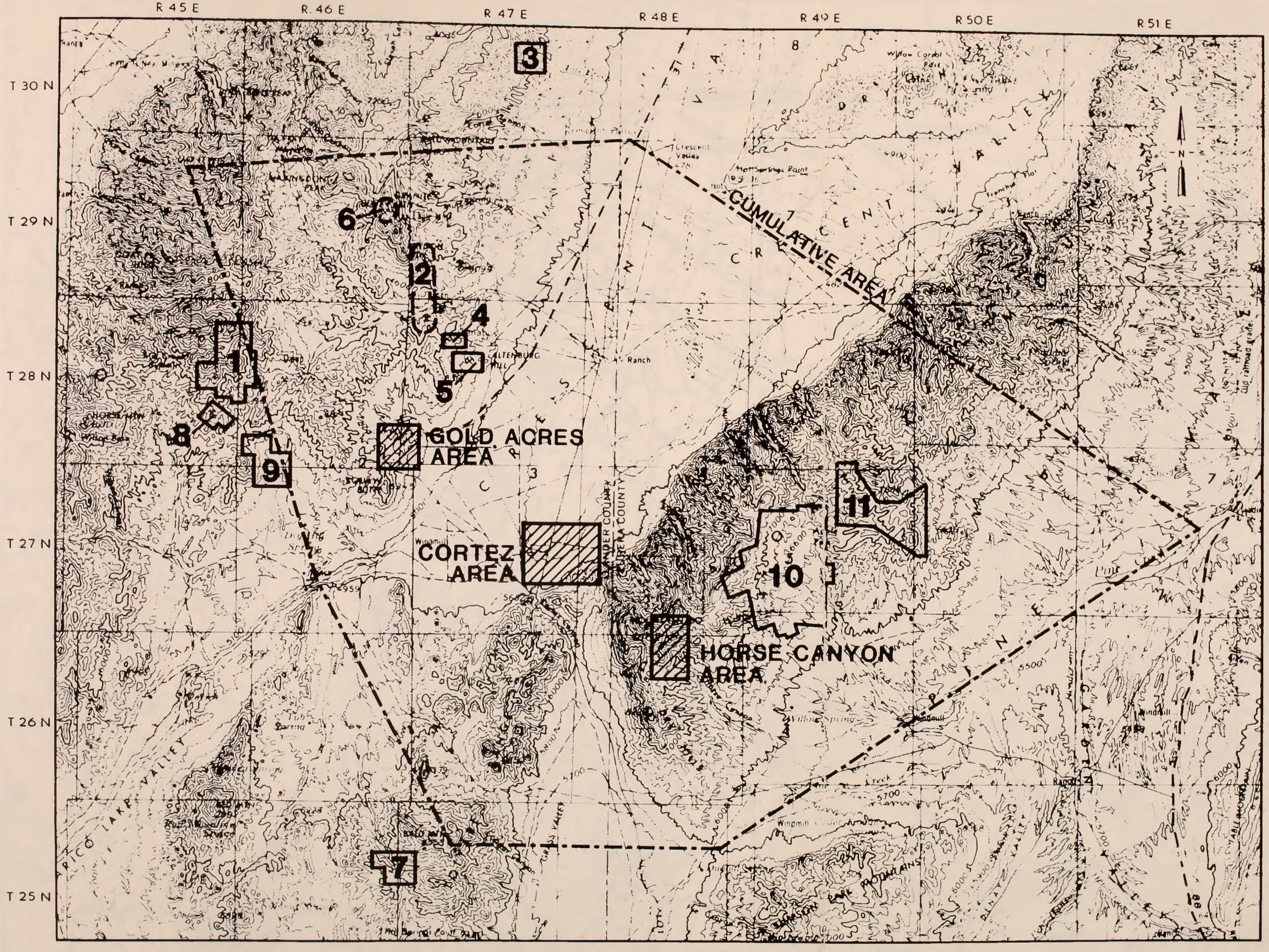
TABLE 3.11-2

NUMBER OF SITES RECORDED IN SAMPLING DOMAIN WITHIN THE CLASS III SURVEY AREA

Site Types	Pinyon	Basin	Mountain
Prehistoric:			
Isolated Finds	4	5	4
Simple Assemblage	5 (1)*	5	3
Complex Assemblage	1 (1)*		
Historic:			
Isolated Finds	4	3	3
Ranches/Homesteads	1		
Ranching/Mining Affiliated	5 (1)*	1	11 (1)*
Mining	1	2	1
Charcoal Production	2 (2)*		
Transportation			
Dumps			
Unknown			

Source: BLM Cultural Resources Report 6-1368-0(P).

* Number in parentheses indicates number of sites eligible for inclusion on the National Register of Historic Places.



MINES

1 ELDER CREEK (GOLD)
3 FIRE CREEK (GOLD)
4 ROBERTSON PROJECT (GOLD)
5 TRIPLET GULCH (GOLD)
6 GRANITE/BULLION - GREY EAGLE MINES (GOLD-SILVER)
7 TOIYABE MINE (GOLD)
8 GREYSTONE MINE (BARITE)
9 CLIPPER MINE (BARITE)
10 BUCKHORN MINE (GOLD)

EXPLORATION PROJECTS

2 INDIAN CREEK (GOLD)
11 COTTONWOOD CANYON / BROCK CANYON (GOLD)

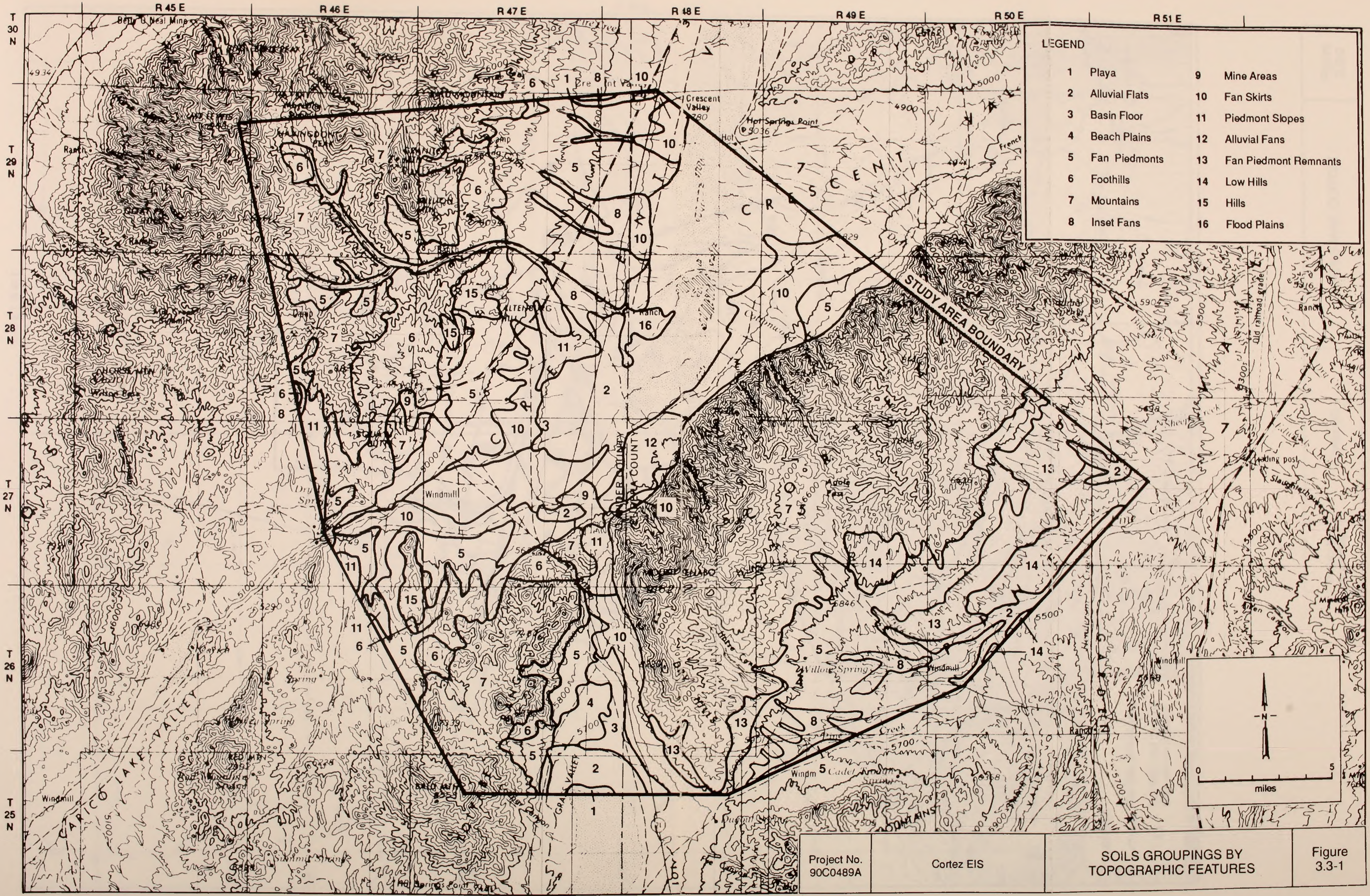
Scale 1:250,000

5 0 5 10 MILES

5 0 5 10 15 KILOMETERS

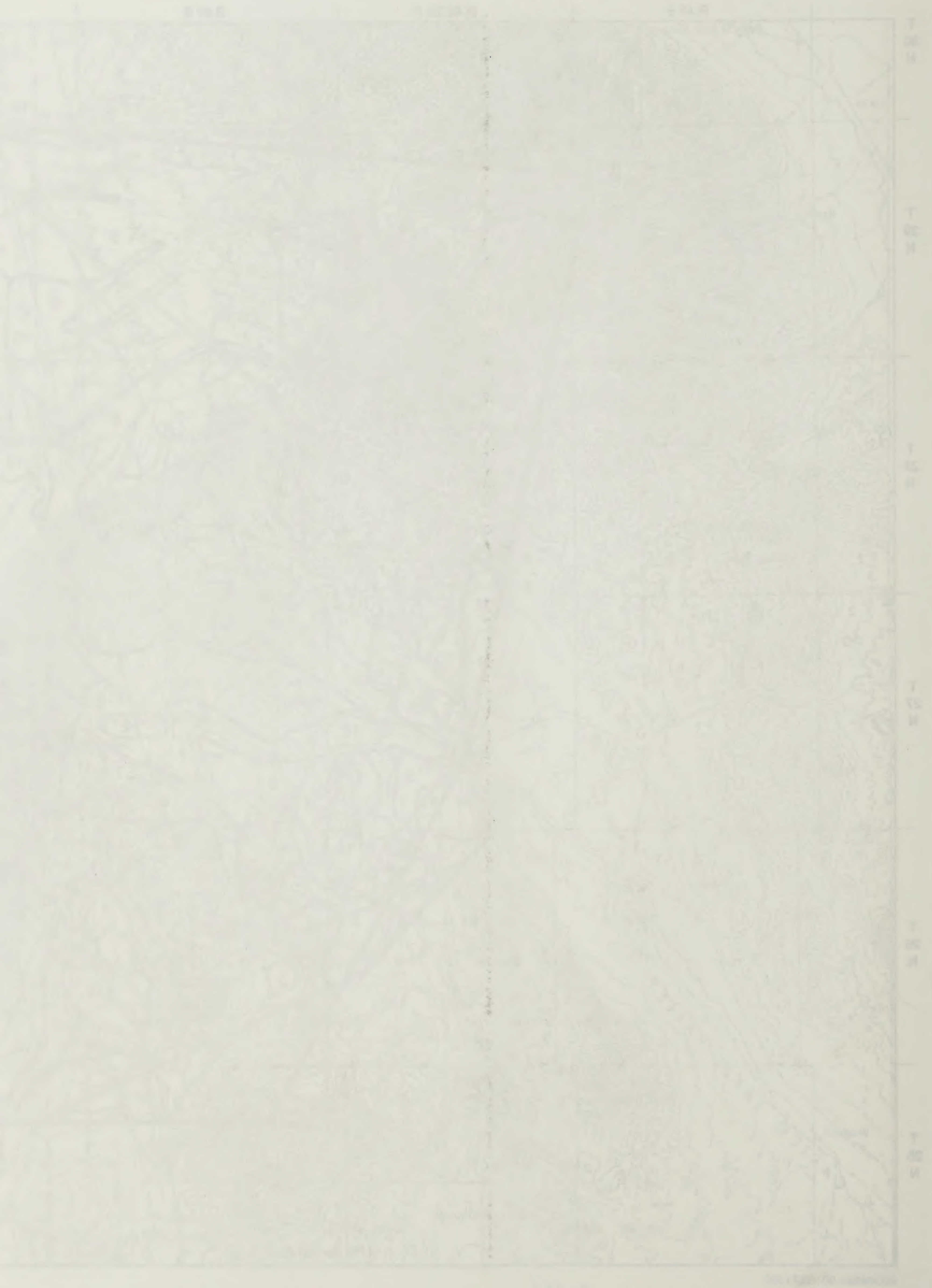
Project No. 90C0489A	Cortez EIS	MINING AND EXPLORATION VENTURE LOCATION MAP	Figure 3.2-1

90C0489A-9010/071392



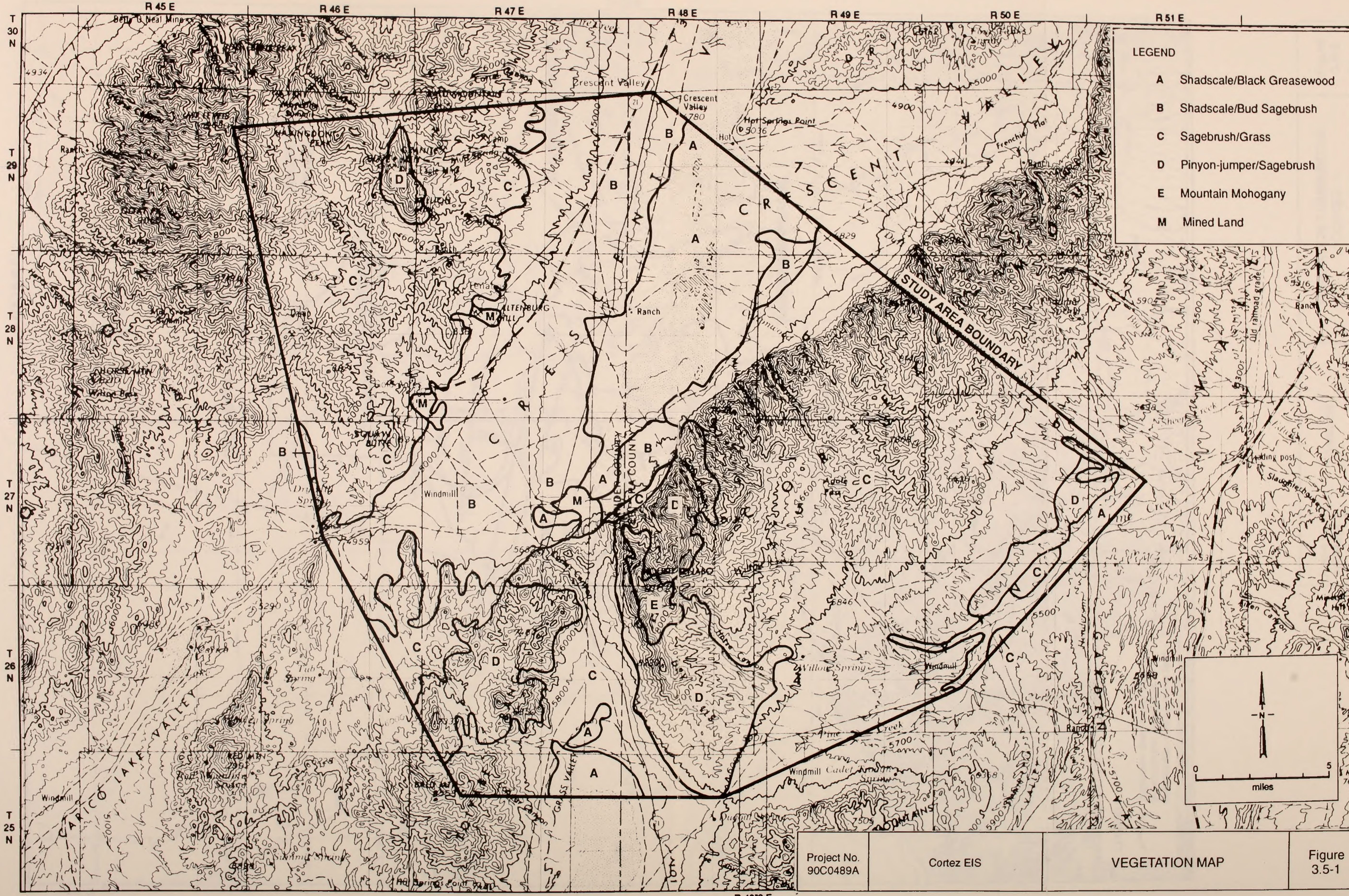
Project No. 90C0489A | Cortez EIS | SOILS GROUPINGS BY TOPOGRAPHIC FEATURES | Figure 3.3-1

90C0489A-9010/071392

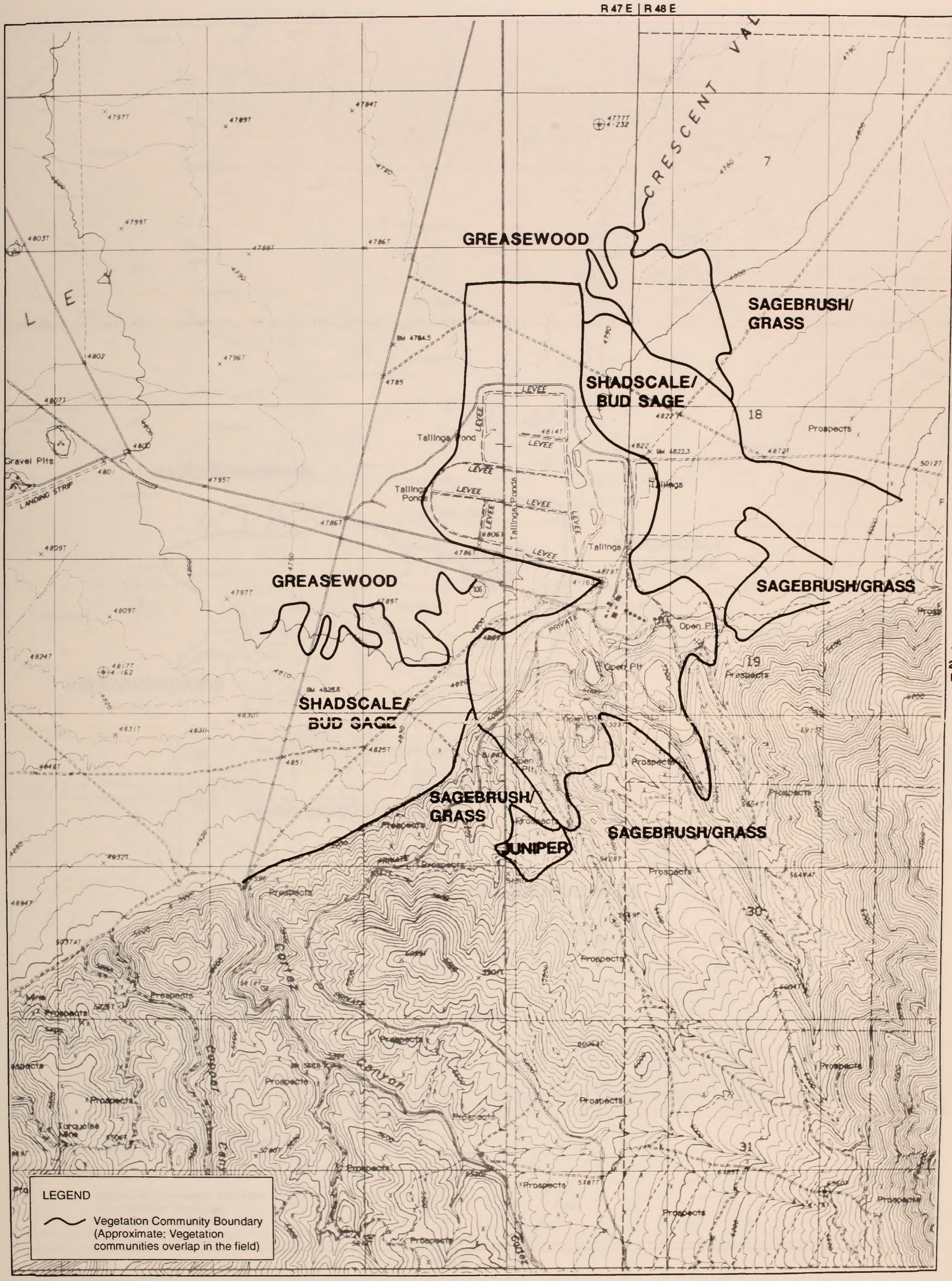


Project No. 90C0489A	Cortez EIS	SOILS MAP, CORTEZ	Figure 3.3-2

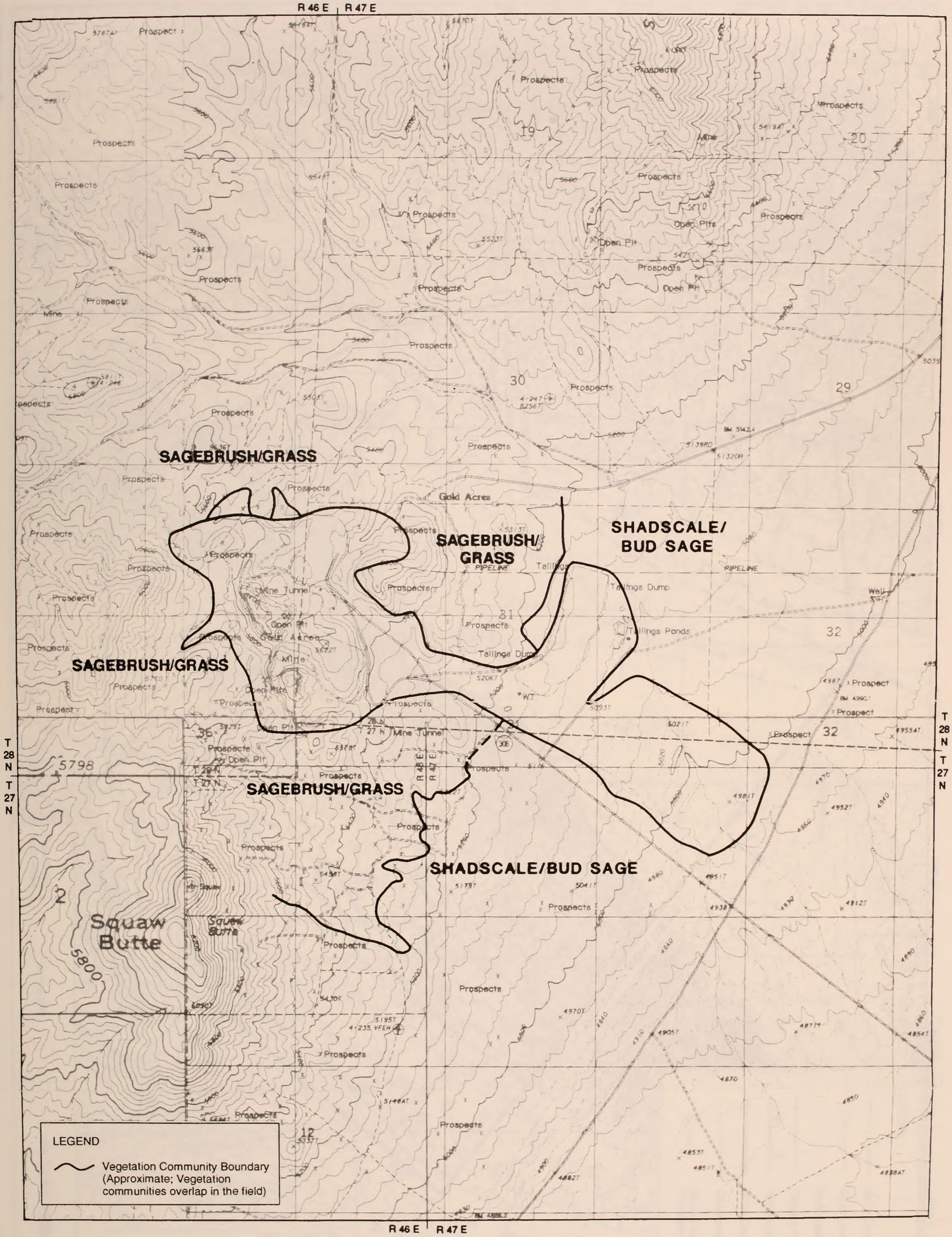
Project No. 90C0489A	Cortez EIS	SOILS MAP, GOLD ACRES	Figure 3.3-3



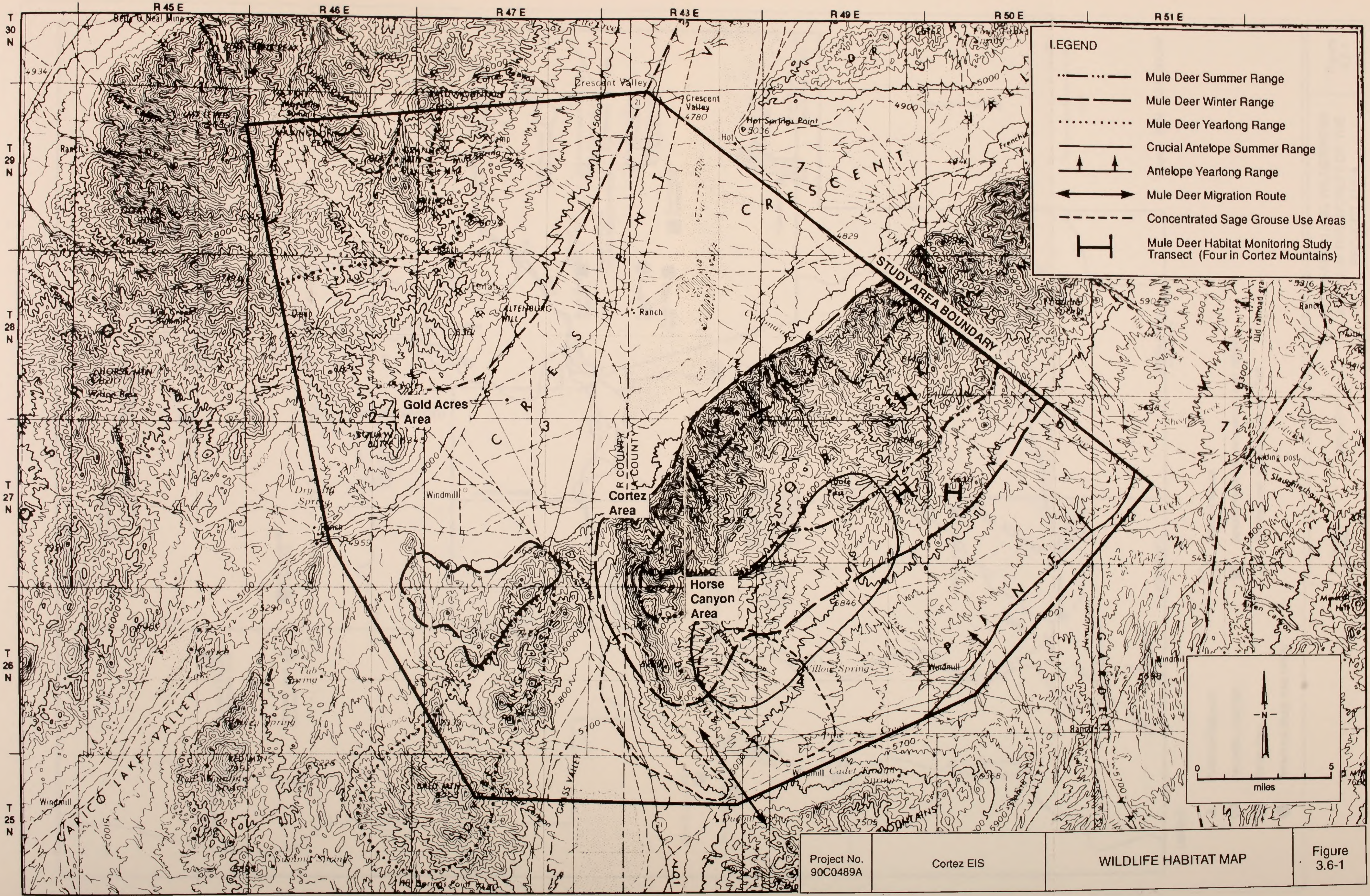
Project No. 90C0489A	Cortez EIS	VEGETATION MAP	Figure 3.5-1



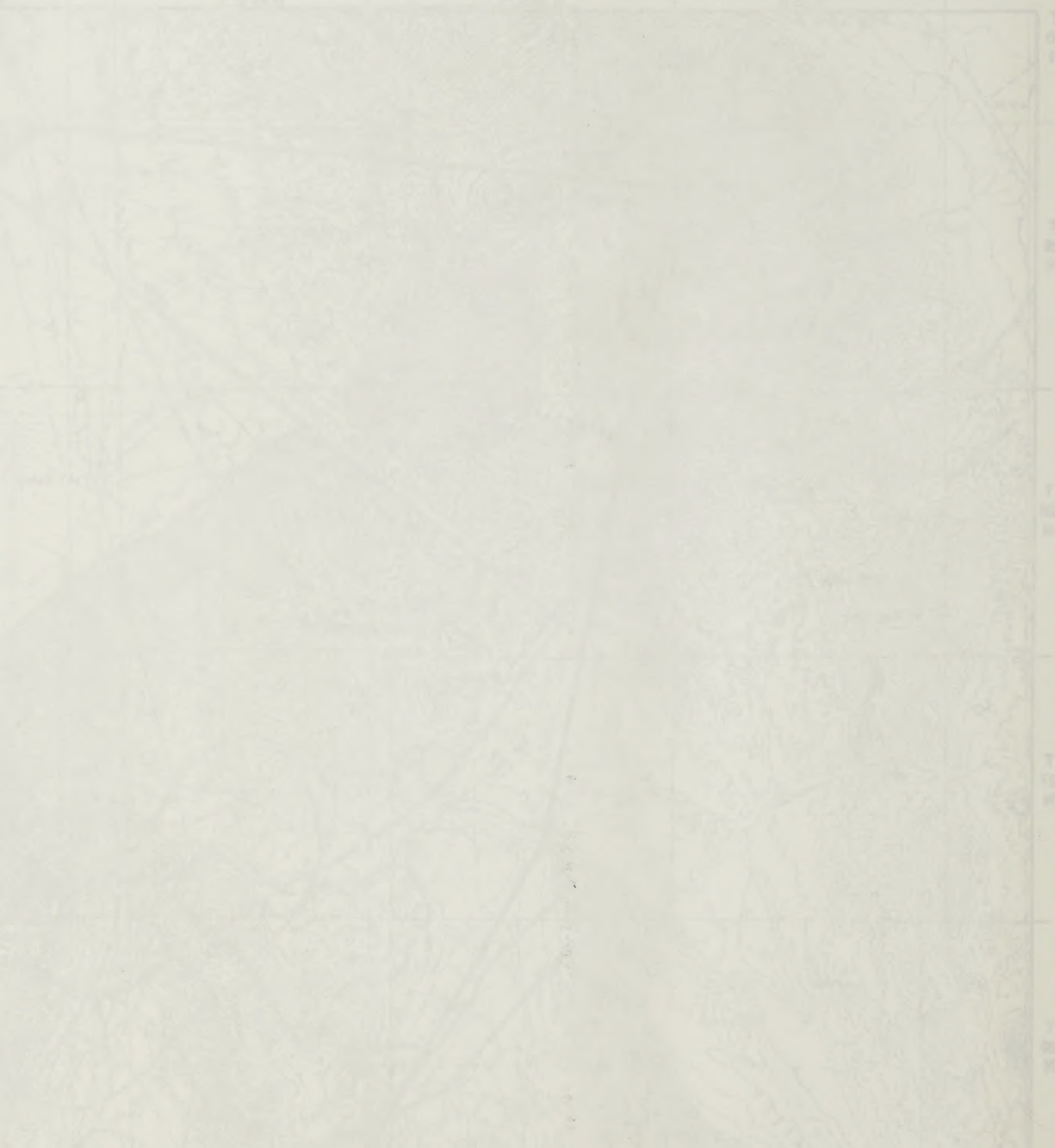
Project No. 90C0489A	Cortez EIS	VEGETATION COMMUNITIES, CORTEZ	Figure 3.5-2

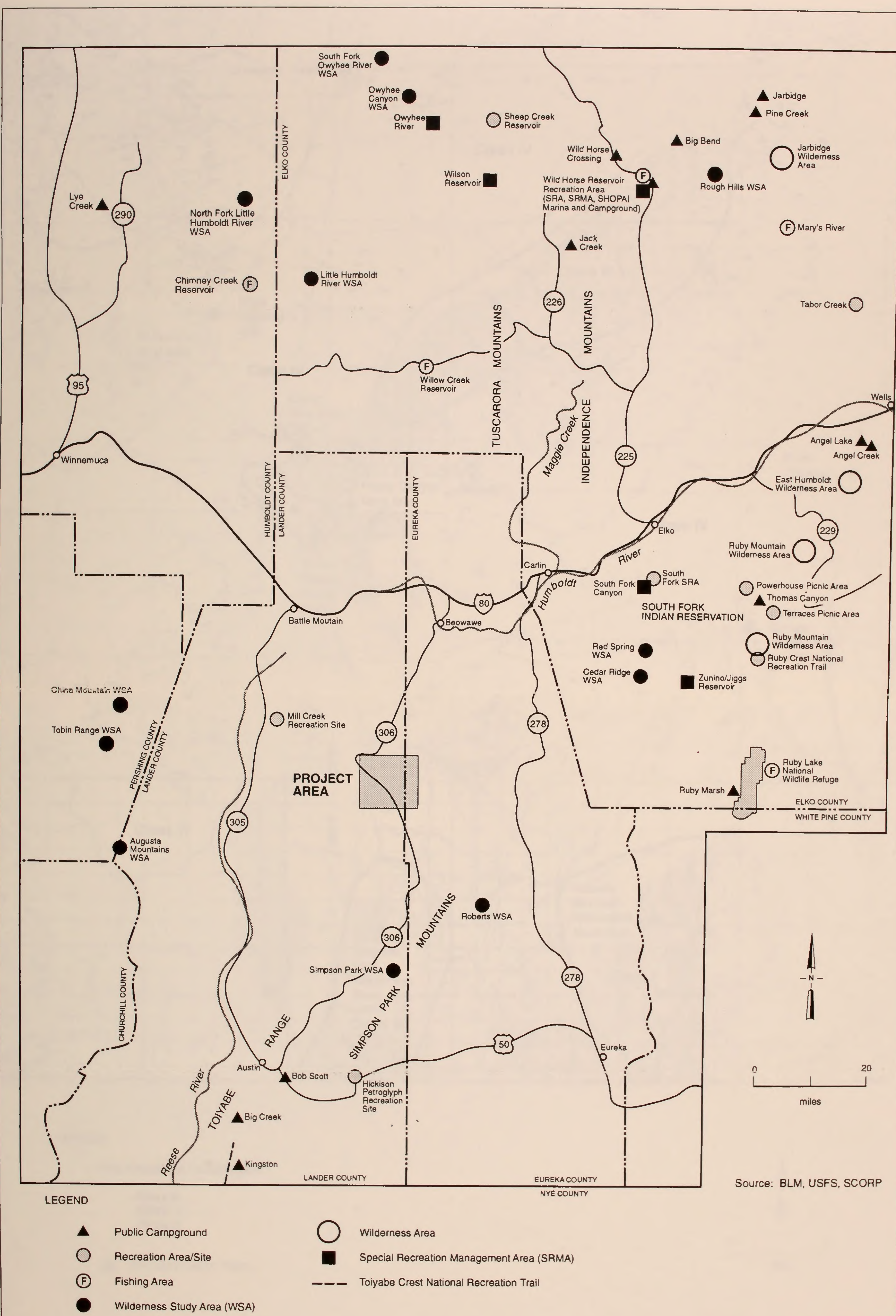


Project No. 90C0489A	Cortez EIS	VEGETATION COMMUNITIES, GOLD ACRES	Figure 3.5-3

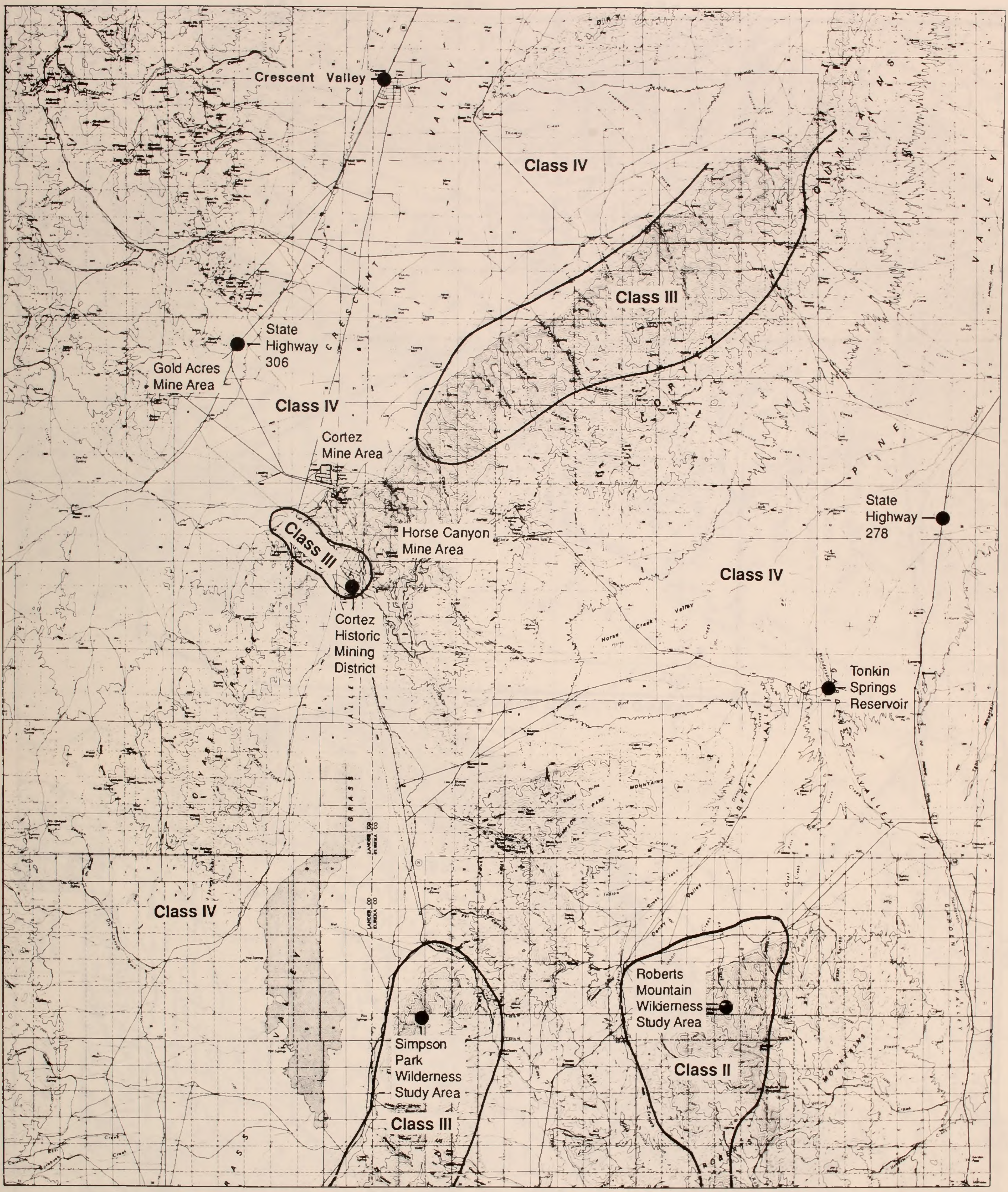


LEGEND
Mule Deer Summer Range
Mule Deer Winter Range
Mule Deer Yearlong Range
Crucial Antelope Summer Range
Antelope Yearlong Range
Mule Deer Migration Route
Concentrated Sage Grouse Use Areas
Mule Deer Habitat Monitoring Study Transect (Four in Cortez Mountains)
STUDY AREA BOUNDARY
Gold Acres Area
Cortez Area
Horse Canyon Area
Crescent Valley
R 45 E
R 46 E
R 47 E
R 43 E
R 49 E
R 50 E
R 51 E
T 30 N
T 29 N
T 28 N
T 27 N
T 26 N
T 25 N
miles
Project No. 90C0489A
Cortez EIS
WILDLIFE HABITAT MAP
Figure 3.6-1





Project No. 90C0489A	Cortez EIS	RECREATION AND WILDERNESS AREAS IN THE VICINITY OF THE PROJECT AREA	Figure 3.7-1



LEGEND

VRM Objectives Classification:

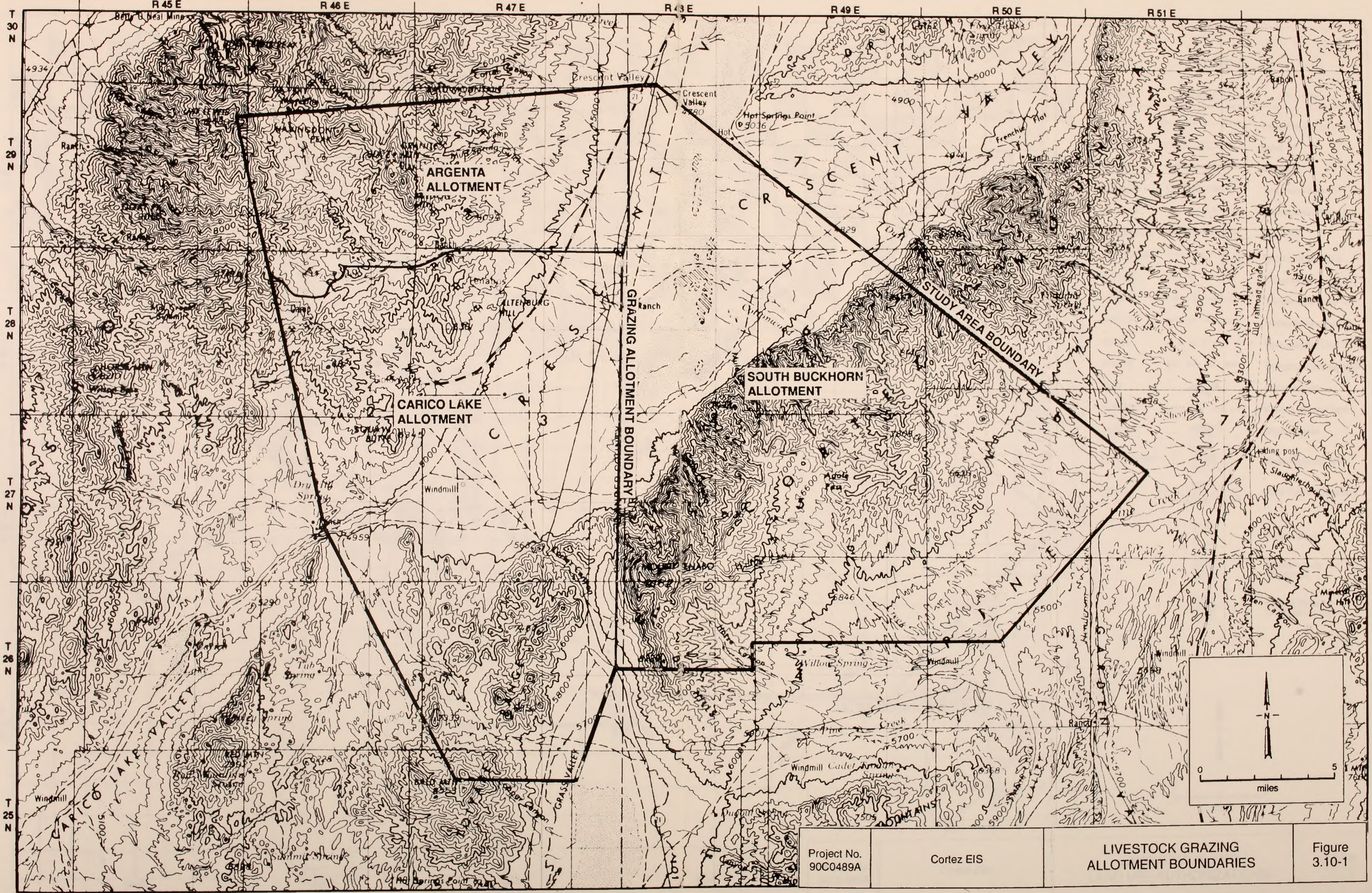
Class II
Class III
Class IV

● Key Observation Points

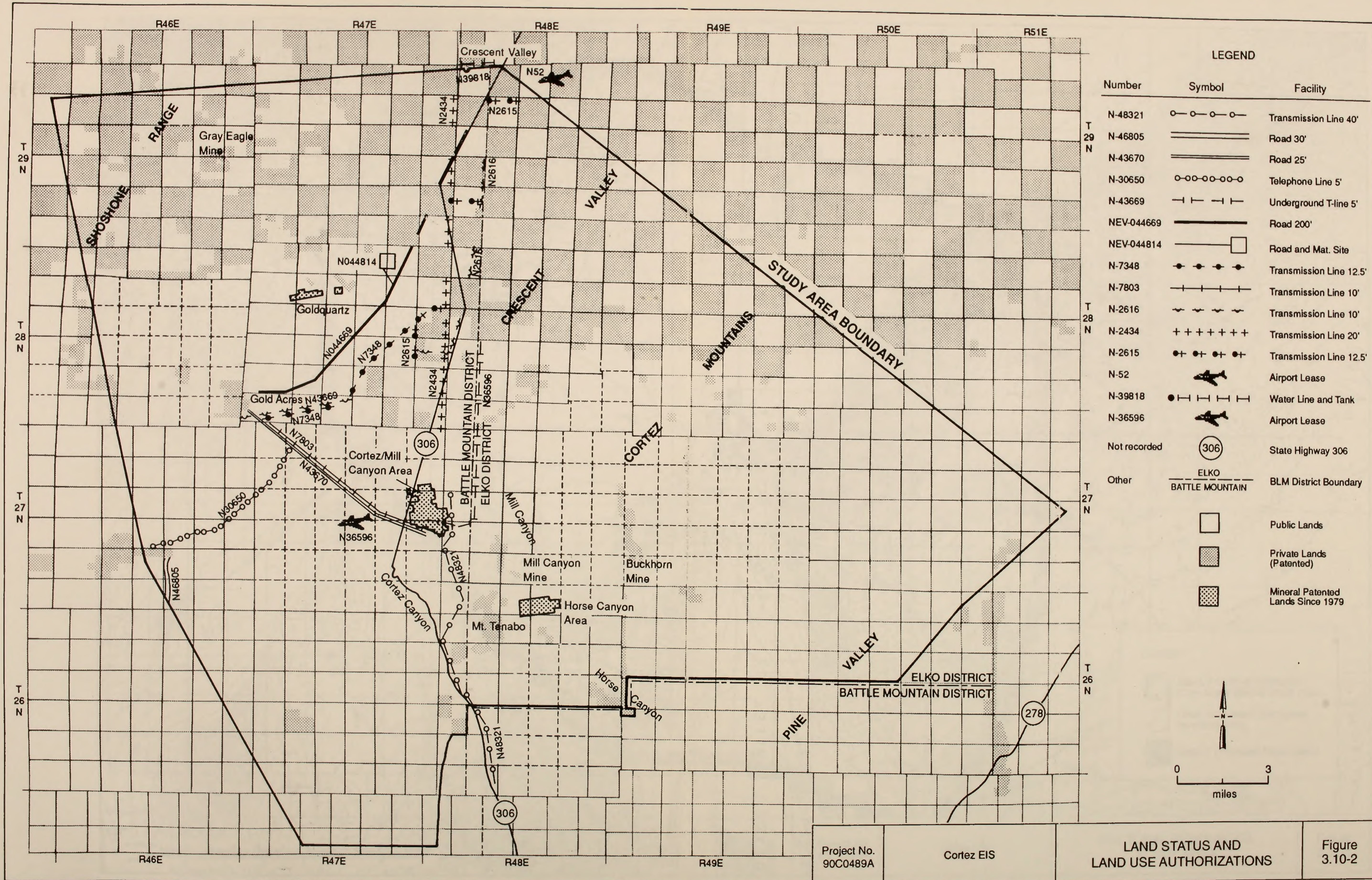
0 4
miles

Project No. 90C0489A	Cortez EIS	VISUAL RESOURCES MAP	Figure 3.8-1

90C0489A-9010/071392

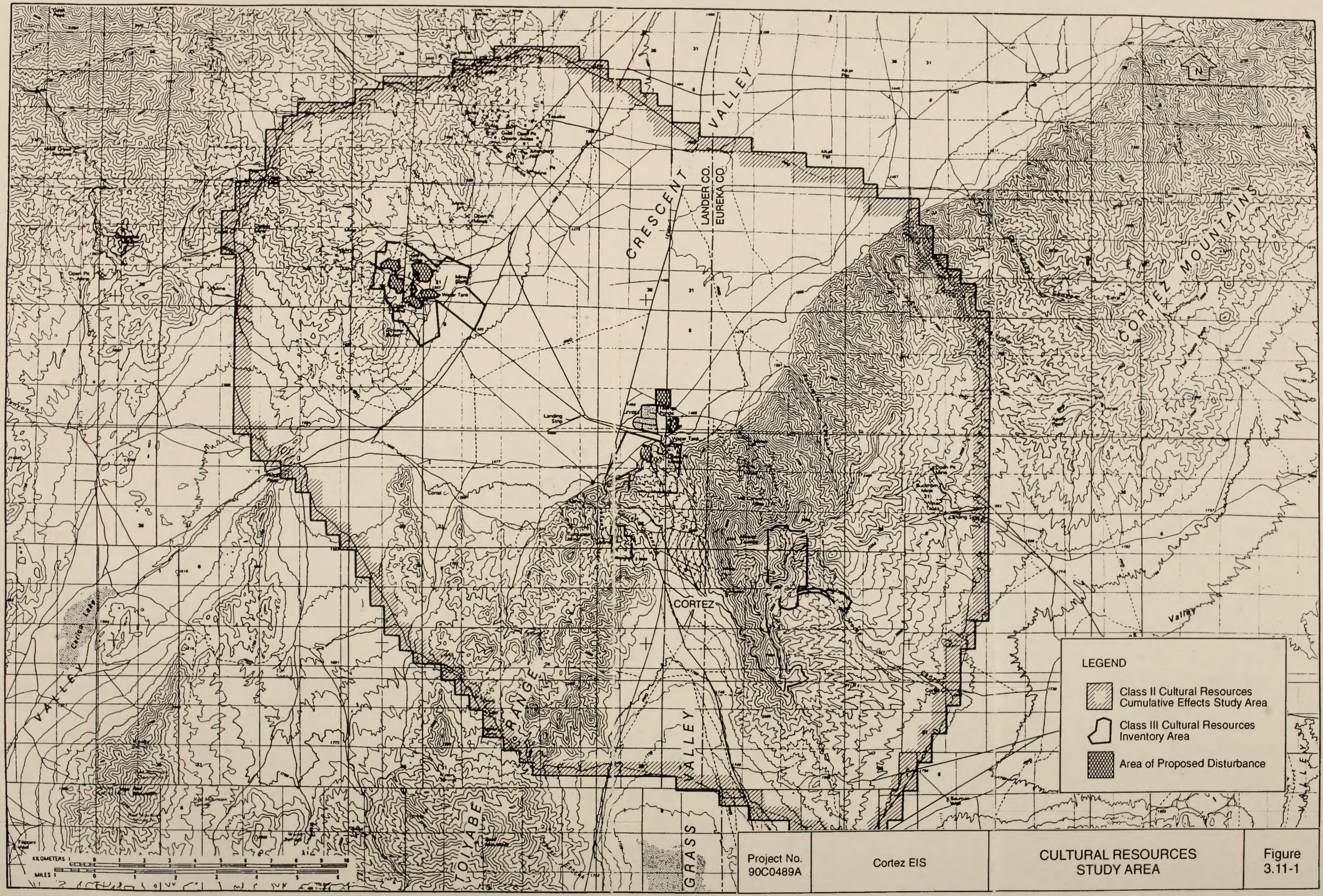


Project No. 90C0489A | Cortez EIS | LIVESTOCK GRAZING ALLOTMENT BOUNDARIES | Figure 3.10-1



LAND STATUS AND LAND USE AUTHORIZATIONS

Figure 3.10-2



Project No. 90C0489A	Cortez EIS	CULTURAL RESOURCES STUDY AREA	Figure 3.11-1

90C0489A-9010/071392

4.0
ENVIRONMENTAL CONSEQUENCES

The purpose of this section is to describe potential environmental impacts that would result from construction of the proposed expansion facilities, operation of those facilities, and reclamation. Impacts are evaluated based on an assumed project life of 6 years with 3 additional years required for reclamation. The No Action Alternative is also addressed.

The scope of the impact analysis includes evaluation of all impacts resulting from proposed expansion but does not address impacts that are associated with current, (i.e., already permitted) activities. These existing disturbances are addressed under the No Action Alternative in Section 4.12. As addressed under the No Action Alternative, current disturbances would continue for a period of 2 to 4 years until permitted ore depletion would result in closure of the Cortez facilities. A specific timetable for the No Action Alternative is not possible because the current production schedule could be modified to accommodate market and other business considerations.

The impact analysis for each resource area begins with a definition of significance criteria. These criteria are designed as threshold levels to indicate when a significant impact would occur. In some cases, established standards are used, e.g., water quality and air quality standards. In other cases, more qualitative criteria are used as general indicators of significance based on professional judgement and agency guidelines.

Assessment of impact significance is made after consideration of the application of specific design or reclamation measures described in Section 2.0. When significant or potentially significant impacts would remain after design measures have been applied, mitigation measures are proposed.

Mitigation measures have been recommended in this Environmental Impact Statement which could avoid or reduce anticipated impacts. Residual impacts or unavoidable adverse impacts are identified which would remain after mitigation measures had been applied. It should be noted that recommended mitigation measures presented in the Draft Environmental Impact Statement (DEIS) have not been adopted for the proposed project. After the public review period is complete, the Bureau of Land Management (BLM) will identify final mitigation measures in consultation with other agencies and the applicant and include these in the final Environmental Impact Statement.

The evaluation of impacts in this section is limited to those impacts that would result from the proposed action and the No Action Alternative. The incremental effect of these impacts added to other impacts resulting from past, present, or reasonably foreseeable projects are addressed in Section 5.0.

4.1 AIR QUALITY

4.1.1 Significant Criteria

Estimated air quality impacts from the proposed project will be compared to Nevada State Ambient Air Quality Standards (AAQS). These standards are presented in Table 3.1-2. If an air quality impact exceeds the AAQS, then the impact will be considered significant.

4.1.2 Impacts

Air quality in the local vicinity of the project would be affected by the proposed expansion of an open pit mine, new and expanded heap leach facilities, new tailings disposal facilities, waste rock dumps, and exploration activities. Additionally, cumulative effects on regional air quality could result from existing and proposed operations at the Cortez Gold Mine in conjunction with emissions from other permitted or planned sources in the Crescent Valley Air Basin.

Air pollutant emissions from the existing and proposed operations of the Cortez Gold Mine are associated with a number of processes at the mill facility as well as from other mining and exploration activities. These pollutant emissions can be considered as either point source (e.g., through a process stack or exhaust vent) or fugitive emissions (in particular, fugitive dust emissions). The term "fugitive dust" refers to particulate matter emitted from an open area (i.e., not through a stack or an exhaust vent), due to human activities or by the forces of wind acting on exposed material such as soil or storage piles.

The primary air pollutants of concern for the Cortez Gold Mine operations are SO_2, TSP, and PM_{10}. Fugitive dust emissions (i.e., PM_{10}) would result from various activities associated with the open pit mine expansion, construction, and exploration. These activities include land clearing, earth moving, loading and unloading trucks with ore or overburden, vehicle travel on unpaved haul roads, and blasting. Point source emissions of SO_2 and TSP would result from various ore processing and related operations at the mill facility. Pollutant sources of TSP and/or SO_2 at the mill facility include the following: the grinding mill, the fluid bed roaster, the ore storage silo, the primary crusher, the secondary screen, the vibrating screen, and the furnace.

Discussed below are the analyses of potential air quality effects from the proposed project (open pit mining and expansion) and ore processing operations at the Cortez mill. Cumulative air quality effects associated with the Cortez mill and other sources in the Crescent Valley Air Basin are discussed in Section 5.1. Mitigation measures are discussed in Section 4.1.3.

4.1.3 Fugitive Emissions

The proposed project, which involves development of new heap leach facilities, expansion of existing facilities, and exploration activities, would result in fugitive dust emissions from the following activities: earthmoving, truck loading and unloading of ore and overburden, haul truck travel on unpaved roads, and blasting during expansion of open pits. Fugitive dust emissions from each of these activities are discussed separately below. For the purposes of this evaluation it was assumed that PM_{10} emissions constitute 36 percent of TSP emissions (EPA 1985). TSP is generally considered as being all particles less than approximately 30 micrometers (µm) in diameter. PM_{10} emissions would be less than the TSP emissions, since PM_{10} generally represents only a fraction of fugitive TSP emissions. Emissions of PM_{10} from fugitive dust were estimated using projected ore reserves and overburden from each of the mining areas (Gold Acres and Cortez).

<u>Surface Disturbance</u>

To estimate PM_{10} emissions from surface disturbance during excavation of the open pits, an emission factor of 1.2 tons TSP/acre of excavation per month of activity was used (EPA

1985). This is a general emission factor for TSP that includes activities such as landclearing, earthmoving, truck haulage, and wind erosion. Estimated emissions are based on proposed acres of surface disturbance at each of the mining areas, and duration of disturbance. Emissions of PM_{10} from surface disturbance are presented in Table 4.1-1.

Haul Truck Travel on Unpaved Roads

Fugitive dust emissions would result from trucks traveling on unpaved haul roads while the ore and over burden are hauled to the processing facilities and dump sites. Emissions from the proposed project are not expected to change significantly from the present, because haul roads that would be used for the proposed project are currently used for existing mining and exploration activities. Emissions from travel over haul roads are controlled as discussed below. A new section of haul road would be constructed to access the expanded Gold Acres pit. Surface disturbance impacts already have been estimated (Table 4.1-1), since the proposed road would be constructed over areas of existing disturbance, or over the area proposed for waste rock dump disturbance. Impacts from truck haulage over this additional 5,600-foot road are considered negligible compared to existing haul road emissions of fugitive dust. A second haul road would be constructed around the proposed Gold Acres heap leach facility. This new 2,500 feet of road would reroute the existing Gold Acres haul road.

Dust control measures would be applied to these roads as part of the requirements of a surface disturbance permit issued by the NDEP. Dust control measures currently in use are watering and chemical dust suppression on roads within and between the Cortez and Gold Acres areas. Control efficiencies from watering and chemical dust suppression for unpaved roads, using substances such as calcium chloride ($CaCl_2$) or magnesium chloride ($MgCl_2$), are estimated at roughly 75% (BAAQMD 1985).

Truck Loading and Unloading

In addition to emissions generated during truck travel over dirt haul roads, fugitive dust emissions (PM_{10}) would result from loading of ore and overburden onto haul trucks, and unloading of ore at processing sites and overburden at dump sites. Estimated emissions are not expected to change from existing emissions during these activities, because ore and overburden hauling would be the same for the proposed project as it is under existing conditions.

Blasting

Fugitive dust emissions would result from blasting during pit expansion activities. Estimated emissions were calculated using an emission factor for blasting at western surface coal mines (EPA 1985). Fugitive dust emissions from blasting were estimated using the number of acres involved in expansion. Table 4.1-2 provides fugitive dust emissions from blasting during expansion in the Cortez and Gold Acres areas. Blasting would occur over roughly two acres per blast at a frequency of approximately twice per week.

Fugitive Dust Impacts

Effects of PM_{10} from construction activities would be highly variable because impacts would be a function of duration of the activity and existing site-specific meteorological conditions. For example, fugitive dust emissions would be greater during dry, windy periods. Locally elevated PM_{10} levels could result during some construction/exploration activities, but would be temporary and transient in nature. Construction and exploration activities, and the day-to-day mining operations of the Cortez mine and proposed project are similar to many of the other mining operations in the surrounding project region. Particulate matter emission levels from mining-related activities, and their ensuing effects on air quality are generally comparable from one mining operation to the next. Local variations do exist, however, depending on the specific level of activity in a particular area.

To assess the potential for significant air quality impacts from particulate matter emissions from the proposed Cortez project, ambient PM_{10} monitoring information from another ongoing similar mining operation were evaluated. PM_{10} monitoring data collected at the Newmont Gold Company's Gold Quarry site (WCC 1991) was used for this purpose. The Gold Quarry site is located approximately 7 miles northwest of the town of Carlin, Nevada, in Eureka County.

The Newmont Gold Company has been monitoring ambient PM_{10} near the Gold Quarry site, beginning in July 1989, to monitor the local effects of its mining operations. Results of the monitoring data (Table 4.1-3) show that Federal and State PM_{10} standards were not violated during the monitoring period. Based on these data, it is concluded that the similar proposed operations at Cortez would not result in violation of the State or Federal ambient air quality PM_{10} standard. This assessment assumes that dust control measures in Section 2.2.8 are implemented.

4.1.4 Point Source Emissions

An emissions inventory provided by the NDEP of sources in operation at the Cortez mill is summarized in Table 4.1-4. Emissions of SO_2 and particulate matter (TSP) are presented in pounds per hour and in tons per year, based on annual hours of operation. Three of the 10 sources listed in the emissions inventory (the carbon reactivation kiln, the lime handling system, and the boiler) produce no emissions, or negligible emissions, of either SO_2 or TSP. Emission rate threshold levels provided in the Nevada Administrative Code are used to determine whether or not emissions from a point source require further review to determine if their impacts are significant. The threshold levels for SO_2 and TSP are 40 tons per year and 25 tons per year, respectively. Emissions of TSP from the grinding mill (29.9 tons/year) exceed the emission rate threshold, and identify this source as requiring further review. Emissions of both TSP and SO_2 from the fluid bed roaster exceed the threshold levels for emissions (135.3 tons/year and 125 tons/year, respectively). This classifies the fluid bed roaster as requiring further review. These sources have already undergone review. Since the proposed project includes no expansion of the Cortez mill facilities, no additional emissions from the mill facilities are expected to occur as a result of the proposed project.

The analysis of air quality impacts for those sources with emissions exceeding the threshold level is based on results of air quality modeling of SO_2 and TSP. Sources of TSP emissions at the mill are shown in Table 4.1-4. The only source of SO_2 emissions at the mill is the fluid bed roaster. The modeling used for this analysis was performed by the NDEP as part of the permitting evaluation of sources at the mill facility. At that time, there was no state ambient air quality standard for PM_{10}. Therefore, TSP was modelled, and the concentrations were compared to the state TSP standard. Ambient background concentrations of SO_2 and TSP assumed by the NDEP for permitting purposes are as follows: 24-hour and annual SO_2 concentrations of 5.0 $\mu g/m^3$ and 0.0 $\mu g/m^3$, respectively; and 24-hour and annual TSP concentrations of 10.2 $\mu g/m^3$ and 9.0 $\mu g/m^3$, respectively.

The VALLEY model was used to determine 24-hour and annual air quality concentrations of SO_2 and TSP from the entire mill facility and from each individual source. At the time the modelling was performed for the permitting evaluation, VALLEY was the EPA-approved model. However, the EPA currently recommends and uses the COMPLEX I and ISCST models to predict maximum air quality impacts. SO_2 concentrations were modeled for the fluid bed roaster only, because it is the only source of SO_2 at the mill. The maximum 24-hour off-site modeled SO_2 concentration is 5.0 $\mu g/m^3$. When added to the 24-hour background concentration, the total SO_2 concentration is 10.0 $\mu g/m^3$. This would not exceed the state or federal ambient air quality standards (AAQS) of 365 $\mu g/m^3$, resulting in no significant impact. The maximum annual off-site modeled SO_2 concentration is 2.1 $\mu g/m^3$. With a background concentration of 0.0, the total annual modeled concentration is 2.1 $\mu g/m^3$. This would be below the AAQS of 80 $\mu g/m^3$, resulting in no significant impact.

Annual and 24-hour average TSP concentrations were modeled for all sources at the mill. The maximum 24-hour predicted off-site concentration is 9.6 $\mu g/m^3$. When an assumed background concentration of 10.2 $\mu g/m^3$ is added to the modeled concentration, the total modeled concentration is 19.8 $\mu g/m^3$. This is below the AAQS of 150 $\mu g/m^3$, resulting in no significant impact. The predicted annual maximum TSP concentration occurring off-site is 4.9 $\mu g/m^3$. When added to the assumed background of 9.0 $\mu g/m^3$, the total annual modeled concentration is 13.9 $\mu g/m^3$. This is below the SAAQS for PM_{10} of 50 $\mu g/m^3$, resulting in no significant impact. Currently, with the new SAAQS for PM_{10}, there is concern for air quality impacts to PM_{10}. Since PM_{10} is a fraction of TSP (Section 3.1), comparison of TSP impacts to the PM_{10} standard is considered conservative.

<u>Crystalline Silica</u>

Emissions of crystalline silica would be most likely from point sources at the mill, due to the presence of crystalline silica in the ore. Quartz is the form of crystalline silica that is present in the ore. Sources of crystalline quartz emissions at the mill are the grinding mill, the fluid bed roaster, and the primary and secondary crushers.

The percentage of crystalline quartz in the TSP emissions was estimated from results of TSP sampling performed at the mill. Personal sampling equipment was used by the crusher operator and the loader operator. A sample was also taken in the dry grind building. An average of these three samples shows that crystalline quartz emissions are roughly 11.6 percent of TSP emissions (Cortez 1992).

The concentration of crystalline quartz from sources at the mill was estimated from 24-hour TSP modeling results. Since the crystalline quartz ambient air quality standard of 2.38 $\mu g/m^3$ applies to an 8-hour average, an 8-hour crystalline quartz concentration was needed for comparison.

An 8-hour TSP concentration of 16.8 $\mu g/m^3$ was derived from the 24-hour concentration using EPA conversion factors appropriate for screening-level modeling. The percentage of crystalline quartz in TSP, 11.6, was applied to this 8-hour maximum to obtain an 8-hour maximum crystalline quartz concentration of 1.95 $\mu g/m^3$.

It should be noted that the crystalline quartz concentration was derived from modeled TSP increases from all sources. Since crystalline quartz emissions would only be generated from the roaster and crushing and grinding operations, this is a conservative estimate of concentration. The 8-hour crystalline quartz concentration is below the ambient standard of 2.38 $\mu g/m^3$, and is therefore not considered significant.

4.1.5 Mitigation

The general design measures described in Chapter 2.2.8 for dust control are sufficient and no further mitigation will be required. Specific implementation of design measures will include:

- Provide surface watering and/or chemical dust suppressant. Watering is estimated to reduce dust emissions by 50 to 75 percent (Bay Area Air Quality Management District 1985). Chemical dust suppression is through the use of dust palliatives (i.e., non-toxic, hydroscopic compounds such as $CaCl_2$ or $MgCl_2$) mixed with the water to increase moisture retention in the surface dust particles.

- Limit areas to be cleared to facility construction areas and necessary equipment and materials stockpile areas.

- Wet the area down sufficiently to form a compact surface upon completion of grading and earthmoving. Repeat wettings as necessary, to maintain this surface and prevent dust from being picked up by the wind.

Overall project emissions and project activity durations were used to calculate annual emissions. That is, estimates of total emissions of each pollutant occurring over the entire project duration were initially computed, then based on these total emissions and expected activity durations, an average annual emission rate was computed. The assumption that particular activities occur each day of its scheduled duration results in calculations that are gross estimates of emissions from different activities. For example, earthmoving might be scheduled to be completed during a specified time period, but all equipment associated with earthmoving activities, quantities of materials moved, and locations of activities could be used to provide a more refined estimate of project emissions, if such a schedule were available. It is also important to note that concurrent reclamation would occur as proposed expansion takes place. This, in combination with the design measures discussed above, would sufficiently control fugitive dust emissions.

4.2 GEOLOGY, MINERALS, AND PALEONTOLOGY

4.2.1 Significance Criteria

The movement of materials due to slope failures sufficient to breach the sediment control structures or block natural drainages would cause significant erosion and transport of sediments off site.

4.2.2 Geology and Minerals Impacts

The proposed expansion of the Gold Acres open pit would result in the mining of approximately 32 million tons of ore and waste rock that would be permanently relocated. About 7 million tons of this would be gold ore. Approximately 57 percent (or tons) of the ore would be expected to be heap leached and would be permanently placed on leach pads. The remaining 3 tons of ore would be milled and would eventually be placed in tailings ponds. The 25 million tons of waste rock would be placed in the newly constructed waste rock dump that is proposed or in the existing waste rock dumps to be expanded.

Exploration drilling has indicated that no mineral resources would be located beneath the sites of the proposed facilities. The pit expansion at Gold Acres would actually make remaining low-grade ore, which is presently sub-economic and not included in present mining plans, available for future development if market conditions and advances in mining and mineral processing technology allow.

The proposed facilities in the Cortez area have the potential to be impacted by seismic events. However, because depth to bedrock is expected to be at least several hundred feet, extensions of the Crescent Fault would not be expected to provide pathways of potential leakage from surface leakage. Any additional design measures (beyond the existing design for specified earthquake loadings) would be identified as part of NDEP permitting requirements for these facilities.

Available data suggest that the subsurface under the proposed facilities at Gold Acres may provide pathways to conduct potential releases from the proposed facilities. However, because the proposed facilities are planned to utilize appropriate liners, releases to the subsurface are not expected. In the event of an earthquake, rupturing of the liner may be possible, however the facility has been designed according to an appropriate design earthquake (Welsh Engineering, 1992).

The waste rock dumps, as constructed at angle of repose, could be expected to experience minor slope failures during an earthquake. They would also be designed to remain stable during a 100-year, 24-hour storm event. Following reclamation and regrading to lower slope angles (design measures specified in Section 2.0), the dumps would be stable during the design earthquake. The pit wall design would be based on short-term safety factors including worker safety and would be consistent with the length of the proposed mining operations. Over the longer term, limited rock sloughing is expected from the pit walls, but would be contained on the benches. None of the predicted slope failures would be of sufficient scale to significantly escalate sediment transport.

The short-term result of the proposed exploration drilling is that additional ore bodies could be defined and could require further investigation. The long-term impact of exploration activities could be the additional removal of ore from the mining areas by Cortez or other companies. This future development would depend upon market conditions. Reclamation of drill sites, trenches and access roads would be accomplished with the use of native materials and, consequently, no long-term impacts due to mineral exploration would be expected.

4.2.3 Paleontology Impacts

An assessment of paleontological resources through the examination of inventories prepared by the BLM and review of the literature found no known vertebrate or invertebrate localities within the proposed areas of mine expansion (Appendix A). Consequently, no impacts to paleontological resources would be expected as a result of the proposed activities.

4.2.4 Mitigation for Geologic Hazards

Because the proposed leach facilities and tailings ponds have been designed as lined facilities, no mitigation beyond the current design has been proposed. Review of subsurface site investigations regarding contaminant mobility from potential releases, and requirements for any additional mitigation measures, would be identified during the permitting processes required by the State of Nevada Division of Environmental Protection for these facilities.

4.3 SOILS AND TOPOGRAPHY

4.3.1 Significance Criteria

The erosion of disturbed or reclaimed sites that would overwhelm sediment control structures, block natural drainages leading to perennial waters, or that could not support revegetation efforts would be significant. The loss of limited topsoil materials during stockpiling or reclamation that would in turn limit reclamation success would be significant.

4.3.2 Soils Impacts

The proposed mining operations would impact the soils in the vicinity of the expanded waste dumps, heap leach pads, tailings pond in the Cortez area, and the pit expansion and roads in the Gold Acres area, and the proposed exploration activities in both areas. The proposed mining activity would result in the alteration of land forms and soil formations as they now exist.

The proposed operations in the Cortez area would result in disturbance to 136 acres of soils during the peak of mining activity, and another 13 acres of soils during reclamation activities, for a total disturbance of 149 acres. Tables 4.3-1 and 4.3-2 outline the acres of disturbance by facility and soil map unit.

The proposed operations in the Gold Acres area would result in disturbance to 215 acres of soils during the peak of mining activity, and another 64 acres of soils during reclamation activities, for a total disturbance of 279 acres. Tables 4.3-3 and 4.3-4 outline the acres of disturbance by facility and soil map unit.

Erosion of soil from disturbed areas, including growth medium stockpiles and roads, would be anticipated. In addition, sediments from mine dumps would add to the overall sediment loads moving from the site. The open pits would not cause an erosion or sediment problem as all sediments would remain in the pits. Steep slopes where vegetation and topsoil had been removed would be vulnerable to water erosion and gravitational soil movement. Since no perennial waters would receive sediments, the impact is insignificant.

During reclamation, the stockpiled soils would be re-distributed in a random and unstratified manner on waste rock dumps and leach pads. Disturbance caused by the expansion of the open pit (1 acre) would remain as a permanently disturbed soil site. As shown in Tables 4.3-5 and 4.3-6, approximately 925,039 cubic yards of growth medium material would be available for salvage. About 70 percent would actually be salvaged and stockpiled for future reclamation use. This assumes an approximate loss of 30 percent during salvaging and stockpiling due to equipment capability to recover material on steep and rocky terrain. Following reclamation of the disturbed surfaces, the potential for continued erosion and off-site transport of sediment from the project area would be greatly reduced. The sediment control facilities would be maintained to control sediment produced during the reclamation period and until the reclamation work was deemed successful by the BLM.

Because there would be a minor to moderate shortfall in topsoil available from salvaging, about 25 acres of slopes would not be topsoiled and revegetation on these sites might not stabilize the slope. Failure of reclamation due to lack of topsoil would be considered a significant impact. In addition, lack of timely precipitation and difficulty in reclamation of arid lands could result in reclamation failure on other sites with redistributed topsoil. This would also be considered a significant impact.

The removal, stockpiling and re-distribution of the soils would disrupt the microbial systems and destroy the structure of the horizons, reducing the nutrient cycling capability and water-holding capacity of the developed soil profiles. The re-distributed soils would exist as an undifferentiated, composite material.

4.3.3 Topography Impacts

The roads, dumps and leach pads constructed as part of the proposed project would be modifications of the terrain at each site. The roads would be a linear, flat form that would blend with the valley floors but would introduce a new landform in the hills. The road landforms would be eliminated by reclamation. The dumps and leach pads would be similar in dimension to the hills but the flat tops and sharp shoulders of the dumps and pads would be different in form than the rounded hills. The sharp forms of the dumps and pads would be softened by regrading during reclamation but not eliminated. The square form of the tailings pond cell would introduce a new shape to the valley floor. The modification of the valley floor created by the flat top, short slopes, and square shape of the tailings pond cell would remain following reclamation.

The open pits created by the mining activity would be a major modification of the terrain and would remain after reclamation.

4.3.4 Mitigation

Erosion and sedimentation impacts from soils not successfully reclaimed would require mitigation measures beyond the standard reclamation measures proposed in Section 2.0. Proposed mitigation is discussed below.

- Reclamation efforts would be monitored longer than the 3 years proposed as part of standard reclamation procedures in Section 2.0.

- If reclamation efforts were not successful during the extended monitoring period, additional seedbed preparation and reseeding would be implemented.

- If supplemental reclamation proposed above is not successful, substitute topsoil materials may be obtained from Cortez reasonably foreseeable projects discussed in Section 5.0.

4.4 WATER RESOURCES

4.4.1 Significance Criteria

Significance criteria for assessing qualitative and quantitative potential impacts to surface water drainages and groundwater resources in the Cortez and Gold Acres areas are listed below:

<u>Surface Water Drainages</u>

Since no year-round flowing streams are located in the Cortez or Gold Acres study area, aquatic toxicity standards for surface water bodies are not applicable. Instead, potential impacts are evaluated for possible changes to the surface water drainages themselves, such as:

- Reduction of the carrying capacity of natural drainages (issues of erosion and sedimentation)

- Diversion and consumptive use of surface water
- Transport of mining-related contaminants to drainages due to spills or inundation of project facilities

<u>Groundwater</u>

- Concentration of weak acid dissociable (WAD) cyanide exceeding the federal primary drinking water standard (Maximum Contaminant Level [MCL]) of 0.2 milligrams per liter (standard becomes effective January 1, 1994).
- Withdrawal of groundwater in excess of the certificated amounts for the two facilities

4.4.2 Potential Impacts

Several categories of potential impacts from the proposed project on surface water drainages and groundwater resources are identified and discussed below. These potential impacts were identified based on the significance criteria listed above and include both water quality and quantity considerations.

<u>Surface Water Drainages</u>

Impact categories for surface water drainages include:

- Erosion and sedimentation within rerouted drainages
- Erosion of topsoil from rainfall runoff
- Spills of chemicals, fuels, or lubricants into drainages
- Acid mine drainage

- Inundation of project facilities due to rapid spring snow melt and/or intense thunderstorms and subsequent transport of contaminants to drainages

No surface water quantity impacts have been identified for either the Cortez or Gold Acres facilities since Cortez Gold Mines does not impound or retain any surface water runoff for use.

The proposed project would require the alteration or diversion of some natural drainages around facilities. Generally, erosion would occur with increased surface disturbances. Sediment from this increased erosion would tend to accumulate in these surface water drainages. Given the sporadic nature of flow to and within these drainages, significant sedimentation problems are not expected to occur. During rainfall and subsequent runoff events, any deposited sediment could be re-mobilized and transported further downstream. Potential impacts from this sedimentation could include the temporary addition of nutrients (e.g., nitrogen and phosphorus) to the flowing water that were previously bound to soil particles. Another potential impact is deposition behind silt fences (interim mitigation feature) which could render them ineffective. Accelerated erosion would be controlled by appropriate interim and final reclamation measures summarized below and discussed in more detail in Section 2.2.8 (Applicant Committed Practices). After implementation of applicant committed practices, no significant impacts are anticipated.

Potential impacts associated with the leakage of chemicals (including solvents, cyanide, acids and caustics), fuels, or lubricants during facility operation would most likely be minimal and limited to small areas. Implementation of the Spill Prevention and Containment Plan (Section 2.3.8) would further reduce these already low potential impacts. Therefore, spills of chemicals and fuels stored and used at the facilities are not expected to significantly affect surface water resources.

Typically, impacts to surface water quality from acid mine drainage of active waste rock dump embankments are high if the waste rock contains unoxidized sulfur. Sulfuric acid is produced by the interaction of unoxidized sulfur in rock with water and oxygen. Addition of sulfuric acid to storm water runoff reduces its pH and causes trace metals to be more readily dissolved and, therefore, mobile. Acid mine drainage could impact surface water drainages by the long-term transport and deposition of trace metals in near-surface sediments.

The acid generating potential of the waste rock generated by the proposed project is thought to be very low due to the low concentrations of sulfur in the oxidized ore. In accordance with NDEP Permit No. NEV00023, waste rock and overburden are analyzed quarterly for acid generation-acid neutralization potential. Testing to date has confirmed that the oxidized ore has excess neutralizing capacity. This means that the ore neutralizes or buffers any acidic water that is produced and, therefore, lowers the potential for acid mine drainage.

To further reduce the potential for acid mine drainage from waste rock dumps, the upslope portion of each waste rock dump facility would be sloped back into the hill to prevent runoff down the face of the facility. Engineered surface water diversion features such as ditches or berms would be constructed upslope of the facilities to prevent the run-on of storm water runoff into the facilities. The excess neutralizing potential of the waste rock coupled with low annual rainfall and the engineered diversions mentioned above, would greatly reduce the likelihood of surface water drainage degradation and, therefore, impacts.

The proposed tailings ponds and heap leach facilities are designed as zero discharge or closed systems in accordance with NDEP Permit No. NEV00023. As such, the facilities would not discharge process solutions to surface water drainages. The solution collection ponds are designed to store process solutions and to contain runoff from a 100-year 24-hour storm event. The proposed heap leach facilities would be surrounded by containment berms. The berms would prevent surface runoff from entering the facility and causing erosion of structures or dilution of the leach solution. The berms would also prevent any possible escape of process solutions from the facility. The operation of the heap leach facilities is designed for zero discharge of leach solutions to the environment. Therefore, the potential impacts to surface water drainages due to the inundation of project facilities is considered low.

No potential impacts to surface water drainages other than those discussed above are expected due to proposed disturbances related to pit expansion (for Gold Acres only), exploration, or road construction (at Gold Acres only) activities.

Groundwater

Impact categories for groundwater resource include:

- Degradation of groundwater quality by the release of mining related constituents from a new tailings pond (Tailings Pond No. 7 at the Cortez Facility) or the expanded or new heap leach facilities

- Spills of chemicals, fuels, or lubricants

- Acid mine drainage

- Lowering of the water table due to increased groundwater pumping rates

If leakage of process water from the proposed tailings impoundment or heap leach facilities were to occur during operation, there would be a potential impact to groundwater. However, this potential is thought to be low due to design features and operating procedures. In accordance with NDEP Permit No. NEV00023, Tailings Pond No. 7 would be constructed as a zero discharge or closed system. At this time, the design of the facility is in the conceptual stage. As specified in Section 2.2.3, the facility would consist of a tailings embankment; a lined, impervious impoundment area; and tailings slurry and water return pipelines. To detect mining-related constituents that had potentially entered groundwater, monitoring wells would be installed downgradient of the facility (in the direction of groundwater flow). The number, location, and completion depths of the wells would be designed to meet the requirements of the NDEP. Due to the commitment of Cortez Gold Mines to construct a lined, zero discharge facility that meets regulations enforced by the NDEP, the potential for groundwater degradation from proposed Tailings Pond No. 7 is considered low.

As discussed in Section 3.4.4, shallow groundwater beneath and downgradient of the tailings ponds at the Cortez Facility has been impacted by mining-related constituents. Cortez has monitored groundwater quality since Facility operations began in 1969. References to existing groundwater quality monitoring reports are provided in Section 3.4.4.

Low levels of cyanide have been used as the primary indicator of groundwater contamination at the Cortez Facility. The furthest edge of the plume was confirmed by Cortez to be about 4,000 feet from Tailings Pond No. 6 with the installation of a row of monitoring wells. In accordance with Water Pollution Control Permit No. NEV00023 finalized by the NDEP in May 1991, 40 monitoring wells are monitored quarterly for cyanide and other chemicals (see Appendix C for additional details). The water pollution control wells appear to be effective in controlling the localized plume. The nearest downgradient domestic well is located approximately 6 miles from the Facility. Due to this large distance and the completion of the domestic well in a deeper aquifer, the likelihood of impacting groundwater presently being used is very low.

No changes are planned by Cortez for the operation of the existing ponds or heap leach facilities, or the proposed expansion of heap leach facilities at the Cortez Facility. Therefore, no additional impacts are expected. As discussed above, groundwater contamination has resulted at the Cortez Facility due to the existing ponds (Pond nos. 1 through 6). Cortez has changed their operating procedures to minimize the potential for further groundwater quality degradation. The ponds are operated to minimize standing water and optimize evaporation and reclamation rates. Apparently, these operational changes have been beneficial because seepage rates from the ponds are apparently lower as evidenced by the dropping water table.

At Gold Acres, a new heap leach facility is proposed. As specified in Section 2.2.3, the new facility would be constructed with a single liner on a prepared native soil base. The leach solution collected from the pad would be routed to a lined pond system for containment. As for the proposed new tailing pond discussed above, the new heap leach facility is designed as a closed-circuit, zero discharge system both in terms of potential leakage and in terms of overflow (see Section 2.2.3 for design criteria to prevent overflow). If leakage from the facility were to occur, there would be potential impacts to groundwater. However, the likelihood of an impact to groundwater is thought to be low based on the condition of Permit No. NEV00023 to construct and operate the heap leach facility as a zero discharge system.

Potential impacts to groundwater quality due to a large or long-term leak of chemicals, fuels, or lubricants during facility operation are thought to be minimal and limited to small areas. Implementation of the Spill Prevention and Containment Plan (Section 2.2.8) would further reduce these already low potential impacts.

The potential for groundwater quality degradation during facility operation due to acid mine drainage is expected to be low due to the low acid generating potential of the rock. As discussed above for potential impacts to surface water resources, the waste rock and overburden are analyzed quarterly in accordance with Permit No. NEV00023. The results to date have shown that the neutralizing capacity of the oxidized ore exceeds its acid producing potential. Therefore, the ore is unlikely to produce an acid mine drainage problem since the ore can neutralize or buffer any acidic water percolating through it. While storm runoff is expected to infiltrate to the water table, no acid mine drainage is presently being produced.

No groundwater quantity impacts are expected as a result of the proposed project. The proposed project would not materially change the gold process facilities or the size of the work force. No changes are expected in the present water supply well pumping rates which are below Cortez's certificated amounts (personnel communication, Cortez Gold Mines, June 1992). Water pollution control wells are presently operated in the immediate vicinity of the ponds and heap leach pads at the Cortez Facility. As a result, groundwater flow directions are controlled. Relative to groundwater resources in Crescent Valley as a whole, these extraction wells have a localized effect and do not influence any other groundwater users. No springs or seeps occur, and none have been observed, in the vicinity of the water pollution control wells that could potentially be impacted by pumping at these wells.

No impacts to groundwater are expected from the expansion of the pit at Gold Acres since it would not reach groundwater. Groundwater at this facility is 1000+ feet below ground surface.

4.4.3 Mitigation

Mitigation measures for the potential impacts identified above for surface water drainages and groundwater resources are discussed below. Measures previously identified as an Applicant Committed Practice (Section 2.2.8) are briefly identified although these are not considered mitigation because they are part of the design assumed for impact assessment.

Surface Water

As discussed above, no year-round flowing surface water exists on or in the immediate vicinity of the Cortez and Gold Acres facilities. Most drainages are naturally diverted around the Cortez Facility due to its location on a knoll of the valley upland. Drainages are present as a result of erosion by spring snow melt and storm runoff. Minor impacts due to the alteration and diversion of some drainages are expected. Small drainages impacted by roads and small facilities would be returned to their natural through-draining condition. Permanent drainage alterations would consist of open channels and berms. These features would be reclaimed with a vegetated or rock lining to be stable under long-term conditions (Section 2.2.7).

The design measures proposed by Cortez appear to be adequate to protect the surface water drainages utilized by seasonal snow melt and storm runoff. No additional mitigation measures are proposed. Cortez, working with the Bureau and the NDEP, is currently preparing a detailed reclamation plan for the entire facility. The detailed reclamation plan for the 428 acre 1990 Plan of Operations (POO) is currently under review at the Shoshone-Eureka Resource Area of the Battle Mountain District of the BLM and the NDEP. The 1990 POO will not be approved by the NDEP and BLM until this reclamation plan is accepted and the bond in place. Important components of that plan pertain to controlling soil erosion and restoring surface water drainage patterns (Section 2.2.7). Applicant committed practices pertaining to sediment control, in particular, are discussed in Section 2.2.8.

Groundwater

Primary protection measures for groundwater resources are the permit conditions (NEV00023) to construct and operate all facilities as zero discharge units. No further measures are required.

Potential impacts from spills of chemicals used at the mines are thought to be low, and are further reduced by the implementation of the Spill Prevention and Containment Plan. Potential impacts from the acid mine drainage are also thought to be low. No further measures are thought to be needed to protect groundwater resources.

4.5 VEGETATION

4.5.1 Significance Criteria

The loss of a majority of a plant community within the study area is considered significant. The loss of any threatened and endangered species is significant and requires mitigation under the Endangered Species Act. The failure of reclamation to re-establish a diverse, perennial plant community similar to the undisturbed community is significant due the requirement of stability under the Nevada Reclamation Act.

Any jurisdictional wetlands loss exceeding one acre is considered significant and requires mitigation under Section 404 of the Clean Water Act. Loss of riparian communities violates the BLM Riparian Initiative and is significant.

Cortez Area

Approximately 149 acres of new disturbance, including reclamation-related disturbance, is proposed for the Cortez area. All of this disturbance would be subject to reclamation. The community types directly impacted and the acreage of impact is outlined in Table 4.5-1. Refer to the discussion for Gold Acres for a discussion of impact significance.

There would be no impacts to wetlands or riparian communities at either Cortez or Gold Acres.

Gold Acres Area

As a result of the proposed action, all of the new disturbance in the Gold Acres area would be within the sagebrush/grass community type. Of this disturbance, 1 acre would encompass open pit development and would not be reclaimed. The residual 1 acre loss is insignificant.

The remaining 278 acres would be reclaimed as discussed in the Proposed Action. When revegetation was successful, vegetation would establish as a diverse and perennial plant community and provide wildlife habitat and livestock forage similar to the adjacent terrain. Due to the inherent low annual precipitation in the project area, standard revegetation efforts might be unsuccessful except in years of above normal precipitation. In addition, a shortage of growth medium would require some dump slopes to be revegetated without topsoiling. It is likely that some untopsoiled areas and other areas would not be revegetated satisfactorily using standard reclamation procedures.

Mitigation

Mitigation measures discussed for soils in Section 4.3.4 are also recommended for vegetation mitigation.

4.6 WILDLIFE RESOURCES

4.6.1 Significance Criteria

The disturbance of over 10 percent of critical wildlife habitats is considered significant. The loss of any threatened and endangered species habitat is significant and requires mitigation under the Endangered Species Act. The loss of species protected by the Migratory Bird Act is significant and requires mitigation to prevent the loss.

4.6.2 Impacts

Cortez Area

Habitat that would be disturbed is not classified as either mule deer or antelope range by the BLM, though small numbers of either species may occur in the area. The proximity of these habitats to existing disturbance limits the use of the areas by the more wary wildlife species.

The loss of acres of previously undisturbed habitat in the Cortez area represents a relatively minor loss of approximately 30 potential mule deer and 40 potential antelope AUMs (calculated from the loss to livestock AUMs). In the past, the project area has received little use by these big game species. Antelope have been recorded in the area recently, however, (one sighting of a band of eight animals) and deer may pass by the mine site.

No sage grouse strutting grounds are known to occur within 5 miles of the proposed Cortez Mine area activities. Chukar populations are high in the northern Toiyabe Mountains, within 1 to 2 miles of the project area. Chukar tend to remain in steeper, more rocky terrain, seldom utilizing the sagebrush and greasewood flats. Impacts to both these species of game birds are, therefore, expected to be minimal. Mourning doves may occur in the flats, and can be expected to utilize available water sources. The proposed action would result in the loss of a minor amount of potential mourning dove habitat, relative to that available nearby.

No raptors are known to nest in the project area, but raptors do hunt the flats and foothills in and near the project area.

A variety of small game and nongame species and small- to medium-sized carnivores currently utilize the habitats to be disturbed. These species include coyotes, badgers and possibly kit foxes, as well as small mammals and a variety of birds. Avian species occurring in the project area include horned larks, western meadowlarks, Brewer's blackbirds, rufous-sided towhees, sage and Brewer's sparrows. These species would be displaced by planned operations.

Two Candidate, Category 2 species could be affected by the proposed action. The pigmy rabbit, while not observed during field surveys, may occur in denser shrub (particularly rabbitbrush) habitats, or in sage habitats in rocky areas. Destruction of a part of a habitat unit utilized by this species may result in the elimination of a local population (Sherwood 1992). Such an impact would be locally significant.

The loggerhead shrike occurs in shrub habitats both on the flats and in foothill and mountain habitats. Loggerhead shrikes are fairly common in the Great Basin, and only a small number of individuals or pairs may be affected by the proposed action. The number of shrikes potentially affected would be so small that this loss is not considered significant.

All of the impacts resulting from surface disturbance in the Cortez area would be insignificant, excepting the possible loss of any local pigmy rabbit habitat.

As noted in the Proposed Action, WAD cyanide concentrations in the proposed tailings pond at the Cortez Mine would be maintained below acute toxicity levels for waterbirds and other terrestrial wildlife that could contact water in the pond. Also, leach solution ponds would be fenced and netted to exclude terrestrial wildlife. Heap surfaces would either be scarified to prevent pooling of leach solution or a drip system would be utilized to accomplish this same end. The Industrial Pond System permit, administered by the Nevada Department of Wildlife, requires the reporting of wildlife mortalities and monitoring by the department to correct acute toxic environments. Since the design and operation of cyanide ponds would be closely monitored in accordance with permit conditions, acute toxicity problems would be quickly corrected to minimize wildlife mortality, and are considered an insignificant impact.

Chronic toxicity levels in the tailings ponds are uncertain. Potential impacts would not be readily ascertained because wildlife suffering from chronic toxicity may not suffer mortality in areas that could be monitored. Several factors would affect chronic toxicity including concentrations of cyanide in upper levels of the food chain, sensitivity of life stages exposed (e.g., egg, larval or adult forms), and longevity of cyanide in the environment. Due to the uncertainty associated with these factors, impact significance is unknown but could be potentially significant.

Cyanide occurs in several forms and its toxicity varies with the form in which it occurs. Cyanide is toxic to most forms of life above varying threshold concentrations. Free cyanide is the most toxic form but is short-lived in the environment. Free cyanide readily breaks down into less toxic forms when exposed to air or organic matter. A release of cyanide at any of the proposed cyanide facilities would not directly impact any aquatic environments at Cortez or Gold Acres. The impact to the arid environments would be expected to be local and short-lived.

<u>Gold Acres Area</u>

Developments in the Gold Acres area would disturb 276 acres of primarily sagebrush-grass foothill and fan habitats. An additional 9 acres would be disturbed by road construction. The remaining 159 acres of disturbance would occur on previously disturbed land. The 9 acres of disturbance resulting from construction of roads would be located on both disturbed and undisturbed sites. Additionally, exploration in the Gold Acres area would disturb a total of 3 acres, 2 acres of which would involve improving approximately 1 mile of existing access road.

The Gold Acres area is located to the east of identified mule deer yearlong range in the Shoshone Mountains (BLM 1983), but deer have been recorded in the general area, particularly in winter and during migration (Sherwood 1991, Teske 1991). Habitat in the Gold Acres area itself is highly disturbed and contains little if any mule deer habitat. The Gold Acres phase of the project is expected to have low to minimal impacts on mule deer.

The area is also not located near identified antelope range. In the spring of 1992, however, a small band of antelope (eight animals) was recorded in the area. The loss of previously undisturbed habitat represents a loss of approximately 70 potential mule deer or approximately 85 potential antelope AUMs (calculated from the loss to livestock AUMs). Like the Cortez area, actual big game use of the Gold Acres area has, to date, been limited.

The nearest recorded sage grouse strutting ground is located approximately 2.5 miles northwest of the project area, and no riparian or wet meadow areas occur within the Gold Acres area. This phase of the project is therefore expected to have little if any impacts on sage grouse.

Similarly, while chukar and Hungarian partridge may occasionally utilize the area, the extensive existing habitat modification has resulted in little use of the Gold Acres area by these species.

Raptors and ravens utilize the area as hunting and foraging territory. The proposed action would reduce or eliminate the value of currently undisturbed lands as raptor hunting territory. Ravens may continue to utilize the area to a degree. Affected acreage would also no longer be available as nesting and foraging habitats for small numbers of horned larks, western meadowlarks, sage thrashers, and Brewer's, sage and possibly black-throated sparrows.

The comments relating to the Candidate, Category 2 pigmy rabbit and loggerhead shrike, as described under the Cortez Project Area, above, also apply to the Gold Acres area. Field surveys suggest, however, that little suitable pigmy rabbit habitat exists in the Gold Acres Project Area.

All of the impacts to wildlife in the Gold Acres area would be considered insignificant.

Indirect Impacts

In all areas, most larger and more easily disturbed wildlife species would be expected to avoid areas of active disturbance. Generally, the larger and more wary species, including mule deer, antelope, game birds and most large carnivores would be expected to avoid active disturbance by a distance of ¼ mile or more, effectively increasing the impact area of each disturbance by this distance. In the case of the proposed action on undisturbed land in the Cortez area, the proposed disturbance would affect wildlife in the actual project area plus an approximately 500 to 1000 additional acres affected by disturbance resulting from the proposed activities. The differing acreages for this "zone of disturbance" result from differing project shapes (lesser area affected by a square shape, greater area affected by a circular shape). The majority of disturbance proposed in the Gold Acres area would result from the construction of four waste dumps. For the purposes of this analysis, if it is assumed the four proposed waste dumps, directly affecting a total of approximately 200 acres, would be built to the same size, the resulting additional zone of disturbance surrounding all four pits would vary from a total of an additional approximately 650 to a total of approximately 2,000 acres, again depending on project shape, and assuming a regular source of disturbance at each of the four sites. Neither the Cortez or Gold Acres area is near identified mule deer or antelope migration corridors, and neither is used by these species to any large degree, however. The smaller wildlife species residing near roads used by haul truck and other traffic may be subject to a higher incidence of road kill.

Constructing or improving roads for exploration or other purposes can increase public access to previously less accessible areas. This in turn can result in increased harassment of wildlife by humans. Assuming a ½ mile disturbance zone bordering each road (¼ mi. on either side of the road), and a 20 ft. road width, a zone of disturbance encompassing 322 acres would be created per mile of road. In this case, however, this zone would not be subject to regular disturbance. Rather, the 322 acre area would be susceptible to increased disturbance only when some source of disturbance is present. Such a source could include drill rig and support traffic, other exploration related traffic, and recreationists. The volume of such traffic is subject to a large degree of variability.

These indirect disturbances would be short-term and insignificant.

4.7 RECREATION AND WILDERNESS

4.7.1 Impact Significance Criteria

Direct effects to recreational resources would occur if construction or operation of the project resulted in the termination of use or modification of recreational resources within the study area. Indirect effects would occur if construction and operation activities altered recreation use patterns, recreation demand, or access to use areas near the proposed project.

The following considerations were used to identify effects to recreational resources: (1) project-related changes that alter or otherwise physically affect established, designated, or planned recreation or wilderness areas or activities; (2) project-related changes that affect officially adopted policies or goals for recreational or wilderness land management of recognized organizations or agencies; (3) project-related changes that increase or decrease accessibility to areas established, designated, or planned for recreational or wilderness use; (4) project-related changes that effect duration, quantity, and quality of impact to recreational and wilderness resources.

4.7.2 Impacts of the Proposed Action

The proposed action would have a small, incremental impact on the recreational resources found within the study area. Developed recreational facilities would not be directly impacted. Since the proposed action would not cause an increase in the workforce, the demand for both dispersed and developed recreation should be unaffected.

The proposed action would result in a loss of approximately 428 acres of previously undisturbed land that could be used for dispersed activities such as hunting, off-road vehicle use and rockhounding. This acreage is adjacent to existing mining operations where recreational opportunities are limited. The increased area of mining disturbance would, however, cause a corresponding increase in the amount of adjacent land affected by mining operations. This would not have a significant effect on the amount of land available for dispersed recreation activities within the resource area. In the future, reclamation efforts would restore some of the existing recreational opportunities, especially hunting. The restoration of recreational opportunities within the project area would depend on both the successful reclamation of the land, and the status of other mining activities that may exist at that time.

Roberts Mountain Wilderness Study Area is located approximately 18 miles to the south-southeast of the project area. Intervening topography effectively blocks any views of either the Gold Acres or Cortez sites. No impacts are anticipated for this WSA.

4.7.3 Mitigation

Cortez Gold Mines should encourage their workers to attend periodic environmental education/training for off-road vehicle use, firearms safety, hunting regulations, developed recreation site use and dispersed recreation ethics.

4.8 VISUAL RESOURCES

4.8.1 Impact Significance Criteria

The assessment of visual impacts is based upon impact criteria and methodology described in the BLM Visual Contrast Rating System (BLM Manual Handbook, Section 8431-1). Effects to visual resources are assessed for the construction, operation, and closure of the proposed project. Quality of the visual environment is defined by BLM Visual Resource Management (VRM) classes. Two issues are addressed in determining impacts: (1) the type and extent of actual physical contrast resulting from the proposed action and related activities, and (2) the level of visibility of a facility, activity, or structure. Impacts are considered high if visual contrast are identified for landscape modifications affecting the following: the quality of any scenic resources; scenic resources having rare or unique value; views from, or the visual setting of, designated or planned parks, wilderness, natural areas, or other visually sensitive land use; views from, or the visual setting of, travel routes; and views from, or the visual setting of, established, designated, or planned recreational, educational, or scientific facility, use area, activity, and viewpoint or vista.

The extent to which the proposed project would affect the visual quality depends upon the amount of visual contrast created between the proposed facilities and the existing landscape elements (form, line, color, and texture) and features (land and water surface, vegetation, and structures). The magnitude of change relates to the contrast between each of the basic landscape elements and each of the features. Assessing the project's contrast in this manner indicates the severity of potential impacts and guides the development of mitigation measures so the VRM objectives would be met.

4.8.2 Impacts of Proposed Action

<u>Construction and Operation</u>

Landscape modifications resulting from the construction and operation of the proposed project would be within the BLM VRM Class IV objectives. The project site is located on VRM Class IV lands, where changes to the characteristic landscape can be high and be the major focus of viewer attention. Where the proposed activity involves expansion of existing sites, the incremental increase in visual contrasts would not draw significant additional visual attention.

Potentially sensitive viewing locations (places where people travel, recreate, or reside) were examined. From these, six key observation points (KOPs) were identified and evaluated. These included State Highway 306, the Cortez Historic Mining Area, State Highway 278, Tonkin Springs Reservoir and Simpson Park and Roberts Mountain wilderness study area. With the exception of State Highway 306, the remaining KOPs had minimal to no visibility of the project area.

The proposed mining activities in the Cortez area would be visible from the State Highway 306 KOP. This KOP is approximately 6 miles north-northwest of the Cortez site and is representative of the view the majority of viewers have traveling along this portion of the study area. From this background distance zone, particularly during midday light conditions, color, form and line contrasts of the proposed project would be evident. The proposed action would represent an incremental change in an already highly modified landscape and would not draw strong additional visual attention.

Proposed development at the Gold Acres site would entail expansion of existing facilities and the redevelopment of a waste dump and heap leach areas, and road construction. Visual impacts from this activity would be similar to those which already exist from past and ongoing mining activities. From the State Highway 306 KOP, these impacts would include strong line and color contrasts created by form and color contrasts resulting from the pit, leach and disposal areas. One of the most intrusive modifications to the landscape affecting the visual resource is the use of haul roads. Certain mitigation techniques could be employed during operations and are provided in Section 4.8.3.

Exploration activity is included in the Cortez Gold Mine proposed action. This activity would disturb approximately 9 acres, and would include sites for exploration and development drill holes, construction of new access roads and improvement of existing access roads. These activities, especially the building of new access roads, would create additional visual contrast in the landscape, but would occur on a relatively small scale and would be within VRM Class IV objectives.

Closure and Abandonment

After successful reclamation, the visual contrast of the proposed project would be slightly reduced. Color and texture would harmonize more with the natural landscape. Revegetation would reduce the existing strong color contrasts; natural vegetation over the long term would begin to blend with the color and texture of the existing natural landscape. Recontouring and revegetation of the disposal and heap leach areas would help reduce the color and form contrasts, but, to some degree the scale of visual disturbance of these existing modified pyramidal landforms, would remain visually evident.

4.8.3 Mitigation

For reducing visual contrast, minimization of disturbance is the most effective mitigation technique. Where disturbance is proposed, consideration should be given to repetition of the basic landscape elements (form, line, color, and texture) to minimize visual change. Additionally, the use of color would help reduce visual contrast. Described below are specific measures that would effectively reduce visual contrast.

- During construction, clearing of land for stockpiles and other project facilities should create curvilinear boundaries instead of straight lines to minimize disturbance of the landscape. Grading should be done in a manner that would minimize erosion and conform to the natural topography.

- To the extent possible, all foliage adjacent to the site should remain undisturbed to provide maximum available screening of the installation relative to the landscape character type.

- Where the opportunity exists, strategic location techniques should be used to minimize the visibility of mining activities.

4.9 SOCIAL AND ECONOMIC IMPACTS

This section evaluates the potential impacts of the proposed project and the No-Project Alternative on the study area population, employment, schools, housing, utilities, community services, and public finance.

The proposed project comprises the expansion of an open-pit mine and new heap leach facilities in Gold Acres area, and the expansion of existing heap leach facilities and tailing disposal facilities in the Cortez Area. This expansion is necessary to provide ore to existing Cortez operations and does not involve much change in annual mining and production rates. Existing employees would be utilized to work the new areas, and no additional persons would be hired. Only a small number of construction workers would be required, who would work on the project for a short period of time.

4.9.1 Significance Criteria

Impacts would be considered significant if the project resulted in the growth of population in excess of 3 percent per annum, or if the project changed the unemployment rate substantially or caused a significant shift in the sectoral distribution of jobs. Impacts on housing, utilities, services and schools would be considered significant if the project-related demand exceeded the capacity of the communities to provide these services. Impacts to public finance would be considered significant if the project caused a substantial change in the revenues or expenditure of local jurisdictions.

4.9.2 Direct Impacts

The project would involve no change in the number of permanent Cortez employees; therefore the population in the study area would not change. The proposed project would not affect the sectoral pattern of jobs and unemployment rates in the study area because no additional persons would be hired.

Given that there will be no change in the number of persons employed by Cortez, the population in the communities would not change because of the project. Therefore no additional demand (over current levels) would be created for housing, utilities, schools and other community services.

Current mining operations of Cortez generate revenues for the counties of Elko, Eureka and Lander through property tax and net proceeds-from-mines. County-wise distribution of revenues from Cortez operations is shown in Table 3.9-5. In 1991 approximately 23 percent of the Lander County net proceeds-from-mines tax revenues and about 28 percent of the county property tax revenues were generated by Cortez operations. Fiscal impacts on Eureka County are relatively smaller, with about 2 percent of the property tax revenues and about 1 percent of the net proceeds from mines revenues accruing from Cortez operations. Elko County currently receives a small amount in property tax from Cortez. No change in this revenue would occur due to the project. With the proposed project, current revenues to the three study area counties would continue, and additional revenues for Eureka and Lander counties would be generated because of an increase in assessed valuation attributable to the proposed facilities.

In summary, the project would result in the continuation of the current impacts of Cortez operations on the study area.

4.9.3 Indirect Impacts

The project would result in continued employment of the 193 persons currently employed by Cortez. Given that every direct job in mining is estimated to support 0.74 indirect jobs in the economy through the income multiplier process (Dobra 1988), these 193 jobs currently support 143 indirect jobs. The proposed project would result also in the continued employment of the persons holding these indirect jobs.

Project implementation would also ensure the continued presence of the current 193 employees and their dependents in the study area communities. Rapid mining growth in the study area in the late 1980s has caused the demand for school services to outstrip the available services. Elko County School District has been most severely affected by growth in mining in Elko and Eureka counties. The school district services are utilized by dependents of not only those who live and work in Elko County but also persons who work in neighboring counties but live in Elko County. School district revenues on the other hand are derived from Elko County property tax revenues only. The proposed project would continue to contribute to the current burden on Elko County schools, which, as described in Section 3.9.5, are severely overcrowded and adversely affected. Currently, an estimated 100 to 110 school-age children of Cortez employees utilize the schools in Beowawe, Carlin and Elko (Table 4.9-1). Children of employees who live in Battle Mountain utilize schools locally. Given that the school in Beowawe is an elementary school with an enrollment of only 34, the majority of school-age children of Cortez employees above utilize Elko County schools. The proposed project would result in the continued utilization of Elko County schools by Cortez employee dependents and a continuation of the effects of overcrowding.

Cortez payroll is spent by the employees in the study area on both taxable and non-taxable goods. Spending on taxable goods generates sales tax revenues for the local communities and the State. Based on the current sales tax rate, it is estimated that in 1991 the payroll spending generated approximately $138,675 in sales tax revenues, with part of this accruing to communities of Battle Mountain, Elko and Carlin where the Cortez employees reside and carry out their expenditures. In addition, Cortez paid out about $251,000 in sales/use tax in 1991. Local spending by Cortez and its employees generates additional income in the study area economy through the income multiplier process. The proposed project would facilitate the maintenance of this income in the regional economy and would support the current trend of economic growth.

4.9.4 No Project Alternative

Under the No Project Alternative, existing milling operations at Cortez would cease sometime in 1994. The closure would result in unemployment of up to 193 direct employees and possible termination of some of the 143 indirect jobs supported by the direct mining jobs in the regional economy. If the closure of the mine does not coincide with the expansion or opening of other mining operations in the study area, the holders of the direct jobs and their dependents would be forced to move out of the area in search of employment. The holders of indirect jobs would not necessarily move out of the area if laid off, but would add to the number of persons applying for unemployment benefits in the three counties.

Based on the number of Cortez employee households provided in Table 3.9-3, and the average household size by county shown in Table 3.9-1, it is estimated that about 532 persons would be displaced. This displacement, and possibly the displacement of some of the households of the indirect job-holders would result in a decrease in demand for housing, school services, utilities and other municipal services. Table 4.9-1 provides the number of persons by place of residence, and the number of school-age children who would be affected by the No Project Alternative.

Mine closure would also result in loss of the revenues that were reported under the proposed project from property tax and net proceeds-from-mines taxes. Additionally the study area would lose sales tax revenues and other income resulting from the working of the income multiplier based on the spending of Cortez payroll, and other spending by Cortez in the regional economy.

4.10 LAND USE/LIVESTOCK GRAZING

4.10.1 Significance Criteria

The loss of forage and water or undue harassment sufficient to adversely affect normal livestock operations would be significant and mitigation is required under the Department of Interior regulations.

4.10.2 Land Use Impacts

The increased mining development at Cortez and Gold Acres would not increase haul road traffic crossing Nevada State Highway 306 beyond current and historic levels. Since there will be no traffic increase, there will be no additional impact to vehicles travelling the state road. Also, warning and stop signs are presently located in critical areas in conjunction with the existing operation.

Due to the location of the proposed activity in the valley and lower foothills, there will be no additional impact to other resource values except for livestock grazing and cultural resources as addressed in Sections 4.10.3 and 4.11.

4.10.3 Livestock Grazing

Cortez Area

The proposed expansion involving the heap leach pad, waste rock dumps and tailings disposal facility would occupy 204 acres of which 143 acres constitute new disturbance. Based on the 1976 BLM range survey of the Cortez Planning Unit (BLM 1976), approximately six AUMs of livestock forage would be impacted by the Proposed Action. Five of the six AUMs would be lost from federal lands. The area is part of the Carico Lake Grazing Allotment. Consequently, the 6 AUMs lost represent 0.02 percent of the active grazing preference (36,958 AUMs) in the allotment. This is not considered a significant impact. Mining activity associated with the Cortez area would tend to spook livestock from forage resources immediately adjacent to the disturbed areas. Although the potential impact is not quantifiable, it is not expected to be significant. The potential exists for livestock mortality in the vicinity of haul roads and existing access roads as a result of traffic to and from the area. This is not considered significant based on records of existing operations.

Gold Acres Area

Similar to the Cortez area, direct impacts to livestock forage would be minimal, with an estimated 13 AUMs of forage (including 2 AUMs from private lands) being lost from mining activity. Again, as with the case at the Cortez area, indirect impacts to livestock grazing in the vicinity at Gold Acres would be caused by equipment operations.

The combined total of Public lands AUMs to be impacted as a result of the Cortez and Gold Acres proposed new disturbance is less than 0.04 percent of the 36,958 AUM active grazing preference of the Carico Lake Grazing Allotment, the only allotment within the area that would be affected by the proposed action.

The livestock forage impact from proposed exploration activity on nine acres of the project areas would be negligible. The natural drift of livestock in Crescent Valley in the vicinity of Cortez and Gold Acres would be affected by the haul road traffic between Gold Acres and Cortez, a distance of eight miles.

None of the range improvements of record are located in the Cortez or Gold Acres project areas.

All of the impacts to livestock would represent minimal losses and would be considered insignificant.

4.11 CULTURAL RESOURCES

4.11.1 Significance Criteria

The following significance criteria were used to evaluate the significance of impacts to archaeological, historic or ethnographic resources:

- Disturbance to properties that are eligible for inclusion on the National Register of Historic Places

- Disturbance to an area of traditional or religious importance to Native Americans

4.11.2 Potential Impacts

Results of the Class III cultural resources inventory indicate a relatively modest archaeological record for the project area. The proposed project would result in the destruction of five sites within the project area. Specifically, three small prehistoric archaeological sites, BLM site numbers CrNV-62-6407, 6410, 6411 would be either buried or extensively disturbed by tailings disposal at the Cortez area of the mine expansion. At the Gold Acres component of the proposed project, two historic archaeological sites, 26La071 (Nevada State Museum number) and CrNV-62-6446 (BLM site number) would be either buried or extensively disturbed by the placement of two of the waste dump locations. No archaeological sites identified within the project study area are eligible for inclusion on the National Register of Historic Places. The recordation of these sites during the Class III inventory has exhausted their potential to yield significant information. The BLM has satisfied the requirements of Section 106 requirements of the NHPA. As a result any potential impacts to these resources are not considered significant.

As a result of the Native American consultation effort, various Native Americans were identified who still have memories of traditional activities near the project area. Most of the concerns of Native Americans centered on mining activities that have, or are currently, disturbing traditional or religious features or values associated with Mt. Tenabo. Although the proposed project would result in the expansion of existing facilities at Cortez Mine and Gold Acres, no new impacts would occur on Mt. Tenabo. Therefore, there would be no additional incremental impact to locations important for prayer and meditation or to specific traditional resource-use areas.

Currently, access to Mt. Tenabo for pine nut harvesting is limited because of ongoing mining activity. The proposed project will not affect or change current access. No pine trees will be cut as a result of the proposed project.

No specific clay-collecting locations were identified by the informants that would be impacted by the proposed action.

4.11.3 Mitigation

Archaeological Resources

No mitigation measures are required.

Ethnographic Resources

To mitigate effects on any grave sites that may be found, informants asked that, if any of these are found in the course of mining expansion, they be avoided by mining personnel and activities and left undisturbed. Discovery of Native American grave sites would be treated according to established BLM procedures. Work near the grave will be stopped for up to 30 days until appropriate Native Americans can be contacted upon such discovery in order to implement these procedures in a manner consistent with BLM policy. No specific locations for physical features of traditional or religious value (e.g., the cave, white rock or turquoise mining areas) would be impacted by the proposed project.

No mitigation is required because the proposed project would not result in new impacts to traditional or religious values of importance to Native Americans.

4.12 NO ACTION

As described in Section 2.4.1.2, the No Action Alternative would result in a continuance of mining ore from various existing pits as authorized under existing approvals. This would result in a closure of operations sometime during the period 1994-1996.

The objective of the No Action Alternative analysis is to describe environmental consequences that would result if the Proposed Action is not implemented in order to provide a comparison to the consequences of the proposed project. In general, the No Action Alternative would result in similar operational impacts as the proposed action until sometime in 1994-1996, when operations would cease. After that time, operating impacts (e.g., air emissions, risk of upset from processing facilities, and water use) would continue for the proposed project for several more years.

New disturbance from the proposed projects (e.g., to soils, vegetation, and wildlife habitat) would total approximately 428 acres. This would not occur with the No Action Alternative.

Reclamation requirements would be somewhat greater with the proposed project because of the additional disturbance and need for additional topsoil. In addition, reclamation of haul roads and other sites of ancillary facilities could occur earlier with the No Action Alternative than with the Proposed Action. In the discussion below, the No Action impacts are compared to the Proposed Action by resource category. A summary of this discussion is provided in Table 2.5-1.

4.12.1 Air Quality

Present levels of SO_2, TSP, and PM10 emissions from mining and processing would continue until about 1994-1996, when operations would cease. At this time reclamation would proceed and air emissions associated with ore processing would also cease. Air quality in the Crescent Valley Air Basin may still be affected by other sources in the air basin.

4.12.2 Geology and Minerals

Under the No Action Alternative, Cortez would continue to mine existing pits and operate the existing processing facilities (including the existing tailings pond) until tailings capacity and ore were depleted. The ore proposed for development would remain unmined. Presently subeconomic ore near the Golden Acres pit expansion site would not be available for future mining.

4.12.3 Soils and Topography

Additional soil disturbance would be minimal because Cortez's current operations have disturbed all the area that is to disturbed under authorization granted by existing plans of operations. Reclamation would be conducted in accordance with existing approvals. Additional topsoil required for the Proposed Action would not be required. Reclamation at haul roads and processing facilities would begin much sooner than with the Proposed Action.

4.12.4 Water Resources

Other than water requirements for reclamation, water use would cease during the period 1994-1996. Risk of release of hazardous materials (e.g., cyanide) would also cease. The existing groundwater plume containing cyanide would be remediated under the direction of NDEP. Remediation requirements and monitoring of groundwater would not differ between the No Action and the Proposed Action.

4.12.5 Vegetation

Additional disturbance to common vegetation types (i.e., about 428 acres) would not occur. All disturbed areas would be regraded and reclaimed allowing vegetation to reestablish somewhat sooner than with the Proposed Action.

4.12.6 Wildlife Resources

The No Action Alternative would not result in the additional 428 acres of disturbance to wildlife habitat. Existing disturbance would be reclaimed on a schedule slightly accelerated compared to the Proposed Action.

4.12.7 Recreation and Wilderness

Demand for recreation facilities would decreased slightly after operations cease unless workers remain in the regional area.

4.12.8 Visual Resources

Reclamation of existing facilities would proceed and reduce visual contrasts somewhat sooner than with the Proposed Action.

4.12.9 Social and Economic

Demand on schools and infrastructure (primarily in Elko) would cease after current operations are ended unless workers and their dependents remain in the area. Additional revenues generated by current operations would end as operations are concluded.

4.12.10 Land Use/Livestock Grazing

A minor number of AUMs would be preserved with the No Action Alternative. No additional AUMs would be lost.

4.12.11 Cultural Resources

No additional prehistoric or historic sites would be disturbed. Human presence would be reduced and as a result potential for disturbance to remote sites would be reduced.

4.13 UNAVOIDABLE ADVERSE EFFECTS

After implementation of the mitigation measures proposed in this section, most impacts resulting from the Proposed Project would be reduced to levels which are no longer considered significant. However, some adverse impacts would remain that cannot be entirely mitigated. These impacts are considered unavoidable. Unavoidable adverse impacts may be short term or long term and may vary in significance. An evaluation of unavoidable adverse impacts is given below.

- There would be minor short-term and long-term alterations of landform and surface drainage patterns after reclamation.

4.14 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY

This section addresses the balance between the short-term use of the project area and the long-term productivity that the project area would provide if the proposed expansion did not occur. Short-term is defined as the life of the project including reclamation activities. Long-term is defined as the period following final reclamation activities.

Currently, the project area is used for mining, milling, waste rock disposal, cattle grazing, and wildlife habitat. Productivity from the site includes production of gold, approximately 193 jobs, and approximately one million dollars in annual taxes (property tax, mines tax, and sales tax). If the proposed expansion were not implemented, these uses of levels of productivity would continue until sometime in the period 1994-1996 when mining would cease.

If the Proposed Project is implemented, the types of short-term uses of the site would be similar to current uses but would be extended over 428 additional acres. Current levels of productivity in terms of jobs and revenue generated would be extended for another 4 to 6 years, depending on the rate of mining and milling. No new jobs or annual revenues would be generated.

Over the long term, i.e., after closure and reclamation, land use and productivity would be returned as closely as possible to pre-project levels. Depending on the species reestablished by reclamations efforts, it is possible that vegetative productivity could exceed current conditions. However, there is also potential that while the seed mix and species established may be productive for domestic livestock, reestablished vegetation may not be as diverse and/or productive for native wildlife species.

- Short-term consumption of groundwater by the mill and mining processes would be unavoidable but would not affect current groundwater users.

- Control measures on processing facilities and land disturbing activities would limit point source emissions such as particulates as well as fugitive dust. Although these emissions would be below Nevada and/or federal air quality standards, control measures would not totally eliminate emissions. These remaining emissions are considered unavoidable adverse impacts.

- The proposed erosion control program and reclamation design would minimize soil erosion from wind and water. However, soil erosion cannot be completely eliminated. Loss of soils after mitigation is considered unavoidable.

- Loss of vegetation communities and wildlife habitat from approximately 428 acres is considered a short-term (life of the project) unavoidable adverse impact.

After self-sustaining vegetation is reestablished by reclamation activities and mining activities are ended, the impacts to vegetative communities and wildlife habitat would be reduced. However, the resulting vegetative communities and wildlife habitat are likely to be different from the original communities for the long term. The degree to which vegetation and wildlife habitat do not recover to predisturbance habitat value is considered an unavoidable adverse impact.

- There would be a long-term modification of viewsheds in Crescent Valley caused by remaining project features after reclamation. This is considered unavoidable but insignificant because the project is located in a Class IV visual resource management area.

4.15 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible commitment of resources occurs when an action alters the resource so that it cannot be restored or returned to its original or predisturbance condition. An irretrievable commitment of resources occurs when a resource is removed or consumed.

The mining of waste rock and ore would be an irreversible commitment of resources. Although the precious metals contained in ore would be irreversibly committed from geologic formations, they would be retrieved and placed in long-term economic circulation.

Soil losses from handling, erosion losses from topsoil stockpiles, and other unavoidable erosion losses would be irreversible. Erosion control, stabilization of stockpiles, and other handling procedures would limit but not eliminate these losses.

Waste rock disposal areas, heap leach pads, and other disturbed areas would be reclaimed but would still represent an irreversible alteration of land form, lines, and (in the short term) color of the landscape. The expanded mine pits would not be backfilled or reclaimed and therefore represent an irreversible loss of vegetation and wildlife habitat.

With the No-Action Alternative the commitment of resources would be similar in nature but would be less extensive because mining and processing would end sooner. Resources that would be consumed by the project such as water and electricity would not be consumed. Waste rock and ore would not be irreversibly committed and would remain available for future use.

TABLE 4.1-1

ESTIMATED FUGITIVE DUST EMISSIONS FROM SURFACE DISTURBANCE FOR THE PROPOSED PROJECT

Area	Acres Disturbed	Estimated Average Annual Emissions (tons)
Cortez		
Waste Rock Dump Expansion	33	2.4
Tailing Pond No. 7	110	7.9
Heap Leach Facilities	61	4.4
Total	204	14.7
Gold Acres		
Pit Expansion	85	6.1
Waste Rock Dumps	299	21.5
Heap Leach Facilities	51	3.7
Road Construction	9	0.6
Total	444	32.0
Exploration		
Cortez	6	0.4
Gold Acres	3	0.2
Total	9	0.6

Notes: 1) Emission factor = 1.2 tons/acre/month of activity (EPA 1985). PM10 is assumed to be 36 percent of TSP emissions.

2) Proposed project duration is assumed to be 6 years.

3) These emissions are based on disturbance of a total of 657 acres, including 428 previously undisturbed acres and 229 acres associated with previous mining activity.

4) Emission estimates were calculated assuming no controls. These emissions would be controlled by approximately 50 percent with implementation of design measures.

TABLE 4.1-2

FUGITIVE DUST EMISSIONS FROM BLASTING DURING PIT EXPANSION

Mining Area	Total Area of Pit Expansion[a]	Area per Blast	Estimated Emissions per Blast (tons)	Estimated Total Project Emissions[b] (tons)
GOLD ACRES	3,697,500	87,000	6.4	1,777

[a] Based on number of acres disturbed during pit expansion

[b] Emission factor used is $0.0005A^{1.5}$ lb/area blasted; where A is the area in ft^2 over which blasting occurs (EPA 1985, p.8.24-5)

TABLE 4.1-3

NEWMONT GOLD QUARRY
AMBIENT PM_{10} LEVELS, 1989 ($\mu g/m^3$)
(Page 1 of 2)

Date	PM_{10} Concentrations
July 3	31
9	--
15	22
21	15
27	32
August 2	24
8	19
14	20
20	17
26	19
September 1	19
7	10
13	31
19	7
23	34
October 1	16
7	21
13	24
19	22
25	5
31	11
November 6	14
12	27
18	23
24	5
30	22

TABLE 4.1-3

NEWMONT GOLD QUARRY
AMBIENT PM_{10} LEVELS, 1989 (μg/m^3)
(Page 2 of 2)

Date	PM_{10} Concentrations
December 6	11
11	12
18	16
24	21
30	6
Number of Samples	30
Highest	34
Second Highest	31
Mean (Arithmetic)	19

Source: WCC 1991

TABLE 4.1-4

EMISSION INVENTORY OF PERMITTED SOURCES AT THE CORTEZ GOLD MINE FACILITY

Source Number	Source Type	Controls	Location	Hours of Operation Per Year	Capacity[a]	TSP (lb/hr)	SO^2 (lb/hr)	TSP (ton/yr)	SO^2 (ton/yr)
1	Carbon Reactivation Kiln	Achieve Allowable	S23 T27N R47E	8760	0.08	0	0	0	0
2	Grinding Mill	Cyclone, Baghouse	S24 T27N R47E	8544	90	8.15	0	29.9	0
3	Fluid Bed Roaster	Cyclone, Esp, Scrubbers	S24 T27N R47E	8544	90	32.47	29.15	135.3	125
4	Lime Handling System	Enclosed Systems, 20%	S24 T27N R47E	8760	2.1	0	0	0	0
5	Boiler	None	S24 T27N R47E	8760	6.31	0	0	0	0
6	Ore Storage Silo	Fabric Filter, 7%	S24 T27N R47E	8544	90	0.22	0	0.9	0
7	Primary Crusher	Moisture, 20%	S19 T27N R48E	6570	200	3.99	0	13.1	0
8	Secondary Crusher	Moisture, 20%	S24 T27N R47E	6570	200	6.52	0	21.4	0
9	Vibrating Screen	Moisture,m 20%	S24 T27N R48E	6570	200	3.52	0	11.6	0
10	Furnace	Gas Scrubber	S19 T27N R48E	8760	0.09	0.48	0	2.1	0

Source: NDEP 1991; Woodward-Clyde Consultants

[a]Capacity = MMBTU/hr for boilers and other combustion sources

= Tons/hr for all others, except land disturbances

= Acres disturbed for land disturbance sources

TABLE 4.3-1

DISTURBANCE TO SOIL MAP UNITS BY FACILITY, CORTEZ

Facility	Soil Map Unit	Acres Disturbed (Direct Impacts)	Acres Disturbed (Reclamation)	Total Acres of Disturbance
Dump Expansion	14c	0	1	1
Tailing Pond No. 7	4a	8	0	8
	4b	52	0	52
	7a	21	0	21
Heap Leach	4b	35	9	44
	14a	14	3	17
Exploration	Unknown	6	0	6
TOTAL		136	13	149

TABLE 4.3-2

ACRES OF DISTURBANCE BY SOIL MAP UNIT, CORTEZ

Soil Map Unit	Acres Disturbed (Direct Impacts)	Acres Disturbed (Reclamation)	Total Acres of Disturbance
4a	8	0	8
4b	87	9	96
7a	21	0	21
14a	14	3	17
14c	0	1	1
Unknown	6	0	6
TOTAL	136	13	149

TABLE 4.3-3

DISTURBANCE TO SOIL MAP UNITS BY FACILITY, GOLD ACRES

Facility	Soil Map Unit	Acres Disturbed (Direct Impacts)	Acres Disturbed (Reclamation)	Total Acres of Disturbance
Dump #1	3840	31	20	51
	2b	7	0	7
	ML*	14	0	14
Dump #2	3840	75	2	77
	2a	27	31	58
Dump #4	3843	40	6	46
	1a	1	4	5
	2a	<1	1	2
Leach Pad	3843	6	0	6
Pit Expansion	2c	1	0	1
Roads	Unknown	9	0	9
Exploration	Unknown	3	0	3
TOTAL		215	64	279

*ML = Mined Land, from Order III Soil Survey (USDA, SCS, unpublished).

TABLE 4.3-4

ACRES OF DISTURBANCE BY SOIL MAP UNIT, GOLD ACRES

Soil Map Unit	Acres Disturbed (Direct Impacts)	Acres Disturbed (Reclamation)	Total Acres of Disturbance
1a	1	4	5
2a	28	32	60
2b	7	0	7
2c	1	0	1
3840	106	22	128
3843	46	6	52
ML	14	0	14
Unknown	12	0	12
TOTAL	215	64	279

TABLE 4.3-5

DISTURBED ACREAGE AND GROWTH MEDIUM AVAILABLE, CORTEZ

Facility	Acreage	Soil Map Unit	Topsoil Depth (inches)	Growth Medium Volume (cubic yards)
Dump	1	14c	24	3,227
Tailing Pond	8	4a	24	25,815
	52	4b	24	167,795
	21	7a	24	67,763
Leach Pad	44	4b	24	141,980
	17	14a	24	54,856
TOTALS	143			461,436

TABLE 4.3-6

DISTURBED ACREAGE AND GROWTH MEDIUM AVAILABLE, GOLD ACRES

Facility	Acreage	Soil Map Unit	Topsoil Depth[a] (inches)	Growth Medium Volume (cubic yards)
Dump #1	7	2b	6	8,472
	51	3840	15	102,858
	14	ML	0	0
Dump #2	58	2a	10	54,589
	77	3840	15	155,296
Dump #4	5	1a	20	13,446
	2	2a	10	1,882
	46	3843	15	92,774
Pit Expansion	1	2c	6	538
Leach Pad	6	3843	15	12,101
TOTAL	267			441,956

[a] Actual depth based on suitability by horizon. See Appendix B for explanation of topsoil and technical report.

TABLE 4.5-1

VEGETATION IMPACTS, CORTEZ

Community Type	Facility	Total Acres of Disturbance
Greasewood	Tailings Pond	8
Shadscale/bud sagebrush	Tailings Pond	53
	Leach Pad	61
Sagebrush/grass	Tailings Pond	21
Unknown	Exploration	6
TOTAL		149

TABLE 4.9-1

AFFECTED POPULATION AND SCHOOL-AGE CHILDREN

Community of Residence	No. of Cortez Employee Households[a]	No. of Persons[b]	No. of School-Age Children[c,d]
Beowawe	3	7	1
Crescent Valley	57	143	27
Elko	70	203	45
Spring Creek	12	35	8
Carlin	35	102	22
Battle Mountain	16	42	11
TOTAL	193	532	114

[a] It is assumed that there is one household per Cortez employee. It is likely that there are some households with more than one Cortez employee; however, the number of such households is likely to be small.

[b] Based on an average household size of 2.9 for Elko County; 2.5 for Eureka County, and 2.6 for Lander County from Census 1990.

[c] Based on an average number of 0.64 school-age children per household for Elko County; 0.47 school-age children per household for Eureka County; and 0.69 school-age children per household for Lander County. County averages across all types of households have been used; the number of school-age children would be zero for single person households and would be greater than the reported average in the case of married couple households.

[d] The affected school children reside in the communities listed. Many of these children who live in Crescent Valley utilize schools in Elko, Spring Creek and Carlin.

Cumulative impacts are defined as the sum of all past, present, and reasonably foreseeable impacts resulting primarily from mining and grazing operations. The purpose of the cumulative analysis in this EIS is to evaluate the significance of the contributions to cumulative impacts from the proposed Cortez expansion activities. The cumulative analysis was accomplished in a 3-step process:

- Step 1 - Identify study areas for each resource evaluated.
- Step 2 - Define time frames, scenarios, and acreage estimates for cumulative impact analysis. Past and existing disturbances include mining operations with disturbed areas not reclaimed or unsatisfactorily reclaimed. Future scenarios address reasonably foreseeable mining operations identified in Mining Notices, Plans of Operations, or best judgement based on recent history. Future grazing operations are based on assumptions and goals in Rangeland Program Summaries.
- Step 3 - Identify and quantify where possible project-specific impacts from the proposed Cortez project and judge the significance of this contribution to overall cumulative impacts.

5.1 STEP 1 - CUMULATIVE IMPACT STUDY AREA

Individual study areas were identified in Section 3.0 for each resource area to include the region where direct, indirect, and cumulative impacts could occur. These study areas vary in size depending on the anticipated impact region for a given resource. For most of the physical and natural resources, e.g., air quality, water quality, geology, soils, cultural resources, vegetation, wildlife, land use, and livestock grazing, the study area is very similar. In general, these resources were evaluated for an area bounded by the Shoshone Range to the west, Cortez range to the east, the town of Crescent Valley to the north and the north Toiyabe Range to the south. This general region is the area within which past, present and future development disturbances were evaluated for the cumulative impacts assessment of surface disturbance. This collective region is referred to in this section as the cumulative study area (CSA).

For other resources, such as socioeconomics, visual resources and recreation, study areas described in Section 3.0 and used in this section for cumulative impact assessments represent a much larger region that includes consideration of communities and viewpoints that could be impacted.

For the purposes of developing the reasonably foreseeable development scenario, the Bureau assumed a cutoff date of June 1, 1991. The was necessary to finalize the cumulative impact analysis. Plans of Operations filed with either Bureau of Land Management District after that date (for the study area) are not considered in this analysis.

5.2 STEP 2 - EVALUATION OF PAST, PRESENT AND FUTURE DISTURBANCE

5.2.1 Historical and Existing Disturbance

Past disturbances have been associated primarily with livestock grazing and mining. The entire study area has been extensively utilized for past and ongoing livestock grazing. Native plant communities have been altered by this long-term grazing activity. In addition, relatively small acreages have been developed for water projects and fencing. Much of the disturbance associated with range improvements is currently vegetated with native and exotic vegetation.

The older mining disturbances were generally in small areas because mining was confined mostly to vein-type deposits. The exception is Gold Acres, which was one of the first large-scale gold mining operations that used leaching to retrieve the gold from low grade ore. The more recent mine activities in the 1980s have been large-scale mining operations for low grade deposits.

A summary of historic and more recent mining disturbances have been separated into old operations and newer operations. The old operations were generally those from the 1800s to the 1950s. The newer operations were from the 1950s to present but most of the acreage was disturbed in the late 1970s through the 1980s. Estimated acreage for these disturbances is shown in Table 5.2-1. Estimates of disturbance are based on the assumptions and methodology described in Section 5.3.11 for cultural resource cumulative impacts.

Cortez Mining District

The older operations in this historic silver mining district disturbed 92 acres. An additional 50 acres have been disturbed by recent operations: 42 acres as seismic lines, 7 acres as roads and 1 acre as additional tailings.

Gold Acres

The older 1930s operations through 1950 disturbed 450 acres consisting of roads, pits, tailings and the community of Gold Acres. Currently mining disturbance has disturbed a total of 881 acres, 431 acres in addition to the old disturbances.

Lander

An older mining site with about 4 acres of disturbance is located at Lander.

Utah Mine and Utah Camp

An older mining site on the west edge of the CSA is located at Utah Mine and consists of about 6 acres of disturbance when all the surrounding small sites are included. The Utah Camp site is almost revegetated.

Tenabo

Tenabo consists of an older mining site and community with about 6 acres of disturbance. No disturbance has occurred recently.

Gold Quartz

Gold Quartz is another older mining site with a small residential area. Past disturbances consist of about 6 acres with an additional 150 acres of disturbances from more recent mining activity.

Mill Canyon

The Mill Canyon disturbances of 17 acres occurred prior to 1950 and still exist today. One acre of new disturbance due to mineral exploration has occurred.

5.2.2 Reasonably Foreseeable Development Scenarios For Mining

The Cortez Gold Mine properties are situated along a well-defined mineral trend. The Battle Mountain/Eureka trend, as it is referred to in the mining literature, has a history of precious metals production, including major gold and silver mines. Given this background, coupled with an increase in mineral applications (both mining development and exploration drilling) in and around the Cortez area, it could be assumed that surface disturbing activities associated with mineral exploration and mine development will continue at the same rate it has for the last 5 to 10 years. This scenario is very likely since it follows the norm with respect to the nature of the mineralized formation structure such as in the Shoshone, Cortez and Toiyabe mountain ranges.

For the purposes of analyzing cumulative impacts, the BLM has defined the "reasonably foreseeable future" as the project life (i.e., 6 years for the 1990 Plan Amendment) plus an estimate of the time needed for successful reclamation; in this case that is assumed to be 3 years. This equates to a total of 9 years for the "reasonably foreseeable future" scenario.

For the purposes of developing the reasonably foreseeable development scenario, the Bureau assumed a cut-off date of June 1, 1991. This was necessary to finalize the cumulative impact analysis. Plans of Operations filed with either Bureau of Land Management District after that date (for the study area) are not considered in this analysis.

For the purpose of identifying cumulative environmental impacts as a result of mining activities in the CSA, the BLM has hypothesized the following scenarios as the most likely to occur in the foreseeable future.

<u>Exploration</u>

Exploration disturbance will consist of construction of drill access roads and drill pads.

The Cortez Mountain Range, outside of Cortez's claim block, will average approximately 10 acres per year of surface disturbance due to continued mineral exploration; or 90 acres over the foreseeable future scenario.

The north Toiyabe Range, outside of Cortez's claim blocks, will experience limited exploration drilling. For the purposes of this analysis, the BLM will assume that 40 acres of exploration surface disturbance will occur in the northern part of the Toiyabe Range during 1992-93, and 5 acres per year thereafter, for a total of 80 acres for the foreseeable future scenario.

The Cortez Gold Mine expects to perform limited exploration over the life of the project. For the purposes of this analysis, the BLM will assume 2 acres total of exploration surface disturbance in the Cortez claim block.

The Shoshone Range will likely experience the most exploration disturbance during this period. The BLM estimates that an average of 50 acres of exploration disturbance per year (for a total of 450 acres of exploration disturbance in the reasonably foreseeable future) will occur over the mountain range from that area known as the Cedars to the northern most extension of the range.

<u>Mine Expansion</u>

The Cortez 1990 Plan of Operations provides sufficient detail to explain the mine expansion anticipated by the BLM to occur in the Cortez/North Toiyabe Ranges in the reasonably foreseeable future. The direct and indirect impact from this mine expansion Plan of Operations amendment are addressed in the "Environmental Consequences" chapter.

Certain deposits that are of interest to Cortez are in the exploration or early development stage and the extent and type of mineralization has not been fully determined. Information needed to develop a distinct mine plan is unavailable. However, using the current data base, a preliminary estimate of the impact (with respect to size) can be made based on engineering and geological experience. The estimated acreages that would be disturbed by these reasonable foreseeable projects are summarized in Table 5.2-2. In addition, other reasonably foreseeable projects (not sponsored by the applicant) have been identified in the cumulative impact study area. These are also identified in Table 5.2-2 as the basis for the cumulative impact assessment.

Cortez Area

West Pixie. Mining activities in the Cortez Canyon area, known as West Pixie, would consist of developing a new open pit and two new waste rock dump areas. The West Pixie Pit is located west of Cortez Canyon. The preliminary minable reserve of this deposit is 343,000 tons of ore, with a 5.3:1 (overburden: ore) stripping ratio.

The West Pixie waste rock dump areas would be located immediately north and southeast of the West Pixie Pit. Approximately 16,200 feet of new haul road would be required to transport ore from the West Pixie Pit to the Cortez milling and heap leach facilities. The ore haul route to the Cortez facilities is planned to utilize the Cortez Canyon county road, pending approval from Lander County. This could involve using tractor/trailer units for the ore haul. Approximately 6,800 feet of haul road would be constructed from the pit to the county road, and another 9,400 feet of haul road would be built across the Crescent Valley pediment for the final haul to the facilities. The entire new haul road would disturb 30 additional acres. Total estimated disturbed acreage including reclamation would be approximately 145 acres.

Cortez Pit Area. Mining operations in the Cortez Pit area would consist of pushing back existing pits and developing new areas. The proven reserves are not yet fully determined in this area. However, it is reasonably certain once development of the reserves was completed, the deposits would be minable, including those below the current water table. The ore mined in this area is generally oxidized and would be treated by either the mill or heap leaching facilities located at the Cortez mill site. The waste rock dump areas are located near the range front. Existing haul roads would be used whenever possible. Historical dewatering of the Cortez Pit was at the rate of approximately 2,000 to 3,000 gallons per minute. Total estimated disturbed acreage including reclamation would be approximately 359 acres.

Mill Canyon Tailings. Mining activities in his area would consist of removing tailings from an historic mining operation northwest of Mill Canyon. The ore would be hauled to the Cortez mill site for processing. Total estimated disturbed acreage including reclamation is approximately 33 acres.

Gold Acres Area

Golden Zone. Mining activities around the Golden Zone would consist of development of a new open pit and waste rock dump area. Mill ore would be hauled to the Cortez mill on the existing Gold Acres haul road. Leach ore is planned for processing at the Gold Acres heap leach facility. Total estimated disturbed acreage including reclamation would be approximately 110 acres.

North London Extension. The North London Extension would include the development of a new open pit and waste rock dump area located north of the London extension pit. The reserve contains mixed carbonaceous/oxide material.

The waste rock dump areas are planned to the north and east of the pit area. Ore would be hauled either to the Gold acres heap leach facilities or to the Cortez mill facilities. Total estimated disturbed acreage including reclamation would be approximately 118 acres.

Low Grade Ore Stockpiles. Low grade ore stockpiles located over the existing dump areas and tailings located in the valley floor would be processed at the Gold Acres or Cortez new heap leaching facilities. Existing roads or routes through previously disturbed areas would be utilized wherever possible.

Pipeline Deposit. The Pipeline deposit, named for the presence of an existing water pipeline used historically at Gold Acres, represents a very significant and foreseeable development. Exploration activities are at an early stage; however, the magnitude of the deposit and the potential development that could result from such a deposit can be described with some certainty.

For planning purposes, the Pipeline deposit area could produce a 20-million-ton ore body suitable for conventional carbon-in-leach milling. An additional 10 million tons of material suitable for heap leaching could also be developed in this area. Waste stripping requirements would be high to develop this deposit. A total of 200 million tons of waste is expected using open pit mining techniques. A waste rock dump of this size could cover a square mile. The pit would disturb 200 acres; heap leach and tailings facilities would disturb 480 acres, and 950 acres would be disturbed by roads and waste rock dumps. The total estimated disturbance by this reasonably foreseeable project is 1,600 acres.

Development of the Pipeline deposit would involve the construction of a new milling facility which would be located east of the Gold Acres area. A mill throughput for this size of deposit would be in the range of 4,000-5,000 tons/day. Along with a new milling facility, support facilities such as shops, offices and laboratories would be constructed. A tailings storage facility and heap leach pads would also need to be constructed in the Pipeline project area to process the ore tonnages listed above. A work force of approximately 250 people would be required to operate the facilities. A peak construction work force of 250 people would be employed during the 18-month construction phase.

Development of the open pit mine would involve pit dewatering operations. The water table would be encountered at a depth of approximately 250 feet below the surface with an ultimate pit envisioned to a depth of 800 feet. Rate of water production and the discharge method are unknown at this point; however water production rates from dewatering operations are expected to be in the range of 10,000 to 20,000 gpm. When mining is complete, a "pit lake" would remain. Water chemistry would be studied to determine water quality.

Providing electrical power to the proposed development would involve the construction of a new 120 kV overhead powerline from the Battle Mountain area.

Horse Canyon

South Silicified Zone. The South Silicified Zone is located south of the Horse Canyon pits. This reasonably foreseeable project would involve an expansion of an existing pit in this area. The ore would be hauled down the existing Horse Canyon haul road to the Cortez milling facility. The South Silicified Zone is composed of a carbonaceous roaster/mill ore which would be blended with the London Extension roaster ore.

Two million tons of overburden removed from this pit expansion would be hauled via the existing South Silicified Zone haul road to the waste rock dumps south of the South Silicified Zone Pit. This is an existing overburden storage area which would be expanded to accommodate the additional overburden material.

Total estimated disturbed acreage including reclamation would be approximately 60 acres.

North and South Pit Extensions. These pits would be pushbacks of existing pits at Horse Canyon mined from 1983 through 1987. The mill ore would be hauled down the Horse Canyon haul road to the Cortez mill facility and the leach ore would be hauled to the Horse Canyon or the Cortez leach facility. The deposit is composed of leach, oxide and roast ore.

Waste would be hauled via existing roads to the current waste rock dumps. Existing maintenance and office facilities would be sufficient for supporting the mining operation. Disturbance would take place on unpatented mining claims. The total estimated disturbed acreage including reclamation would be approximately 136 acres.

Red Hills. The reasonably foreseeable disturbance on the Red Hills Deposit, located east of the South Silicified Zone, would involve developing a new open pit and waste rock dump area. The deposit consists of oxide ore which would be treated by milling at the Cortez facilities. Mill ore would be transported to the Cortez mill via the Horse Canyon haul road. All disturbances would be located on unpatented mining claims.

Total estimated disturbed acreage including reclamation would be approximately 70 acres.

The BLM does not anticipate any other mine expansions in the Cortez/North Toiyabe or Shoshone Mountain Ranges during this period.

Mine Development

The BLM anticipates the development of two new mines in the Shoshone Range in the foreseeable future (Table 5.2-2). The development of these two projects will begin in early 1992 with various phases of discovery, construction, operation and concurrent reclamation occurring through the 9-year reasonably foreseeable future period.

Small Mine Scenario. The first mine is expected to be a relatively small mine.

- It is anticipated that only 150-200 acres at any one time will be disturbed. The BLM assumes an average concurrent reclamation rate of 5 percent of the total disturbance per year.

- Construction force will consist of 60-75 employees employed for 2 years constructing ancillary facilities, initial stripping, etc.

- It will employ a permanent work force of 75-100 employees.

- It will use approximately 400 acre-feet of water per year (250 gallons per minute).

- It will be a heap leach, mill operation, processing oxide ores.

- It will likely see its full cycle (discovery, development, reclamation and closure) occur within the nine year reasonably foreseeable future scenario.

Large Mine Scenario. The second mine is anticipated to be a relatively large mine (approximately 4,000 acres). The large mine would begin construction in December 1994 and continue operations for 15 years.

- Disturbance will average 1,500 acres at any one time, with an average concurrent reclamation rate of 5 percent of the surface disturbance per year. Total disturbance over the life of the mine could include 4,000 acres.

- Construction force will be approximately 300 employees for the first 3 years, constructing ancillary facilities, performing initial stripping, etc.

- It will employ a permanent work force of 250 workers.

- It will be mining and processing sulfide ore deposits.

- A large, deep pit of approximately 800 to 1,000 feet deep will be excavated.

- The mine will use 1,600 acre-feet (1,000 gallons per minute) of water per year.

- Processing of sulphide ores will require a pre-treatment circuit using an autoclave. The use of this device may contribute to air quality degradation.

5.2.3 Reasonably Foreseeable Development Scenarios for Rangeland Management

Following are the reasonably foreseeable future scenarios for the three major types of rangeland consumers (grazers and browsers) in the Cortez EIS cumulative analysis area. These are livestock, wild horses, and wildlife. Land Use Plan (LUP) objectives as identified in the Shoshone-Eureka and Elko Rangeland Program Summaries (RPS) are identified as short-term (5 years or less) and long-term (5 years or longer). Objectives related to the upland and riparian vegetation are also included in this projection.

<u>Livestock</u>

For purposes of analysis, the following assumptions will be made based on the RPS for grazing and current trends for reasonably foreseeable future mining scenarios (Table 5.2-3). These assumptions are provided such that future management actions that may contribute to cumulative impacts may be analyzed.

Project life is nine years.

Long term goals stated in the RPS are 20-year goals.

BLM intends to implement proposed projects/ improvements.

Since the RPS was approved in 1987, 70 percent of the proposed management improvements will have been completed by project end.

Future funding and staffing considerations as well as the number 22 priority of the Carico Lake Allotment will affect feasibility of completion of 70 percent of the proposed livestock management projects/ improvements within the specified time frame.

Carico Lake Allotment. Existing use in the Carico Lake Allotment is 27,171 cattle and sheep AUMs. Of the 28 "I" category allotments, Carico lake has a priority rating of 22 for completion of activity plans. The long-term goal is to increase licensed grazing use to 30,892 AUMs, a 13.6 percent increase. If 70 percent of this goal is completed by project end, then licensed grazing use would be increased 2,605 AUMs.

The following range improvements are identified in the RPS:

- 12 spring developments
- 4 water wells
- 4 water reservoirs
- 20 miles of water pipeline
- 86 miles of fence
- 8 cattleguards
- 4,250 acres of seeding

The long-term vegetation and ecological condition and trend objectives for the allotment include:

- Improve 99,038 acres to good condition and 3,158 acres to excellent condition

- Stop the downward trend of 114,826 acres and manage for upward trend on 110,808 acres

Utilization objectives for the allotment are:

- Not to exceed 50 percent on key species by seed dissemination and 60 percent by the end of the grazing year
- Utilization of key browse species will not exceed 50 percent in terrestrial big game habitat

Argenta Allotment. Existing actual use in the Argenta Allotment is 12,107 AUMs for cattle, sheep and horses. The long term goal is to sustain 13,197 AUMS, an increase of 9 percent. In the long-term time period, an Allotment Management Plan (AMP) is proposed to be completed. Since only a small amount of the allotment on the valley floor is within the cumulative study area, specific objectives for the allotment are not considered applicable to the cumulative affect.

South Buckhorn Allotment. Existing active grazing preference in the South Buckhorn Allotment is 20,654 AUMs for livestock. The permittees in the South Buckhorn Allotment are Dominek Pieretti (3,774 AUMs), Daniel Russell (5,355 AUMs), Slagowski Ranches (2,142 AUMs), Maynard Alves (6,563 AUMs), Mary Bailey and Sons (1,260 AUMs), Dewey Dann Estate (965 AUMs), and the Lander County Development Corp. (595 AUMs).

The long-term goal is to sustain 20,175 AUMs, a slight decrease of 2 percent. This allotment is scheduled for an evaluation in FY 1992 that will identify changes, if needed, in the stocking levels and grazing management practices. Also in the long term, an AMP is proposed to be completed. Currently there is no grazing system. Season of use is from April 16 to November 30 of each year.

The following range improvements are identified in the RPS for the allotment within the long-term time period.

- 10 spring developments
- 8 water reservoirs
- 4 water wells
- 15 miles of pipeline

- 61 miles of fences
- 10 cattleguards
- 4 water storage tanks

The long-term vegetation and ecological status and trend objectives for the allotment include:

- Improve ecological status on 1,495 acres from mid-late seral and 279 acres from late to potential natural community. Maintain or enhance the current forage condition on the non-native range.

Utilization objectives for the allotment are:

- Maintain or enhance native vegetation with utilization levels not to exceed 50 percent on the key species.

Wildlife

Objectives. Wildlife management objectives in the Carico Lake Allotment are specifically defined in the Shoshone and Callaghan Habitat Management Plans (HMP) and the RPS. The objectives are considered for the Cortez CSA.

The existing big game use is 1,241 AUMs. The long-term objective is to provide forage for 1,750 AUMs of big game use. The expected level of big game AUMs at project end is 1597 AUMs.

Within the Shoshone HMP Area, the objective is to improve 26,678 acres of big game habitat to good condition and 851 acres to excellent condition. Another objective is to stop downward trends on 30,932 acres and manage for upward trends on 29,849 acres.

The long-term objectives within the Callaghan HMP Area are to improve 1,980 acres to good condition and 63 acres to excellent condition and to stop downward trends on 2,296 acres and manage for upward trends on 2,215 acres.

An overall objective is to manage rangeland habitats to maintain or enhance sage grouse leks and nesting areas.

In the Argenta Allotment, a riparian management plan specifies improvement for 2.0 miles of riparian/aquatic habitat on Indian Creek. The utilization of riparian habitat to be improved will not exceed 30 percent on key species.

The South Buckhorn and Pine Creek Allotments are located within the Elko Resource Area. Both short-term and long-term wildlife management objectives for the South Buckhorn Allotment are defined in the Elko Resource Management Plan (RMP), completed in 1987. The existing use by big game on the South Buckhorn Allotment is 864 AUMs. The long-term objective is to manage rangeland habitat and forage condition to support 2,058 AUMs for reasonable numbers of mule deer. A general long-term objective is to maintain or improve all crucial mule deer and pronghorn antelope habitat to at least good condition.

Other long-term objectives are to manage rangeland habitat to protect or enhance crucial sage grouse leks and nesting areas, and to improve and maintain meadow and riparian areas for mule deer and sage grouse. Utilization levels will not exceed 50 percent on these areas.

No wildlife objectives have been established for the Pine Creek Allotment.

Big Game Use. Existing and reasonable levels of big game use for the South Buckhorn and Pine Creek Allotments are shown in Table 5.2-4. Reasonable use is based on the numbers of animals an allotment could reasonably support if objectives for habitat improvement are met.

Big Game Habitat. Distribution of important seasonal big game ranges are shown for the study area in Figure 3.6-1. Acres by ranges are summarized in Table 5.2-5. Four big game habitat monitoring studies have been established in deer winter range and one monitoring study has been established in deer summer range. Results of these studies are summarized in Table 5.2-6. Table 5.2-6 also shows the limiting factors which have been identified in these areas. No studies have been established for the purpose of evaluating antelope habitat.

Sage Grouse Habitat. Although no wintering grounds are known to exist within the Cortez CSA, nine sage grouse leks have been identified within the CSA. Five of these are in the south or southeast end of the Cortez range, or south of that in the flats. The other four sage grouse leks are located across the valley in the Shoshone range. No specific studies have been established to evaluate habitat conditions for sage grouse in the vicinity of strutting grounds.

Stream and Riparian Habitat. Very limited information on stream and riparian habitat conditions is available for the area encompassed by the study area. Ocular stream surveys were completed on Brock Canyon and Cottonwood Canyon Creeks by the BLM and the Nevada Department of Wildlife (NDOW) in 1980. Results of the studies indicated that stream and riparian habitat conditions are poor for Brock Canyon as a result of overuse of riparian vegetation by livestock. Although habitat conditions rated out as good with the ocular survey on Cottonwood Creek, problems associated with poor livestock grazing practices were evident.

Surveys were again conducted by BLM on streams in the Cortez Range in 1991. Almost without exception, stream and riparian habitat conditions were found to be poor (Table 5.2-7). Streambanks are cut and eroding, riparian vegetation is lacking, sedimentation levels are excessive, and stream channels are wide and shallow. A deep, narrow channel configuration characteristic of streams in good condition is critical for modifying temperature extremes, providing pool habitat for fish, and allowing for overbank flooding and dissipation of stream energy during periods of high flow. Streams in the Cortez Range quickly overheat during the summer and may turn to solid ice in the winter. In addition, there is little opportunity to dissipate flood energies in deeply incised channels, consequently these streams tend to erode even with small runoff events. Poor livestock grazing practices resulting in overuse of the riparian zone are the primary cause of poor habitat conditions along streams in the cumulative effects study area.

Ongoing Studies. The South Buckhorn and Pine Creek Allotments are scheduled for evaluation in FY92, and monitoring data was collected during the summer of 1991. All existing wildlife studies will be reread and new studies will be established as time permits to evaluate objectives for which little past information is available. Given recent problems with severe overstocking of livestock combined with season-long use, results obtained in 1991 show downward trends in both terrestrial and aquatic wildlife habitat. Although the monitoring data is not yet available in summary form, the individual plot data is available in the Elko BLM office.

Wild Horses

Portions of two wild horse herd management areas extend into the study area, although there are wild horse populations in areas projected for disturbance.

The Bald Mountain Herd Management Area extends into the Carico Lake Allotment. Management objectives would initially provide 4,344 AUMs of forage for 362 wild horses (USDI, BLM 1988). The Shoshone Herd Management Area, which is 91.7 percent within the Carico Lake Allotment, would initially provide 936 AUMs of forage for 78 wild horses, according to management objectives.

The wild horses would be managed in a manner to enhance and improve the wild and free-roaming behavior of the herds. The management guidelines would include the absence of fences and free access to water.

The other allotments do not have wild horse herds under Herd Management Plans (HMAPs).

5.3 STEP 3 - EVALUATE CONTRIBUTION OF CORTEZ IMPACTS TO CUMULATIVE IMPACTS

For each resource discussed below the contribution of impacts from the proposed project to cumulative impacts from past, present, and reasonably foreseeable projects is evaluated. Impact significance criteria used for individual resources in Section 4.0 are also used for cumulative analysis. For cumulative impact analysis the percentage or portion of cumulative impacts that would be contributed by the proposed project is the basis for judging the significance of incremented impacts resulting from the proposed action.

5.3.1 Air Quality

Point Sources

Emissions of Total Suspended Particulates (TSP) and SO_2 from the Cortez mill facility combined with TSP and SO_2 emissions from other sources in the Crescent Valley Air Basin were evaluated to identify potential cumulative impacts. The emissions inventory of other existing sources in the Crescent Valley Air Basin (Table 5.3-1) shows no emissions of SO_2 from either the Black Beauty Gold facility or the M-I Drilling Fluids facility. Annual TSP emissions from Black Beauty Gold are negligible, and no significant impact is anticipated from this source. Therefore, the only other existing facility that would contribute to cumulative impacts from the Cortez mill is M-I Drilling Fluids.

The EPA SCREEN model was used to conservatively estimate ambient TSP concentration increases from the primary crusher and single deck screen at M-I Drilling Fluids. The analysis used hypothetical, worst-case meteorological conditions to estimate maximum 1-hour concentration increases. The resulting 1-hour modeled concentrations were multiplied by the scaling factors 0.4 and 0.1 to derive 24-hour and annual concentrations, respectively. Results of the EPA VALLEY model, run by the NDEP for permitting of sources at the Cortez mill, was used to estimate modeled TSP concentrations increases from Cortez.

To assess cumulative impacts from M-I Drilling Fluids and Cortez, a significance level area was defined for 24-hour and annual TSP impacts from the two sources. Significance levels are defined as modeled values below which is assumed no detriment to air quality. Significance levels for TSP for 24-hour and annual impacts are 5.0 µg/m^3 and 1.0 µg/m^3, respectively.

A significance level area is determined by outlining an area around the Source beyond which modeled values fall below significance levels (5.0 µg/m^3 for a 24-hour average and 1.0 µg/m^3 for an annual average). Outside this area, no significant impact to air quality would occur. From the Cortez mill, the 24-hour impact area extends roughly 5.5 km outward. The annual impact area extends approximately 10 km outward. From M-I Drilling Fluids, the 24-hour impact area extends 2.5 km from the source, and the annual impact area extends 3 km from the source. Therefore, the significance level areas from modeled values of TSP (24-hour average and annual average) from the Cortez mill and from M-I Drilling Fluids do not overlap. No cumulative impacts would result from sources at the Cortez mill and at M-I Drilling Fluids.

Other point sources have been identified as part of reasonably foreseeable developments. For example, additional CIL plants are planned as part of Cortez's future operations and as part of the large mine scenario. These sources would add to ambient levels of pollutants such as TSP and SO_2. However, impacts from these cannot be quantified at this time, because no permit applications for them have been filed with the NDEP.

<u>Fugitive Dust Emissions</u>

The reasonably foreseeable future activities would involve surface disturbances that would result in fugitive dust emissions. Emissions from the reasonably foreseeable future activities are summarized in Table 5.3-2.

Surface disturbance activities occur at a great enough distance from each other, such that an additive, i.e. cumulative, impact from fugitive dust is not anticipated. Surface disturbance acreage at each area is less than or approximately equal to those at the Newmont Gold Company Gold Quarry site.

5.3.2 Geology, Minerals, and Paleontology

Approximately 32 million tons of ore and waste rock would be removed and permanently relocated to waste rock dumps, heap leach pads and tailings ponds as a result of the proposed expansion of the open pit at Gold Acres. An additional 275 million tons may be excavated and relocated during the activities discussed under Reasonably Foreseeable Future projects.

The short-term result of the proposed expansion of mining and minerals exploration activities would be that additional mineralization may be encountered that may warrant additional investigation. The long-term impact would be that the proposed work may lead to the defining of additional ore reserves and, subsequently, future mining operations should market conditions allow. No significant cumulative impacts are anticipated.

5.3.3 Soils and Topography

Current and historic mining operations within the CSA have resulted in disturbance to approximately 3,528 acres of soils. An additional 428 acres of disturbance would result from the proposed project. Of this acreage, 8.5 acres would remain disturbed as an open pit. Foreseeable future mining operations will result in an additional 4,953 acres of soil disturbance. With the exception of any open pits, this disturbance would also be required to be reclaimed. During reclamation activities, growth medium would be distributed in a random and unstratified manner. Erosion would result in the loss of additional soil materials over the time frame of the foreseeable future.

Total current, historic, proposed, and foreseeable future disturbance to soils from mining activities within the Cortez CSA is 8,909 acres. For the purpose of this analysis, it is assumed that about 5 percent (425 acres) of this disturbance is historic and not subject to current reclamation regulations. The remaining approximately 8,484 acres of this disturbance would be subject to reclamation regulations. Assuming further that 17 percent of this disturbance consists of open pits, and assuming that all mining related disturbance other than these pits will be required to be reclaimed, 6,686 acres would be reclaimed. These disturbances would be short-term and insignificant providing reclamation was successful in stabilizing the disturbed sites. Approximately 1,398 acres would remain as long term disturbances. The entire CSA includes approximately 350,000 acres; the 1,398 acres of long term disturbance (and the small contribution by Cortez long term disturbance) represents 0.4 percent of the CSA and is not considered significant.

Livestock grazing activity has had, and would continue to have, direct and indirect impacts on soils. Grazing impacts to soils are not quantified. The expected disturbance to soils due to range improvements is 4,462 acres (Table 5.2-3).

5.3.4 Water Resources

No additions to cumulative impacts are anticipated to perennial streams because no perennial drainages are located within the immediate vicinity of the proposed project areas. The potential erosion and sedimentation impacts to ephemeral drainages are relatively minor and would not reach the same drainages that could be impacted by the reasonably foreseeable projects that may occur.

For groundwater resources, the contribution to cumulative water quality impacts would be minor. The proposed facilities would be constructed and operated as zero discharge units and, therefore, the potential for additional groundwater quality degradation or increase in plume size is considered to be low. For the reasonably foreseeable projects, other facilities would utilize similar chemicals and, if constructed and operated as zero discharge units, should have a similarly low potential for degrading groundwater quality. Given the limited extent of existing contaminated plume at the Cortez Facility, it is unlikely that the plume at Cortez would contribute to potential groundwater contamination at reasonably foreseeable projects located well away from the Cortez Facility.

The potential cumulative impacts from the proposed project on groundwater resources from a water quantity standpoint are insignificant. For the proposed project, no changes to the present groundwater pumping rates are expected with the exception of several new water pollution control wells recently installed at the Cortez Facility. Pumping rates and State of Nevada permit numbers for these new wells have not been finalized. However, the additional rate of groundwater extraction will not exceed the total appropriation for Cortez. The operation and monitoring of these wells is done in accordance with Water Pollution Control Permit No. NEV00023 finalized by the NDEP in May 1991.

5.3.5 Vegetation

Existing mining-related disturbance to vegetation within the study area encompasses approximately 3,528 acres. Tables 5.3-3 and 5.3-4 summarize existing, proposed and other foreseeable future disturbance by community type within the study area. The site-specific estimates for existing and reasonably foreseeable disturbances are listed in Tables 5.2-2 and 5.2-3. Although total existing, proposed and other foreseeable future disturbance within the study area encompasses only 2.5 percent of the study area, a disproportionate amount of that disturbance is within the mountain mahogany community type. Approximately 13 percent of the mountain mahogany community type within the study area, in the Cortez mountains, would be disturbed by mining-related activities. This disturbance is considered significant and long-term because the mountain mahogany is a very slow growing species and would not re-establish the mature community for 75-100 years. The proposed project would not add any disturbance to this community.

Impacts to vegetation due to livestock grazing are noted throughout the study area; however, these impacts are not quantified.

Approximately 0.2 percent of the shadscale/greasewood community type, 3.9 percent of the shadscale/bud sagebrush community, 1.8 percent of the sagebrush/grass community type, and 1.2 percent of the piñon-juniper/sagebrush community would be disturbed by mining-related activities. The cumulative impacts to these communities is not significant.

5.3.6 Wildlife Resources

The environmental consequences to most wildlife species resulting from the Proposed Action as described in Section 4.6 are low to minimal, largely because the majority of disturbance would occur either on or adjacent to existing disturbance and/or in habitat not utilized by a wide variety of wildlife. Mule deer seldom utilize the dry, open flats of the valley floor, while antelope numbers in the area are low. The nearest identified antelope use area is located east of the Cortez Mountains. As is the case with big game, areas which would be disturbed are seldom utilized by game bird species, with the exception of mourning doves.

Approximately 143 acres of undisturbed pediment habitat in the Cortez Mine and Mill area would be affected by the Proposed Action. Approximately 276 acres of currently undisturbed habitat near Gold Acres would be affected by proposed activities. These habitats would be lost to local carnivores, a variety of small game (principally cottontail rabbits) and small mammal species, and to nongame birds. This acreage would also be lost as raptor hunting territory. Species involved and potential effects are listed in Sections 3.6 and 4.6. The acreages that would be lost directly to mine-related disturbance represent considerably less than 1 percent of the available habitat present in the CSA.

Implementation of the Proposed Action would result in the loss of 428 acres of currently undisturbed habitat. This 428 acres represents a potential loss of 96 mule deer or 120 antelope AUMs. The significance of this loss would be low because the affected habitat is seldom used by deer or antelope. Much of the area is adjacent to existing disturbance, as well.

Cumulatively, when the disturbances are summed for past, present and reasonably foreseeable future are included, a total of 8,481 acres of currently available habitat would be directly disturbed by various mining activities within the CSA. Table 5.3-5 presents a breakdown of this direct disturbance, by habitat, in those cases where locations of disturbance are known. While these figures are estimates, it is apparent that current and future disturbance has and will continue to affect a substantial percentage of the valuable mountain mahogany habitat within the CSA. The proposed project does not add significantly to the directly affected acreage for mountain mahogany or any other in any category of wildlife habitat.

A much larger area would be indirectly impacted by disturbance created from the cumulative activities associated with other mining projects. Zones of disturbances created by these activities would affect approximately 11,800 to 13,190 acres (with this variation in size resulting from the different potential project shapes used in this analysis). Zones of disturbance created by haul roads would affect another 4,760 acres. When these figures for actual and indirect disturbance are combined, a total of 16,560 to 17,950 acres of habitat within the 350,100 acres CSA area, or 4.7 to 5.1 percent of the total CSA area, would be affected by historic, present and reasonably foreseeable mining. Adding existing zones of disturbance, estimates of the total acreage of the CSA affected by mining, including both direct and indirect disturbance, range from approximately 18,630 to 20,150 acres or 5.3 to 5.8 percent of the CSA. The proposed project disturbance of 428 acres does not add significantly to this total.

The Reasonably Foreseeable Future scenario also projects considerable exploration activity. When indirect disturbance from these exploration activities are included in the analysis of acreage directly or indirectly affected by mining and exploration activities, an additional 82,460 acres would fall within potential zones of disturbance. This figure should be considered separately from disturbance resulting from actual mining operations. Disturbance resulting from actual mining can be assumed to be regular and in many cases continuous. Disturbance resulting from exploration roads is irregular and not continuous over the long term. Disturbance resulting from recreationists utilizing exploration roads is likewise irregular. The 82,460-acre estimate for these cumulative zones of disturbance created by exploration roads is also a maximum as described above, principally since the zones of disturbance created by many exploration roads would frequently overlap, reducing the acreage potentially affected. This maximal figure, however, represents 23.6 percent of the CSA affected irregularly either by exploration activities or recreationists utilizing exploration roads. These disturbances are generally short-term and do not affect wildlife habitat significantly. The proposed project would not add significantly to this total.

5.3.7 Recreation and Wilderness

Reasonably foreseeable actions include exploration and mining activities at the Gold Acres, Cortez and Horse Canyon sites. There could be approximately 2,631 acres of new disturbance associated with these foreseeable actions. These disturbances would continue to decrease the amount of land available for dispersed recreation within the resource area. Increased traffic in Cortez Canyon would adversely affect recreationists using the highway to access the Cortez historic mining district or other dispersed recreational opportunities in the area.

Other reasonably foreseeable actions discussed in Section 5.3.9 would result in additional workers during construction and operation phases. Recreational opportunities are already limited in many of the communities where the new workers are likely to live. An increase in population would increase the demand of an already inadequate supply of developed recreation opportunities.

5.3.8 Visual Resources

Foreseeable actions include continued mining activities at the Cortez, Gold Acres and Horse Canyon sites. Exploration activities are expected to continue in the future on an annual basis. Potential mining activities in Cortez Canyon, known as West Pixie, would occur on BLM VRM Class III lands. This project would not be an expansion of existing operations, but would be a new activity on previously undisturbed land. This disturbance would attract attention from a travel route; however, the duration of view would be short. The Pipeline deposit near Gold Acres represents a potential major development. If that development occurred, it would result in large scale modifications to the natural landscape. Possible future development at Horse Canyon site would take place on VRM Class IV lands. This would represent a continuation of a small incremental increase in visual impacts. Other foreseeable actions discussed in Section 5.2.2 will contribute to a continued degradation of scenic quality in viewsheds containing the new mining developments.

5.3.9 Socioeconomics

Cumulative socioeconomic impacts would result from all actions that have the potential of affecting population, housing, public services and the economy in the study area. As described in Section 3.9.1, the study area for socioeconomic impacts encompasses a three-county area, focused on the communities of Elko, Carlin, Beowawe, Crescent Valley and Battle Mountain. For the evaluation of cumulative socioeconomic impacts, all proposed developments in this study area were examined.

Reasonably foreseeable developments in the study area include mining developments noted in Section 5.2.2 and six other envisioned/planned mining projects: U.S. Goldfields/Mule Canyon project, the Barrick/Betze project, Barrick/Miekle underground expansion, Newmont/Gold Quarry project, the Dee Gold project and the Jerritt Canyon Project. Most of these projects do not involve an increase in the number of mining employees. However, four of the reasonably foreseeable projects (namely Betze, Miekle, Mule Canyon and Cortez's Pipeline Deposit) would result in an increase in mining employment in the study area. All the above projects would involve short-term (from a few months to two to three years) construction jobs, from about 70 jobs on each of three smaller projects to about 250 on the larger expansion projects. In addition to these projects, the Elko County School District is currently building one school per year, creating additional construction jobs in the study area. This increase in short- and long-term employment would result in additional economic benefits to the area, while also causing an increase in total population and an accompanying demand for housing, infrastructure and school services. About 80 to 85 percent of the new mining employees would be likely to live in Elko. This would cumulatively have a significant effect on these overburdened resources in this community.

The proposed project does not involve an increase in the number of jobs and population, and does not place any incremental demand on housing and infrastructure over the current levels. However, it allows the continuation of the current demand for infrastructure and school services. The burden on school services from Cortez operations singly does not constitute a major impact, because an estimated 100 to 110 school children from Cortez employee households use school services. However, in an area where school services are overburdened, this small number, when added to the other school children associated with other existing and envisioned developments, contributes to the continuation of overburdened conditions.

5.3.10 Land Use/Livestock Grazing

Table 5.3-6 reflects the estimated cumulative impact to livestock forage as a result of existing, proposed and foreseeable future mining activity in the CSA. The data related to AUMs is based on 1976 BLM range surveys by the Battle Mountain and Elko districts of the BLM. The estimate of foreseeable future actions pertaining to BLM and private lands is difficult to quantify both with respect to land ownership and grazing capacity. It is estimated that much of the future mining in the Cortez area and Mule Canyon will occur on patented mining claims whereas mining in other areas within the CSA will take place on unpatented mining claims (BLM administered lands). Grazing forage capacity for livestock in areas to be mined would be similar to those presently being impacted. The level of harassment and potential livestock mortality due to increased mining activity and vehicle traffic would be expected to increase in proportion to the increase in activity. Because the allotments are large, the relative loss of 471 AUMs would not be significant (1.9 percent of the total AUMs in the CSA).

No single range improvements would be lost, but in some areas where fences are breached, cattle guards would have to be installed to prevent drift of livestock. Also, the potential exists for competition at developed water sources where exploration activities require water for drilling purposes. Livestock could be subject to both harassment and actual loss of historically available water.

5.3.11 Cultural Resources

<u>Incremental Impact of the Proposed Action</u>

The cumulative impact analysis is based on a BLM Class II inventory of a larger regional area to provide a statistically valid portrait of the regional cultural resources base. The statistical portrait is an estimate of significant and non-significant prehistoric and historic sites that can be expected per square mile within the cultural resources cumulative effects study area. The incremental cumulative impacts from the proposed action can then be measured against total cumulative impacts and against the greater regional setting.

As presented in Table 5.3-7 the past, present, and future impacts cumulatively represent losses of less than 10 percent for each site category when measured against the total resource base for the study area.

The proposed action ("present") represents less than 2 percent of the total cumulative impacts to non-significant prehistoric cultural resources and no loss of significant prehistoric resources. For non-significant historic resources, the proposed action represents approximately 13 percent of total impacts and no impact to significant resources.

For the entire study area, the contribution to cumulative impacts from the proposed action is less than .01 percent for non-significant prehistoric and historic resources and 0 percent for significant sites in both categories. Based on these results, the incremental addition of the proposed project to cultural resource cumulative impacts is not significant. Details of the cumulative impact analysis is provided below.

The objective of the cumulative impacts analysis for cultural resources is to first evaluate the extent of cumulative impacts for past, present and future disturbances. The incremental impact of the proposed action can then be measured against the total cumulative impacts to cultural resources within the study area.

The compilation of past, present and future impacts to cultural resource within the cultural resources cumulative effects study area has been summarized in Table 5.3-8. Site density (frequency) per square mile for each of the three sampling domains has been developed for each of the site types identified in the Class II study.

By using these projections (expectations) of site density, a determination of total number of sites affected by past, present and future impacts can be made based on the estimates for the number of acres disturbed in the cumulative study area. The expected occurrence of significant sites (those considered eligible to the NRHP) is also provided.

According to input from Native American informants, the effects of past and present mining activity have impacted the traditional and religious value of Mt. Tenabo. Other specific concerns included the present loss of access to pine nut harvesting areas, diminished numbers of trees, and scarring of the mountain. These past and ongoing activities have cumulatively impacted Mt. Tenabo. The proposed project does not incrementally add to these impacts. Therefore, there is no incremental cumulative impact from the proposed project to traditional resources and values of importance to Native Americans.

Impacts from Past Disturbance to Historic Resources

Because the Class II survey is a randomized selection of survey plots, certain locations known to have historical significance were not as well represented in the sample survey. To supplement the survey several historically important locations were independently evaluated to determine how much prior disturbance has occurred at these locations. Eight locations identified by BLM for this analysis are:

- Cortez Mining District
- Gold Acres
- Lander
- Utah Mine and Utah Mine Camp
- Tenabo
- Gold Quartz
- Mill Canyon
- Buckhorn Mine

The assessment of prior disturbance was based on 1950 aerial photographs (when available) compared and contrasted with recent aerial photographs, and/or field visits made during the course of the Class II survey. Comparisons were made between the earlier and later information to interpolate the degree of effect that has occurred within the defined historic areas.

Cortez Mining District: The Cortez Mining District encompasses an area of 1,954 acres. Baseline 1950 aerial photo data indicate 92 acres have suffered direct impacts in the forms of roads, mines, and tailings.

An analysis of recent aerial photographs shows an increase to a total of 176 acres of affected area within the district boundaries. Of the additional 84 acres of affected area, new roads account for 41 acres — of which 34.5 acres can be attributed to the Cortez Mining Company haul road. Clearing for seismic lines accounts for 42 acres and additional tailings account for 1 acre. One building at the old town site remains visible on the recent photo. The site of Shoshone Wells at the west end of the district shows no additional effects when contrasted with the earlier photo.

Gold Acres: The 1950 baseline photo indicates mining activity within an area of approximately 1,300 acres. Of that area, 450 acres had been impacted by roads, mines, tailings and the community of Gold Acres. Roads account for 44 acres of disturbance. Mines and tailings cover 377 acres. The community occupies 29 acres. Thirty-eight buildings were visible in the community and structures were also associated with the main mine complex and a smaller mine to the north.

Analysis of recent photos indicates mining associated with the Gold Acres mine appears to encompass 4,970 acres of which 1,163 acres appear affected. The affected area includes a 1,022-acre main pit area and associated roads, tailings and separation ponds. Other ancillary activity has affected 10 acres. Geologic exploration activity and access roads has impacted 93 acres. Two remaining structures and seven foundations are visible in the recent photos.

Lander: The 1950 baseline aerial photo shows an area of approximately 26 acres at the site of Lander of which 4 acres appear to be impacted from roads and a possible corral at the east edge of the area.

Recent field visitation indicates no further development within the 26-acre area. A small number of dugout residences not visible in the 1950 photo are located at the west end of the area.

Utah Mine and Utah Mine Camp: The 1950 baseline aerial photo shows three tailings mounds at the entrances to shafts. The camp/mining area is located approximately 1/2-mile to the north and covers an area of 2.7 acres of which 2 acres have been affected by road construction. Two possible structures are visible at the camp and one at the mine.

A recent field visit yielded no evidence of the camp or the mine. No structures or materials were apparent at the camp site or the mine. No recent activity is evident at either location.

Tenabo: The 1950 baseline aerial photo shows Tenabo covering an area of 11 acres including the residential area and adjacent mine complex. The total affected area includes 6 acres including the community, the mine and access roads. Seven structures in the town site appear in the photo.

A recent field visit verifies five extant structures. No new disturbances were noted.

Gold Quartz: The 1950 baseline aerial photo shows the Gold Quartz mine complex encompassing 8.5 acres including mine, tailings and a small residential area. About 5.5 acres of the area appear affected by activity associated with the complex. Seven possible buildings appear in the photos.

No recent photos were available and no field visits were made to this locale.

Mill Canyon: The 1950 baseline aerial photos show a mining activity area of 17 acres, including the main mine complex, mill, residential areas and a smaller mine complex up the canyon. Nine buildings, both residential and industrial are present in the photo.

No later aerial photos were available, however a field visit indicates little new disturbance. Essentially the historic mining features have not suffered any damage other than the kind of deterioration expected from weathering since abandonment.

Buckhorn Mine: No baseline aerial photos were available. Recent aerial photos combined with recent field investigations show activities associated with the Buckhorn Mine to encompass at least 4,500 acres. Direct impacts associated with an open pit mine, tailings and ancillary facilities covers approximately 1,000 acres. Any historic remains associated with earlier periods of mining at this location should be considered to be completely impacted and no longer in existence.

Impacts from Past Disturbance to Prehistoric Resources

Table 5.3-9 provides a breakdown of the expected frequency of prehistoric sites by sampling domain based on the site density data developed in the Class II study coupled with the data discussed above. The total estimated acreage from past mining activity in the eight historic mining districts has been broken down into three domains (environmental zones) — piñon, basin, and mountain. Expected site frequencies per square mile (640 acres) developed in the Class II cumulative effects analysis are used to estimate the predicted number of each type of prehistoric site that has been affected by past mining activity in these areas.

Based on the expected prehistoric site frequencies provided in Table 5.3-9 it is evident that the greatest impact from past mining-related activities has taken place in the mountain zone. The expected site density suggests 0.7 NRHP eligible sites have been impacted by the 587 acres of prior disturbance in the Basin zone in contrast to the 12.8 NRHP eligible sites that are predicted to have been impacted in the 1,611 acres of prior mining-related activities in the Mountain zone.

Historic sites were not subjected to the same type of analysis because descriptive data presented above were available for each of the areas and provide a more meaningful estimate of the nature of mining impacts on these historic areas over the last 40+ years.

Impacts from Present Disturbance to Cultural Resources

The proposed project would result in the new disturbance of 428 acres. Tables 5.3-10 and 5.3-11 summarize site distributions (actual derived from Class III data and expected from Class II data) for each of the proposed expansion areas based on new disturbed acreage by environmental zone. Although based on a small sample size there is still an apparent trend that suggests most site categories appear to be under-represented based on expected frequency/density. It is probable that the historic activity that has taken place at these two locations over the last 100+ years has resulted in the destruction of much of the surface archaeology.

Impacts from Reasonably Foreseeable Disturbances to Cultural Resources

Potential cumulative impacts to cultural resources are based on reasonably foreseeable operations of the Cortez Gold Mine operations, minerals development sponsored by other interests, and range improvement activities.

Possible minerals development activities include the following:

- Cortez Area
- Gold Acres Area
- Horse Canyon (east of Cortez)
- Other Exploration (Cortez Range, North Toiyabe Range, Shoshone Range)
- Small Mine (Shoshone Range)
- Large Mine (Shoshone Range)

The reasonably foreseeable scenarios for future minerals development identify general areas (e.g., West Pixie, Cortez Area). Specific configurations of the potential developments are not available. If this information were available, the Class III data available for these areas could be employed in assessing cumulative effects to cultural resources. Absent specifically defined areas, the Class II data characterized in Table 5.3-9 are used to assess the nature and distribution of cultural resources in these areas.

Total acreage figures for reasonable foreseeable disturbances at the Cortez, Gold Acres, Horse Canyon Areas, Other Exploration Areas and a "Small Mine/Large Mine Scenario" have been provided by BLM. Acreage figures encompass pit expansions, waste rock dumps, tailings disposal areas, heap leach facilities, roads, and acreage needed to accomplish reclamation. Table 5.3-12 summarizes the expected frequency/density of prehistoric and historic sites for these areas and the "Small Mine/Large Mine Scenarios." Because specific areas have not been delineated for this analysis, acreage by environmental zone (Piñon, Basin, Mountain) are estimates only based on location of presently operating facilities and known distribution of ore deposits.

The results of the analysis indicate the greatest loss to significant prehistoric cultural resources would occur in the Mountain domain. Losses to NRHP eligible prehistoric resources in Basin areas would be significantly less.

Statistical data suggest a negligible loss of significant historic properties as a result of future mining activity. However, the co-occurrence of an ore body within a location that was historically mined could result in impacts to historic sites in a number greater than that indicated by site density data.

Range improvements pose another set of potential impacts to cultural resources. BLM has identified future activities in two grazing allotments, Carico Lake and South Buckhorn (Figure 3.10-1), which are considered in the cumulative effects analysis. Because site-specific data are not available for the exact location of the proposed improvements for purposes of analysis, the following assumptions have been made regarding their placement based on environmental setting for each allotment.

Carico Lake Allotment

- 12 spring developments: 1 acre each - 9, Mountain; 3, Piñon
- 4 water wells: 1 acre each - 4, Basin
- 20 miles of water pipeline: 121 acres (6 acres/mile @ 50' ROW) - 30 acres, Piñon; 30 acres, Mountain; 61 acres, Basin
- 86 miles of fence: 521 acres (6 acres/mile @ 50' ROW) - 109 acres, Piñon; 206 acres, Mountain; 206 acres, Basin
- 8 cattleguards: N/A
- 4,250 acres of seeding: N/A (assumes aerial seeding)

South Buckhorn Allotment

- 10 spring developments: 1 acre each - 8, Mountain; 2, Piñon
- 8 water reservoirs: 1 acre each - 8, Mountain
- 4 water wells: 1 acre each - 4, Basin
- 15 miles of water pipeline: 91 acres (6 acres/mile @ 50' ROW) - 12 acres, Piñon; 18 acres, Mountain; 61 acres, Basin

- 61 miles of fence: 370 acres (6 acres/mile @ 50' ROW) - 36 acres, Piñon; 152 acres, Mountain; 182 acres, Basin
- 10 cattleguards: N/A
- 4 water storage tanks: 1 acre each - 4, Basin

Table 5.3-13 summarizes the expected site frequency of potentially affected sites based on the total new acreage disturbed by range improvement activities within the cumulative effects study area.

TABLE 5.2-1

HISTORICAL AND EXISTING DISTURBANCE IN THE CUMULATIVE STUDY AREA

Sites	Old Disturbance (acres)	New Disturbance (acres)	Total (acres)
Cortez District	92	50	142
Gold Acres	450	431	881
Lander	4	0	4
Utah Mine and Utah Camp	6	0	6
Tenabo	6	0	6
Gold Quartz	6	150	156
Mill Canyon	17	1	18
Buckhorn Mine	0	1,000	1,000
Horse Canyon	0	436	436
Cortez Mine	0	858	858
Mud Spring Gulch	21	0	21
Totals	**602**	**2,926**	**3,528**

TABLE 5.2-2

SUMMARY OF REASONABLY FORESEEABLE DISTURBANCES BY MINING (ACRES)

Area	Pit	Waste Rock Dump	Other	Roads	TOTAL* ACRES
Cortez					
West Pixie	68	47	--	30	145
Cortez	196	143	--	20	359
Mill Canyon Tailings	23	0	--	10	33
Exploration				2	2
Gold Acres					
No. London Extension	48	60	--	10	118
Golden Zones	40	60	--	10	110
Pipeline Deposit	200	950	400**	50	1,600
Horse Canyon					
No. & So. Pit Extensions	100	36	--	--	136
Red Hills	30	30	--	10	70
So. Silicified Zone	24	36	--	--	60
Other Exploration					
Cortez Range				10/yr.	90
North Toiyabe Range				40/92-93 5/yr.	80
Shoshone Range				50/yr.	450
Small Mine					200***
Large Mine					1,500***

* Total includes acreage affected to accomplish reclamation.
** Includes area affected by plant site, heap leach facilities, and tailing disposal facilities.
*** Acres disturbed at any one time assuming concurrent reclamation.

TABLE 5.2-3

SUMMARY OF REASONABLY FORESEEABLE DISTURBANCES BY RANGELAND MANAGEMENT (ACRES)

Range Improvements by Allotment	Seedings	Constructed Projects	TOTAL ACRES
Carico Lake	4,250	118	4,368
Argenta			
South Buckhorn		94	94
Pine Creek			
TOTALS	4,250	212	4,462

TABLE 5.2-4

EXISTING AND REASONABLE NUMBERS AND AUMs OF BIG GAME USE FOR THE SOUTH BUCKHORN AND PINE CREEK ALLOTMENTS

	Existing		Reasonable	
Species	Numbers	AUMs	Numbers	AUMs
SOUTH BUCKHORN				
Mule deer	400	865	953	2,058
Pronghorn antelope	25[1]		*	*
PINE CREEK				
Pronghorn antelope	*	*	*	*

[1] These 25 antelope were counted in Winter '91 on the north end of the Simpson Range, but are known to summer in the Buckhorn Mine area (personal communication, Larry Teske).

* No data are available

TABLE 5.2-5

SEASONAL BIG GAME HABITAT IN PORTIONS OF THE SOUTH BUCKHORN AND PINE CREEK ALLOTMENTS INCLUDED WITHIN THE CORTEZ CSA

Habitat Type	Acres
Crucial antelope summer	576
Antelope yearlong	1,577
Deer summer range	903
Deer winter range	895

TABLE 5.2-6

LOCATION AND CONDITION OF WILDLIFE HABITAT AS INDICATED BY RANGE CONDITION SURVEYS IN THE CORTEZ MOUNTAINS, BLM ELKO RESOURCE AREA

Transect	Habitat Type	Habitat Condition[1]	Limiting Factors[2]
DW-1-T-03	Deer Winter	Poor	SAC, SFC, FP, DM
DW-1-T-04	Deer Summer	Good	SAC, SFC
DW-1-T-05	Deer Winter	Fair	SFC, SAC
DW-1-T-07	Deer Winter	Fair	SAC, SFC, FD
DW-1-T-08	Deer Winter	Good	SAC

1 The habitat condition score and rating are based on a composite of several factors, including browse vigor, forage quality, cover, disturbance and interference, and water distribution.

2 SAC - Shrub Age Class
SFC - Shrub Form Class
FD - Forage Density
FP - Forage Production
DM - Disturbance from Mining

TABLE 5.2-7

RESULTS OF STREAM SURVEYS CONDUCTED ON STREAMS IN CORTEZ RANGE BY BLM IN 1991

	Percent Optimum[a]	Riparian Condition Class[a]	Percent Sedimentation[b]	W/D Ratio[c]
Horse Canyon Creek	32.0	25.0	20.0	31.3
Cottonwood Creek	41.4	32.8	55.9	21.0
Brock Creek	25.4	25.0	43.6	29.0
Cottonwood Canyon Creek	39.8	34.4	20.2	29.0

[a] Based on the following scale: 0-49% = Poor: 50-59% = Fair; 60-69% = Good; 70+% = Excellent.

[b] Streambottom sedimentation levels in excess of 5% are generally considered undesirable.

[c] W/D ratio = Width-to-Depth ratio. The following scale can be used to evaluate the W/D ratio: 26+ = Poor; 15-25 = Fair; 8-15 = Good; <7 = Excellent.

TABLE 5.3-1

EMISSION INVENTORY OF PERMITTED SOURCES WITHIN THE CRESCENT VALLEY AIR BASIN

Source Number	Company	Source Type	Controls	Location	Hours of Operation Per Year	Capacity[a]	TSP (lb/hr)	SO2 (lb/hr)	TSP (ton/yr)	SO2 (ton/yr)
1	Black Beauty Gold	Furnace	Wet Scrubber, 20%	S23 T30N R47E	208	0.08	1.19	0	0	0
2	Black Beauty Gold	Mercury Retort	Wet Scrubber, 20%	S23 T30N R47E	832	0.08	0.04	0	0	0
3	M-I Drilling Fluids	Primary Crusher and Single Deck Screen	Water Sprays	S06 T27N R46E	5420	125	0.62	0	1.7	0

Source: NDEP 1991

[a]Capacity = MMBTU/hr for boilers and other combustion sources
= Tons/hr for all others, except land disturbances
= Acres disturbed for land disturbance sources

TABLE 5.3-2

ESTIMATED FUGITIVE DUST EMISSIONS FROM SURFACE DISTURBANCE FOR THE REASONABLY FORSEEABLE FUTURE

Area	Acres Disturbed	Estimated Average Annual Emissions (tons)
Cortez		
West Pixie	145	10.4
Cortez	359	25.8
Mill Canyon Tailings	33	2.4
Exploration	2	0.1
Total	539	38.8
Gold Acres		
No. London Extension	118	8.5
Golden Zones	110	7.9
Pipeline Deposit	1600	115.2
Total	1828	131.6
Horse Canyon		
No. & So. Pit Extensions	136	9.8
Red Hills	70	5.0
So. Silicified Zone	60	4.3
Total	266	19.2
Other Exploration		
Cortez Range	90	6.5
North Toiyabe Range	80	5.8
Shoshone Range	450	32.4
Total	620	44.6
Small Mine	200	14.4
Large Mine	1500	108.0

Notes: 1) Emissions factor = 1.2 tons/acre/month of activity PM_{10} assumed to be 36 percent of TSP emissions.
2) Duration of reasonably forseeable future activities is assumed to be 6 years.
3) Emission estimates were calculated assuming no controls. These emissions would be controlled by approximately 50 percent with implementation of design measures.

TABLE 5.3-3

EXISTING AND FORESEEABLE FUTURE DISTURBANCE BY VEGETATION COMMUNITY TYPE

Community Type	Existing Disturbance	Proposed Action	Foreseeable Future	Total
Shadscale/greasewood	70	8	0	78
Shadscale/bud sagebrush	986	114	1,617	2,717
Sagebrush/grass	2,189	297	1,124	3,610
Pinyon/juniper/sagebrush	162	0	307	469
Mountain mahongany	121	0	205	326
Unknown	0	9	1,700	1,709
TOTALS	3,528	428	4,953	8,909

TABLE 5.3-4

PERCENTAGE OF DISTURBANCE BY COMMUNITY TYPE

Community Type	Acres in Study Area	Percent of Study Area	Acres of Disturbance	Percent of Community Type
Shadscale/greasewood	38,800	11	78	0.2
Shadscale/bud sagebrush	69,100	20	2,717	3.9
Sagebrush/grass	200,900	57	3,610	1.8
Pinyon-juniper/sagebrush	38,800	11	469	1.2
Mountain mahogany	2,500	1	326	13.0
TOTALS	350,100	100	7,093	

TABLE 5.3-5

HABITAT TYPES WITHIN THE CSA DIRECTLY AFFECTED BY EXISTING, PROPOSED, AND FORESEEABLE FUTURE DISTURBANCE

Habitat Type	Affected Acreage	Percent of Habitat Type Affected within CSA
Shadscale/Budsage	363	0.9
Shadscale/Black Greasewood	2,585	3.7
Sagebrush/Grass	1,356	0.7
Pinyon-Juniper/Sagebrush	198	0.5
Mountain Mahogany	632	25.3

TABLE 5.3-6

CUMULATIVE IMPACTS
TO LIVESTOCK GRAZING (ACRES AND AUMS)[1]

Category	Allotment	Area	Acres		AUMs	
			Public	Private	Public	Private
1. Existing Disturbance	Carico	Cortez	326	532	18	29
	Carico	Gold Acres	657	224	31	11
	South Buckhorn	Horse Canyon	436		44	
	CSA-wide	Other[a]	1,069		58	
Sub-total			2,488	756	151	40
2. Proposed Action	Carico	Cortez	128	15	5	2
	Carico	Gold Acres	199	77	17	2
Sub-total			327	92	22	4
3. Foreseeable Future	Carico	Cortez	506	28		
	South Buckhorn	Cortez	33	2		
	Carico	Gold Acres	1,828		86	
	South Buckhorn	Horse Canyon	266		27	
	CSA-wide	Other Exploration[a]	620		48	
	CSA-wide	Small Mine	200		11	
	CSA-wide	Large Mine	1500		82	
Sub-total			4,953	30	254	0
TOTAL			7,768	878	427	44

NOTE: Number of AUMs is estimated and is based on 1960 BLM Range Survey data for the Cortez Unit and South Buckhorn Grazing Allotment. Acreage arrived at by planimeter.

[a]Other than Cortez Gold Mine.

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TABLE 5.3-7

TOTAL ESTIMATED SITES AFFECTED BY CUMULATIVE IMPACTS WITHIN THE CULTURAL RESOURCES CUMULATIVE EFFECTS STUDY AREA

Site Types	Past	Present (Proposed Disturbance)	Future	Cumulative Total	Estimated Total Sites Expected in Cumulative Effects Study Area	Estimated Affected Sites as % of Estimated Total Sites	Sites Affected by Proposed Project as % of Estimated Total Sites
*Prehistoric - non NRHP eligible	17.6	3	33.9	54.5	825	7%	.004%
Prehistoric - NRHP eligible	14	0	26.4	40.4	500	8%	0%
*Historic - non NRHP eligible	3.5	2	10.3	15.8	388	4%	.005%
Historic - NRHP eligible	0.1	0	0.5	0.6	137	<1%	0%

* Excludes isolated finds.

TABLE 5.3-8

EXPECTED SITE FREQUENCY PER SQUARE MILE BY SAMPLING DOMAIN

Site Types	Pinyon	Basin	Mountain
Prehistoric:			
Isolated Finds	26.10	13.74	21.14
Simple Assemblage	3.81	2.37	2.44
Moderate Assemblage	2.95	0.36	1.44
Complex Assemblage	1.58	0.36	1.65
NRHP Eligible	3.9	0.8	5.1
Historic:			
Isolated Finds	24.27	12.21	15.62
All Other	4.07	1.31	0.79
NRHP Eligible	1.4	<0.1	<0.1

Source: Class II Sample Survey for the Cortez Cumulative Effects Study Area.

TABLE 5.3-9

PREDICTED NUMBER OF SITES BY SAMPLING DOMAIN WITHIN AREAS PREVIOUSLY DISTURBED BY MINING-RELATED ACTIVITIES

Site Type	Pinyon (88 acre/.14 sq. mi.)	Basin (587 acres/.9 sq. mi.)	Mountain (1611 acres/2.5 sq. mi.)
Isolated Finds	3.6	12.3	52.9
Simple Assemblage	0.5	2.1	6.1
Moderate Assemblage	0.4	0.3	3.6
Complex Assemblage	0.2	0.3	4.1
NRHP Eligible	0.5	0.7	12.8

Sources: Class II Cultural Resources Cumulative Effects Report
Personal Communication - Kelly McGuire, Far Western Anthropological Research Group, 1992

TABLE 5.3-10

SITE FREQUENCY (ACTUAL/EXPECTED) BY SAMPLING DOMAIN FOR PROPOSED EXPANSION AT CORTEZ AREA

Site Type	Pinyon ---	Basin (143 acres/.2 sq. mi.)	Mountain (6 acres/.01 sq. mi.)
Prehistoric:		Actual/Expected	Actual/Expected
Isolated Finds	---	2/3.1	0/0.2
Simple Assemblage	---	1/0.6	0/0
Moderate Assemblage	---	0/0.1	0/0
Complex Assemblage	---	0/0.1	0/0
NRHP Eligible	---	0/0.2	0/0.1
Historic:			
Isolated Finds	---	0/2.8	0/0.2
All Other	---	0/0.3	0/0
NRHP Eligible	---	0/0	0/0

TABLE 5.3-11

SITE FREQUENCY (ACTUAL/EXPECTED) BY SAMPLING DOMAIN FOR PROPOSED EXPANSION AT GOLD ACRES AREA

Site Type	Pinyon ---	Basin (96 acres/0.15 sq. mi.)	Mountain (183 acres/0.3 sq. mi.)
Prehistoric:		Actual/Expected	Actual/Expected
Isolated Finds	---	2/2.1	0/6.0
Simple Assemblage	---	0/0.4	0/0.7
Moderate Assemblage	---	0/0.1	0/0.4
Complex Assemblage	---	0/0.1	0/0.5
NRHP Eligible	---	0/0.1	0/1.5
Historic:			
Isolated Finds	---	0/1.8	0/4.5
All Other	---	1/0.2	1/0.2
NRHP Eligible	---	0/0	0/0

TABLE 5.3-12

EXPECTED SITE FREQUENCY BY SAMPLING DOMAIN FOR AREAS OF FORESEEABLE DISTURBANCE BY MINING

Area/Site Types	Pinyon (acres/sq. mi.)	Basin (acres/sq. mi.)	Mountain (acres/sq. mi.)
Cortez Area	---	(359/.6)	(180/.3)
*Prehistoric - non NRHP eligible		1.8	1.6
Prehistoric - NRHP eligible		.5	1.5
*Historic - non NRHP eligible		.8	.2
Historic - NRHP eligible		0	0
Gold Acres Area	---	(1255/1.9)	(523/.8)
*Prehistoric - non NRHP eligible		5.8	4.4
Prehistoric - NRHP eligible		1.5	4
*Historic - non NRHP eligible		2.5	.6
Historic - NRHP eligible		0	0
Horse Canyon Area	---	---	(266/.4)
*Prehistoric - non NRHP eligible			2.2
Prehistoric - NRHP eligible			2.0
*Historic - non NRHP eligible			.3
Historic - NRHP eligible			0
OTHER EXPLORATION AREAS			
(Cortez, N. Toiyabe, Shoshone Ranges)	(65/.1)	---	(545/.8)
*Prehistoric - non NRHP eligible	.8		4.4
Prehistoric - NRHP eligible	.4		4
*Historic - non NRHP eligible	.4		.6
Historic - NRHP eligible	.1		0
Small Mine Scenario	---	(50/.1)	(150/.2)
*Prehistoric - non NRHP eligible		.3	1.1
Prehistoric - NRHP eligible		.1	1
*Historic - non NRHP eligible		.1	.2
Historic - NRHP eligible		0	0
Large Mine Scenario	---	(375/.6)	(1125/1.8)
*Prehistoric - non NRHP eligible		1.8	10
Prehistoric - NRHP eligible		.5	9.2
*Historic - non NRHP eligible		.8	1.4
Historic - NRHP eligible		0	0

* Excludes isolated finds.

TABLE 5.3-13

EXPECTED SITE FREQUENCY BY SAMPLING DOMAIN FOR ACRES OF FORESEEABLE DISTURBANCE FROM RANGE IMPROVEMENTS

Site Type	Pinyon (192 acres/.3 sq. mi.)	Basin (514 acres/.8 sq. mi.)	Mountain (401 acres/.6 sq. mi.)
*Prehistoric - non NRHP eligible	2.5	2.5	3.3
Prehistoric - NRHP eligible	1.2	.6	3
*Historic - non NRHP eligible	1.2	1	.5
Historic - NRHP eligible	.4	0	0

*Excludes isolated finds.

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GLOSSARY

Acid Generating Potential - The amount of acid producing constituents in a given material. For rock material, the total sulfur concentration is determined, assumed to be reactive sulfide, and reported in terms of calcium carbonate equivalent per mass of material.

Ball Mill Circuit - Fine grinding of ore to a desired size is completed by circulating the material in a closed circuit consisting of grinding and size classification operations. Steel balls are used as the grinding medium and the grinding mill discharge is sorted such that properly sized material leaves the circuit while oversize material is returned for further grinding.

Carbon Adsorption Circuit - A vessel or system of vessels containing activated carbon. As the gold bearing solution passes through the system, the carbon adsorbs the dissolved gold; subsequently, the "loaded" carbon is removed from the circuit, stripped of gold, reactivated, and returned to the adsorption circuit.

Carbon-in-Leach - The process where activated carbon capable of adsorbing gold is introduced into the ore leaching circuit as opposed to passing the leach solution through a separate carbon adsorption circuit.

Carbonaceous/Oxide Ore - Two general ore types occur in mineral deposits mined in the Cortez project area: 1) Carbonaceous ore refers to mineralized material which requires a pre-treatment step (such as roasting) prior to successful recovery of gold values by conventional cyanide tank leaching methods; and, 2) Oxide ore refers to mineralized material which is mildly carbonaceous to oxidized in nature and for which effective recovery of gold values can be achieved by direct processing using conventional cyanide leaching methods.

CCD - Countercurrent Decantation. In metallurgical plants which use cyanide to extract gold from the ore, this processing step can be employed to separate an enriched gold solution from the rock pulp.

Chronology - A time frame for the sequential ordering of artifacts and/or sites.

Circulating Fluid Bed Roaster - A mineral processing equipment system which achieves a desired reaction by controlled circulation and heating of ore material in a suspended form. This process is used to pre-treat difficult ores which otherwise would not respond effectively to conventional cyanide tank leaching.

Class II - A professionally conducted statistical sample survey designed to characterize the probable density, diversity, and distribution of cultural resources in a designated area.

Class III - A professionally conducted continuous intensive survey of the entire area of potential effect.

Component - A culturally homogenous stratigraphic unit within an archaeological site.

Cyanidation - A mineral liberation process by which a cyanide compound is used to dissolve gold or silver values occurring in the ore.

Euroamerican - American of European descent or origin.

Fluxes - Substances which aid in controlling the melting or fusibility of a metal during refining or fire assaying.

Free Cyanide - This term refers to the analytical method used to determine the simple cyanide concentration. Free Cyanide is considered to represent available cyanide, e.g., that which has not combined with other substances to form simple or complex cyanide compounds.

Freeboard - For an impoundment, pond, or dam: the vertical distance between the maximum operating level and the embankment crest which is provided by design to account for wave action.

French Drain - A gravel filled trench used to collect and direct groundwater flow.

Heap Leach Ore - Lower grade ore of sufficient gold value to justify processing by heap leach methods: that is, ore is placed upon a constructed pad over which a cyanide solution is applied. Gold is leached from the ore as the cyanide solution percolates through the heap and is recovered as the solution is collected and processed.

Heap Leaching - The process whereby lower grade ore is placed on a constructed pad over which a low concentration of cyanide solution is applied. Gold is leached from the ore as the cyanide solution percolates through the heap and is recovered along the periphery of the heap in collection ditches for further processing (see Carbon Adsorption Circuit) to recover the gold.

Leach Solution - A cyanide solution applied to the heap leach ore as a means of extracting the gold values. The solution is a "barren" solution when applied to the heap and a "pregnant" solution when collected from the heap.

Lift - A single vertical interval in the placement of fill material.

Lithic Scatter - An archaeological site consisting of flashed stone tools and waste associated with tool maintenance and manufacture.

Mass Stability - The degree to which a rock or soil mass will remain permanently in-place. Slope angle, rock or soil characteristics, type of foundation materials, seismic risk, and surface and groundwater conditions are factors affecting mass stability.

National Register of Historic Places - This country's basic inventory of historic resources which is maintained by the Secretary of the Interior.

Neutralizing Potential - The amount of alkaline or basic constituents in a given material. The capacity of this material to neutralize acidity is determined and reported in terms of the equivalent mass of calcium carbonate per mass of material.

Oxidized Ore - Mineralized rock which is comprised predominantly of oxidized or weathered rock types and is of sufficient economic value to justify mining and recovery costs.

Patented Mining Claim - A parcel of mineral land for which the Federal Government has conveyed title to the private sector.

Projectile Point - A sharpened stone or other material attached to the end of a dart, spear, or arrow shaft.

Reagent - A substance used to chemically react with another substance to create or maintain a desired product or process condition.

Reduction Locality - A site or sites where quarried stone materials are flaked and formed into tools or pre-tools.

SAG Mill - Semiautogenous grinding mills accomplish ore size reduction by using large pieces of the "as-crushed" ore, along with a small charge of steel balls, as the grinding media.

Secondary Flake - A chipped stone that has no cortex (outer weathered surface from the stone the flake came from) or pressure flaking (flaking pattern that results from directly applying pressure to a stone to create a finely flaked edge).

Stamp Mill - An out-dated method of mineral processing which employed a mechanical stamping device to reduce the size of the ore followed by liberation and recovery of the precious metal values.

Tertiary Flake - Stone flakes that are detached by pressure flaking.

Time-marker - A class of similar artifacts that are associated with a particular period.

Unpatented Mining Claim - A parcel of mineral land for which the Federal Government maintains title.

Weak Acid Dissociable CN - This term refers to the analytical method used to determine the weakly bound complexes of the cyanide compound and is generally considered to include free cyanide and the less stable metallo-cyanide complex compounds. Iron and cobalt cyanide complexes are more stable and typically do not report as WAD Cyanide.

APPENDIX A
PALEONTOLOGICAL ASSESSMENT OF THE CORTEZ DISTRICT WITHIN PORTIONS OF THE BATTLE MOUNTAIN AND ELKO BUREAU OF LAND MANAGEMENT DISTRICTS, NEVADA

PALEONTOLOGICAL ASSESSMENT OF THE CORTEZ DISTRICT WITHIN PORTIONS OF THE BATTLE MOUNTAIN AND ELKO BUREAU OF LAND MANAGEMENT DISTRICTS, NEVADA

Prepared for JBR CONSULTANTS GROUP
By: James R. Firby, Consulting Paleontologist April 23, 1991

INTRODUCTION:

All known fossil localities within the proposed area are evaluated for potential of paleontological resource. No fossil vertebrate localities were confirmed to be within the affected or cumulative areas from literature search, Bureau of Land Management paleontological inventories, or queries to other paleontologists. All known fossil localities are included in this report, and located on an overlay of the 1:100,000 Crescent Valley surface management map, 1979 edition. The potential for the occurrence of vertebrate fossils is real, but considered to be low. Sensitivity of known invertebrate sites is based on their assigned ratings in the BLM inventory series (Firby et al, 1983 and 1984, non published documents prepared for BLM districts of Nevada). In this rating scheme, the most sensitive rating would be S-1 and the least sensitive S-3; the majority of all localities within the Cortez district is S-3. No fossil localities are known from the Black Beauty area.

This report is divided into a description and location of each fossil locality, its sensitivity, and known faunal assemblage. The bibliographical part is annotated as to the significance of the reference. Locality numbers given on the overlay follow the BLM inventory numbers, with the additional numeric code of the Smithsonian standard usage given for those localities within the Battle Mountain District. In this system, requested by the BLM during preparation of that report, all states, districts or counties are numbered; additionally the type of locality (vertebrate, invertebrate, or plant) is numbered corresponding to the numeric position of v, i, or p in the alphabet. This code is then followed by the site number. For example, Nevada is 26, the Battle Mountain District in Lander County is 63, invertebrate paleontological resources are 09, and the last four digits are the site number. Thus, site I-0103 on the overlay is 2663090103. The Battle Mountain BLM inventory is the only one prepared in this way, previous inventories have only district site numbers, for example the I-0103, above. Institution locality numbers is also given, when known.

REGISTER OF FOSSIL LOCALITIES FOR CUMULATIVE AREA

A. Elko District

1. I-84 NE 1/4 Of NW 1/4, section 9, T. 26 N., R. 48 E. This equals United States National Museum (USNM) locality D 92 - SD, Fourmile Canyon Formation, Silurian. Sensitivity level S-2. Fauna: graptolites. Apparently a large collection of graptolites from this locality is housed at USNM.

2. I-091 NW 1/4 Of SW 1/4, section 14, T. 27 N., R. 48 E. Devonian (?) Fourmile Canyon [formation not reported, Fourmile probably refers to location], invertebrate fauna: corals.

3. Not plotted locality south of boundary, in section 17 of T.

25 N., R. 49 E., there are several vertebrate [Devonian fish] localities in the Windmill limestone which have USNM numbers 155931 through 155938 which are rated S-2; included here as information item in regard to any possible occurrences within the cumulative area.

B. Battle Mountain District.

1. I-0101 (2663090101); equals United States Geological Survey (USGS) locality D-104, listed in Bridges' catalog of Cambrian and Ordovician localities, an unpublished document of the Survey and hereafter referred to as Bridges' Catalog in this report. Age: Ordovician, formation not noted. Major reference for this and other Ordovician graptolite localities is Ross and Berry, 1963 (see annotated bibliography). Locality is center section 31, T. 28 N., R. 47 E., UTM coordinates are 484,000 easting, 2,032,250 northing. rated as S-3. Fauna: graptolites.

2. I-0100 (26633090100); equals USGS D-103, Bridges' Catalog. Age: Ordovician, formation not noted. Locality lies in the NW 1/4 of the section 25, T. 29 N., R. 46 E., UTM coordinates are 474,300 easting, 2,008,750 northing. Rating S-3, fauna: graptolites.

3. I-0102 (2663090102); equals USGS locality D-93 (Altenburg Hill locality 1), Bridges' Catalog. Age: Ordovician, formation not noted. Locality is center section 17, T. 28 N., R. 47 E., southwest of Altenburg Hill at elevation 5,520'; UTM coordinates 489,000 easting, 2,019,080 northing. Rated S-3, fauna: graptolites.

4. I-0103 (2663090103); equals USGS 106 (Altenburg Hill 2), Bridges' Catalog. Age: Ordovician, formation not noted. Locality is in NE 1/4 section 17, T. 28 N., R. 47 E., at elevation 5,640'; UTM coordinates 489,200 easting, 2,016,800 northing. Rated S-3, fauna: graptolites.

5. I-0104 (2663090104); equals USGS D-111, Bridges' Catalog. Age: Ordovician, formation not noted. Locality is in NW corner section 34, T. 29 N., R. 46 E., no UTM data. Rated S-3, fauna: graptolites.

6. I-0105 (2663090105); equals USGS D-112, (Cook Creek Divide locality), Bridges' Catalog. Age: Ordovician, formation not noted. Locality is in NE 1/4 section 14, T. 28 N., R. 45 E., South Fork of Cooks Creek divide, east of Mill Creek summit, no UTM data. Rated S-3, fauna: graptolites.

7. I-0106 (2663090106); equals USGS D-113, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in NE 1/4 of the SW 1/4, section 36, T. 29 N., R. 46 E., at elevation 5,860 feet, 1,500 feet north of bench mark 5584 at junction of Feris and Indian creeks. No UTM. Rated S-3, fauna: graptolites.

8. I-0107 (2663090107); equals USGS locality D-114, Feris Creek Junction locality, Bridges' Catalog. Age: Ordovician, formation not noted. Locality is east of center of section 2, T.28 N., R. 46 E., south of Feris Creek junction with Indian Creek, no UTM data. Rated S-3, fauna: graptolites.

9. I-0110 (2663090110); equals USGS locality D-117, Bridges' Catalog. Locality is 600' east of SW corner section 23, T. 29

N., R. 46 E., no UTM data. Age: Ordovician, formation not noted. Rated S-3, fauna: graptolites.

10. I-0113 (2663090113); equals USGS D-122, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in the SE 1/4 of the NW 1/4, section 9, T. 29 N., R. 45 E., at elevation 7,600' on north side of Crippen Canyon, UTM coordinates 429,250 easting, 2,057,100 northing. Rated S-3, fauna: graptolites.

11. I-0115 (2663090115); equals USGS locality D-125, Bridges' Catalog. Age: Ordovician, no formation noted. Locality lies on spur just west of center of border between sections 28 and 27, T. 29 N., R. 46 E., at elevation 6,200', no UTM data. Rated S-3, fauna: graptolites.

12. I-0116 (2663090116); equals USGS locality D-127, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in the NE 1/4 of the NW 1/4, section 31, T. 28 N., R. 46 E., 800 feet south, 3,600 feet west of northeast corner of section 31; no UTM data. Rated S-3, fauna: graptolites.

13. I-0117 (2663090117); equals USGS locality D-128, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in the NW 1/4 of section 12, T. 28 N., R. 45 E., at elevation 8,200', north of head of south fork of Mill Creek; no UTM data. Rated S-3, fauna: graptolites.

14. I-0118 (2663090118); equals USGS locality D-118, Bridges' Catalog. Age: Ordovician, no formation noted. Locality data is not precise; about center of western 1/2 of section 23, T. 28 N., R. 46 E., at elevation 6080' on spur SW of bench mark 5740, SE of

Utah Mine Camp; no UTM data. Rated S-3, fauna: graptolites.

15. I-0119 (2663090119); equals USGS locality D-123, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in SE 1/4 of section 22, T. 28 N., R. 46 E., at elevation 6,160' on NE spur of hill 6821, 3,500' WSW of BM 5740, SE of Utah Mine. No UTM data. Rated S-3, fauna: graptolites.

16. I-0120 (2663090120); equals USGS locality D-121, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in SE 1/4 of section 15, T. 28 N., R. 46 E., at elevation 6,480', +/- 1 1/2 miles E of Utah Mine Camp, on SE spur of hill 6838 (= hill 2084 of Crescent Valley 1:100,000 map used in this report [6838 ref. Mt. Lewis 1:62,500 1949 quad.]). No UTM data. Rated S-3, fauna: graptolites.

17. I-0122 (2663090122); equals USGS locality C-130, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in NE 1/4 of section 10, T. 28 N., R. 45 E., at elevation 7,320'; no UTM data. Rated S-3, fauna: graptolites.

18. I-0123 (2663090123); equals USGS locality D-131, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in NW 1/4 of section 6, T. 28 N., R. 46 E., at elevation 8,260', on ridge. No UTM data. Rated S-3, fauna: graptolites.

19. I-0125 (2663090125); equals USGS locality D-102, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in center (?) section 25, T. 28 N., R. 46 E., no UTM data. Rated S-3, fauna: graptolites.

20. I-0127 (2663090126); equals USGS locality D-96, Bridges

Catalog. Age: Ordovician, no formation noted. Locality is in NW 1/4 of section 6, T. 28 N., R. 47 E., at elevation 5,600'; UTM coordinates 481,650 easting, 2,029,250 northing. Rated S-3, fauna: graptolites.

21. I-0128 (2663090128); equals USGS locality D-97, Bridges' Catalog. Age: Ordovician, no formation given. Locality is in the SE 1/4 of the SE 1/4 of section 6, T. 28 N., R. 47 E., at elevation 6,080' on round-topped hill. UTM coordinates 488,200 easting, 2,029,650 northing. Rated S-3, fauna: graptolites.

22. I-0129 (2663090129); equals USGS locality D-98, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in W 1/2 of section 25, T. 28 N., R. 48 E., at elevation 6,000', on spur NE of mouth of Mule Canyon, Cortez Range. UTM coordinates 543,500 easting, 2,008,450 northing. Rated S-3, fauna: graptolites.

23. I-0130 (2663090130); equals USGS locality D-107, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is in NW 1/4 of section 19, T. 28 N., R. 47 E., at elevation 5,740', west side of quartzite ridge due north of Gold Acres. UTM coordinates 481,300 easting, 2,018,750 northing. Rated S-3, fauna: graptolites.

24. I-0131 (2663090131); equals USGS locality D-110, Bridges' Catalog. Age: Ordovician, no formation noted. Locality is west of center of section 21, T. 29 N., R. 46 E., at elevation 6,500', no UTM data. Rated S-3, fauna: graptolites.

MISCELLANEOUS LOCALITIES ADJACENT TO CUMULATIVE AREA: Not plotted

25. I-0140 (2663090140); equals USNM [U.S. National Museum] locality 17212, and equivalent localities of University California, Riverside, 4553; also USNM locality 10807. Most of these localities differ in stratigraphic position and only slightly in geographic position. Age: Devonian (Givetian); Denay Formation. Although this locality lies south of the cumulative area boundary and within the Elko District of the BLM, it is included here due to its importance in invertebrate brachiopod research of the Great Basin. Additionally, it lies just north of the Devonian Red Hill localities, noted for fossil fish (placoderms). Locality is in section 8, T. 25 N., R. 50 E., and is not plotted on overlay of this report.

26. USGS vertebrate locality SF-248, equals BLM Paleontological Inventory number (Elko District) V-19. Age: Cretaceous, Newark Canyon Formation; north east of cumulative area boundary in section 14, T. 30 N., R. 51 E. Mentioned (but not plotted) in this report because of its <u>very</u> high sensitivity, being one of the very few dinosaur localities in Nevada.

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<u>Notes</u>: Stratigraphy and biostratigraphic correlations; primarily sedimentological.

CHRISTIANSEN, D. J. 1980. Petrology and biostratigraphy of Middle, Lower Devonian strata, southern Cortez Mountains, Nevada. M.S. thesis, University of California.

Notes: Sedimentation, physical and biostratigraphic correlations based primarily on conodonts. Includes the McColley Canyon Formation (all members) and correlative units within the Cortez Mountains, and Wenban Peak. Discussion of anoxic marine environments.

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Notes: Bears directly on several of the graptolite localities mentioned in the present report [Ordovician].

CLARK, D. L. and R. L. ETHINGTON 1966. Conodonts and biostratigraphy of the Lower and Middle Devonian of Nevada and Utah. Journal of Paleontology, 40:(3)659-689.

Notes: Biostratigraphy applies to cumulative area.

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Notes: Biostratigraphy applies to cumulative area.

DUEKER, G. T. 1985. Devonian rocks of the Roberts Mountains allocthon in the Roberts Mountains, central Nevada. M.S. thesis, University of California.

Notes: Discusses biozones based on conodonts in units which correlate with units in the cumulative area.

EVANS, J. G. 1980. Geology of the Rodeo Creek NE and Welches Canyon quadrangles, Eureka County, Nevada. United States Geological Survey Bulletin 1473.

Notes: Main area of this report lies north and east of the project area, however the type of lithology (western assemblage siliceous limestones and shales) is intermittently exposed in the cumulative area. Fauna reported is composed exclusively of graptolites, contemporaneous those from several localities within the cumulative area.

JOHNSON, D. B. 1972. Devonian stratigraphy of the southern Cortez Mountains, Nevada. M. S. thesis, University of Iowa.

Notes: Describes fauna (primarily brachiopods) and biostratigraphy in parts of the Cortez Mountains lying within Eureka County. Discusses depositional environments and paleoecology of brachiopods.

JOHNSON, J. G. 1966. Middle Devonian brachiopods from Roberts Mountains, central Nevada. Paleontology, 9(1):152-181.

Notes: Includes several taxa found within cumulative area boundaries, primarily brachiopods.

JOHNSON, J. G. 1971. Lower Givetian brachiopods from central Nevada. Journal Paleontology 45:301-326.

Notes: Key biostratigraphic paper for Devonian brachiopods. Specific to locality I-0104 (not plotted as outside cumulative area; see miscellaneous localities, above).

LANGENHEIM, R. L. Jr. and E. R. LARSON 1973. Correlation of Great Basin stratigraphic units. Nevada Bureau of Mines and Geology Bulletin 72:1-36, 3 correlation charts.

Notes: Although several units have been redefined since publication of this work, the basic correlations stand. Fossil content is recorded for applicable strata, and extensive bibliography (up to 1972) presented in this work make it a good biostratigraphic reference for all of Nevada.

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Notes: Basic biostratigraphic and taxonomic reference for Devonian strata of Roberts Mountains, Simpson Park Range, parts of Antelope Valley, and equivalent units within the cumulative area including Fourmile Canyon Formation and the Woodruff Formation.

MULLENS, T. E. 1980. Stratigraphy, petrology, and some fossil data of the Roberts Mountain Formation, north - central Nevada. United States Geological Survey Professional Paper 1063.

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ROSS, R. J. and W. B. N. BERRY 1963. Ordovician graptolites of the Basin Ranges in California, Nevada, Utah, and Idaho. Unites States Geological Survey Bulletin 1134.

Notes: Primary reference for Ordovician localities within the boundaries of the cumulative area; virtually all Ordovician localities noted within the present report are identified in this reference.

SLATTEN, M. H. 1978. The Windmill Limestone at Wenban Peak, southern Cortez Mountains, Nevada. M. S. thesis, University of California.

Notes: The Windmill Limestone or its correlatives are found within the cumulative boundary area. This paper discusses and describes taxa of Ostracoda and their stratigraphic position.

SMITH, J. F. and K. B. KETNER 1975. Stratigraphy of Paleozoic rocks in the Carlin - Pinon Range area, Nevada. United States Geological Survey Professional Paper 867 - A.

Notes: Conodonts collected by USGS personnel from the Late Devonian Woodruff Formation, which has equivalent units south and east of the cumulative area, are listed and their zonation noted. Conodont fauna reported in this paper is essentially similar to conodonts reported from the Roberts Mountain, McColley Canyon, and Denay Formations, which either extend or have correlative units which extend into the cumulative area.

STEWART, J. H., C. H. STEVENS and A. E. FRITSCHE 1977. Paleozoic paleogeography of the western United States;

Pacific Coast paleogeography symposium. Pacific Section Society Economic Paleontologists and Mineralogists. 157-164.

Notes: Contains sections, stratigraphic correlations of units within cumulative area; mostly Ordovician graptolite correlations. Includes the Cortez Mountains and many of the graptolite localities (or at least their lithostratigraphic units) within the cumulative area.

SUYDAM, J. D. 1988. Sedimentology, provenance, and paleotectonic significance of the Cretaceous Newark Canyon Formation, Cortez Mountain, Nevada. M. S. thesis, Montana State University, 1-90.

Notes: Primarily physical stratigraphy and sedimentology, petrography of the Newark Canyon Formations. However, it is noted that the unit in question does, outside of the cumulative area boundary (see miscellaneous localities, above) contain fossil vertebrates.

AFFECTED AREAS

All affected areas within the cumulative area are listed below. None are recognized as having any known fossil localities, either vertebrate or invertebrate, recorded within them based on a survey of the literature, examination of BLM paleontological inventories, or my personal knowledge and that of other paleontologists who are familiar with the area.

BLACK BEAUTY

Sections 14, 15, 22, 23, and 26 of T. 30 N., R. 47 E.. No known localities.

GOLD ACRES

Section 36, T 28 N., R. 46 E.; section 1, T. 27 N., R. 46 E.; section 31, T. 28 N., R. 47 E.; sections 18 and 19, T. 27 N., R. 48 E. No known localities.

HORSE CANYON

Sections 3 and 10, T. 26 N., R. 48 E. No localities known from this affected area, but invertebrate locality I-84 of this report lies within the adjacent section 9.

The Argid soils are Aridisols, soils that formed under an aridic moisture regime. The Argids have either an argillic (clay) layer or a natric (sodium-affected) horizon. Argid soils within the project areas include Typic Haplargids, Xerollic Haplargids, Lithic Xerollic Haplargids, Duric Haplargids, Haplic Durargids, and Haplic Nadurargids.

Typic Haplargids are Haplargid soils, soils with minimal horizon development, that have median Haplargid characteristics. They are not identifiable by the combinations of characteristics that define other Haplargid soils, some of which are discussed herein.

Xerollic Haplargids are characterized by 1) the percentage of organic carbon in the soil which ranges from 0.6 percent to approximately 0.14 percent depending on the ratio of sand and clay in the soil; 2) an average annual soil temperature of 22°C, with a seasonal (summer to winter) of at least 5°C at a depth of 50 cm; and 3) an arid climate bordering on xeric. A xeric climate has moist, cool winters and warm, dry summers.

Lithic Xerollic Haplargids include all of the characteristics of Xerollic Haplargids, and in addition have the presence of a boundary between the soil and the underlying material (a lithic contact) within 50 cm of the surface.

Duric Haplargids include a soil layer (horizon) that is more than 15 cm thick, which either includes at least 20 percent durinodes (weakly cemented to indurated nodules) in a non-brittle matrix, or is brittle when dry and firm when moist.

Durargids are Argids without a sodium-affected component, and that include a duripan (or hardpan) below the clay layer and within 100 cm of the surface. In Haplic Durargids, the duripan is not platy or massive, and is not indurated (very hard).

Nadurargids are Argids with a duripan component underlying a sodium-affected horizon (layer). Haplic Nadurargids are similar to Haplic Durargids, in that the duripan is not platy or massive, and is not indurated.

Mollisols within the Cortez project area include Xerolls and Borolls. No Mollisols are mapped within the Gold Acres project area. Mollisols are characterized by the presence of a mollic epipedon. An epipedon is a horizon that is formed at the surface, but may be buried after its formation. Mollic epipedons consist of mineral, not organic, soil material with a dark color and a strong structure (i.e., does not lose its structure when dry). This epipedon is moist more than three months of the year in non-irrigated soils.

Xerolls are Mollisols with either a xeric moisture regime, or aridic bordering on xeric, but do not have a cryic temperature. Calcixerolls are Xerolls with either a calcic or gypsic horizon. Calcic horizons consist of an accumulation of calcium carbonate or calcium and magnesium carbonate. Gypsic horizons contain gypsum and secondary sulfates. Typic Calcixerolls have median Calcixeroll characteristics, and do not have the combinations of characterists of other Calcixerolls.

Argixerolls are Xerolls with an argillic horizon. Typic Argixerolls have median Argixeroll characteristics, without the combinations of characteristics found in other Argixerolls.

Borolls are Mollisols with a mean average temperature lower than 47°F. The soil temperature of Cryoborolls varies by less than 5°C between summer and winter at a depth of 50 cm. Calcic Cryoborolls have a calcic horizon within or immediately below the mollic epipedon.

Typic Torriorthents are soils with an aridic (or torric) moisture regime.

Typic Xerorthents have a xeric moisture regime. Lithic Xerorthents have a xeric moisture regime and a lithic contact within 50 cm of the surface.

Gold Acres Area

Order III Map Units

Soil map unit 3840 consists of the Jung-Norfork-Buffaran association. Jung soil encompasses 35 percent of the unit, Norfork encompasses 25 percent, and Buffaran encompasses 25 percent. The remaining 15 percent of the unit consists of inclusions, small areas of differing soil types that are generally easily identifiable in the field, but are too small to be mapped at the scale of the soil survey.

The Jung soil is shallow (19 inches to unweathered bedrock). The surface texture to a depth of 8 inches is very gravelly loam. Texture from 8 to 19 inches is very cobbly clay, very gravelly clay loam, and very cobbly clay loam. It is derived from volcanic rock. The pH of this soil ranges from mildly to moderately alkaline (pH 7.4 to 8.2). Suitability of this soil for use as topsoil is poor due to shallowness, the presence of small stones, and the clay content of the soil.

The Norfork soil is 17 inches deep to an indurated duripan, and 22 inches to unweathered bedrock. The pH of the soil ranges from neutral to moderately alkaline (pH 7.2 to 8.2). The suitability of this soil for use as topsoil is poor due to the shallow depth to the cemented pan, the clay content below the surface layer, and the presence of small stones. This soil is derived from volcanic rocks.

The Buffaran soil has a surface texture of gravelly loam to a depth of 4 inches; textures below this depth include gravelly clay loam, gravelly clay, and clay. An indurated hardpan is encountered at 15 inches. The pH of the Buffaran soil is neutral to mildly alkaline (pH 7.2 to 7.6). This soil has been rated as poor for suitability for topsoil due to shallow depth to a cemented pan, and the presence of small stones. This soil is derived from mixed alluvium.

Soils within map unit 3843 include Jung (55 percent) and Robson (30 percent) soil series. Inclusions make up the remaining 15 percent of this soil association.

Two Jung soils are mapped to this unit: Jung, steep and Jung. Both have a very gravelly loam surface texture to a depth of 8 inches. Texture of these soils below 8 inches is very cobbly clay, very gravelly clay loam, and very cobbly clay loam to a depth of 19 inches. The pH of the Jung soils ranges from mildly to moderately alkaline (pH 7.4 to 8.2). This soil is rated as poor for suitability for topsoil due to depth to rock (19 inches), presence of small stones, and excessive clay. The Jung soils are derived from volcanic rock.

The Robson soil has a surface texture of cobbly loam to a depth of 7 inches. Texture from 7 to 19 inches is very cobbly clay and extremely cobbly clay. The pH of this soil ranges from neutral to mildly alkaline (pH 7.0 to 7.4). Suitability of this soil for use as topsoil is poor due to the depth to bedrock (19 inches), presence of large stones, and the steep slope (30 to 50 percent).

Order II Map Units

Soils within map unit 1 are Xerollic Haplargids. Map unit 1a is found in the Gold Acres area south and north of the existing mining activity. The surface texture to a depth of three inches is gravelly clay loam; texture below three inches is clay. To a depth of six inches, the pH of the soil is mildly alkaline (7.4 to 7.6); below six inches, the pH is moderately alkaline (pH 8.0 to 8.4). Suitability for topsoil is considered to be poor because of the clay texture. This soil is derived from sedimentary rock.

Soils within map unit 2 are Lithic Xerollic Haplargids. Map unit 2a is primarily found east of the existing mining activity; however, small areas of this unit are found south of the present mine. This unit is a soil association consisting of similar soils with 65 percent and 35 percent components. The major component has a surface texture of very gravelly loam to a depth of three inches. Soil texture from three to seven inches is clay loam, and from seven to fourteen inches is silt loam. The pH of the soil is strongly alkaline throughout (pH 8.6 to 9.2). This soil is derived from limestone.

The smaller portion of map unit 2a (35 percent) also has a surface texture of very gravelly loam to a three inch depth. Texture from three to six inches is clay loam, and from six to ten inches is light clay loam. The pH to a depth of three inches is moderately alkaline (pH 8.4); below this depth, the soil is strongly alkaline (pH 8.6 to 8.8). Suitability for use as topsoil is limited due to the shallow depth to bedrock. The parent material of this soil is tuffaceous.

Small areas of map unit 2b are found northwest and east of the existing mine. The surface texture of this soil to a depth of three inches consists of very gravelly silt loam. Texture from three to nine inches is silty clay loam. The pH of the A horizon is very strongly alkaline (pH 9.4). Limestone bedrock is encountered at depths between 9 to 20 inches, resulting in limited use as topsoil.

Map unit 2c is found west of the existing Gold Acres mine. The first two inches of this soil consists of gravelly clay loam; soil below this depth consists of clay. The pH throughout the soil is mildly alkaline (pH 7.4). Suitability of this soil for topsoil is poor due to the shallow depth to bedrock and the clay texture. This soil is derived from limestone.

Map unit 3 soils are Duric Haplargids. Map unit 3a, southeast of the Gold Acres mine, consists of very deep, strongly to very strongly alkaline loams. Texture in the first three inches is very gravelly loam. Gravel content throughout this soil ranges from 15 to 60 percent. Topsoil suitability of this soil is fair, due to the clay loam texture and presence of carbonates. This soil is derived from limestone.

The soil in map unit 3b, south of the Gold Acres mine, is very deep and strongly alkaline (pH 8.6 to 9.0). At depth (from 32 to 54 inches), the pH is very strongly alkaline (pH 9.4). The first seven inches of this soil is loam; from seven to 22 inches, the texture is clay; and from 22 inches to 54 inches, the texture is loam. This soil is derived from limestone. The very strongly alkaline conditions make this a poor topsoil.

Map unit 5a, a Haplic Durargid soil, surrounds the Gold Acres leach pad on the north, west and east. The top three inches have a sandy loam texture. From three to 14 inches, the texture is silty clay loam, and from 14 to 20 inches, the texture is very gravelly silt loam. A cemented duripan is encountered at a depth of 20 inch to 43 inches; below this depth is an indurated duripan. This soil is strongly alkaline (pH 8.8) to a depth of 14 inches; below this depth, the soil is very strongly alkaline (pH 9.2). Suitability of this soil for use as topsoil is poor due to the very strong alkaline nature of the subsoil materials. This soil is derived from limestone.

Soil unit 6a, a Haplic Nadurargid, is mapped north and east of unit 5a in the Gold Acres area. Unit 6a consists of a soil association with two similar components. The major soil component in this unit comprises 80 percent of the unit. The surface texture of this soil to a depth of six inches is a silt loam; the first three inches is a gravelly silt loam and the lower three inches is a heavy silt loam. Below this to a depth of 19 inches, the texture is clay. A strongly cemented duripan is encountered at a depth of 19 to 26 inches. From 26 to 32 inches, an indurated duripan is found. Suitability for use as topsoil for this soil is poor due to the clay texture and shallow depth to the duripan. This soil is derived from limestone.

The remaining 20 percent of this unit has a surface texture to a depth of 4 inches of a gravelly fine sandy loam. Below this, to a depth of 9 inches, the texture is sandy loam, and from 9 to 20 inches the texture of the soil is clay. The soil is very strongly alkaline throughout (pH 9.4 to 20 inches depth, pH 9.6 from 20 to 60 inches depth). A strongly cemented duripan is present below 36 inches. Suitability of this soil for use as topsoil is poor due to the very strong alkaline nature throughout the soil. This soil is derived from limestone.

Cortez Area

Order II Map Units

Soils within map unit 1 are Xerollic Haplargids. Map unit 1b soils are loams, with textures including loam, gravelly clay loam, very gravelly clay loam, and very gravelly sandy loam. The pH of this soil ranges from strongly to very strongly alkaline (pH 8.8 to 9.4). Suitability for topsoil is poor due to the high pH. This soil is derived from tuffaceous volcanic rock.

Soils within map unit 4 are Typic Haplargids. Surface texture of the soil is silt loam to ten inches and silty clay loam from 10 to 25 inches. The pH of this soil is strongly to very strongly alkaline (pH 9.0 to 9.6). This soil has a poor topsoil suitability rating, due to the lime content. This soil is derived from limestone.

Map unit 4b soil texture is sandy loam to five inches, sandy clay loam from 5 to 11 inches, and silt loam from 11 to 27 inches. The pH of this soil ranges from strongly to very strongly alkaline (pH 8.8 to 9.6). This soil has a fair to poor topsoil suitability rating, due to excess lime. This soil is derived from limestone.

Soils in map unit 7 are Typic Calcixerolls. Surface texture of the soil in map unit 7a is loam to 17 inches. From 17 to 60 inches, the texture is silt loam. The pH of this soil ranges from moderately alkaline to strongly alkaline (pH 8.2 to 8.8). This soil is rated as fair for topsoil suitability. This soil is derived from mixed alluvium.

Soils in map unit 8 are Typic Argixerolls. The surface texture of the soil in map unit 8a is sandy loam to three inches and sandy clay loam from three to eight inches. Soil texture from 8 to 13 inches is very gravelly sandy clay loam, and soil texture below this to a depth of 60 inches is very gravelly loamy sand. The pH of this soil ranges from mildly to strongly alkaline (pH 7.6 to 8.6). Suitability of this soil for use as topsoil is poor, due to high gravel content. This soil is derived from granitic parent material.

Soils in map unit 11 are Calcic Cryoborolls. Map unit 11a is a soil association with 60 percent and 40 percent components. Surface texture of the 60 percent component is gravelly silt loam to 4 inches, very gravelly silt loam from 4 to 10 inches, and extremely gravelly loam from 10 to 20 inches. A weakly cemented gravel bed is present from 20 to 68 inches. The pH of the soil ranges from neutral to mildly alkaline (pH 7.0 to 7.4). The suitability of this soil for topsoil is rated as fair to 20 inches, and poor below that depth. The fair rating is based on percent gravel, and the poor rating is based on the cemented gravel bed below 20 inches. This soil is derived from limestone.

The 40 percent component of map unit 11a has a surface texture of very gravelly silt loam to a depth of 12 inches. Texture from 12 to 20 inches is extremely gravelly silt loam. Below this depth a petrocalcic horizon occurs to a depth of 50 inches. This consists of an indurated gravel pan cemented with calcium carbonate. The pH of this soil ranges from neutral to moderately alkaline (pH 6.8 to 8.4). Suitability of this soil for use as topsoil is rated as fair to 12 inches, and poor below 12 inches. Gravel content of the soil below 12 inches resulted in the poor rating. This soil is derived from limestone.

Soils in map unit 14 are Typic Torriorthents. Surface texture of the soil in map unit 14a is sandy loam to a depth of two inches, and very gravelly sandy loam from two to six inches. The texture of the soil below this to a depth of 39 inches is extremely gravelly sandy loam. The pH of the soil is very strongly alkaline throughout (pH 9.4 to 9.6). This soil is rated as poor for use as topsoil, due to the high percentage of gravel and high pH. This soil is derived from limestone.

Surface texture of the soil in map unit 14b is silt loam to a depth of three inches, and silty clay loam from 3 to 7 inches. Soil texture from 7 to 33 inches is silt loam, from 33 to 41 inches is silt, and from 41 to 60 inches is silt loam. The pH of the soil ranges from strongly to very strongly alkaline (pH 9.0 to 9.6). This soil is rated as fair to poor for use as topsoil; the high pH is a limiting factor. This soil is derived from mixed allluvium.

Surface texture of the soil in map unit 14c is gravelly silt loam to a depth of 9 inches. Soil texture below this depth is gravelly silt loam from 9 to 22 inches, extremely gravelly fine sandy loam from 22 to 30 inches, very gravelly sandy loam from 30 to 36 inches, extremely gravelly silt loam from 36 to 47 inches, and very gravelly loamy sand from 47 to 60 inches. The pH of the soil ranges from strongly to very strongly alkaline (pH 9.0 to 9.6). The soil is rated as poor for use as topsoil due to excess lime (high pH). The soil is derived from limestone.

Soils in map unit 15 are Typic Xerorthents. The surface texture of the soil in map unit 15a is gravelly loam to a depth of 3 inches, and gravelly clay loam to a depth of 8 inches. Soil texture from 8 to 34 inches is extremely gravelly sandy loam, and from 34 to 60 inches is very gravelly loamy sand. The pH of the soil ranges from strongly to very strongly alkaline (pH 9.0 to 9.4). This soil is given a poor topsoil suitability rating because of the gravelly texture and high pH. This soil is derived from mixed alluvium.

Soils in map unit 16 are Lithic Xerorthents. The soil in map unit 16a has a very gravelly loamy texture throughout, and is very strongly alkaline (pH 9.2 to 9.4). This soil is rated as poor for use as topsoil, due to its high gravel content and high pH. This soil is derived from limestone.

The surface texture of the soil in map unit 16b is gravelly loam to a depth of two inches. Texture from two to nine inches is very gravelly loam. The pH of the soil is very strongly alkaline throughout (pH 9.4); because of this high pH, the soil receives a poor topsoil suitability rating. This soil is derived from limestone.

Table B-1 Soil Survey of North Lander County Area, Nevada

(Page 1 of 7)

Association or Series	Parent Material	Dominant Texture	Permeability	Erosion Hazard	
				Water	Wind
1 - Soils on Playas					
Playas	lacustrine sediment		very slow		
2 - Soils on Alluvial Flats					
Batan silt loam	alluvium	silt loam	mod. slow	slight	slight
Batan-Wendane-Valmy association	alluvium	silt loam	mod. slow to mod. rapid	slight	moderate
Batan-Ocala-Ocala, rarely flooded association	alluvium	silty clay loam	slow to mod. slow	slight	slight
Wendane silt loam, freq. flooded	alluvium	silt loam	mod. slow	slight	slight
Kelk-Ocala association	alluvium	very fine sandy loam	slow to moderate	slight	slight
3 - Soils on the Basin Floor					
Tulase-Bubus-McConnel association	alluvium	silt loam	moderate to very rapid	slight	slight
4 - Soils on Beach Plains					
McConnel-Tulase association	alluvium	loam	moderate to very rapid	slight	slight
5 - Soils on the Fan Piedmonts					
Beoska-Tenabo silt loams, sloping	alluvium	silt loam	mod. slow to mod. rapid	moderate	slight
Berning-Alley association	alluvium	extremely cobbly loam	slow to mod. slow	moderate	slight

Table B-1 Soil Survey of North Lander County Area, Nevada

(Page 2 of 7)

Association or Series	Parent Material	Dominant Texture	Permeability	Erosion Hazard	
				Water	Wind
Golconda-Dun Glen association	alluvium	gravelly very fine sandy loam	slow to moderate	slight	slight
Orovada-Wieland-Chiara association	alluvium	fine sandy loam	slow to moderate	slight	slight
Tenabo-Ricert association	alluvium	silt loam	mod. slow to mod. rapid	slight	slight
Whirlo gravelly loam, 2-8% slopes	alluvium	gravelly loam	mod. rapid	slight	slight
Redflame-Kingingham association	alluvium	very gravelly loam	slow to mod. rapid	slight	slight
Wieland-Allor association	alluvium	loam	slow to mod. slow	moderate	slight
Wieland-Oxcorel-Allor association	alluvium	loam	very slow to mod. rapid	moderate	slight
Wieland-Grassval-Puett association	alluvium & residuum	gravelly loam	slow to mod. rapid	moderate	slight
Oxcorel-Beoska-Whirlo association	alluvium	very fine sandy loam	very slow to mod. rapid	slight	slight
Oxcorel-Orovada association	alluvium	gravelly loam	very slow to mod. rapid	slight	slight
Oxcorel-Oxcorel, mod. steep-Pineval association	alluvium	gravelly loam	very slow to mod. rapid	moderate	slight
Oxcorel-Rednik-Veta association	alluvium	gravelly silt loam	very slow to mod. rapid	moderate	slight
Allor-Wieland association	alluvium	gravelly loam	slow to mod. slow	moderate	slight

Table B-1 Soil Survey of North Lander County Area, Nevada

(Page 3 of 7)

Association or Series	Parent Material	Dominant Texture	Permeability	Erosion Hazard	
				Water	Wind
Genaw-Wieland-Grina association	residuum & alluvium	gravelly loam	slow to moderate	moderate	slight
6 - Soils on Foothills					
Humdun-Havingdon-Bucan association	residuum & colluvium	silt loam	slow to moderate	severe	slight
Trunk-Dewar-Stingdorn association	residuum, colluvium & alluvium	very cobbly loam	very slow to mod. slow	severe	moderate
Boulflat-Havingdon-Dewar association	residuum, colluvium & alluvium	gravelly loam	slow to mod. slow	severe	slight
Bojo-Stingdorn association	residuum	fine sandy loam	mod. slow	slight	slight
Atlow-Colbar-Rock outcrop association	residuum & colluvium	very gravelly loam	mod. slow	moderate	slight
Stingdorn very cobbly loam, 4-30% slopes	residuum	very cobbly loam	mod. slow	slight	slight
Perwick-Puett-Tulase association	residuum & alluvium	very gravelly loam	moderate to mod. rapid	severe	moderate
Laped-Stingdorn-Colbar association	residuum & colluvium	cobbly loam	mod. slow	moderate	slight
Robson-Old Camp-Rock outcrop association	residuum	extremely cobbly loam	slow to mod. slow	moderate	slight
Zoesta-Wieland-Akerue association	alluvium & residuum	gravelly loam	very slow to slow	moderate	slight
McVegas-Old Camp-Kingingham association	residuum & alluvium	very cobbly loam	mod. slow to slow	moderate	slight
Jung-Norfork-Buffaran association	residuum & alluvium	gravelly loam	slow	severe	slight
7 - Soils on Mountains					

Table B-1 Soil Survey of North Lander County Area, Nevada

(Page 4 of 7)

Association or Series	Parent Material	Dominant Texture	Permeability	Erosion Hazard	
				Water	Wind
Millerlux-Reluctan-Cleavage association	residuum & colluvium	gravelly loam	very slow to mod. slow	severe	slight
Hapgood-Packer-Layview association	residuum & colluvium	very gravelly loam	mod. slow to moderate	moderate	slight
Hapgood-Sumine-Cleavage association	residuum & colluvium	very gravelly loam	mod. slow to moderate	moderate	slight
Quarz-Linrose-Slaven association	residuum & colluvium	very gravelly loam	slow to moderate	moderate	slight
Slaven-Linrose-Cleavage association	residuum & colluvium	very gravelly loam	slow to moderate	severe	slight
Slaven-Wiskan-Graley Variant association	residuum & colluvium	very gravelly loam	slow to mod. slow	severe	slight
Wiskan-Locane association	residuum	gravelly silt loam	slow to mod. slow	moderate	moderate
Rock outcrop-Loncan Variant-Glean association	residuum & colluvium	gravelly silt loam	mod. to mod. rapid	severe	slight
Sumine-Reluctan-Cleavage association	colluvium & residuum	very gravelly loam	mod. slow	moderate	slight
Sumine-Hapgood-Cleavage association	residuum & colluvium	very cobbly loam	mod. slow to moderate	severe	slight
Floer-Slaven-Roca association	residuum	gravelly silt loam	very slow to slow	moderate	slight
Punchbowl-Clanalpine-Sumine association	residuum & colluvium	cobbly loam	slow to mod. slow	severe	slight
Old Camp-Colbar-Rock outcrop association	residuum & colluvium	very cobbly loam	mod. slow	slight	slight
Ninemile-Zoesta-Itca association	residuum & alluvium	extremely cobbly loam	very slow to slow	moderate	slight
Zoesta-Loncan-Welch association	alluvium & residuum	cobbly loam	very slow to moderate	slight	slight
Locane-Zoesta-Bucan association	residuum & alluvium	cobbly loam	very slow to slow	severe	slight

Table B-1 Soil Survey of North Lander County Area, Nevada

(Page 5 of 7)

Association or Series	Parent Material	Dominant Texture	Permeability	Erosion Hazard	
				Water	Wind
Izod-Rock outcrop association	residuum	extremely cobbly loam	moderate	slight	slight
Jung-Itca-Roca association	residuum & colluvium	very cobbly loam	very slow to slow	moderate	slight
Jung, steep-Robson-Jung association	residuum	very gravelly loam	slow	severe	slight
8 - Soils on Inset Fans					
Shirlo very fine sandy loam, 2-4% slopes, occ. flooded	alluvium	very fine sandy loam	mod. rapid	slight	slight
Whirlo-Creemon association	alluvium	gravelly loam	moderate to mod. rapid	slight	slight
Settlemeyer fine sandy loam, drained, 0-4% slopes	alluvium	fine sandy loam	mod. slow	slight	slight
Settlemeyer, drained--Settlemeyer loams	alluvium	loam	mod. slow	slight	slight
Welch loam, drained, 2-8% slopes	alluvium	loam	mod. slow	slight	slight
9 - Mined Areas					
Disturbed soils.					
10 - Soils on Fan Skirts					
Broyles very fine sandy loam, 0-2% slopes	alluvium	very fine sandy loam	mod. rapid	slight	slight
Creemon-Cren association	alluvium	silt loam	moderate to mod. rapid	slight	slight
Creemon-Hessing association	alluvium	silt loam	moderate to very rapid	slight	slight

Table B-1 Soil Survey of North Lander County Area, Nevada

(Page 6 of 7)

Association or Series	Parent Material	Dominant Texture	Permeability	Erosion Hazard	
				Water	Wind
Whirlo-Broyles association	alluvium	gravelly very fine sandy loam	mod. rapid	slight	slight
Zineb gravelly loam, 2-8% slopes	alluvium	gravelly loam	mod. rapid	slight	slight
11 - Soils on Piedmont Slopes					
Relley-Broyles association	alluvium	silt loam	moderate to mod. rapid	slight	slight
Ricert-Oxcorel-Whirlo association	alluvium	gravelly fine sandy loam	very slow to mod. rapid	slight	slight
Ricert-Whirlo-Pineval association	alluvium	gravelly silt loam	mod. slow to mod. rapid	slight	slight
Oxcorel-Golconda-Whirlo association	alluvium	gravelly very fine sandy loam	very slow to mod. rapid	slight	slight
Grassval-Zineb-Izod association	alluvium & residuum	very gravelly sandy loam	mod. slow to mod. rapid	severe	slight
Dun Glen-Whirlo association	alluvium	very fine sandy loam	moderate to mod. rapid	slight	slight
15 - Soils on Hills					
Laped-Colbar association	residuum & colluvium	very cobbly loam	mod. slow	moderate	slight
Puett-Genaw-Orovada association	residuum & alluvium	very gravelly loam	moderate to mod. rapid	moderate	slight

Table B-1 Soil Survey of North Lander County Area, Nevada

(Page 7 of 7)

Association or Series	Parent Material	Dominant Texture	Permeability	Erosion Hazard	
				Water	Wind
Old Camp-Kram Variant-Rock outcrop association	residuum	gravelly loam	mod. slow to moderate	moderate	slight
Old Camp-Osoll-Colbar association	residuum	gravelly loam	mod. slow to mod. rapid	severe	slight
Genaw-Orovada-Puett association	residuum & alluvium	fine sandy loam	moderate to mod. rapid	severe	slight
16 - Soils on Flood Plains					
Needle Peak silt loam, occ. flooded	alluvium	silt loam	mod. slow	slight	slight

Table B-2 Soil Survey of Eureka County Area, Nevada

(Page 1 of 4)

Association or Series	Parent Material	Dominant Texture	Permability	Erosion Hazard	
				Water	Wind
1 - Soils on Playas					
Playas	lacustrine sediment		very slow		
2 - Soils on Alluvial Flats					
Ocala silt loam, occ. flooded	alluvium	silt loam	slow	slight	slight
Batan-Ocala association	alluvium	silty clay loam	slow to mod. slow	slight	slight
Wendane silt loam, freq. flooded	alluvium	silt loam	mod. slow	slight	slight
3 - Soils on the Basin Floor					
Tulase-Bubus-McConnel association	alluvium	silt loam	moderate to very rapid	slight	slight
5 - Soils on the Fan Piedmonts					
Hodedo-Coils association	alluvium	stony loam	slow	slight	slight
Coils-Umil association	alluvium	loam	slow to mod. rapid	slight	slight
Tomera loam, 4-8% slopes	alluvium	loam	slow	slight	slight
Valcrest-Tomera association	alluvium	loam	slow	slight	slight
Tenabo-Ricert association	alluvium	gravelly very fine sandy loam	mod. slow to rapid	slight	slight
Allker gravelly sandy loam, 2-8% slopes	alluvium	gravelly sandy loam	mod. slow to rapid	slight	slight
Cortez-Tenvorrd association	alluvium	silt loam	very slow to moderate	moderate	slight

Table B-2 Soil Survey of Eureka County Area, Nevada

Association or Series	Parent Material	Dominant Texture	Permability	Erosion Hazard	
				Water	Wind
6 - Soils on Foothills					
Perwick-Puett-Tulase association	residuum & alluvium	gravelly loam	moderate to mod. rapid	moderate	slight
7 - Soils on Mountains (crests and side slopes)					
Mau-Shagnasty-Eightmile association	residuum & colluvium	stony loam	slow to moderate	moderate	slight
Hopeka-Solak-Ados association	residuum, alluvium & colluvium	very gravelly loam	moderate	moderate	slight
Chen-Singletree-Jivas association	residuum & colluvium	very cobbly loam	very slow to moderate	moderate	slight
Soughe Variant-Pie Creek-Singletree association	residuum & colluvium	gravelly loam	very slow to mod. slow	severe	slight
Decram-Decram Variant-Duff association	residuum & colluvium	very gravelly loam	mod. slow to moderate	severe	slight
Chad-Gando-Softscrabble association	residuum & colluvium	cobbly loam	slow to moderate	severe	slight
Shagnasty-Softscrabble association	residuum & colluvium	extremely stony loam	slow	moderate	slight
Freznik-Quarz-Jivas association	residuum & colluvium	stony clay loam & cobbly loam	very slow to moderate	moderate	slight
Freznik-Whitepeak association	residuum & colluvium	very stony loam	very slow to slow	moderate	slight
Quarz-Bregar-Duff association	residuum & colluvium	very gravelly loam	slow to moderate	severe	slight
Quarz-Chen-Duff association	residuum & colluvium	gravelly loam	very slow to moderate	severe	slight
Quarz-Duff association	residuum & colluvium	very gravelly loam	slow to moderate	severe	slight

Table B-2 Soil Survey of Eureka County Area, Nevada

(Page 3 of 4)

Association or Series	Parent Material	Dominant Texture	Permability	Erosion Hazard	
				Water	Wind
Bregar-Fortank-Jivas association	residuum & colluvium	very gravelly loam	slow to moderate	moderate	slight
Bregar-Jivas-Duff association	residuum & colluvium	very gravelly loam	mod. slow to moderate	severe	slight
Bregar Variant-Hymas-Quarz association	residuum & colluvium	very cobbly loam	slow to moderate	moderate	slight
Ebic-Ziram-Jivas association, mod. steep	residuum & colluvium	very stony clay loam & very cobbly clay loam	very slow to moderate	moderate	slight
Ebic-Ziram-Jivas association, steep	residuum & colluvium	very stony clay loam & very cobbly clay loam	very slow to moderate	moderate	slight
Solak-Highams-Hymas association	residuum	very gravelly loam	moderate	severe	slight
8 - Soils on Inset Fans					
Tulase silt loam, 2-8% slopes	alluvium	silt loam	moderate	slight	slight
Tulase silt loam, 0-2% slopes	alluvium	silt loam	moderate	slight	slight
Perwick-Puett-Tulase association	residuum & alluvium	gravelly loam	moderate to mod. rapid	moderate	slight
9 - Mined Land					
Disturbed soils.					
10 - Soils on Fan Skirts					
Broyles-Ricert association	alluvium	very fine sandy loam	mod. slow to mod. rapid	slight	slight
Creemon-Relley association	alluvium	silt loam	moderate	slight	slight
Enko-Davey-McConnel association	alluvium	loam	slow to rapid	slight	slight

Table B-2 Soil Survey of Eureka County Area, Nevada

(Page 4 of 4)

Association or Series	Parent Material	Dominant Texture	Permability	Erosion Hazard	
				Water	Wind
Zineb gravelly loam, 2-8% slopes	alluvium	gravelly loam	mod. rapid to rapid	slight	slight
Tulase-Bubus-McConnel association	alluvium	silt loam	moderate to very rapid	slight	slight
12 - Soils on Alluvial Fans					
Whirlo gravelly loam, 2-8% slopes	alluvium	gravelly loam	mod. rapid	slight	slight
13 - Soils on Fan Piedmont Remnants					
Hodedo-Coils association	alluvium	stony loam	slow	slight	slight
Cherry Spring Variant-Tomera-Bregar association	alluvium & residuum	fine sandy loam	slow to mod. slow	slight	slight
Nevador-Ricert-Tulase association	alluvium	very fine sandy loam	mod. slow to mod. rapid	slight	slight
Pineval-Tulase-Perwick association	alluvium & residuum	gravelly loam	mod. slow to moderate	slight	slight
14 - Soils on Low Hills					
Cherry Spring Variant-Tomera-Bregar association	alluvium & residuum	fine sandy loam	slow to mod. slow	slight	slight
Perwick-Tulase association	residuum & alluvium	gravelly loam	moderate	slight	slight
Perwick-Puett-Tulase association	residuum & alluvium	gravelly loam	moderate to mod. rapid	moderate	slight
16 - Soils on Flood Plains					
Needle Peak silt loam, occ. flooded	alluvium	silt loam	mod. slow	slight	slight
Paranat silt loam, drained, occ. flooded	alluvium	silt loam	mod. slow	slight	slight

APPENDIX C
WATER RESOURCES

This appendix summarizes presently available information pertaining to the hydrogeology of Crescent Valley (Regional Hydrogeology) as well as the local hydrogeology of the Cortez and Gold Acres facilities.

Regional Hydrogeology

The regional hydrogeology of Crescent Valley, and, to a much smaller degree, the Cortez Mountains and Shoshone Range surrounding Crescent Valley, has been studied by the U.S. Geological Survey and reported in Water-Supply Paper 1581 (Zones 1961). Much of the following section is derived from Zones (1961) and SHB (1981).

Groundwater in the Cortez Mountains and Shoshone Range surrounding Crescent Valley occurs mainly in joints and fractures within the metamorphic and sedimentary bedrock. Most precipitation falling on the mountains travels downslope in ephemeral streams toward the valley floor. Recharge from this runoff enters the regional groundwater system as it crosses the alluvial deposits of the valley uplands at the base of the mountains. Groundwater moves through these alluvial deposits (fanglomerates) toward the alluvium beneath the valley floor where large quantities of groundwater are stored. The valley floor is a relatively flat area of playas, small dunes, and some terraces. There has not been enough deep drilling performed in the valley to accurately estimate the thickness of the basin fill underlying the valley floor, but from experience in other intermountain basins in central Nevada, alluvium is likely to exceed several hundred feet, and may be up to several thousand feet in thickness (Zones 1961).

There is some north to northeast movement of groundwater in Crescent Valley, but the movement may be very slow, as exhibited by small water table gradients. Gradients are reported to range from 0.006 ft/ft in alluvial fan material in the valley uplands to less than 0.001 ft/ft in the valley sediments (Zones 1961). Only a small amount of groundwater leaves the valley by subsurface outflow, and almost all that is removed is due to evapotranspiration and water well pumpage (Zones 1961).

There are several irrigation, stock, and domestic wells in use within 2 to 5 miles of the Cortez mine. The water in these wells varies from artesian near the axis of Crescent Valley to more than 40 feet in depth west of the axis (Zones 1961).

Aquifer testing performed during research for a U.S. Geological Survey report (Zones 1961) has shown that wells located on or near the alluvial fans were significantly higher in transmissivity (ability of an aquifer to transmit groundwater) than those on the valley floor. Within the valley, finer-grained material is reflected by the results of pumping tests. Four tests were performed with results for transmissivity ranging from 6,500 to 61,000 gallons per day per foot (gpd/ft). The specific capacities (yield of a well per unit of drawdown) ranged from 5 to about 25 gallons per minute per foot of drawdown, which also indicates the presence of fine-grained alluvium beneath the valley floor.

Hydrology of the Cortez Area

The following information is available for the groundwater resources of the Cortez Area.

<u>Hydrostratigraphy and Groundwater Occurrence</u>

The hydrostratigraphy beneath the Cortez Facility and vicinity has been characterized through the completion of 68 monitoring and pollution control wells since 1980 (Figure C-1). Table C-1 summarizes the following available information for monitoring and pumping wells: date drilled, availability of geologic logs and well construction details, screen interval, total depth, and data source. Most of the logs are included in SHB (1981, 1990a, and 1990b). In accordance with the Final Water Pollution Control Permit (NEV00023) issued by the NDEP in May 1991, 5 additional water pollution control wells were recently completed in the shallow aquifer.

The Cortez Facility is located on a gently sloping piedmont alluvial plain consisting of several Quaternary age coalescing alluvial fans. The fans consist of poorly sorted, unconsolidated, coarse and fine-grained clastic materials which have been eroded from the western flank of the Cortez Mountains and transported by water, wind, and gravitational forces.

Near the site of the Cortez tailings disposal and heap leach facilities, the alluvial fan deposits are probably interbedded with finer-grained deposits of silt and clay which were formed in a closed basin environment which has periodically been occupied by playas and shallow lakes, and small aeolian dunes. Some well-sorted sandy units encountered during drilling probably formed in a beach or near-beach environment along the boundary of the alluvial fan deposition (SHB 1981).

As depicted on a generalized cross-section (Figure C-2), alluvial materials encountered during well drilling varied from silty clay to sandy and clayey gravel with cobbles. Generally, these alluvial deposits are discontinuous with individual units within the mine site area ranging in thickness from about 2 feet to over 30 feet (SHB 1990a).

Surficial soils are fairly uniform across the study area and range in thickness from 2 to 5 feet. The soils are typically tan to light brown and consist of clays and silts with some areas of fine to medium-grained silty or clayey sand. The surface soils support a thick growth of short grass and desert shrub vegetation on the sloping alluvial surfaces (SHB 1990a). Details of the subsurface lithology encountered during site drilling programs are available in SHB (1990a) and SHB (1981).

An alluvial aquifer consisting of silty sand and gravel and irregularly distributed clay lenses lies below the silty clay surface soil. Groundwater beneath the Cortez Facility occurs at depths ranging from about 11 to 59 feet below existing grade (SHB 1990a). Using water level data obtained between November 1989 and January 1990, it is apparent that groundwater flow is generally to the northeast, closely following the topographic contours. According to SHB (1990a), hydraulic gradients are small, ranging from 10 to 30 feet per mile (0.002 to 0.006 ft/ft).

HSI (1990) has detected the presence of highly conductive material (interpreted to be a paleochannel) trending about N30E from Tailings Pond No. 6. A paleochannel is a buried stream channel containing coarser-grained material that allows groundwater to be transmitted at higher rates than adjacent finer-grained sediment outside the paleochannel. The presence of the paleochannel was interpreted from subsurface data collected from numerous borings. Irregularly distributed clay lenses of varying thickness retard the vertical movement of groundwater within the unconfined alluvial aquifer.

Figure C-3 shows groundwater elevations recorded in April and May 1990. Contoured groundwater elevations indicate flow is north to northeast and influenced by the presence of the paleochannel.

Hydrographs were constructed for five monitoring wells to show water level changes with time. Figure C-4 shows the monthly water level change for the year of 1990. Figure C-5 illustrates the annual water level change for the month of April from 1984 to 1990. Two of the wells, MW-1 and MW-2, are located upgradient or cross-gradient of the tailings ponds (Figure C-3). Of the three downgradient wells selected, MW-21 is thought to be located within the paleochannel.

As shown in Figure C-4, the monthly water level change during 1990 is less than approximately 2 feet in each of the wells monitored. In general, the groundwater elevations tended to be highest during the winter and spring months and likely reflect groundwater recharge from precipitation and snowmelt. The overall water level decline from 1984 to 1990 ranged from about 2 feet to 10 feet in the wells observed with the exception of MW-15 (Figure C-5). This well exhibited a 10-foot drop in water level from 1984 to 1986. This decline appears to be explained by the well's close proximity to the pollution control wells. These wells were installed in 1984 and began pumping and locally lowering the water table. From 1986 to 1990, the groundwater elevation in well MW-15 declined an additional 6 feet. This trend in declining water levels from 1984 to 1990 may reflect the ongoing drought. The applicant maintains a spreadsheet with all available water level data recorded from their wells.

Aquifer Properties and Groundwater Flow Rates

The nature and distribution of aquifer characteristics are markedly different across the mine area due to the high variability of the aquifer materials. Aquifer testing completed by SHB (1981) indicated hydraulic conductivities (capacity of subsurface material to transmit groundwater) ranging from 12 to 40 ft/day for silty clay to clayey sand strata and 92 to greater than 535 ft/day for the silty sand and coarse sand units located within the valley floor immediately northwest of the tailings ponds (Table C-2). The higher values of hydraulic conductivity for the sandier or coarser-grained units result in higher groundwater flow velocities and, depending on the thickness of the aquifer, the transmission of greater volumes of groundwater per unit time (i.e., gallons per day). The higher values of hydraulic conductivity (e.g., wells MW-15 and MW-44) are thought to represent the highly conductive coarse-grained materials in the paleochannel (Table C-2).

The results of 10 constant discharge aquifer tests conducted by HSI (1990) are also summarized in Table C-2. The tests were conducted on three pumpback wells and seven monitoring wells. The test data indicate that hydraulic conductivity values range from 4 to 2,230 feet/day, and transmissivity values range from 409 to 302,000 gallons per day per foot of aquifer thickness (gpd/ft). The wide range of values reflects the variability of the different geologic materials present in the area.

Groundwater flow velocities were estimated using the range of hydraulic conductivity values reported by HSI (1990), a hydraulic gradient of 0.004 ft/ft, and an effective porosity of 0.30. The estimated linear pore flow velocities range from about 0.05 to about 30 ft/day.

Groundwater Quality

The mining history of the Southern Crescent Valley and the potential impact on soil and groundwater contamination is briefly summarized by SHB (1990a). Properties of cyanide, including environmental behavior such as biological toxicity, transport in groundwater, and monitoring, are discussed in SHB (1981).

Water quality in wells within Crescent Valley was found to be acceptable for domestic use, with no elements present that exceeded acceptable limits based on standards in effect in 1961 (Zones 1961). The quality of water near the mountains is generally better, in terms of total dissolved solids, than water near the axis of the valley. This condition may be due to the effects of evapotranspiration in discharge areas located in the center of the valley.

Based on available data, concentrations of cyanide in natural waters of the region are below levels of detection (SHB 1981). Therefore, any water tested in the Cortez Facility area which contains cyanide is assumed to have been contaminated by disposal or operational activities at the Cortez Facility (SHB 1981).

Groundwater quality has been monitored at the Cortez Facility since they began operation in 1969. SHB (1988) presents a detailed chronology of groundwater monitoring at the site from

1969 to 1988. A discussion of field measurements of pH, temperature, and specific conductance from on-site monitoring wells is presented in SHB (1990a). Analytical data reported for samples collected during four monitoring events from October 1989 to April 1990 are provided in Table C-3.

The January 1990 monitoring data discussed below are relatively complete and are thought to be representative of the groundwater quality for the Facility area. The January 1990 sampling included two process fluids, groundwater from 6 wells upgradient of the mining facilities, groundwater from 10 downgradient wells, and water from pumpback wells near a recently-completed pumpback pond. According to HSI (1990), the sample results consist of four basic types of water: 1) process fluids, 2) groundwater that has been impacted by process fluids, 3) groundwater that has mixed with discharge from Mill Creek, and 4) groundwater that is unaffected or only slightly affected by outside sources.

Cyanide is thought to be the primary indicator of groundwater affected by gold mining activities. Cyanide rarely occurs in natural groundwater systems in detectable concentrations. Other parameters such as sulfate, certain heavy metals, and pH are also potentially useful indicators of groundwater affected by mining activities. However, the NDEP and Cortez Gold Mines believe that cyanide is the most useful indicator of groundwater potentially affected by gold mining processes, i.e., in high leaching operations. Groundwater quality monitoring performed at the Cortez Facility prior to May 1991 primarily focussed on cyanide species (total cyanide, WAD cyanide, and free cyanide) rather than the other parameters mentioned above.

Figure C-6 shows kriged estimates of weak acid dissociable (WAD) cyanide concentrations in the mine vicinity. Kriging is a geostatistical method of estimating the value of a parameter (e.g., WAD cyanide) at grid points based on irregularly spaced data points. The estimation process is intended to be unbiased in most software packages. The estimated values can then be contoured as shown on Figure C-6. The estimated contours are based on analytical data collected in October and December 1989, and January 1990.

In accordance with Water Pollution Control Permit NEV00023, a total of 40 monitoring wells are now sampled quarterly for various heavy metals and general minerals. Table C-4 lists the monitoring wells and the analysis parameters (referred to as Profile I). Four quarterly monitoring reports have been submitted to the NDEP as of June 1992. The most recent sampling performed at the site, representing the third quarter of 1992, was completed on September 3, 1992. The results of this sampling are expected to be reported to the NDEP in November 1992. The highest value of WAD cyanide measured in the 40 wells monitored was 0.785 mg/L in well MW-13. As shown on Figure C-1, well MW-13 was completed through Tailings Pond No. 3. The second highest value of WAD cyanide (0.473 mg/L) was measured in monitoring well MW-44, located approximately 2,000 feet downgradient of Tailings Pond No. 6, within the well-defined plume (see Figures C-1 and C-6).

Groundwater Usage

Groundwater at the Cortez Facility is presently pumped from two production wells and used for the following purposes: process water, domestic supply, dust control, and hydraulic gradient control as part of the pollution control wells for groundwater remediation. Shallow groundwater extracted from the 14 pollution control wells is used as makeup water for the process solution circuit. The primary consumptive use of water at the Cortez Facility is due to evaporative losses. The use of shallow, poor quality groundwater for the process solution makeup minimizes the consumptive use of higher quality fresh water.

Table C-5 summarizes well permit numbers, appropriate groundwater pumping information, and dates for proof of completion and beneficial use for all wells owned and operated by Cortez Gold Mines. Table C-6 summarizes the current or planned groundwater consumptive use for each of the mine sites. Total usage as reported by Cortez Gold Mines in April 1991 is 665 gpm, or 1,072 acre-feet per year at the Cortez Facility. Total groundwater usage reported by Cortez Gold Mines in June 1992 for this Facility is about 1,300 to 1,400 gpm, which is less than their certified amount.

Hydrogeology of the Gold Acres Area

Groundwater data for the Gold Acres study area is presently limited to pump test information for a water supply well. According to Cortez Gold Mines, two wells are known to exist in the mine area but no lithologic or well completion logs are available. The wells were completed in the 1930s by the previous land owner. Water is currently pumped from one of the two wells and used primarily for dust control.

A letter report, dated June 23, 1975, for a pump test of the fresh water well at the Gold Acres Facility is also available. It documents that the well was able to produce 1,117 gpm after 4.5 hours of pumping. As reported, the water level recovered 105 feet within 5 minutes of the pump being shut off. According to Cortez Gold Mines, the well is presently pumped at 62 gpm or about 100 acre-feet/year (Table C-6).

Groundwater in the Gold Acres study area is expected to occur in joints and fractures within the carbon chert strata. Groundwater flow directions under non-pumping conditions are expected to generally follow surface water drainages. Groundwater flow directions are also influenced by fracture orientation, degree of interconnection, and density. No groundwater quality data are presently available for this area.

Table C-1. MONITORING WELL CONSTRUCTION SUMMARY

Date Drilled	Well No.	Geologic Log	Well Const.	Screen Interval (ft)	Total Depth (ft)	Data Source
Jan-81	MW-1	YES	YES	14-29	34	Data for MW-1 to MW-15 from SHB
Dec-80	MW-2	YES	YES	18-33	45	(1981).
Jan-81	* MW-3	YES	YES	12-27	38.5	
Dec-80	MW-4	YES	YES	18-33	43.5	
Jan-81	MW-5	YES	NO	N/A	98	
	* MW-6	YES	YES	12-27	38.5	
	* MW-7	YES	YES	11-21	34	
	MW-8	YES	YES	19.5-34.5	40	
	MW-9	YES	YES	14-24	30.5	
	* MW-10	YES	YES	20-35	44	
	MW-11	YES	NO	N/A	75	
	MW-12	YES	YES	21-36	44	
	MW-13	YES	YES	38.5-53.5	64	
	MW-14	YES	YES	33-48	59	
	MW-15	YES	YES	16.5-31.5	39	
Sep-82	* PB-16	N/A	N/A	18-38	43	Data for PB-16 to PB-20,
	* PB-17	N/A	N/A	18-38	43	MW-21 TO MW-25 and PB-26 to
	PB-18	N/A	N/A	16-36	41	PB-34 from Cortez Gold Mines.
	PB-19	N/A	N/A	14-34	39	
	PB-20	N/A	N/A	18-38	43	
Sep-82	MW-21	N/A	N/A	13-33	33	
	MW-22	N/A	N/A	18-38	38	
	MW-23	N/A	N/A	17-37	37	
	MW-24	N/A	N/A	16.5-36.5	36.5	
	MW-25	N/A	N/A	17.5-37.5	37.5	
Sep-84	PB-26	N/A	N/A	N/A	43	
	PB-27	N/A	N/A	N/A	40	
	PB-28	N/A	N/A	N/A	42	
	PB-29	N/A	N/A	N/A	43	
	PB-30	N/A	N/A	N/A	42	
	PB-31	N/A	N/A	N/A	43	
	PB-32	N/A	N/A	N/A	40	
	PB-33	N/A	N/A	N/A	40	
	PB-34	N/A	N/A	N/A	43	
	MW-35	N/A	N/A	N/A	41.8	Data for MW-35 to MW-52 from
	MW-36	N/A	N/A	N/A	40.4	Cortez Gold Mines.
	MW-37	N/A	N/A	N/A	40	
	MW-38	N/A	N/A	N/A	39.9	
	MW-39	N/A	N/A	N/A	40.2	
	MW-40	N/A	N/A	N/A	41.8	
	MW-41	N/A	N/A	N/A	41.7	
	MW-42	N/A	N/A	N/A	39.4	
	MW-43	N/A	N/A	N/A	39.3	
Sep-84	MW-44	N/A	N/A	N/A	43.8	
	MW-45	N/A	N/A	N/A	40.7	
	MW-46	N/A	N/A	N/A	40.7	
	MW-47	N/A	N/A	N/A	38.6	
	MW-48	N/A	N/A	N/A	44.8	
	MW-49	N/A	N/A	N/A	37	
	MW-50	N/A	N/A	N/A	39.4	
	MW-51	N/A	N/A	N/A	44.4	
	MW-52	N/A	N/A	N/A	42.6	
Dec-86	MW-53	YES	N/A	N/A	70	Data for MW-53 to MW-56 from
	MW-54	YES	N/A	N/A	23	Parson's Drilling (1986).

Table C-1. MONITORING WELL CONSTRUCTION SUMMARY (concluded)

Date Drilled	Well No.	Geologic Log	Well Const.	Screen Interval (ft)	Total Depth[1] (ft)	Data Source
	MW-55	YES	N/A	N/A	35	
	MW-56	YES	N/A	N/A	36	
Nov-88	MW-57	YES	YES	25-45	45	Data for MW-57 to MW-62 and PB-63 to PB-64 from Nevada Division of Water Resources Well Drillers Report.
	MW-58	YES	YES	25-45	45	
Dec-88	MW-59	YES	YES	65-105	105	
Nov-88	MW-60	YES	YES	25-45	45	
Dec-88	MW-61	YES	YES	25-45	45	
Nov-88	MW-62	YES	YES	25-45	45	
Dec-88	PB-63	YES	YES	20-40	45	
Dec-88	PB-64	YES	YES	20-40	45	
Jul-89	MW-65	N/A	N/A	N/A	N/A	
Jul-89	MW-66	YES	N/A	N/A	45	Data for MW-66 and PB-T from Parson's Drilling (1986).
Jul-89	PB-T	YES	N/A	N/A	45	

[1] = Total Depth below ground surface.
[2] = Abandoned

Source: Hydro-Search, Inc. (1990)

Note: See Figure C-1 for well locations.

TABLE C-2

AQUIFER HYDRAULIC CHARACTERISTICS
(Page 1 of 2)

Reference	Well Number	Hydraulic Conductivity (ft/day)	Thickness (ft)	Transmissivity (gpd/ft)	Aquifer Material
Zones (1961)	30/48-27C1	2.8	309	6,500	Valley Floor
Zones (1961)	30/48-33C1	22	225	37,000	Alluvial Fan
Zones (1961)	28/48-18A1	27	300[b]	61,000	Toe of Alluvial Fan
Zones (1961)	29/49-34C2	25	163	30,000	Toe of Alluvial Fan
SHB (1981)	MW-3	13-25	10	940-1,880	Sand
SHB (1981)	MW-3	13-26	10	980-1,950	Sand
SHB (1981)	MW-6	92-184	9	6,190-12,390	Silty Sand
SHB (1981)	MW-7	12-24	4	356-708	Sand
SHB (1981)	MW-10	16-32	15	1,770-3,540	Clayey Sand
SHB (1981)	MW-10	22-45	15	2,500-5,000	Clayey Sand
SHB (1981)	MW-12	15-31	15	1,710-3,420	Undifferenti-ated Alluvium
SHB (1990)	PB-T	78-119	28[b]	16,246-24,847	Silt, sand, gravel
HSI (1990)	OW[a]	273-306	28[b]	57,081-64,000	Alluvium[c]
HSI (1990)	MW-44[a]	1,755-2,230	23[b]	302,000-384,000	Alluvium[c]
HSI (1990)	PB-64	168-353	20	25,142-52,800	Sand, gravel

TABLE C-2

AQUIFER HYDRAULIC CHARACTERISTICS
(Page 2 of 2)

Reference	Well Number	Hydraulic Conductivity (ft/day)	Thickness (ft)	Transmissivity (gpd/ft)	Aquifer Material
HSI (1990)	PB-18	28-98	20	4,168-14,666	Alluvium[c]
HSI (1990)	MW-1	5-12	11	409-955	Silty clay
HSI (1990)	MW-12	15-19	15	1,689-2,112	Silty clay
HSI (1990)	MW-25	4-75	15.5	441-8,712	Alluvium[c]
HSI (1990)	MW-42	132-264	23[b]	22,704-45,408	Alluvium[c]
HSI (1990)	MW-50	193-356	25[b]	36,156-66,528	Alluvium[c]
HSI (1990)	MW-65	110-353	25[b]	20,625-66,000	Alluvium[c]
HSI (1990)	MW-66	51-156	30	11,440-35,020	Undifferentiated Alluvium
SHB (1981)	MW-15	535	14	56,000	Undifferentiated Alluvium

Source: Hydro-Search, Inc. (1990).
Note: See Figure C-1 for well locations.

[a] Observation wells for well PB-T.
[b] Estimated.
[c] Detailed geologic information unavailable.

Table C-3. GROUNDWATER QUALITY DATA FOR CORTEZ

WELL NO.	WAD CYANIDE (mg/l) OCT 1989	DEC 1989	JAN 1990	APR 1990
MW-1	-0.002	NA	-0.002	-0.002
MW-2	0.035	0.020	0.023	0.025
MW-4	0.128	NA	0.060	0.075
MW-5	NA	NA	NA	NA
MW-8	0.002	NA	NA	-0.002
MW-9	0.092	NA	0.390	0.087
MW-11	NA	NA	NA	NA
MW-12	0.108	NA	NA	NA
MW-13	0.440	NA	-0.002	0.35
MW-14	NA	NA	NA	
MW-15	0.144	NA	0.113	0.161
PB-18	NA	NA	NA	
PB-19	NA	NA	0.700	0.22
PB-20	NA	NA	NA	
MW-21	0.011	NA	-0.002	-0.002
MW-22	0.002	NA	-0.002	
MW-23	0.002	NA	-0.002	0.005
MW-24	0.026	NA	-0.002	
MW-25	0.012	NA	0.004	0.006
PB-26	NA	NA	NA	
PB-27	NA	NA	NA	0.16
PB-28	NA	NA	0.108	
PB-29	NA	NA	NA	
PB-30	NA	NA	NA	
PB-31	NA	NA	NA	
PB-32	NA	NA	NA	
PB-33	0.242	NA	NA	
PB-34	NA	NA	NA	
MW-35	0.004	NA	NA	
MW-36	NA	NA	NA	
MW-37	0.002	NA	NA	
MW-38	0.238	NA	0.125	0.118
MW-39	0.420	NA	0.164	0.2
MW-40	0.056	NA	0.031	0.036
MW-41	NA	NA	-0.002	
MW-42	NA	NA	0.002	-0.002
MW-43	-0.002	NA	-0.002	
MW-44	0.310	0.158	0.278	0.207
MW-45	0.111	NA	0.055	0.084
MW-46	0.063	NA	0.026	0.031
MW-47	0.033	NA	0.027	0.022
MW-48	0.005	NA	0.013	0.004
MW-49	0.005	NA	-0.002	0.007
MW-50	0.004	NA	NA	
MW-51	0.003	NA	-0.002	0.006
MW-52	0.003	NA	-0.002	0.002
MW-53	0.003	NA	NA	0.003
MW-54	NA	NA	NA	
MW-55	NA	NA	NA	
MW-56	NA	NA	NA	0.061
MW-57	0.020	NA	0.009	0.011
MW-58	0.112	NA	0.072	0.065

January 30, 1990

WELL NO.	Alk	BiCarb	Carb	Hydrox	Ca	Cl	Mg	NO3	K	Na	SO4	TDS	Sb	As	Cr	Fe	Mn	Hg	Se	Ag
MW-2	346	346	0	0	11	86	7	1.8	10	188	111	698	0.009	0.27	0.01	0.49	0.01	-0.0001	0.003	-0.01
MW-15	138	0	80	58	375	900	151	8.8	29	775	1385	3826	0.001	0.025	0.01	1.83	0.01	0.0003	0.01	-0.01
MW-21	326	0	286	38	78	79	12	7.5	8	77	144	750	-0.001	0.01	0.01	0.2	-0.01	-0.0001	0.001	-0.01
MW-44	306	306	0	0	630	110	381	15	85	655	3048	5070	0.003	0.016	-0.01	3.29	0.01	0.0002	0.055	-0.01

Table C-3. GROUNDWATER QUALITY DATA FOR CORTEZ (concluded)

	WAD CYANIDE (mg/l)				January 30, 1990																			
WELL NO.	OCT 1989	DEC 1989	JAN 1990	APR 1990	Alk	BiCarb	Carb	Hydrox	Ca	Cl	Mg	NO3	K	Na	SO4	TDS	Sb	As	Cr	Fe	Mn	Hg	Se	Ag
MW-59	0.003	NA	-0.002	-0.002																				
MW-60	NA	NA	0.129	0.232																				
MW-61	NA	0.280	0.091	0.23	274	274	0	0	214	260	92	8.2	24	209	683	2370	0.001	0.015	-0.01	5.6	0.14	0.0003	0.008	-0.01
MW-62	0.037	NA	0.010	0.014																				
PB-63	NA	NA	NA																					
PB-64	NA	NA	-0.002	0.23																				
MW-65	0.187	NA	0.076	0.113																				
MW-66	0.133	NA	0.031	0.114	70	0	56	14	316	470	136	5.6	19	344	1134	2504	-0.001	0.025	-0.01	0.99	0.23	-0.0001	0.02	-0.01
PB-T	0.135	NA	NA	0.204																				
OW	NA	NA	NA																					
AW	0.008	NA	NA																					
TB-1	NA	NA	-0.002		872	0	540	332	99	41	30	0.23	18	91	121	1236	0.001	0.032	0.02	13.6	0.31	-0.0001	-0.001	-0.01
TB-2	NA	NA	0.003		772	0	408	364	195	120	65	11	30	204	311	1554	0.01	0.21	0.15	64	1.7	-0.0001	0.001	-0.05
TB-3	NA	NA	-0.052		194	0	192	2	92	96	17	10.4	11	121	130	630	-0.001	0.017	0.01	9.9	0.27	-0.0001	0.002	-0.01
TB-4	NA	NA	-0.032		600	0	372	228	73	63	11	4.6	8	95	138	1014	-0.001	0.006	0.01	0.28	0.05	-0.0001	0.003	-0.01
TB-5	NA	NA	-0.002		466	0	360	106	125	104	50	4.9	40	112	136	948	-0.005	0.13	0.15	130	3.35	-0.0001	0.004	-0.05
TB-6	NA	0.027	NA		280	280	0	0	61	45	19	2.2	4	89	161	550	0.002	0.03	-0.01	0.74	0.02	-0.0001	0.005	-0.01
TB-7	NA	0.173	NA		244	244	0	0	74	96	15	6	9	127	146	600	0.001	0.014	-0.01	0.69	0.05	-0.001	0.003	-0.01
TB-8	NA	0.003	NA																					
TB-9	NA	0.007	NA																					
TB-10	NA	0.005	NA		254	254	0	0	96	69	18	4.6	9	111	165	644	-0.001	0.024	0.01	5.3	0.22	-0.0001	0.004	-0.01
TB-11	NA	0.003	NA																					
TB-12	NA	-0.002	NA		296	296	0	0	66	77	14	2.3	7	97	142	660	0.001	0.024	0.01	0.64	0.04	-0.0001	0.003	-0.01
TB-13	NA	NA	-0.002		654	0	360	294	56	34	18	5.7	6	40	109	948	0.002	0.098	0.01	3.2	0.22	-0.0001	-0.001	-0.01
TB-14	NA	NA	-0.002		900	0	452	448	110	71	70	1.24	25	74	163	1362	-0.005	0.18	0.15	72.5	4.15	-0.0001	0.003	-0.05
TB-15	NA	NA	-0.002		466	0	288	178	93	30	42	1.13	12	93	440	1196	0.005	0.95	0.01	1.49	0.29	-0.0001	0.001	0.01
BCLM	1.50	NA	9.0	2.8																				
TS	0.028	NA	NA		448	0	48	400	230	700	42	52	42	1194	1984	4680	0.002	0.46	0.01	0.85	0.4	0.0023	0.03	-0.01
PP	NA	0.800	2.02	1.47	324	324	0	0	280	690	104	22	36	731	1484	3526	0.002	0.027	-0.01	0.58	0.03	0.0009	0.021	-0.01
PS	NA	4.80	NA		158	0	128	30	82	600	25	31.4	41	929	1307	3184	0.007	0.28	0.01	1.35	0.01	0.03	0.044	-0.01
TO1	NA	NA	29.0																					
TO2	NA	NA																						
T	NA	NA																						
08	NA	0.007	0.003	0.011																				
sp				0.202																				

Note: Negative sign "-" denotes that the value is less than "<"

Chem. Parameter (mg/l except where noted)

Comments:
PB-T = Recently completed pumpback well.
OW = Well 100 ft. from PB-T.
BCLM = Reclaimed water from tailings pond.
TS = Seepage entering the toe ditch.
PP = Recently completed pumpback pond.
PS = Pregnant solution from the heap leach pads.
TO1 = Thickener overflow at Pond 1.
DB = Distilled water blank.

Source: Hydro-Search, Inc. (1990) See Figure C-1 for well locations

TABLE C-4

QUARTERLY GROUNDWATER MONITORING PROGRAM

Monitoring Wells

MW1	MW23	MW47	MW60
MW2	MW24	MW48	MW61
MW4	MW25	MW49	MW62
MW8	MW38	MW50	MW65
MW9	MW39	MW51	MW66
MW12	MW40	MW52	MW37
MW13	MW43	MW56	MW41
MW15	MW44	MW57	MW42
MW21	MW45	MW58	MWP1
MW22	MW46	MW59	MWSP

Profile I Analysis Parameters

Alkalinity (as $CaCO_3$) Bicarbonate Total	Magnesium Manganese Mercury
Arsenic	Nitrate
Barium	pH (±0.1 units)
Cadmium	Potassium
Calcium	Selenium
Chloride	Silver
Chromium	Sodium
Copper	Sulfate
Fluoride	Total Dissolved Solids
Iron	WAD Cyanide
Lead	Zinc

Source: NDEP Permit No. NEV00023
Note: See Figure C-1 for well locations.

Table C-5. SUMMARY OF CORTEZ GOLD MINES WATER RIGHTS APPROPRIATION

Well	Location	Appl.	Permit	Cert.	Q (cfs)	Proof of: compl.	ben. use
PB 26	tailings		51247		.111	12/16/89	12/16/91
PB 27	tailings		51248		.111	12/16/89	12/16/91
PB 28	tailings		51249		.111	12/16/89	12/16/91
PB 29	tailings		51250		.111	12/16/89	12/16/91
PB 30	tailings		51251		.111	12/16/89	12/16/91
PB 31	tailings		51252		.111	12/16/89	12/16/91
PB 32	tailings		51253		.111	12/16/89	12/16/91
PB 33	tailings		51254		.111	12/16/89	12/16/91
PB 34	tailings		51255		.111	12/16/89	12/16/91
PB 63	tailings		*51252				
PB 64	tailings		*51254				
PB 18	tailings		46224		.111	8/6/84	8/6/87
PB 19	tailings		46225		.111	8/6/84	8/6/87
PB 20	tailings		46226		.111	8/6/84	8/6/87
W 1	mill site		24664	7293	1.3	filed	filed
W 2	mill site		24663	7292	1.1	filed	filed
GA 1	goldacres	52926	10746	2908	.193	under application	
GA 2	goldacres	52927	14310	4425	.666	to change point	
GA 1	goldacres	52928	14521	4127	.9	of use	
HC 1	Horse Can		46333		.22		4/23/90
HC 1	Horse Can	52134	46333		.28	4/23/90	4/23/91
PB-T	downgrad.	53783			1.11	8/23/91	8/23/93

* Filed under existing permit in same sectional subdivision.

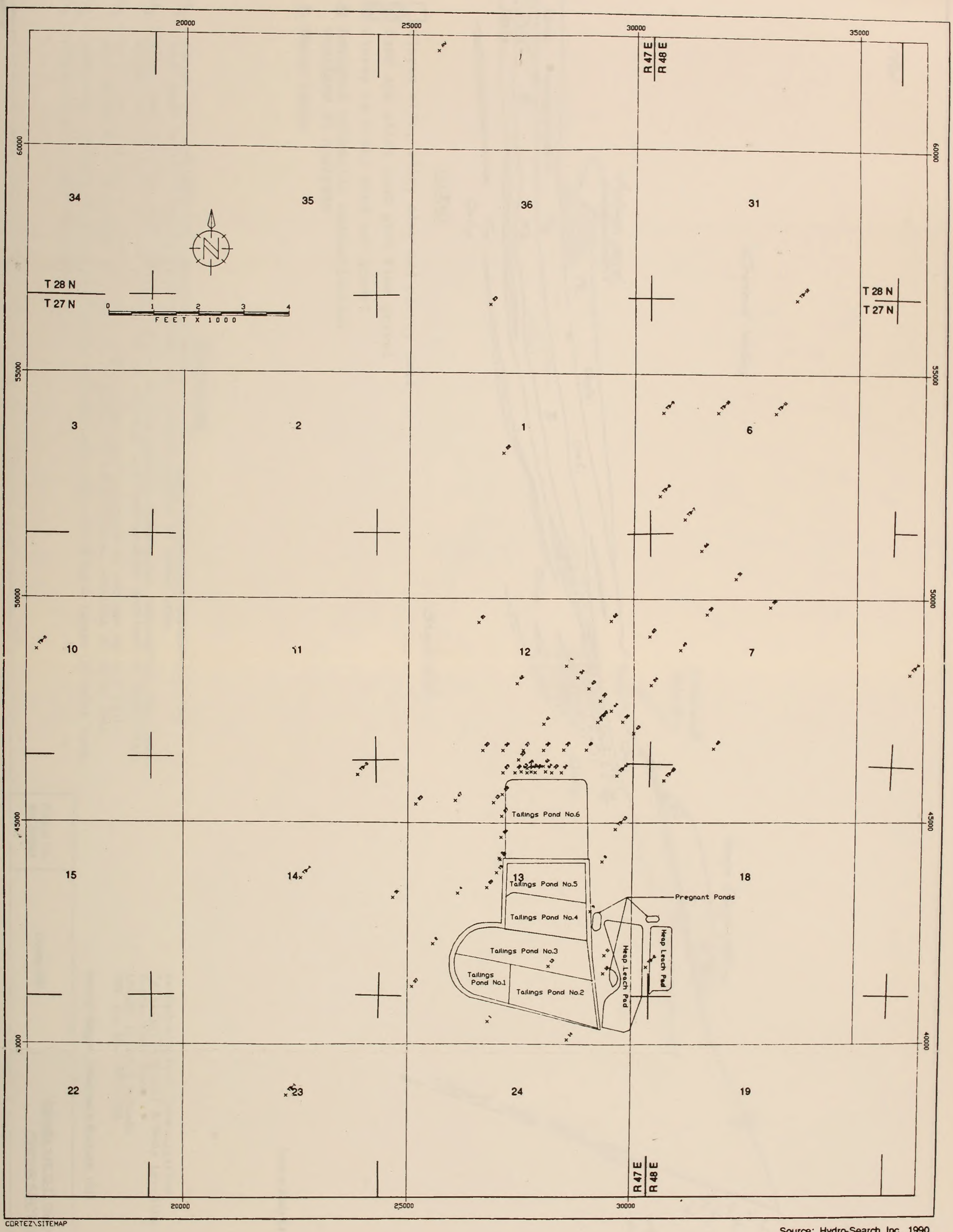
Source: Cortez Gold Mines, March 1991.

Table C-6

PRESENT OR PLANNED GROUNDWATER WITHDRAWAL/CONSUMPTIVE USE

Area	Permit No.	Process (gpm)	Domestic (gpm)	Dust (gpm)	Total (gpm)
Cortez:	24663				
(2 wells)	24664	110	10	45	165
Pollution Control	46224				
(14 wells)	46225				
	51247				
	51248				
	51249				
	51250				
	51251				
	51252				
	51253				
	51254				
	51255				
	53783	500			500
Gold Acres:	52926				
(1 well)	52927				
	52928		2	60	62
Total:	gpm	610	12	105	727
	acre-feet/yr	984	19	170	1,174

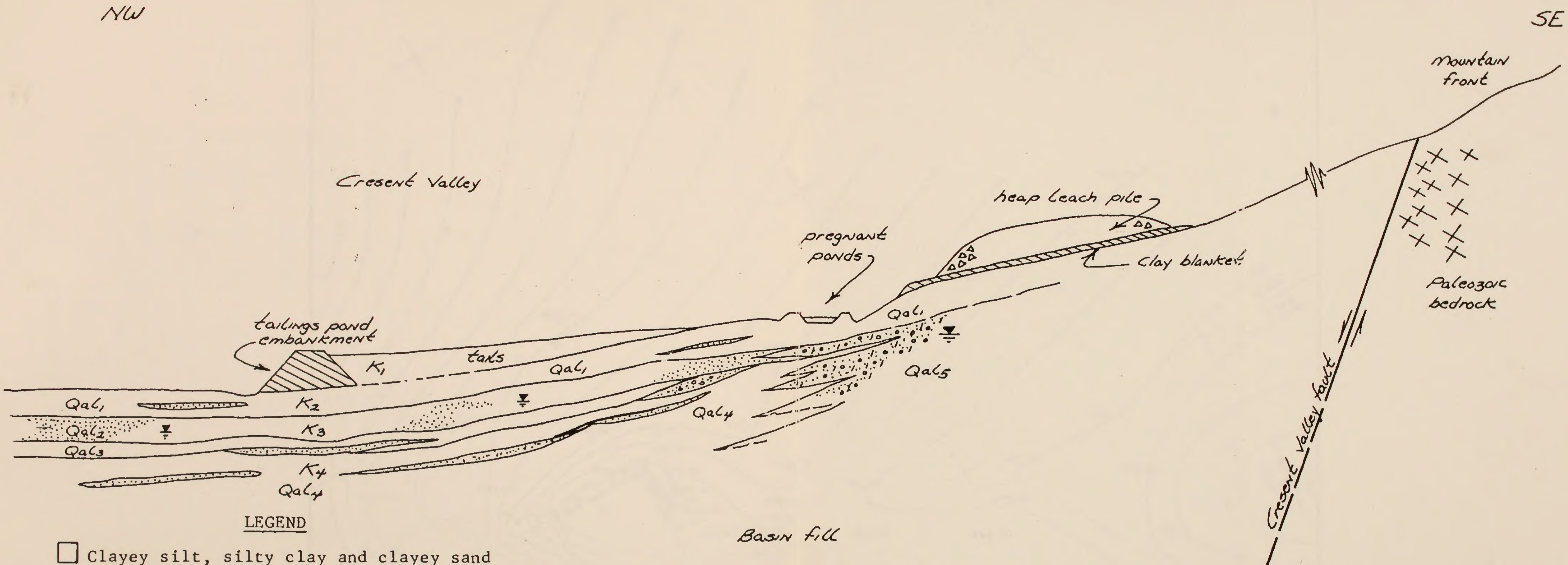
Source: Cortez Gold Mines, April 1991.



Source: Hydro-Search, Inc., 1990.

Project No. 90C0489A	Cortez EIS	LOCATION OF MONITORING AND PUMPBACK WELLS	Figure C-1

90C0489A-3000/090492



LEGEND

- Clayey silt, silty clay and clayey sand
- Sand and silty sand with fine gravel
- Clayey to silty sand and gravel
- K_1 Assigned hydraulic conductivities utilized in analysis
- Water table

Vertical Scale Exaggerated

DESCRIPTIONS

Qal_1 - Clayey silt and silty clay with minor lenses of silty sand; thicknesses encountered vary from about 4 feet to in excess of 40 feet in southern portion of study area.

Qal_2 - Silty sand and clean sand with some lenses of fine gravel; thicknesses encountered vary from about 5 to 20 feet; unit not encountered in southern and northeastern portions of study area.

Qal_3 - Silty clay with minor lenses of silty sand; thicknesses encountered average about 7 feet; unit thickens to in excess of 25 feet in southern and northeastern portions of study area.

Qal_4 - Lenticular sequence of silty clay and clayey sand beds with subordinate lenses of silty sand.

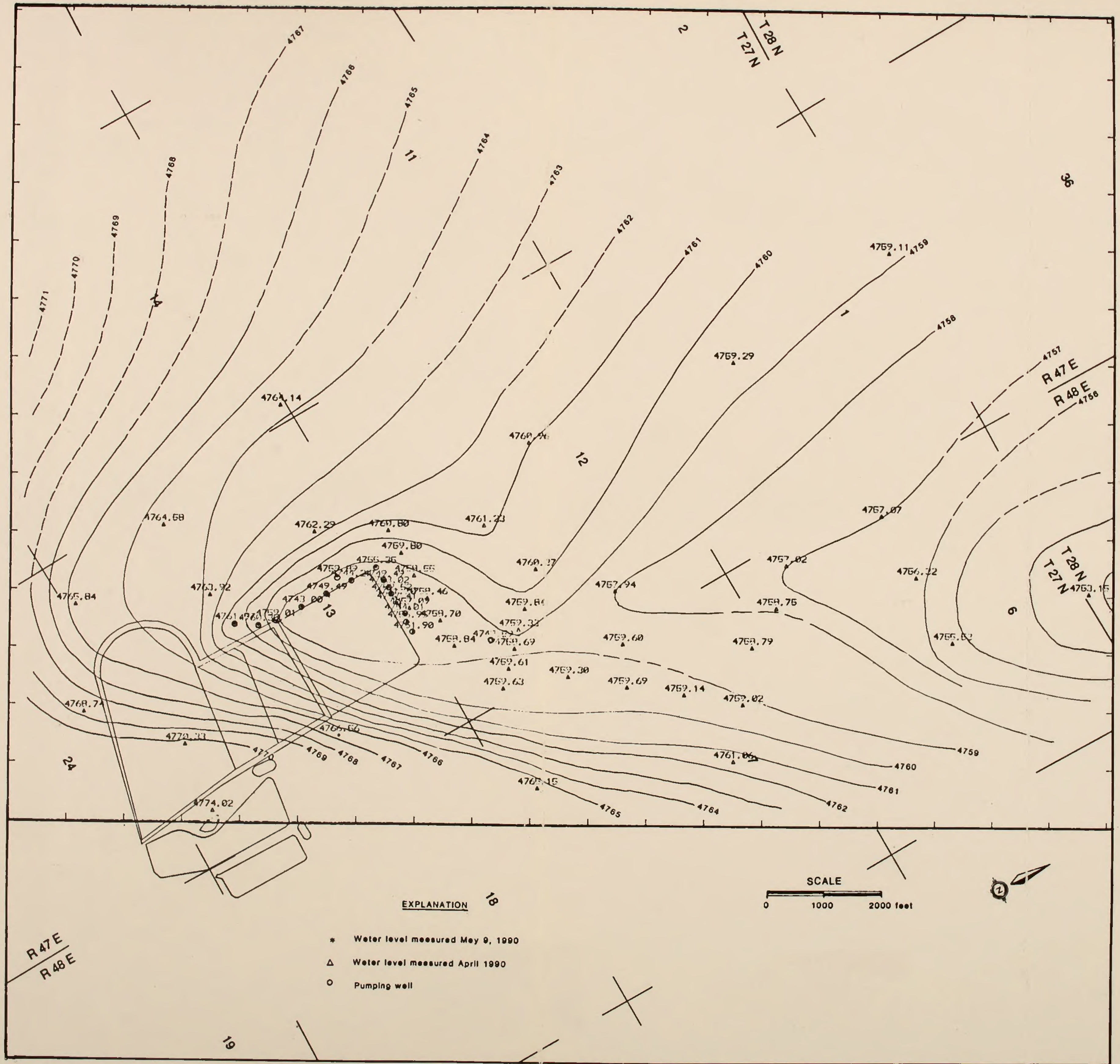
Qal_5 - Clayey to silty sand and gravel.

Geohydrological Investigation
Tailings Disposal & Heap Leaching Systems
Cortez Gold Mine
Lander County, Nevada
SHB Job No. E80-180

Source: Sergent, Hauskins & Beckwith, 1981

Project No. 90C0489A	Cortez EIS	GENELARIZED GEOLOGIC CROSS SECTION	Figure C-2

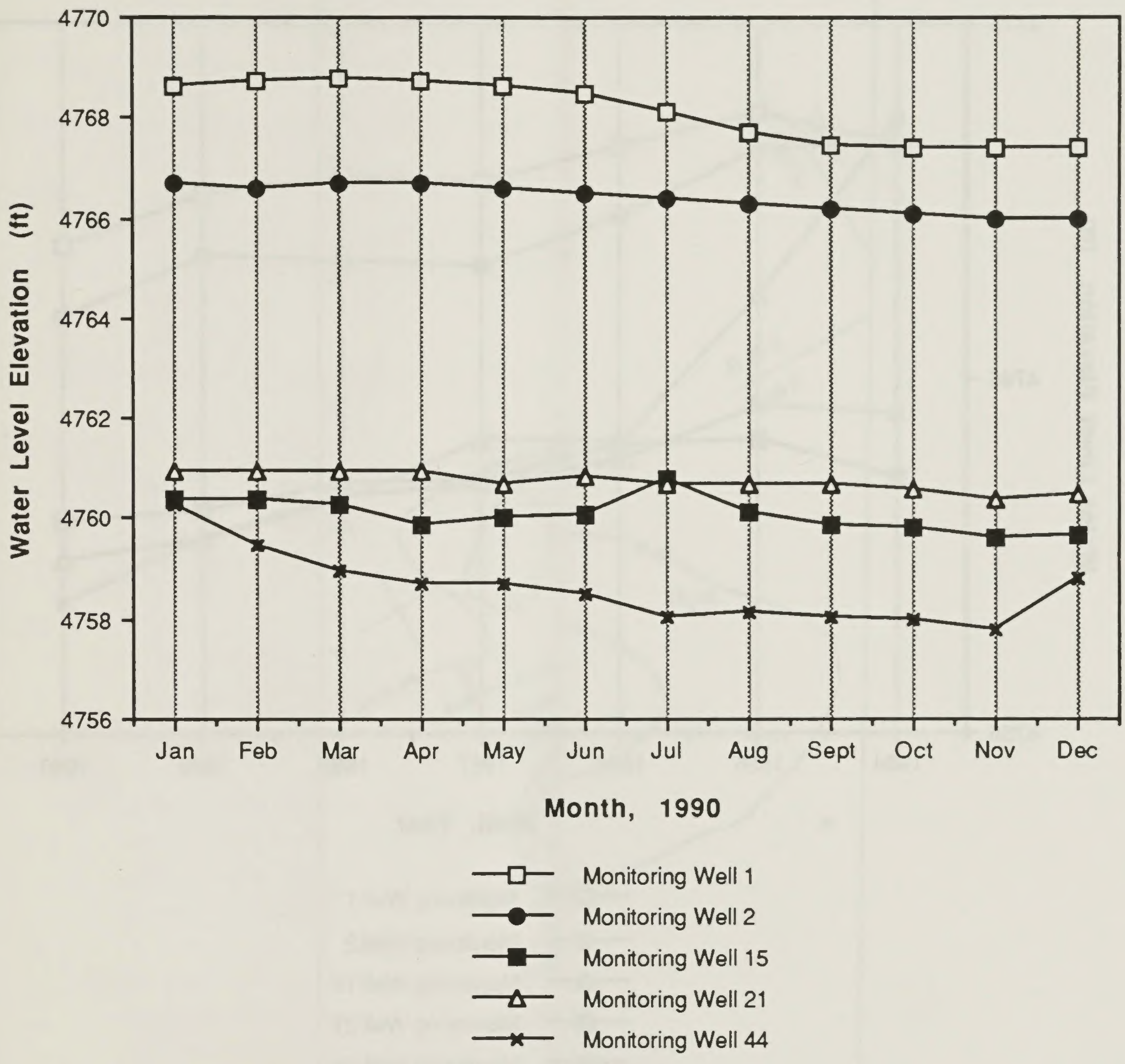
90C0489A-3000/090492



Source: Hydro-Search, Inc., 1990.

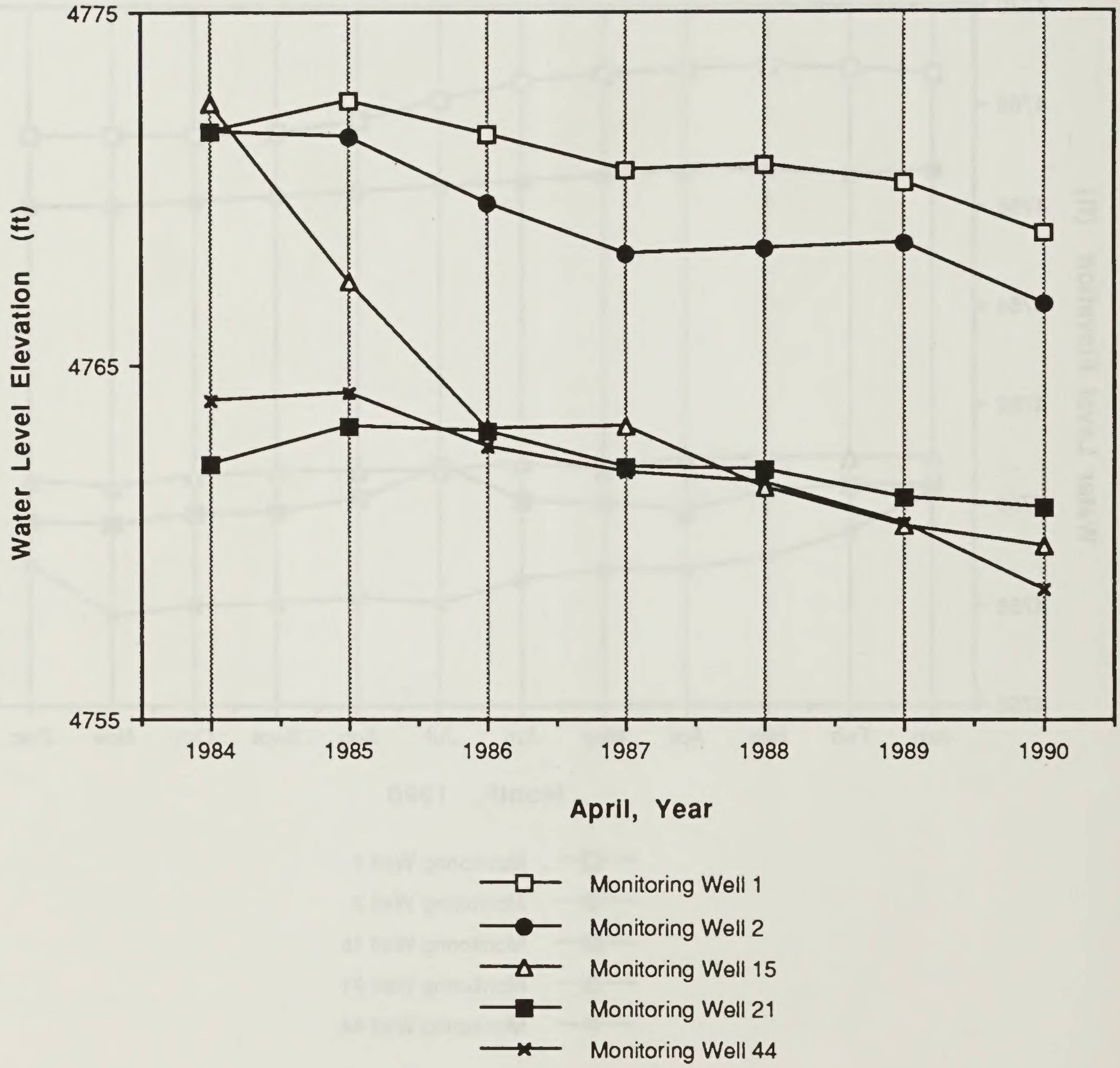
Project No. 90C0489A	Cortez EIS	WATER TABLE CONTOUR MAP: APRIL AND MAY 1990	Figure C-3

90C0489A-3000/090492



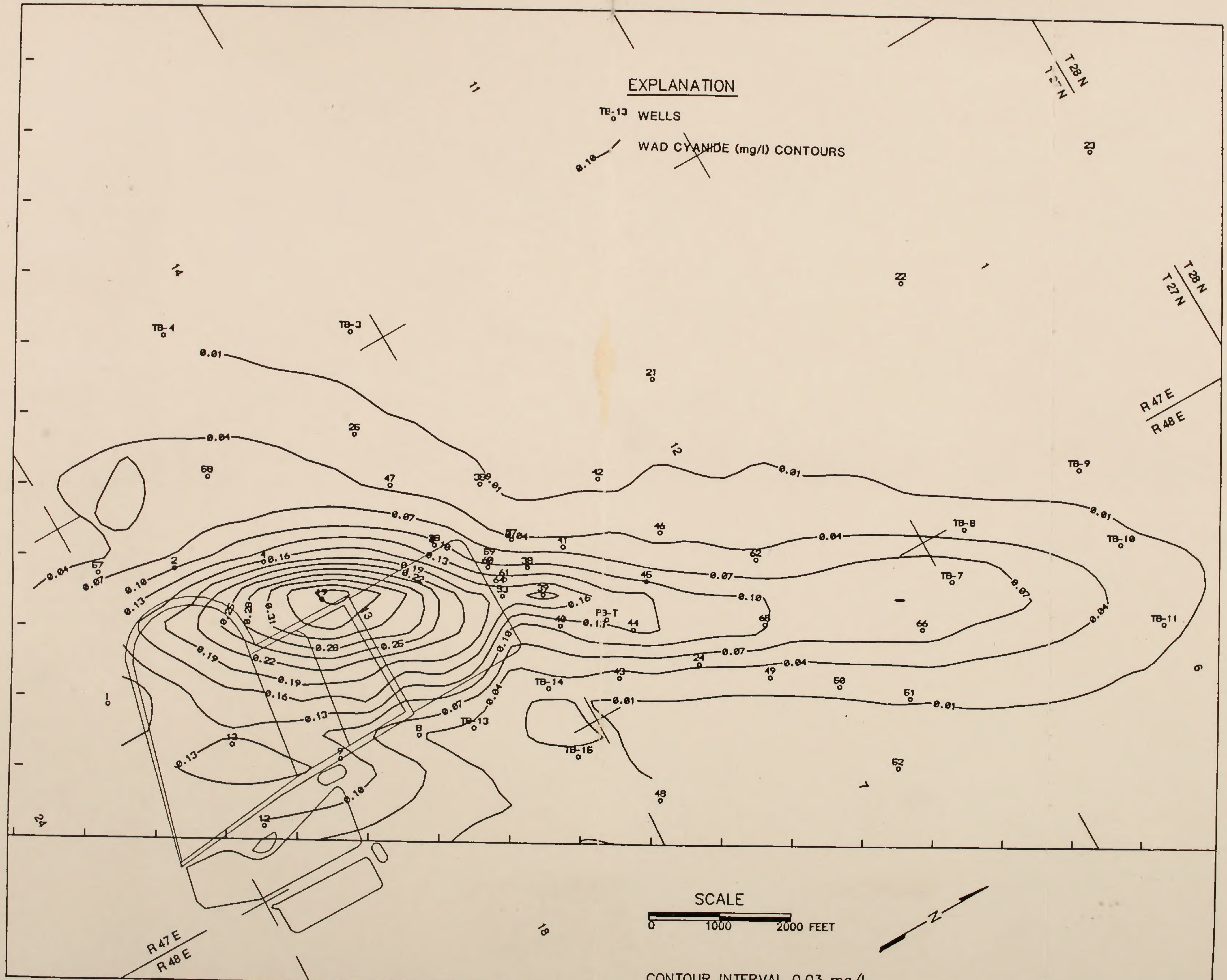
Project No. 90C0489A	Cortez EIS	HYDROGRAPHS OF SELECTED WELLS FOR 1990	Figure C-4

90C0489A-3000/090492



Project No. 90C0489A	Cortez EIS	HYDROGRAPHS OF SELECTED WELLS FOR 1984 TO 1990	Figure C-5

90C0489A-3000/090492



Source: Hydro-Search, Inc., 1990.

Note : Contours are based on analytical data collected in October and December 1989, and January 1990.

90C0489A-3000/090492

Project No. 90C0489A	Cortez EIS	KRIGED ESTIMATES OF WAD CYANIDE IN GROUNDWATER	Figure C-6

APPENDIX D
BLM RESOURCE MANAGEMENT PLAN DECISIONS FOR THE ELKO RESOURCE AREA (ELKO DISTRICT) AND SHOSHONE-EUREKA RESOURCE AREA (BATTLE MOUNTAIN DISTRICT)

Elko Resource Management Plan Record of Decision

Lands

Make available, primarily through sale, up to 8,340 acres of public lands that are difficult and uneconomic to manage and 5,900 acres to meet community expansion needs.

Identify for transfer, primarily through exchange, 243,200 acres.

Corridors

Designate 243 miles of right-of-way corridors including 109 miles of low visibility corridor along Interstate 80 and identify 130 miles of planning cooridors for future facilities.

Access

Acquire legal access for 60 roads (242 miles) considered high prioroity for management of all resources.

Recreation

Designate 98 percent of the planning area open to off road vehicles, and the remaining 2 percent, consisting of Special Recreation Management Areas and preliminary suitable portions of Wilderness Study Areas, limited to designated roads and trails.

Designate the following five Special Recreation Management Areas to enchnace camping and water based recreation: South Fork Owyhee River (3,500 acres); Wildson Reservoir (5,440 acres); Zunino/Jiggs Reservoir (800 acres); South Fork Canyon (3,360 acres); Wildhorse (5,760 acres). Manage the remainder of the planning area for dispersed recreation activities.

Wilderness

Preliminarily recommend the Rough Hills Wilderness Study Area (6,685 acres) and a portion of the Little Humboldt River Wilderness Study Area (29,775 acres) suitable for wilderness designation.

Preliminarily recommend the Cedar Ridge and Red Spring Wilderness Study Areas and a portion of the Little Humboldt River Study Area, a total of 30,294 acres, nonsuitable for wilderness designation.

Livestock Management

Initially license livestock use at the three to five year (1979-1983) average licensed use level of 305,247 AUMs. There would be no change in active preference unless adequately supported by monitoring.

Treat or seed 120,978 acres; construct 258 miles of fence; drill 28 wells, lay 132 miles of pipeline; install 24 storage tanks, develop 97 spring sources and 97 reservoirs to improve livestock distribution, utilization of the range, provide additional livestock forage and enhance other multiple-use values.

Develop Allotment Management Plans on 22 Category I allotments and 6 Category M allotments.

Implement a rangeland monitoring program to determine if management objectives are being met and adjust grazing management systems and livestock numbers as required.

Wildlife

Manage wildlife habitat to provide 34,513 AUMs of forage for mile deer, 1,215 AUMs for pronghorn antelope, and 140 AUMs for bighorn sheep.

Construct 20 guzzlers, 40 spring protection facilities, 40 water developments, and 189 miles of fencing to improve habitat. Implement 500 acres of vegetation treatment and modify 20 miles of fence within crucial big game habitat.

Monitor the interaction between wildlife habiutat cvondition and other resource uses and make adjustments to season-of-use for livestock to improve or maintain essential and crucial wildlife habitats.

Jointly evaluate and analyze availability and condition of habitat areas identified by the Nevada Department of Wildlife to provide for the reestablishment, augmentation, or introduction of bighorn sheep another wildlife species.

Apply restrictions on leasable and/or salable mineral developments to protect crucial deer winter range, sage grouse strutting and nesting habitats, and antelope kidding areas.

Manage 117 miles (3,480 acres) of high priority riparian/stream habitat to provide good habitat conditon for wildlife and fish.

Wild Horses

Manage four existing wild horse herd areas with an appropriate management level of 330 horses.

Construct two water development projects.

Conduct wild horse gatherings as needed to maintain numbers.

Woodland Products

Implement intensive management of Christmas tree cutting on approximately 23,000 acres of woodlands.

Manage fuelwood harvesting to allocate the full allowable cut on approximately 60,000 acres.

Provide for commercial pine nut sales in years when pine nuts are abundant.

Minerals

Designate the resource area open to mineral entry for locatable minerals, except for an 11 acre administrative site in the City of Elko.

Provide for oil/gas and geothermal leasing as follows:

Designation: Limited - subject to no surface occupancy.

Purpose: Protection of Special Recreation Management Areas (SRMAs) and sage grouse strutting grounds. No surface occupancy would apply to areas within one-half mile of the high water line around Wilson, Zunino/Jiggs, Wildhorse, Rock Creek and South Fork Reservoirs and the South Fork Owyhee and South Fork Humboldt rivers within the designated Special Recreation Management Areas.

Acres: 36,872 (1.2 percent of RMP area; 11,092 - SRMAs and 25,780 - sage grouse strutting grounds.)

Designation: Limited - subject to seasonal restruction.

Purpose: Protect crucial deer winter range, crucial antelope yearlong habitat, and sage grouse brood rearing areas.

Acres: 470,714 (15 percent of RMP area).

Designation: Open - subject to standard leasing stipulations.

Acres: 2,571, 337 (82 percent of RMP area).

Designation: Closed.

Purpose: Areas recommended as preliminarily suitable for wilderness designation, including 18,625 acres addressed in the Draft Owyhee Canyonlands Wilderness EIS and an 11 acre administrative withdrawal.

Acres: 55,096 acres (1.8 percent of RMP area).

Shoshone-Eureka Resource Management Plan Management Decision

Wilderness Designation

Recommend the Roberts Wilderness Study Area totaling 15,090 acres and a major portion of the Antelope Wilderness Study Area totaling 83,100 acres as preliminarily suitable for wilderness designation.

Recommend the Simpson Park Wilderness Study Area and a portion of the Antelope Wilderness Study Area totaling 54,470 acres as nonsuitable for wilderness designation.

Land Tenure Adjustments

Dispose of public lands up to approximately 105,000 acres to meet the needs for recreation or other public purposes, community expansion, economic development, agriculture, and for the creation of blocked-ownership patterns.

Dispose of up to 13,440 acres of public lands suitable for agricultural purposes in eight valley areas in the long-term.

Utility Corridors

Designate 112 miles of utility corridors which include existing transmission lines and identify an additional 167 miles of planning corridors.

Woodland Products

Manage approximately 600,000 acres of pinyon-juniper woodland for non-commercial sustained-yield harvest of woodland products.

Manage approximately 500,000 acres of pinyon-juniper woodland for commercial harvest of woodland products.

Manage approximately 480,000 acres of pinyon-juniper woodland for commercial harvest of pinyon pine nuts.

Develop forest management plans for all pinyon-juniper areas capable of sustained-yield production of woodland products.

Livestock Grazing

Short-Term Management Actions

Livestock use may be licensed up to active preference (300,572 Animal Unit Months (AUMs)). However initial licensed use by livestock is anticipated to continue at the 5-year (1977-1981) average licensed use levels (239,717 AUMs), which is 20 percent below active preference.

Continue existing rangeland monitoring studies and establish new studies as necessary to determine what adjustments in livestock use and wild horse numbers are needed to meet the objectives of this amendment.

Actions could include, but will not be limited to, change in seasons-of-use, implementation of deferment and rest rotation grazing systems, change in livestock numbers, correction of livestock distribution problems, adjust the number of wild horses, and development of range improvements. Specific measures to improve wildlife habitat could include, but will not be limited to, restricting livestock use along streams to late summer or fall, limiting grazing use on riparian areas to moderate levels, fencing meadows and stream corridors, limiting grazing use on bitterbrush to moderate levels by winter in crucial mule deer winter range, constructing wildlife guzzlers for water, and planting desirable shrub and forb species in vegetation manipulation projects.

Implement allotment management plans on ten allotments in the "Improve" category.

The projects needed to support these plans are described below and summarized by allotment in Table 1.

Develop 16 reservoirs to provide water in areas where there are no other sources of available water. The additional water would be made available to livestock, wildlife, and wild horses to encourage more even utilization of vegetation.

Develop 21 springs to promote better distribution of livestock for more even utilization of vegetation. This action would include the installation of 20 miles of pipeline and 36 water troughs.

Construct 222 miles of fence to foster better distribution of livestock for more even utilization of vegetation. This action would include installation of 15 cattle guards.

Manipulate 7,500 acres of vegetation by plowing, burning, spraying and seeding, or reseeding, in increase available forage for livestock, wild horses, and big game and improve water infiltration and holding capacity of the soil. the areas would be fenced to allow establishment of the seeded species.

Long-Term Management Actions

Implement 18 additional AMPs on "Improve" category allotments by the end of the long-term.

Continue the rangeland monitoring program and make necessary adjustments in grazing use to achieve the objectives of this amendment.

As a result of long-term management actions, available forage is projected to increase by 22,783 AUMs above the 5-year average licensed use.

Riparian and Aquatic Habitat Management

Improve and maintain, in good or better condition, aquatic and riparian habitat on approximately 64 miles of stream in the short-term.

Improve approximately 250 acres of wetland habitat to benefit waterfowl and shore birds in northern Diamond Valley.

Improve and maintain in good or better condition 500 acres of meadows, springs, and aspen groves.

Improve and manage aquatic habitat to support reintroduction of Lahontan cutthroat trout into streams identified as historic habitat.

Shoshone-Eureka Rangeland Program Summary

Vegetation

Establish a grazing management program designed to provide key forage plants with adequate rest from grazing during critical growth periods.

Achieve, through management of livestock and wild horses, utilization levels consistent with those recommended by the Nevada Rangeland Monitoring handbook (NRMH) to allow more plants to complete cycles and to increase storage of reserves for future growth.

In the long term, improve ecological condition of 585,191 acres to good condition and 25,900 acres to excellent condition.

In the long term, stop downward trends in ecological condition on 464,873 acres and manage for upward trends on 634,868 acres.

Livestock Management

Manage livestock use at 239,717 animal unit months (AUMs) (5-year average use) in the short term and determine if such use can be maintained. In the long term, manage livestock use at 262,500 AUMs, in conformance with other objectives of the RMP.

Wildlife Habitat Management

Maintain existing wildlife habitat including big game habitat, sage grouse strutting and nesting areas.

Improve and maintain habitat for state listed sensitive species and Federally listed threatened or endangered species.

Provide habitat to allow big game populations to achieve reasonable numbers in the long-term, in conformance with other objectives of the RMP.

In the short-term, improve and maintain in good or better condition, 64 miles of aquatic habitat and 768 acres of riparian habitat associated with the streams and an additional 1,067 acres of other meadows, springs, and aspen groves.

In the long-term, improve and maintain in good or better condition, a total 84.8 miles of aquatic habitat and 1,018 acres of riparian habitat associated with the streams and an additional 1,414 acres of other meadows, springs, and aspen groves.

In the long-term, improve and maintain 133,075 acres of big game habitat in good condition and 6,104 acres in excellent condition.

In the long-term, stop downward trend on 65,702 acres of big game habitat and manage for upward trends on 144,186 acres.

Wild Horse Use

Manage viable herds of sound, healthy wild horses in a wild and free-roaming state.

Initially manage wild horse populations at existing numbers based on 1982 aerial counts and determine if this level of use can be maintained in conformance with other objectives of the RMP.

Manage wild horses within the area which constituted their habitat at the time the Wild and Free-Roaming Horse and Burro Act became law in 1971.

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