U.S. Department of the Interior
Bureau of Land Management

Winnemucca District Office
Winnemucca, Nevada

January 1998

Draft Environmental Impact Statement

TRENTON CANYON PROJECT

In Cooperation With:
Nevada Division of Wildlife

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/WN/PL-97/018

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Winnemucca Field Office
5100 East Winnemucca Boulevard
Winnemucca, Nevada 89445
702-623-1500

In Reply Refer To:
1793/3809
NV-020

February 11, 1998

Dear Reader:

This Draft Environmental Impact Statement (DEIS) for Newmont Gold Company's Trenton Canyon Project, prepared by the Bureau of Land Management, Winnemucca Field Office, is submitted for your review and comment.

The DEIS is based on a Plan of Operations submitted to the Bureau under 43 CFR 3809. This DEIS analyzes the direct, indirect and cumulative impacts associated with the continued mining and expansion of the North Peak and Valmy deposits and commencement of mining in the Trenton deposit. The DEIS also analyzes impacts related to new haul roads, waste rock storage areas, an additional heap leach facility, widening of the primary access road, and additional ancillary facilities. The Proposed Action and the No Action alternatives are analyzed, as well as backfilling alternatives and alternative configurations for waste rock dumps. The Plan of Operations and technical reports in support of the plan and DEIS are available for review at this office. Supporting materials referenced in the DEIS (but not the Plan of Operations) are also available for review at the Bureau's Nevada State Office, 850 Harvard Way, Reno, Nevada.

Comments on this DEIS will be accepted until the close of business on April 14, 1998. There will be public meetings to take comments on March 18, 1998 at the BLM Battle Mountain Field Office and on March 19, 1998 at the BLM Winnemucca Field Office. The meetings are scheduled for 7:00 pm. Written comments should be directed to Rodney Herrick, Project Manager, at the Bureau of Land Management, Winnemucca Field Office, 5100 East Winnemucca Boulevard, Winnemucca, Nevada, 89445. The Battle Mountain Field Office is located at 50 Bastian Road, Battle Mountain, Nevada.

Following a 60 day public review and comment period, a Final Environmental Impact Statement (FEIS) will be prepared that will consider the comments received. Please keep this DEIS as a reference since the FEIS may be published in an abbreviated format. You may direct questions to Rodney Herrick, Project Manager, at the above address or phone number.

Sincerely yours,

Ron Wenker

Ron Wenker
District Manager

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

[illegible]

In Reply Refer To:
[illegible]
NV-020

[illegible]

Dear Reader:

This Draft Environmental Impact Statement (DEIS) for Santa Fe Pacific Gold Company's Trenton Canyon Project, prepared by the Bureau of Land Management, Winnemucca Field Office, is submitted for your review and comment.

The DEIS is based on a Plan of Operations submitted to the Bureau under 43 CFR 3809. The DEIS analyzes the direct, indirect and cumulative impacts associated with the continued mining and expansion of the North Peak and Trenton deposits and development of mining in the Trenton deposit. The DEIS also analyzes potential impacts to new haul roads, waste rock storage areas, an additional heap leach facility, realignment of the primary access road, and additional ancillary facilities. The Proposed Action and the No Action alternatives are analyzed, as well as backfilling alternatives and alternative configurations for waste rock dumps. The Plan of Operations and technical reports in support of the plan and DEIS are available for review at this office. Supporting materials referenced in the DEIS and the Plan of Operations are also available for review at the Bureau's Nevada State Office, 850 Harvard Way, Reno, Nevada.

Comments on this DEIS will be accepted until the close of business on April 14, 1998. There will be public meetings to take comments on March 16, 1998 at the BLM Battle Mountain Field Office and on March 19, 1998 at the BLM Winnemucca Field Office. The meetings are scheduled for 7:00 pm. Written comments should be directed to Rodney Herrick, Project Manager, Bureau of Land Management, Winnemucca Field Office, 5100 East Winnemucca Boulevard, Winnemucca, Nevada 89445. The Battle Mountain Field Office is located at 50 Bastian Road, Battle Mountain, Nevada.

Following a 60-day public review and comment period, a Final Environmental Impact Statement (FEIS) will be prepared that will consider the comments received. Please keep this DEIS as a reference document. The FEIS may be published in an abbreviated format. You may direct questions to Rodney Herrick, Project Manager, at the above address or phone number.

Sincerely yours,

[illegible]

District Manager

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
TRENTON CANYON PROJECT

Lead Agency: U.S. Department of the Interior
Bureau of Land Management
Winnemucca District Office

Project Location: Humboldt County, Nevada
Lander County, Nevada

Comments on this Draft EIS Should be Directed to: Rodney Herrick, EIS Project Manager
Bureau of Land Management
Winnemucca District Office
5100 East Winnemucca Boulevard
Winnemucca, Nevada 89445
(702) 623-1500

Date Draft EIS Filed with EPA: February 13, 1998

This Draft Environmental Impact Statement (DEIS) analyzes the impacts that would occur with the implementation of Newmont Gold Company's (Newmont) *Revised Final BLM Plan of Operations and NDEP Reclamation Plan and Permit Modification* for the Trenton Canyon Project. The Trenton Canyon Project is composed of mining operations in three distinct deposits: North Peak (T32N, R42E, Sections 1, 11, 15), Valmy (T33N, R43E, Sections 20, 21, 29, 31, 32) and Trenton Canyon (T32N, R43E, Sections 7,18, 19 and T32N, R42E, Sections 13). The portion of the Valmy and North Peak operations on private land are currently permitted and would be expanded under the proposed project. The proposed Trenton Canyon deposit mining operations would include 8 open pits; 6 overburden storage areas; diversion channels and ancillary facilities; and improved access. The Valmy deposit would include expansion of the pit and construction of a heap leach facility. The incremental surface disturbance for modifications of permitted facilities and for proposed new activities within the Proposed Action would be approximately 1,480 acres, including 633 acres of public land administered by the BLM. The environmental impacts associated with the proposed mining of the Trenton Canyon deposit and expansion of the Valmy and North Peak mining areas (Proposed Action), the No Action Alternative, the Expansion of TC-6 Alternative, the Rehandling of TC-4 and TC-5 Alternative, and the Partial Sequential Backfill Alternative are presented within this DEIS.

Responsible Official for EIS: Ron Wenker
Ron Wenker
Winnemucca District Manager

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SUMMARY

Santa Fe Pacific Gold Corporation (SFPG) submitted a Plan of Operations for the Trenton Canyon Project in March 1996 to expand their currently permitted operations at Valmy and North Peak deposits and to conduct mining in the Trenton Canyon deposit. In May 1997, Newmont Gold Company (Newmont) merged with SFPG and is currently operating all of the former SFPG mines. Based upon responses received during the review of surface management under 43 CFR Subpart 3809, the Plan of Operations was revised in October 1997.

The Trenton Canyon Project is located approximately 12 miles south of Lone Tree Mine, which is 34 miles east of Winnemucca and 18 miles west of Battle Mountain on Interstate 80 (I-80). The Trenton Canyon Project is accessed via the Stonehouse Interchange (Exit 212) on I-80 (Figure 1-1). Located on the northwestern flank of Battle Mountain, Trenton Canyon Project spans Trout and Cottonwood Creeks in Humboldt and Lander counties.

Newmont's proposal is to expand mining operations from those currently permitted on private lands onto public lands located in Humboldt and Lander counties, Nevada administered by the Bureau of Land Management (BLM). Therefore, the review and approval of Newmont's Plan of Operations is subject to compliance with the Federal Land Policy Management Act and with the associated BLM surface management regulations (43 CFR Subpart 3809). The BLM has determined an Environmental Impact Statement (EIS) is necessary to evaluate the potentially significant impacts of the Proposed Action and alternatives. The Nevada Division of Wildlife, Department of Conservation and Natural Resources has provided information and review capacity regarding wildlife as a cooperating agency in the preparation of this EIS.

PURPOSE AND NEED

The purpose of the Trenton Canyon Project is to allow Newmont to use its existing work force, mining equipment, and ore processing facilities to produce gold from additional reserves occurring on lands near Newmont's currently permitted operations at North Peak and Valmy deposits. The project need is reflected by the demand for gold that has been identified in the national and global markets. Gold is an established commodity with international markets. Uses include investments, a standard for monetary systems, jewelry, electronics, and other industrial applications.

SCOPING PROCESS

The purpose of this EIS is to evaluate reasonable and practical alternatives which meet the purpose and need for the Project as it responds to the requirements of the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) of 1969 (40 CFR Parts 1500-1508) and the Department of the Interior's guidance in the BLM's NEPA Handbook (H-1790-1).

The scoping process for this project consisted of early agency consultation by SFPG during which project concepts and alternatives were developed. A Notice of Intent to prepare an EIS for the Trenton Canyon Project, Humboldt and Lander Counties, Nevada was published in the Federal Register on September 12, 1996 (Vol. 61, No.178). A public scoping meeting was held in Winnemucca, Nevada, on September 24, 1996, and a public notice was issued soliciting comments during a 30-day comment period from September 12 to October 15, 1996. Additional meetings were held with regulatory agencies during preparation of this Draft EIS (DEIS). The consultation and scoping process resulted in the identification of the following major issues:

- Potential impacts to wetlands and fill into wetlands or Waters of the United States (WUS),
- Protection of species of concern and their habitat known in Humboldt and Lander Counties,
- Conforming open pit safety/securing method(s) to the requirements of NAC Chapter 513 following completion of mining,
- Protection of sage grouse and sage grouse strutting grounds,
- Protection of birds habitats, mule deer summer habitat, upland game habitat, wildlife water sources, fisheries resources, raptor habitat, and bat species common throughout the Battle Mountain and Winnemucca areas,
- Preservation of a small seep at the mouth of Trenton Canyon essential to the local upland game and nongame wildlife,
- Preservation of riparian habitat for valley quail populations in the Cottonwood Creek drainage,
- Protection of the Cottonwood Creek trout population by sediment control,
- Livestock access to and from waters and grazing on the Badger Ranch in the North Buffalo allotment near the Trenton Canyon project. Avoid livestock reduction because of fenced out and disturbed lands,
- Mitigate traffic on the access roads in order to avoid safety hazards to cattle and livestock,
- Avoid loss of grazing capacity (i.e. reduction in grazing permit) and fiscal losses.

A 60-day comment period will follow release of this DEIS on February 13, 1998. A public hearing on the DEIS will be held during the comment period on March 18 and 19, 1998 in Battle Mountain and Winnemucca, Nevada respectively. Both meetings will be held at BLM's offices in those locations. The close of the DEIS comment period will be April 14, 1998.

EXISTING AND PERMITTED FACILITIES

The existing facilities and permitted activities are primarily on private lands at Valmy and North Peak deposits, but public lands are used for corner crossings of water and communications lines, power lines, and road rights-of-way. Existing and approved facilities at North Peak and Valmy mining areas include:

- Two open pits,
- One heap leach facility and process overflow pond at North Peak mining area,
- Three overburden disposal areas,
- Access and haul roads,
- A water/communications line that is the sole water source for existing facilities,

- A power line,
- Ancillary facilities, and
- Exploration drill sites and access roads.

PROPOSED ACTION AND ALTERNATIVES

Proposed Action

The Proposed Action includes the expansion of the existing approved facilities and the addition of new facilities (Figure 2-3). The existing approved facilities to be expanded and/or modified include the Valmy pit, the North Peak pit, two overburden disposal areas, the heap leach facility, the access road, and other ancillary facilities. The new proposed facilities include the open pit mining area at Trenton Canyon deposit, 11 overburden disposal areas, two heap leach facilities, and other ancillary facilities. In addition, exploration activities would continue to be conducted. The incremental surface disturbance for modifications of permitted facilities and for proposed new activities would be approximately 1,480 acres, including 633 acres of public land.

Alternatives Considered but Eliminated

Use Cottonwood Creek as the Overburden Disposal Area for the Trenton Pits - This alternative was eliminated from further consideration because of the risks to water quality and the impacts to riparian resources, wildlife, and fisheries could be high, as Cottonwood Creek is the principal habitat of that type in the project area. This alternative would have also required a Section 404 Permit from the U.S. Army Corps of Engineers under the Clean Water Act of 1973 and significant design modifications to maintain flows within the creek bed.

Haul Leach Ore to Lone Tree Mine for Processing - This alternative was identified as an alternative to heap leach facilities near the pit sites and would have eliminated the need to store and handle sodium cyanide and other reagents, and for spill prevention and pollution controls at the Valmy and North Peak areas. The processing at Lone Tree Mine would increase, howe.er, and likely require additional infrastructure. The environmental risks of pollution at heap leach facilities are low because of stipulations within the NDEP Water Pollution Control Permit that control or prevent impacts. For this scenario, the environmental benefit does not outweigh the risks and increased impacts of emissions, noise, and costs for equipment maintenance and operation resulting from additional hauling, therefore, it was eliminated from further consideration.

Establish One Centralized Heap Leach Pad - The original mine plan concept included a single location for the heap leach facility near the center of the project area in Section 1, T32N, R42E. This location had benefits because it was on the main access road to the Lone Tree Mine and it eliminated the need (and cost) for developing two separate heap leach facilities. It was eliminated from further consideration, however, because of the increased haul distance and the proximity to both Trout and Cottonwood creeks with the potential for higher surface and ground water impacts.

Total Backfill Alternative - This alternative would involve the mining of all pits, then return of overburden material from stockpiles into the nearest pits to completely fill the adjacent pits. There would still be a need to construct overburden disposal areas due to the 30% swell factor and increased costs associated with re-handling of materials would be economically prohibitive. The cut-off grade for ore under this alternative would have to be higher and a greater amount of lower grade mineralization would be left in place. Therefore, this alternative was considered unreasonable and was eliminated.

Underground Mining - To reduce surface disturbance impacts, underground mining of the Trenton Canyon deposits instead of open pit mining was reviewed as an alternative. Underground mining has higher initial capital and operating costs than open pit mining and typically only becomes practical when extracting deep, high-grade ore. The ore within all three mine areas (i.e., North Peak, Valmy and Trenton Canyon) is primarily low-grade oxide ore which requires cyanide leach extraction. This alternative was eliminated from further consideration because it would be technically infeasible and economically prohibitive.

Alternatives Evaluated in Detail

In addition to the No Action alternative, alternatives to the Proposed Action were developed in response to the issues and concerns identified during the scoping process. These issues focused primarily on potential slope stability hazards, cumulative impacts of surface disturbance to wildlife habitats and other resources, and protection of the Cottonwood Creek drainage and riparian resources.

No Action - The currently permitted activities at the Valmy and North Peak mine areas and the permitted exploration activities within the project area, represent the "No Action" Alternative. This involves construction, operation, reclamation, and closure of the currently permitted existing and approved facilities on private lands and use of federal lands for access at both Valmy and North Peak mining areas as stipulated by the State of Nevada and BLM. The currently permitted project boundary includes Sections 29 and 31, T33N, R43E and Sections 1, 11, and 15, T32N, R42E.

Expansion of TC-6 to Eliminate TC-4 and TC-5 - The objective of this alternative is to identify an alternate location for the overburden that was proposed to be deposited in ravines on the west side of Cottonwood Creek. All elements of this alternative would be identical to the Proposed Action except that overburden designated for disposal in areas TC-4 and TC-5 of the Trenton pit area would be disposed in area TC-6 (Figure 2-11).

Partial Pit Backfill Alternatives - Two partial pit backfill options which were formulated to protect downslope resources, improve aesthetics, and reduce surface disturbance. The partial backfill alternatives respond to specific BLM concerns including issues of protection of surface water (particularly Cottonwood Creek), reduction of erosion and siltation, long-term stability of reclaimed slopes, and improved post-reclamation aesthetics. Because of its linear configuration of multiple pits, the Trenton Canyon deposit was preferred over North Peak or Valmy mine areas for sequential pit backfilling.

Rehandling of TC-4 and TC-5 - The protection of Cottonwood Creek was a high priority; therefore, the focus of this concern was a perceived higher potential for sedimentation of Cottonwood Creek resulting from the location and proximity of overburden disposal areas TC-4 and TC-5. The objective of this alternative is to use material in areas TC-4 and TC-5 as pit backfill following completion of the mine sequence.

Partial Sequential Backfill - This alternative would effect the partial backfilling of certain mine pits with overburden that becomes available during the planned mine development sequence, and it would potentially reduce the total area of mine disturbance, reduce or eliminate some overburden disposal areas, reduce the reclamation effort for the overburden disposal areas, maximize the total amount of land reclaimed to beneficial use, and reduce potential sedimentation to Cottonwood Creek. Most of the components of this backfill alternative would be similar to the Proposed Action except the final geometry of the pits and overburden disposal areas, and some difference in haul routes. The ultimate size and shape of the pits and mine sequencing can change over the life of the project as a function of commodity prices.

Agency Preferred Alternative

In accordance with NEPA, the lead agency is required by the Council on Environmental Quality (40 CFR 1502.14) to identify its preferred project alternative in the EIS. The BLM's preferred alternative is the Proposed Action with the sequential backfilling of overburden material (if it is economically feasible at the time of mining) and implementing appropriate mitigation for each significant potential resource impact.

AFFECTED ENVIRONMENT

Surface Water - Surface water quality in the project vicinity is generally good. Concentrations of some constituents in surface water at the project site exceeded Nevada surface water quality standards for aquatic life and agriculture. Constituents with exceedances at a number of locations and times were lead and phosphorus. Those with isolated exceedances were total suspended solids, copper, mercury, molybdenum, selenium, silver, and zinc. The level of exceedance for these constituents was generally low.

Groundwater - The project is located along ridges and upland areas of the Battle Mountain massif. This area serves as a recharge zone for the deep alluvial aquifers beneath the adjacent valley floors. Groundwater flow within the project area is toward the northwest, reflecting local topography (Figure 3-2 and 3-2a). The proposed pits are all located in different rock units.

The principal hydrostratigraphic units in the study area are: 1) a shallow unconfined system of isolated perched water zones in Quaternary Alluvium and shallow bedrock; and 2) a deep unconfined system located in heavily fractured bedrock. Geologic structures in the project area that influence groundwater movement include the West Side, 300, Oyarbide, and Buffalo and other high angle fault systems, the Golconda Thrust, and small unmapped structures. Groundwater levels are below the lowest elevation of all the proposed pits. The water quality data indicate that the groundwater is a calcium bicarbonate dominated system above the ore deposit, and a calcium sulfate-bicarbonate system below the ore deposit. Groundwater quality upgradient of the ore bodies is fairly good, with documented exceedences of the manganese drinking water standard. Downgradient water quality exceeds several drinking water standards.

Hazardous Materials - Sensitive areas for hazardous materials release would include riparian zones along the Cottonwood and Trout Creeks, and areas with direct pathways, usually airborne, to humans, wildlife, or aquatic life. The entire study area is currently subject to drilling and road-building activities associated with mineral exploration. Hazardous materials currently used in conjunction with exploration include petroleum motor fuels and lubricants, antifreeze and solvents to operate and maintain equipment. The hazardous materials are brought on-site in small amounts for daily consumption. No hazardous materials storage facilities are currently located within the project area boundary.

Geology and Minerals - The project includes three deposits: the Trenton Canyon, the Valmy, and the North Peak. These gold deposits are structurally controlled and hosted in sedimentary rocks. Formations hosting gold include the Havallah, Valmy, and Battle Formations. Ore-controlling structures in all of the deposits are high-angle normal faults that trend north-south, northeast-southwest, or northwest-southeast.

Kinetic humidity-cell testing indicates that most rocks from the three deposits that had the potential to generate acid (i.e. ABA less than 3.0) had an average pH greater than 6.5. Toxicity Characteristic Leaching Procedure (TCLP) results showed that no samples exceeded the EPA limits for metals concentrations. None of the tested materials would therefore be classified as hazardous waste under the Resource Conservation and Recovery Act (RCRA).

Air - All four sub-basins within the project area are considered to be PM_{10} attainment areas by the Nevada Bureau of Air Quality. The four sub-basins are designated as unclassified for other criteria pollutants (nitrogen oxides, sulfur dioxide, carbon monoxide, and ozone). The major sources of air emissions in the project area are from the North Valmy Station coal-fired power plant, and emissions from the Marigold and Lone Tree mines, including vehicular traffic on unpaved roads.

Soils - The study area consists of three major landform types: 1) mountains; 2) foothills; and 3) fan piedmonts. The area soils vary widely, ranging from shallow soil and rock outcrops in the highland reaches to deep alluvial loamy soils in the valleys. The total volume of topsoil available for future reclamation activities would be approximately 1.6 million cubic yards (approximately 7 inches of topsoil). This volume would likely fall short of the volume required for adequate reclamation, and would require supplemental material.

Vegetation and Special Status Plant Species - Six major vegetation cover types were identified within the Trenton Canyon Project area (Figure 3-15). The Wyoming big sagebrush, mountain big sagebrush, low sagebrush, and black sagebrush types occur on foothills and mountains. The salt desert shrub type occupies lower elevations associated with alluvial fans. Greasewood occurs at elevations between 5,000 and 5,200 feet in areas of high alkalinity with shallow groundwater. Data that were used to describe and characterize each cover type, including acreages, mean percent cover, mean production (lbs/acre), ecological condition, and percent cover of primary species (greater than 1% cover) are summarized in Table 3-16. No threatened, endangered, or candidate plant species have the potential to occur within the project area.

Several plants with cultural value were collected in the higher elevation areas of the Trenton Canyon project area: Douglas rabbitbrush (*Chrysothamnus viscidiflorus*) has both medicinal and spiritual value for the Western Shoshone. This plant is quite common in the region and is represented in each of the five vegetative cover types within the project area. Buckwheat (*Eriogonum caespitosum*) is used as a salve or as an eye medicine. This plant occurs in higher elevations but is not one of the dominant cover plants.

Wetlands and Riparian Habitat - Jurisdictional wetlands were identified along the drainage systems that cross the project area, as well as at a number of springs and seeps where surface water is sufficient to develop wetland conditions. Approximately 2,125 feet along the upper reach of Cottonwood Creek (29 acres) and areas along Trout Creek that occur as wet meadows (9 acres) were delineated as jurisdictional wetlands. Two springs that occur in the south half of Section, 20, T33N, R43E, were also delineated as jurisdictional wetlands. Mud Spring is the larger of the two, and calculated to be 3 acres; the smaller, unnamed spring covers approximately 2 acres. Ames Spring also supports a relatively large wetland area of approximately 8 acres. This spring is located between Sections 16 and 21, T33N, R43E.

Ten stream reaches totaling 14 acres were identified as Waters of the United States. These areas include reaches of Cottonwood and Trout Creeks and also included a number of tributaries of these drainage systems that contain flow only in response to storm-event runoff or snow melt. The wetlands identified in upper Cottonwood Creek can be classified as a *Populus tremuloides/Salix* c.t. ecological type, one of the recognized riparian communities of Central Nevada (Forest Service, USDA 1996). The Trout Creek riparian ecological type is a dry grass meadow with a trough-shaped drainageway that has been disturbed by grazing along much of the length.

Wildlife, Fisheries, and Special Status Animal Species - The project area (Figure 3-16) is situated in the northern reaches of the basin and range physiographic province. Wildlife habitat types present in the area are generally open areas dominated by mountain big sagebrush, Wyoming big sagebrush, low sagebrush, or shadscale, and, riparian woodlands along streams and other drainage ways. Habitat inclusions of lesser areal extent than the major habitat types listed above include stands of juniper, rock talus, and areas dominated by black sagebrush or greasewood.

Riparian habitats are variously dominated by chokecherry, willow, and elderberry, with occurrences of aspen. Larger overstory trees such as cottonwood are generally lacking in the riparian habitats of the project area. Cottonwood and Trout creeks support high quality aquatic and riparian habitats, representing the most complex and diverse ecosystems in the project area. Cottonwood Creek is characterized by an aspen overstory with a shrubby midstory and understory of grasses and forbs.

The number and diversity of animal species within an area is determined by the diversity of vegetation types. Overall, the diversity of vegetation communities in the project area is not great either in structure or composition, with other limiting factors of surface water and riparian vegetation. Wildlife resources of the project area consist of a variety of small, relatively inconspicuous species of mammals, birds, amphibians, reptiles and fish. Larger species that inhabit the area include mule deer, coyote, badger, bobcat, mountain lion, and several species of game birds and raptors.

Several special status species are present within northern Nevada, however, few of these are documented within the project area. No species federally listed as threatened or endangered were identified in the area, nor does suitable habitat for such species exist. Eight mammal, three bird, and one amphibian species were identified by the USFWS as sensitive and potentially occurring within the project area, although the appropriate habitats are not present within the project area.

Range - The project area encompasses parts of the North Buffalo and Copper Canyon livestock grazing allotments, of which 4,371 acres are on public land and 5,619 acres are on private (Table 3-20). Both allotments are administered by the Battle Mountain BLM District office. Three permittees are licensed for livestock grazing within the two allotments: the Badger Ranch, the Agri-Beef operation, and the Ellison Ranching Company.

Recreation - BLM lands in the project area are managed for dispersed recreation including upland game hunting, off-highway vehicle (OHV) use, and rockhounding. No developed campgrounds or day-use areas are present within the project area. However, the Mill Creek Recreation Area is located approximately 15 miles south-southeast of the southern Battle Mountain Range and Water Canyon is less than ten miles southeast of Winnemucca. Recreation opportunities near Mill Creek include camping, deer, and upland bird hunting, fishing, mountain biking, hiking, geologic sightseeing, and rock-hounding. Water Canyon offers picnicking, bird watching, hiking, and camping. The year-round stream supports a lush riparian environment (BLM Battle Mountain Gold Phoenix Project Baseline Report 1996). Presently, there are no developed facilities.

Land Use and Access - Land ownership in the project area is a "checkerboard" of public and private land. Federal lands are administered by the BLM; private lands are owned by SFPG. Public lands within the two counties are managed for "multiple use," which allows mineral exploration, mining, livestock grazing, wildlife management, recreation, and other uses. Land uses within the study area include mining facilities and mining claims, grazing allotments and range improvements, energy and communications facilities, transportation systems and dispersed recreation. Mining and mineral exploration are the major land uses in the study area and will likely remain so for decades. There are no incorporated towns or rural residences within the study area. Battle Mountain and Winnemucca, are the two most potentially impacted communities within the region of the Trenton Canyon Project study area.

Visual - The landscapes in the project area are characterized by open, expansive views and minimal overstory vegetation. The characteristic landscape is distinguished by isolated, roughly parallel mountain ranges separated by broad valleys draining northeast toward the Humboldt River. The mountains are typically 5 to 10 miles in length and are generally north-south trending. Surrounding the base of the mountains and extending into the broad valleys are distinctive alluvial areas.

The peak, north-facing and east-facing slopes, of the Battle Mountain were rated by BLM for their scenic quality in the early 1980s as level B (some common and some outstanding features), however because of ongoing mining and other activities the scenic quality is rated as level C (fairly common).

The west-facing slopes of Battle Mountain, lower Cottonwood Creek, and the Buffalo Mountains are all rated as Scenic Quality level C. Interstate 80 is classified as a moderate sensitivity viewpoint when considering both use volume and user attitude. The study area is all within Visual Resource Management (VRM) Class III and IV (refer to Table 3-23 and Figure 3-19). Activities within a VRM Class III area may attract attention but should remain subordinate to the characteristic landscape.

<u>Noise</u> - No actual noise measurements have been recorded at the proposed mine sites. Noise generated by trucks, bulldozers, and other equipment typically ranges from 85 to 90 dBA at 50 feet. Sound levels from blasting range from 115 to 125 dBA at 900 feet. This noise is a relatively short-term percussive sound. The nearest residential area where noise from the mining activity may be heard is the town of Valmy, Nevada, approximately 6 miles north of the Valmy mining area and as far as 13 miles from the North Peak and Trenton Canyon mining areas.

<u>Social and Economic Values</u> - The project area's history and development are distinguished by its relatively narrow economic base and dependence on mining, agriculture, gaming/tourism, and transportation. Large-scale gold mining is the dominant economic activity in the region, which has prospered from the influx of skilled workers and expansion of mining support services and supply industries. Most of the workforce for the Trenton Canyon Project reside in the communities of Winnemucca and Battle Mountain, where the mines procure a significant share of their operating supplies and services. The towns are characterized by a core of commercial businesses and civic facilities surrounded by traditional residential neighborhoods, which give way to new tracts of conventional and mobile home developments and commercial developments.

<u>Cultural Resources</u> - The project area was apparently used both by Northern Paiute and Western Shoshone. A total of 152 prehistoric or historic cultural resource sites have been recorded in the study area (Figure 3-23). Twenty-seven have been determined National Register eligible, four multiple component sites are present at which either the prehistoric or historic component is eligible, the eligibility of twelve sites is listed as pending or unknown, and the remaining 109 sites have been determined not to be National Register eligible. Other relevant information in the ethnography applies to the behavior of the sage hen (Western Shoshone identified a sage grouse "strutting" area in the project area).

ENVIRONMENTAL CONSEQUENCES

Impacts were identified and described as being direct or indirect, adverse or beneficial, and short-term or long-term for each environmental resource. The context and expected intensity of impacts are also defined.

<u>Surface Water</u> - Cottonwood Creek is the receiving water for the Trenton Canyon mine area and Trout Creek is the receiving water for the Valmy mine area. The North Peak mine area drains to the north and west and has no receiving watercourse. Constructing and operating the mining facilities, including pits and stockpiles within the studied watersheds could potentially alter flows within established waterways due to diversion channels, have long-term reduction in surface water runoff and watershed area due to mine pits, and change surface runoff characteristics due to surface disturbance. Water quality impacts

would result from long-term meteoric water infiltrating through stockpiles, increased sediment loads due to erosion from roads, stockpiles, and disturbed surfaces, and potential spills, leaks, or overflows from a heap leach facility or other mining activities. Neither the Trenton, North Peak nor Valmy pits would require pit dewatering; therefore, there would be no discharge to surface water as a result of the Proposed Action, the No Action or alternatives.

Under the No Action Alternative, runoff from the watershed draining into the existing permitted area within the Valmy drainage areas would be diverted to avoid run-on into the open pits or stockpiles. The total area removed from the watershed during operation would be the heap leach and overflow pond plus the pit, or approximately 105 acres. The disturbed area that could lead to increased runoff is approximately 198 acres. The total area removed from the watershed after reclamation would be approximately 34 acres (Table 4-1). There would be no risk of sediment loading to riparian areas and aquatic habitats, because, in addition to design features in the existing operating plan, the disturbed areas are not directly upslope of any creeks or riparian habitat.

The watersheds altered under Proposed Action are shown in Table 4-1. Land used for open pits, process ponds, and heap leach pads would produce no runoff during mining and reclamation. As in the No Action Alternative, roads, pipelines, diversions, and ancillary facilities would produce greater runoff during mining but would approximate natural conditions following reclamation. Runoff characteristics would change because of varying drainage characteristics based on slope and intensity of precipitation compared to natural areas.

Under the Proposed Action, the total area removed from the watershed during operation is approximately 592 acres. The total area removed from the watershed following reclamation is approximately 387 acres. No change would occur to channel geometry, and the risk of sedimentation would be minimized by design features and management practices as proposed in the Plan of Operations and Reclamation Plan (Section 2.4.7).

Infiltration of meteoric waters through the proposed overburden disposal areas within both the North Peak and Valmy mine areas are not expected to impact surface waters as the current watershed does not produce perennial flows. The long-term concentrations for water quality would be within state and federal standards for the average conditions for most of the studied parameters. Flows in diversion ditches and along benches within reclaimed slopes and runoff from disturbed areas could potentially lead to increased erosion relative to natural conditions. Increased sediment loading to streams could alter flow regime and habitat quality. Many design features are included in the Proposed Action to control erosion.

Surface water quantity impacts under the Expansion of TC-6 to Eliminate TC-4 and TC-5 alternative would be similar to the Proposed Action. Because of flatter slopes in this alternative, there would be less direct run-off from overburden disposal area slopes. The long-term alteration of drainage area would be 23 acres less than the Proposed Action within Basin 1 of the Cottonwood Creek drainage (Figure 4-1).

A 25-acre increase in aggregate surface area of the overburden disposal areas could potentially lead to an increase in estimated long-term seepage from the overburden disposal areas. Given the small overall flow, the predicted water quality for this alternative would not be materially different than that described for the Proposed Action. Erosion would be reduced from the overburden disposal area slopes in this alternative.

As under the Proposed Action, the total area removed from the watershed during mining and following reclamation would be approximately 592 acres and 387 acres, respectively (Table 4-1). The area of disturbed surfaces due to ancillary facilities, diversion, pipelines, and roads would also be the same as the Proposed Action. After reclamation, the surface contributing to run-off would be approximately 594 acres (i.e., elimination of overburden disposal areas TC-4 and TC-5 and their diversions) or 134 acres less than the Proposed Action.

Under the rehandling alternative, there would be no long-term effect to surface water quality from infiltration of meteoric waters through TC-4 and TC-5 to surface water quality as these materials would be within a pit and any seepage would contribute entirely to the groundwater. The surface expression of flow through TC-3 and TC-6 would be negligible and dispersed. There would be a risk of sediment loading to riparian areas and aquatic habitat during mining. In addition, the risk would remain for a longer period of time compared to the Proposed Action because of having to re-handle the overburden from TC-4 and TC-5 back into the pit.

The Partial Sequential Backfill of Trenton Canyon Pits Alternative would includes construction of some overburden disposal areas in the pits rather than on the natural surface. There would be no diversions required for the disposal areas within the pit; therefore, run-off effects and alteration of drainage could be 100 - 300 acres less than under the Proposed Action, depending on the final configuration. Less surface disturbance implies less risk of erosion; however, the sedimentation risks within the Proposed Action would be minor because of the proposed protection measures which are part of the Plan of Operations and Reclamation Plan. Therefore, this alternative's surface water impacts would be similar to the Proposed Action.

The Proposed Action and alternatives would not require any discharge to surface water and flow and run-off characteristics would not be measurably different from the existing condition. There would be no residual adverse effect on surface water quality within the project area under any of the action alternatives.

Groundwater - The Proposed Action, No Action and each of the other alternatives have similarities of construction and operation which would result in similar groundwater effects. No additional water supply would need to be developed, and there is no expected pit dewatering required under any of the alternatives. Some surficial weathering of pit walls and overburden disposal areas would occur under any of the alternatives, potentially resulting in metals leaching into the groundwater.

Mine process water for all of the project alternatives would be necessary to support the existing permitted facilities, but would be less than 1,500 gpm, the amount projected for use during full operation of the Trenton Canyon Project. This would have no direct impact on groundwater because the process water is supplied from the Lone Tree Mine dewatering well system, which would continue to function regardless of the decision to permit the Trenton Canyon Project.

Indirect impacts of any alternative could include the potential for groundwater degradation as a result of toxic or hazardous chemical release from the North Peak heap leach facility, storage tanks, or transportation routes. Engineering and construction controls, Spill Prevention, Control and Countermeasure (SPCC) Plans, Emergency Response Plans (ERPs), and employee safety training minimize the risk of a release and provide direct immediate remedial activity to limit the size of the release.

Based on the rock type analytical results which indicated mostly low sulfur content and elevated carbonate, the potential for impact due to sulfur oxidation and acid release appears to be minimal. Weighted ANP/AGP were in the range of 4.9 to 30.4, and it can be concluded that the potential for metal leaching due to acidic conditions is extremely low for tested overburden material and pit excavations under any alternative.

Long-term effects of the Proposed Action include the potential change in groundwater chemistry due to the infiltration of precipitation through the overburden disposal areas and pit excavations. The predicted overburden disposal area leachate concentrations (Table 4-4) are well within the drinking water standards except for sulfur where the predicted concentration was 1059 mg/L compared with the maximum secondary standard (for public water supply) is 500 mg/L. Other alternatives would have similar effects on groundwater.

__Hazardous Materials__ - Direct and indirect impacts would be experienced by the Proposed Action, the No Action Alternative, and the Action Alternatives in the event of a release of hazardous substances to the environment. The likelihood of such impacts is low. The releases could occur during transportation to and from the project, or from use or storage of the materials on the project site. The environmental effects of a release would depend on the substance, amount, timing and location of the release. Hazardous materials releases could reach sensitive receptors, primarily via migration through air and water transport mechanisms. The impact of hazardous material exposure to sensitive receptors ranges from slight, transient effects to severe chronic systemic dysfunction or death. In general, the two materials of greatest concern are diesel fuel and sodium cyanide. The storage locations for these materials are indicated on Figure 2-5. Due to the anticipated rapid response and cleanup of a diesel spill, long-term exposures to diesel fuel in soil or groundwater are not expected.

All hazardous materials would be handled in accordance with applicable Mine Safety and Health Administration or Occupation Safety and Health Administration regulations. The hazardous substances to be used in the Proposed Action, the No Action, or the alternatives would be handled as recommended in the manufacturer Material Safety Data Sheets. No residual adverse effects or irreversible and irretrievable commitment of resources are anticipated.

__Geology and Minerals__ - The Proposed Action, the No Action, or alternatives would create direct impacts on geologic and mineral resources. Impacts would be limited to excavation and relocation of overburden, ore processing and removal of gold. A direct impact to the geologic resources from mining would result in an irreversible and irretrievable commitment of resources. The gold would be irretrievably removed from the geologic resource but would remain in circulation indefinitely. Disturbances associated with the Proposed Action, the No Action, and the action alternatives could potentially result in direct impacts on paleontological resources if present. If fossils are discovered during mining activities, the operator would contact BLM to determine the procedures necessary for recovery or avoidance of fossil remains.

Air - The primary issue related to air quality is the increase in fugitive particulate and fugitive gaseous emissions related to construction, operation, closure and reclamation phases of the Proposed Action, the No Action, or the alternatives. The potential air emissions were estimated using air dispersion modeling from the Mule Canyon Project and the Lonetree Mine Project. As a result of this modeling it was concluded that emission releases from the Proposed Action, the No Action, or the alternatives would not cause significant degradation to the ambient air quality in the vicinity of the project area.

Mining, ore-processing, and construction activities associated with the Proposed Action, the No Action, or alternatives would be a source of particulates that are 10 microns or smaller in diameter (PM_{10}), and hazardous air pollutants (fine airborne metal dust as components of particulate matter and as components of volatile organic compounds). Gasoline and diesel-powered vehicles and equipment and fuel storage would be primary sources of gaseous pollutants such as sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), and volatile organic compounds (VOCs). Particulate emissions associated could potentially result in temporary decreases in visibility near the operations, especially during dust storms. The only point source of particulate emissions would result from handling of lime during ore processing.

Soils - Soil resources would be impacted directly in areas where the soil surface is disturbed. Soil resources would also be impacted indirectly as a result of potential increased runoff from disturbed areas. The areas of impact for each development activity are summarized in Table 2-2. Reclamation activities for the Proposed Action, the No Action, or any of the alternatives could require close to 12 inches of topsoil to cover the overburden disposal areas, roads, heap leach pads, and pond areas at a sufficient depth for successful vegetation growth. Under the Proposed Action, the No Action, or the alternatives, the amount of available soil salvaged from disturbed areas would be less than necessary to achieve the desired cover depth. Alternate sources of growth medium would need to be developed to make up for the shortage. The Proposed Action or the alternatives would result in alterations of the natural topography and changes to the short-term erodibility and suitability of soils for use as a medium for growing plants. Reclamation activities, which would include grading and revegetating slopes, however, would promote the long-term reestablishment of soil and plant communities to the impacted areas. A smaller area of soil disturbance would occur under the No Action Alternative.

Vegetation and Special Status Plant Species - Direct impacts are those which would result in the loss or removal of vegetation due to the construction of facilities and haul roads, pit development, and overburden disposal. Indirect impacts include the degradation of vegetation due to trampling and soil compaction. Both of these types of impacts would only be expected to occur in those areas already permitted for facilities and mining operations or would be expected to be included as part of the Proposed Action or alternatives. Short-term loss of habitat would result in those areas where facilities would be removed and revegetation is planned following closure of the mine. Long-term loss of vegetation would occur in the vicinity of the pits, which would not be backfilled or revegetated. Under the Proposed Action, the No Action, or the alternatives there would be the opportunity for noxious weeds to invade and establish, which would change the composition of native vegetation communities. Revegetating disturbed areas and controlling these potential invasions through careful monitoring are the principal means of mitigation. However, the proposed revegetation plan would be expected result in establishing stable communities that would be able to sustain wildlife and livestock levels comparable to pre-mine conditions. No plant populations of listed threatened, endangered, or candidate species, BLM sensitive species, or habitat thereof are within the boundary of the Proposed Action, the No Action or the alternatives.

Under the No Action Alternative, the construction of facilities for existing mining activities would result in the loss of less vegetation during the life of the current operations than under the Proposed Action or alternatives. Under the No Action, vegetation at the proposed Trenton Canyon mine area would remain in its present condition (refer to Table 4-9).

The Expansion of TC-6 to Eliminate TC-4 and TC-5 alternative would result in the surface disturbance of 25 acres more than that estimated for the Proposed Action. The increased haul distance to the expanded disposal area would be 1-2 miles longer than the Proposed Action. Vegetation types that would be affected by the enlargement of TC-6 would be generally similar to those affected by TC-4 and TC-5.

The Rehandling of TC-4 and TC-5 alternative would reduce the long-term erosion and sedimentation impacts at disposal areas TC-4 and TC-5. Short-term erosion impacts would be the same as the Proposed Action, with the exception that erosion would be more likely to occur during removal operations.

Under the Partial Sequential Backfill of Trenton Deposit Pits alternative, erosion and sedimentation impacts would be reduced, as compared to the other alternatives, as a result of the reduction of disturbed surface areas and exposed soils (i.e., overburden disposal areas). This would also reduce the impacts to vegetation due to the decrease in the destruction of plant habitats and areas that would have to undergo reclamation. This would in turn reduce the potential for invasion by noxious weed species.

Wetlands and Riparian Habitat - The Proposed Action and alternatives would have the potential to impact wetlands through excavation and fill activities as well as through degradation of water quality. The jurisdictional wetlands which would the most potential to be affected by the proposed alternative include Mud Spring and Ames Spring. There would be no direct impacts to wetlands or riparian habitat as a result of the Proposed Action, the No Action, or the alternatives. Indirect impacts for all alternatives could result from interference with drainage into the wetlands, water source degradation within the project area as a result of sedimentation, especially during earthmoving activities, or from input of toxic materials as a result of an accidental spill or leak.

The Proposed Action, the No Action, or the alternatives would result in alterations of the natural topography and changes to the short-term erodibility of soils. Some reduction in wetland function is possible as a result of dredge and fill activities and altered stream flows. The extent and intensity of such impacts depends on the erosion and ground and surface water hydrology mitigation measures.

Wildlife, Fisheries, and Special Status Animal Species - No impacts have been identified as significant as a result of the Proposed Action or the other project alternatives. Proposed activities under any of the alternatives may result in the loss or degradation of habitat for wildlife. No riparian habitat, springs or seeps would be directly removed under any of the alternatives. Most of the types of impacts on wildlife would occur with any of the alternatives; however, the magnitude and intensity of the effects would vary between the Proposed Action, the No Action, and the alternatives.

Possible effects on wildlife and wildlife habitat include decreased forage and cover, reduction in prey base due to decreased vegetative habitat, the creation of barriers to wildlife movement, increased human presence in the area, and risks from the presence of cyanide or other hazardous materials. Additionally, some species of wildlife are likely to avoid the area due to increased noise and activity levels. Conversely, some species may use the area more frequently because the fences exclude hunters and forage is not grazed.

Open pits and overburden disposal areas may fragment habitats and create a barrier to wildlife movement. New and upgraded access roads and the subsequent increase in traffic would increase the potential for direct mortality of small animals, such as mammals, birds, and reptiles on a local basis. Roadkill would be minimal because access roads would be located away from the most critical habitats and would occur primarily during construction of the road. Loss of these smaller animals represents the loss of prey species for predators (i.e., bobcats and coyotes) and raptors (i.e., golden eagles and ferruginous hawks). The probability of animal mortality due to spills or leaks of sodium cyanide or hazardous materials would be extremely low. Under the Proposed Action, the No Action, or the alternatives, there would be residual loss of habitat for terrestrial wildlife at the pits.

Range - Implementing the Proposed Action or the alternatives would have the potential to impact livestock grazing through surface disturbances and through the disruption of livestock watering areas. Surface disturbances of 2,198 acres would result in the loss of approximately 154 AUMs (14.3 acres per AUM). Following reclamation, the long-term, irreversible, and irretrievable loss of 358 acres (25 AUMs) would remain due to the unreclaimed mine pits.

Direct impacts to range resources from the proposed project include the loss of grazing land due to construction of open pits, roads, and other facilities. Since grazing generally occurs throughout the project area, any surface disturbances could affect range resources. Indirect impacts that could result from the proposed project include increased vehicle traffic on access and haul roads, which could result in further disturbance of grazing patterns and trailing operations, and the potential for animal-vehicle collisions. Other indirect impacts could result from the potential invasion of noxious weeds.

Recreation - The Proposed Action, the No Action, or the alternatives would result in fewer acres available for dispersed recreational use during and after mining. Access to recreation areas or roads and trails used by OHV users would have minor adverse effects. Impacts to wilderness areas or Wilderness Study Areas (WSAs), or other recreation areas would be negligible.

Land Use and Access - The primary land use impacts associated with the Proposed Action, the No Action, or the alternatives would result from the direct physical conflicts with land uses (e.g., existing mines or mining claims, grazing allotments, OHV/ORV recreation, utilities, transportation systems, ranches and grazing, and rural residences). Under any of the alternatives, land use would continue to change from grazing, dispersed recreation, and wildlife to mining and ore processing. Restrictions to access within the mine expansion area would continue. Land ownership in the project area would remain the same. Public access would be maintained throughout the mining operations and reclamation activities.

Under the No Action Alternative, no additional public lands would be removed from multiple use management. Twenty-nine (29) acres of public land has already been used for access and haul roads under the existing permit and 307 acres of public land has been or would be used for exploration drilling sites or roads. The land use impacts for the Proposed Action would be of the same types as those of the existing and permitted activities under the No Action Alternative; however, the impact duration and magnitude would be greater. Under the Proposed Action there would be direct effect on 633 more acres of public land (Table 2-2) than the No Action Alternative.

For the expansion of overburden disposal on TC-6, an additional 25 acres and one to two miles of haul road would be required over the Proposed Action. Under the Rehandling of TC-4 and TC-5 alternative, long-term land use impacts would be the same as for the Proposed Action. Under the Partial Sequential Backfill of Trenton Canyon pits alternative, more of the open pits could be backfilled and reclaimed, which could return up to 100 acres public land (Section 18 T32N, R43E) back to multiple use management.

<u>Visual Resources</u> - Changes in the landscape that would result from the Proposed Action, No Action, and the alternatives were compared with the characteristic landscape to determine the resulting degree of contrast in form, line, color, and texture in the landscape. Most of the mining activities that would occur under the No Action Alternative would not be visible from key observation points because the North Peak mine area is screened by the surrounding topography. However, exploration roads and drill sites would be noticeable yet not dominant as seen from the key observation points. During and after mining operations, the exploration roads and drill sites would be reclaimed according to NDEP guidelines, resulting in reduction of the visual impacts.

The primary impact of the Proposed Action would be contrasts created by removal of the natural landforms, and color contrasts created by removal of natural surfaces and vegetation. The angular forms and horizontal lines typical of mining would moderately contrast with the rolling hills and ridges of the natural landscape. Land clearing and construction of mine facilities would create short term moderate to strong color contrast between disturbed and undisturbed surfaces. The pits and overburden disposal areas for the Trenton Canyon mining area and the overburden disposal area in the Valmy mining area would be the strongest contrasting visual elements. The pits would create a long-term and irreversible visual impact.

The visual impacts of the Expansion of TC-6 to Eliminate TC-4 and TC-5 alternative would be similar to the Proposed Action, as the expanded overburden disposal area TC-6 would be screened by the natural topography of the Trenton Canyon deposit. The differences in contrast between the two alternatives would not be noticeable to the casual observer. The visual effects of the Rehandling of TC-4 and TC-5 alternative would be similar to the Proposed Action, as the volume of material within overburden disposal areas TC-4 and TC-5 is not sufficient to completely fill the adjacent pit. The resultant effect would be strong visual contrast of the Valmy pit high wall as within the Proposed Action. For the Partial Sequential Backfill of Trenton Canyon Pits Alternative, if any of the pits that are visible from the key observation points could be completely filled and reclaimed, the visual contrast of the high walls would be weaker.

Noise - Under the Proposed Action, the No Action Alternative, and the alternatives, noise impacts including rock drilling, blasting, loading of overburden and ore, and truck hauling would remain at current levels (42 to 47 dBA) until mining and reclamation activities were completed. The Proposed Action would be similar to the No Action but for a longer duration. The Expansion of TC-6 to Eliminate TC-4 and TC-5 alternative would take place for four to six months longer duration than the Proposed Action. The Partial Backfill Alternatives would be similar to the Proposed Action.

Social and Economic Values - Under a No Action Alternative, the public lands portion of the Trenton Canyon Project would not be mined. Newmont already has approximately one-half of the workforce proposed for the project at work at the North Peak site with construction proceeding on ore processing facilities. If denial of permits forced abandonment of the project, the trends and patterns of social and economic activity discussed in Section 3.16 would continue unaccelerated. Population and employment growth in Humboldt and Lander Counties would be slower than with the project, but not by much.

The Proposed Action and alternatives would enable the balance of the workforce--approximately 65 full-time mine workers plus an estimated 20 short-term construction workers--to be hired (Ford, R. 1996). Applying the employment multiplier coefficients to the projected direct hiring for the Trenton Canyon Project, the 130 total long-term direct hires and the projected procurements of equipment, materials and operating supplies would generate approximately 100 secondary jobs in the two-county project area. An additional 65 secondary jobs would be generated elsewhere in Nevada, mostly in the urban areas of Washoe and Clark Counties. The Proposed Action and alternatives would have relatively small but positive effects on the local economy from the consumption spending of its workers and the procurements of local supplies by the project. The Proposed Action would generate additional property taxes and sales taxes, principally for Humboldt County, since the mine property is, and the majority of its personnel would be, located there. Termination and decommissioning of mining at the Trenton Canyon site would reverse the expansion effects set off by construction and operation of the mine. Whether the mine layoffs and termination of procurements would have a significant impact on the area's population, jobs and incomes would depend on the economic situation at the time.

Cultural Resources - The Proposed Action and other action alternatives would result in the loss of cultural resources that are not National Register eligible. These sites have been recorded to BLM standards and the information has been integrated into local and statewide data repositories. Impacts to National Register eligible sites would be mitigated through preparation and implementation of data recovery and/or mitigation plans. Four cultural resources have been identified within the disturbance footprint of the No Action Alternative. Two are prehistoric sites, one is an historic site, and one contains material dating to both periods. Twenty-one cultural resource sites are located within the footprint of disturbance associated with the Proposed Action. Fourteen sites date to the prehistoric period, two date to the historic period, four contain evidence of both periods, and one appears to be of ethnographic importance. Based on consultation between the BLM and the Nevada SHPO, four prehistoric period resources (22-6187, -6204, -6218, and -6243) are eligible to the National Register based on Criterion D. One site has been identified as an ethnographic resource of interest to the Western Shoshone. As a result, re-evaluation of this site would be considered in consultation with the Western Shoshone. The

Western Shoshone are concerned that the Trenton Canyon Project may affect springs, continued wildlife use, water quality, and the continued viability of important plant species. The Western Shoshone identified sage grouse strutting as an issue and remain concerned that past and current activities have caused some sage grouse to move out of the area. There is no anticipated change in flows resulting from the Proposed Action as groundwater would not be impacted (see Section 3.3.2). Water quality of the Ames and Mud Springs, as described in Section 3.2.2, are degraded due to other permitted land uses. The springs would not be directly affected by the project and would be protected from further degradation from spills or sedimentation. The Western Shoshone have also identified burial markers which occur in the general project area as well as any associated burials or burial grounds may be impacted by surface disturbance and/or human intrusion into the area.

Cumulative Effects

Foreseeable activities within the cumulative effects area include mine exploration, development, operation, and reclamation. Mine development and operation would create an additional demand for energy, possibly creating the need for additional rights-of-ways for powerlines or transmission facilities. The disturbed area for present and reasonably foreseeable future mining activities in the region could be as high as 13,366 acres over the next ten years. Existing mines and exploration activities have disturbed or are permitted to disturb 8,008 acres and the future mining activity prior to year 2009 is projected to disturb another 5,331 acres.

The reasonably foreseeable activities at existing mines may include expansion of facilities with new facility designs that may require different uses of the resources. For example, expansion of the tailings impoundment at Marigold Mine could require additional storm water structures to be constructed around the impoundment. Each of these types of changes to an existing mine plan may result in some disturbance to public land or other use of a resource. In addition, there may be a need to modify the existing reclamation permits.

The other uses for the lands within the cumulative effects area would remain unchanged. Livestock grazing, dispersed recreation and hunting would continue. Cumulative effects from past, current, and future activities within the area would be expected to water (surface and groundwater), geology and minerals, air, soils, vegetation, wetlands and riparian habitats, wildlife, special status species, range, visual, and cultural resources.

Chapter 1

Introduction

CHAPTER 1 - INTRODUCTION

In March 1996, Santa Fe Pacific Gold Corporation (SFPG) submitted the Plan of Operations to expand their currently permitted operations at Valmy and North Peak deposits, and to conduct mining in the Trenton Canyon deposit. SFPG proposed to expand mining operations from those currently permitted on private lands, held by SFPG, onto public lands located in Humboldt and Lander counties, Nevada. The proposed expansion would affect additional public lands administered by the Bureau of Land Management (BLM); therefore, the review and approval of SFPG's Plan of Operations is subject to compliance with the Federal Land Policy Management Act and with the associated BLM regulations for surface management (43 CFR Subpart 3809). The BLM has determined an Environmental Impact Statement (EIS) is necessary to evaluate the potentially significant impacts of the Proposed Action and project alternatives. The Nevada Division of Wildlife, Department of Conservation and Natural Resources has provided information and review capacity regarding wildlife as a cooperating agency in the preparation of this EIS.

On May 5, 1997, Newmont Gold Company (Newmont) merged with SFPG and is currently operating all of SFPG mines. Based upon responses received during the surface management 43 CFR Subpart 3809 review, the Plan of Operations was revised in October 1997.

This EIS responds to the requirements of the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act of 1969 (NEPA) (40 CFR Parts 1500-1508) and the Department of the Interior's guidance as interpreted in the BLM's NEPA Handbook (H-1790-1). The components of this EIS include reasonable alternatives to, and environmental consequences of, expansion of mining at the Trenton Canyon, North Peak, and Valmy mining areas.

Chapter 1 provides a description of the purpose and need for the Proposed Action, project location, and describes the authorizing actions that may be implemented by the BLM and cooperating agencies. Chapter 2 provides an overview of permitting history and describes the currently permitted operations, the Proposed Action, and all other alternatives that were considered for this project. Chapter 3 contains an overview of the affected environment in the Trenton Canyon Project and the region. Chapter 4 provides an analysis of environmental consequences that would result from the No Action, the Proposed Action, and the other action alternatives. Chapter 5 contains an overview of the consultation and coordination with the public, governmental agency personnel, and interested individuals that occurred during the preparation of this Draft EIS (DEIS), and Chapter 6 identifies specific preparers and contributors to this DEIS.

1.1 PURPOSE AND NEED

The purpose of the Trenton Canyon Project is to allow Newmont to use its existing work force, mining equipment, and ore processing facilities to produce gold from additional reserves occurring on lands near Newmont's currently permitted operations at North Peak and Valmy deposits.

The project need is reflected by the demand for gold that has been identified in the national and global markets. Gold is an established commodity with international markets. Uses include investments, standard for monetary systems, jewelry, electronics, and other industrial applications.

1.2 GENERAL LOCATION

The Trenton Canyon Project is located approximately 12 miles south of Newmont's Lone Tree Mine (LTM) which is 34 miles east of Winnemucca and 18 miles west of Battle Mountain on Interstate 80 (I-80). The Trenton Canyon Project is accessed via the Stonehouse Interchange (Exit 212) on I-80 (Figure 1-1). Located on the northwestern flank of Battle Mountain, Trenton Canyon Project spans the Trout and Cottonwood creeks in Humboldt and Lander counties. The Lander/Humboldt county line corresponds with the Battle Mountain/Winnemucca BLM district boundary in the southern portion of the property.

1.3 RELATIONSHIP TO BLM AND NON-BLM POLICIES, PLANS, AND PROGRAMS

The Plan of Operations has been reviewed for compliance with BLM policies, plans, and programs. The Proposed Action is in conformance with BLM policies outlined in the Sonoma-Gerlach Management Framework Plan (MFP) and the Shoshone Eureka Resource Management Plan (RMP) and EIS (USDI BLM 1983).

Specifically, on page 29 of the Record of Decision for the RMP, under the heading "Minerals" subtitled "Objectives" number 1:

"Make available and encourage development of mineral resources to meet national, regional and local needs consistent with national objectives for an adequate supply of minerals. Under "Management Decisions." "Locatable Materials," page 29, number 1: "All public lands in the planning areas will be open for mining and prospecting unless withdrawn or restricted from mineral entry."

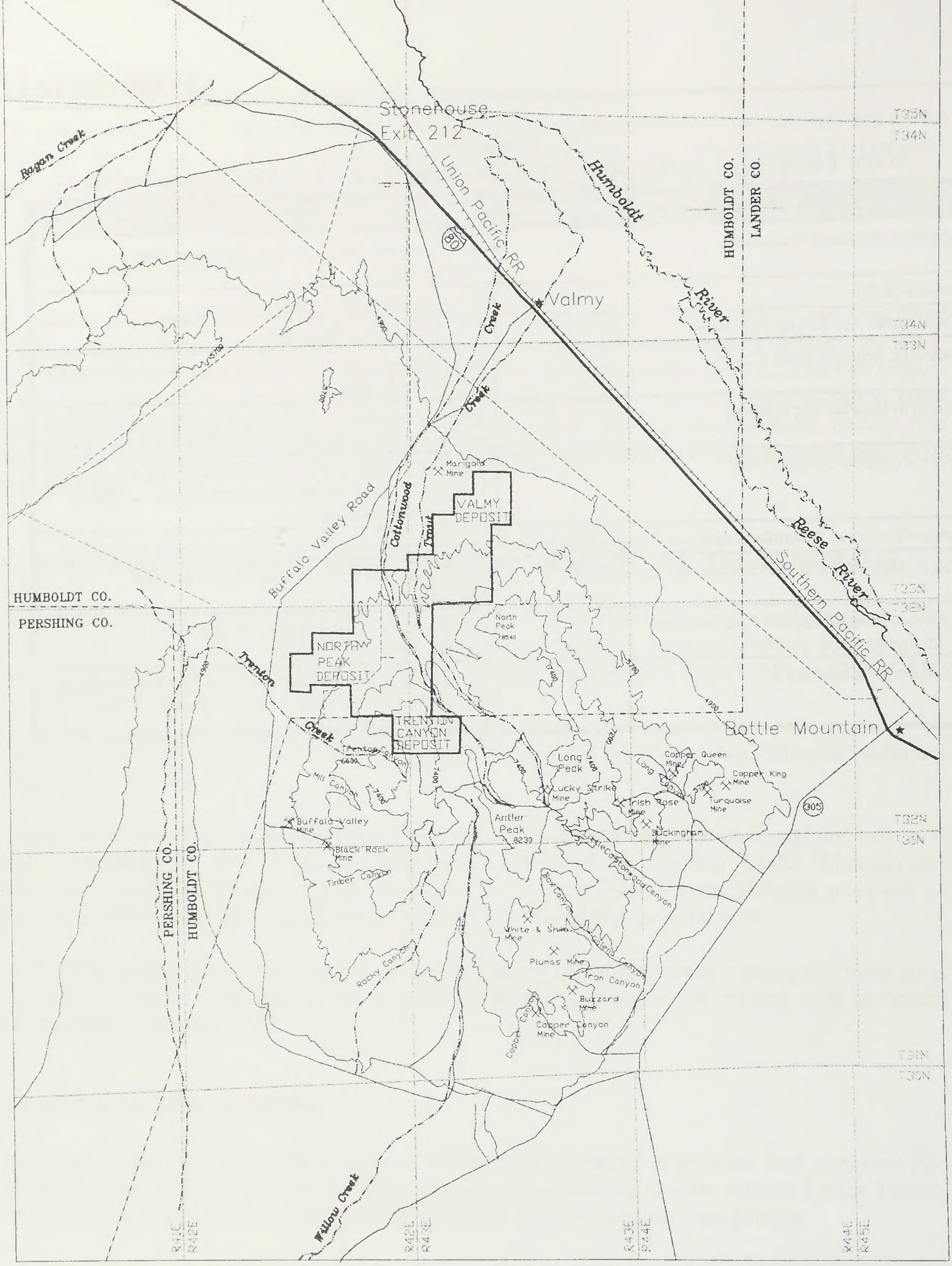
Under "Management Decisions," number 5, Current Mineral Production Areas: "Recognize these areas as having a highest and best use for mineral production and encourage mining with minimum environmental disturbance..."

1.4 AUTHORIZING ACTIONS

Other federal, state, and local agency approval will be required contingent upon the final approved Plan of Operations. Table 1-1 outlines the major permits and authorizing actions required for the Trenton Canyon Project. Newmont is responsible for applying for and acquiring these permits.

Table 1-1
Major Permits and Authorizing Actions Required for the Trenton Canyon Project

Authorizing Action	Regulatory Agency
Approval of Plan of Operations	U.S. Department of the Interior, Bureau of Land Management
Review of EIS	U.S. Environmental Protection Agency
Clean Water Act Section 404 Permit	U.S. Army Corps of Engineers
Industrial Artificial Pond Permit	Nevada Department of Conservation and Natural Resources, Division of Wildlife
Permit to Operate (Air Quality)	Nevada Department of Conservation and Natural Resources, Division of Environmental Protection, Bureau of Air Quality
Water Pollution Control Permit	Nevada Department of Conservation and Natural Resources, Division of Environmental Protection, Bureau of Mining Regulation and Reclamation
Review Project to Determine Impact on Cultural Resources	Nevada Division of Historic Preservation and Archaeology
Native American Graves Protection and Repatriation Act	U.S. Department of the Interior, Bureau of Land Management
American Indian Religious Freedom Act	U.S. Department of the Interior, Bureau of Land Management
Mine Reclamation Permit	Nevada Department of Conservation and Natural Resources, Division of Environmental Protection, Bureau of Mining Regulation and Reclamation



Legend

Project Area Boundary

Powerline

Winnemucca
Elko
Reno

3 miles 0 3 miles

Project Location

Trenton Canyon Project

Figure 1-1

October 1997

Chapter 2

Alternatives Including the Proposed Action

CHAPTER 2 - ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

This chapter describes the alternatives considered for the Trenton Canyon Project. The No Action Alternative includes the range of activities that would result from continuing the currently permitted operations on Newmont's private lands at Valmy and North Peak deposits. The Proposed Action includes the range of activities that would result from implementation of the Trenton Canyon Project Plan of Operations and Reclamation Permit Modification (Newmont 1997). Three other alternatives, Expansion of TC-6, Re-handling of TC-4 and TC-5, and Partial Sequential Backfill in the Trenton Canyon pits, are described in detail. Those alternatives considered but eliminated from detailed analysis are also identified and the rationale for rejecting them is provided.

This chapter also contains a summary of the potential environmental effects of each of the action alternatives and identifies the Bureau of Land Management's (BLM) preferred alternative.

2.2 MINING AND EXPLORATION ACTIVITY IN THE TRENTON CANYON AREA

Limited mineral exploration and mining development occurred in the Trenton Canyon Project vicinity prior to the 1960s. The earliest recorded activity was at Lone Tree Hill in the mid-1860s at about the time the Transcontinental Railroad was being constructed 2 miles north of the present location of the Lone Tree Mine (LTM) (Bloomstein *et al.* 1994). A number of exploration adits, pits, and rock disposal areas lined Lone Tree Hill, where copper mineralization was exposed on the surface. Although the rocks showed copper mineralization and contained some gold, no significant mineable deposits were found. Sporadic exploration continued during the following years, with a burst of copper exploration activity in the 1960s and 1970s by Duval Corporation and Bear Creek. Duval Corporation discovered and mined to completion the Copper Canyon deposit near Battle Mountain in the 1970's. Additionally, Duval mined the Fortitude deposit for copper and gold, and as copper values declined, they eventually operated Fortitude only as a gold mine.

In the mid-1980s, Nerco, Freeport, and several Canadian companies began intensive gold exploration in the Lone Tree Hill area. No significant discoveries were made until Cordex Exploration began exploring on and near the Lone Tree Hill area in 1988 under the Marigold Joint Venture with Santa Fe Pacific Gold (SFPG), formerly Santa Fe Pacific Mining, Inc. (SFPM). Exploration permitting history for the Trenton Canyon Project began in 1988 (Table 2-1). In September 1988, SFPM filed a notice to conduct exploration activities in the Trenton Canyon Program area. Two more notices were filed with the BLM in 1991 to conduct exploration in the Windy Ridge Program area and the Cottonwood Creek Program area.

The discovery hole for the Lone Tree Mine was drilled in 1989. A development decision was made and SFPG began constructing facilities at Lone Tree Mine by December 1990. By 1991 SFPG had commenced mining at LTM, a sulfide expansion project was approved in August 1991. LTM started milling in October 1993 and established an autoclave in February 1994. The Plan of Operations and Record of Decision on the EIS for expansion of the LTM was approved in October 1996.

Table 2-1
Existing Permits within the Project Area

Permitted/Existing Disturbance - Public Lands[a]	Plans of Operations	Permitted Acres
North Peak Battle Cry Notice (Section 6, T32N,R43E)	N26-93-004N	2
Trenton Canyon/Section 12 Notice (Section 12, T32N,R42E)	N26-95-029N	3
Trenton Canyon (Sections 18, 20, and 30 T32N,R43E and Section 24, T32N,R42E)	N64-92-005P	121
Trout Creek (Sections 28 and 32, T33N,R43E)	N26-89-007P	101
Subtotal Previously Permitted on Public Lands		227
Permitted/Existing Disturbance - Private Lands	**NDEP Reclamation Permits**	
North Peak West (Sections 1, 11, and 13 T32N,R42E, and Sections 5, 7, 9, and 17, T32N,R43E)	#0029	273
Trenton Canyon (Sections 19 and 29, T32N,R43E)	#0006	76
Valmy (Sections 29 and 33, T33N,R43E)	#0023	174
Subtotal Previously Permitted on Private Lands		523
TOTAL PERMITTED/REMAINING		**750**

Exploration activities commenced at the Marigold Mine site in the mid-1980's. The environmental assessment for Marigold's current operation was prepared and approved in 1988. Currently, the Marigold Mine, owned by Rayrock Mines, Inc., is an open pit gold mine with facilities and operations occupying approximately 1,000 acres.

In 1992, a Plan of Operations (N64-92-005P) was prepared by SFPM for the Trenton Canyon Exploration Program which combined the Trenton Canyon, Windy Ridge, and Cottonwood Creek exploration case files, and included private lands in portions of Sections 19 and 29, T32N, R43E, into the program areas. Exploration activities for the Trenton Canyon Project were initiated in 1992 under earlier permits.

Santa Fe Pacific Gold Corporation conducted an Environmental Assessment (EA) for water and communication lines, a power line, and access road rights-of-way (ROW's) across BLM land in 1996. A grant for use of those ROW's for mining development of the Valmy and North Peak deposits located on SFPG (non-public) land was issued in 1996.

Santa Fe Pacific Gold Corporation submitted an application for a Consolidated Exploration Plan of Operations/Reclamation Permit (N26-95-001P) which combined four different target exploration areas on public lands: North Peak Battle Cry Notice, the Trenton Section 12 Notice, the Trenton Exploration Project, and the Trout Creek Exploration Project. This permit allows up to 956 acres of surface disturbance (or 260 acres more than the four combined permits) associated with exploration within the exploration boundary. The BLM approved the revised Plan of Operations, dated October 31, 1997, and the EA for this permit, dated October 31, 1997.

2.3 NO ACTION ALTERNATIVE

The National Environmental Policy Act of 1969 (NEPA) requires a No Action Alternative to be evaluated which for this project is defined as maintaining the current management direction (Council on Environmental Quality, 1983). For purposes of this EIS, the currently permitted activities at the Valmy and North Peak mine areas and the permitted exploration activities within the project area, represent the "No Action" Alternative. This involves construction, operation, reclamation, and closure of the currently permitted existing and approved facilities on private lands and use of federal lands for access at both Valmy and North Peak mining areas as stipulated by the State of Nevada and BLM. The currently permitted project boundary includes Sections 29 and 31, T33N, R43E and Sections 1, 11, and 15, T32N, R42E.

The BLM has authorized right-of-way section corner crossings in Sections 10 and 12, T32N, R42E; Section 36, T33N, R42E; and Section 30, T33N, R43E. Public lands are also involved in the rights-of-way for the primary access road, water/communication line, and the power line.

The existing facilities and permitted activities are primarily on private lands owned by SFPG at Valmy and North Peak deposits, but public lands are used for corner crossings for water and communications lines, power line, and road rights-of-way. Existing and approved facilities at North Peak and Valmy mining areas include:

- Two open pits (Valmy and North Peak),
- One heap leach facility and process overflow pond at North Peak mining area (Section 15),
- Three overburden disposal areas (NP-1, VP-1, and VP-2),
- Access and haul roads,
- A water/communications line that is the sole water source for existing facilities,
- A power line,
- Ancillary facilities, and
- Exploration drill sites and access roads.

Table 2-2 lists the currently permitted facilities. The total surface disturbance from operations on existing and approved private lands would be 815 acres. Nearly 50 percent of this disturbance area (358 acres) is approved for exploration.

Rights-of-way to provide access, water/communications, and power to Newmont facilities at Valmy and North Peak mining areas were granted by BLM to cross public land in February 1996. The existing and approved facilities and activities on public lands allow for surface disturbance estimated at 358 acres for exploration activities and 29 acres for access to mining operations and section corner crossings (Table 2-2).

The North Peak and Valmy mining operations would continue to use personnel and equipment from the LTM throughout the mining activities, closure, and reclamation.

Design, construction, operation, and closure of the North Peak and Valmy mining operations are governed by the Nevada Administrative Code, Regulations Governing Design, Construction, Operation and Closure of Mining Operations (NAC 445A.350 to 445A.447) and other applicable state and federal regulations. Reclamation is covered by NAC 519A. Newmont mining activities are authorized under the Nevada Division of Environmental Protection (NDEP), Water Pollution Control Permit NEV95111, and Air Quality Operating Permit AP1041-0685. The construction of the process overflow pond at the North Peak mine area was permitted through the Nevada Division of Water Resources (NDWR) under Dam Permit J-447. The Water Pollution Control Permit allows Newmont to use and store chemicals required for the leaching operation at the North Peak mine area.

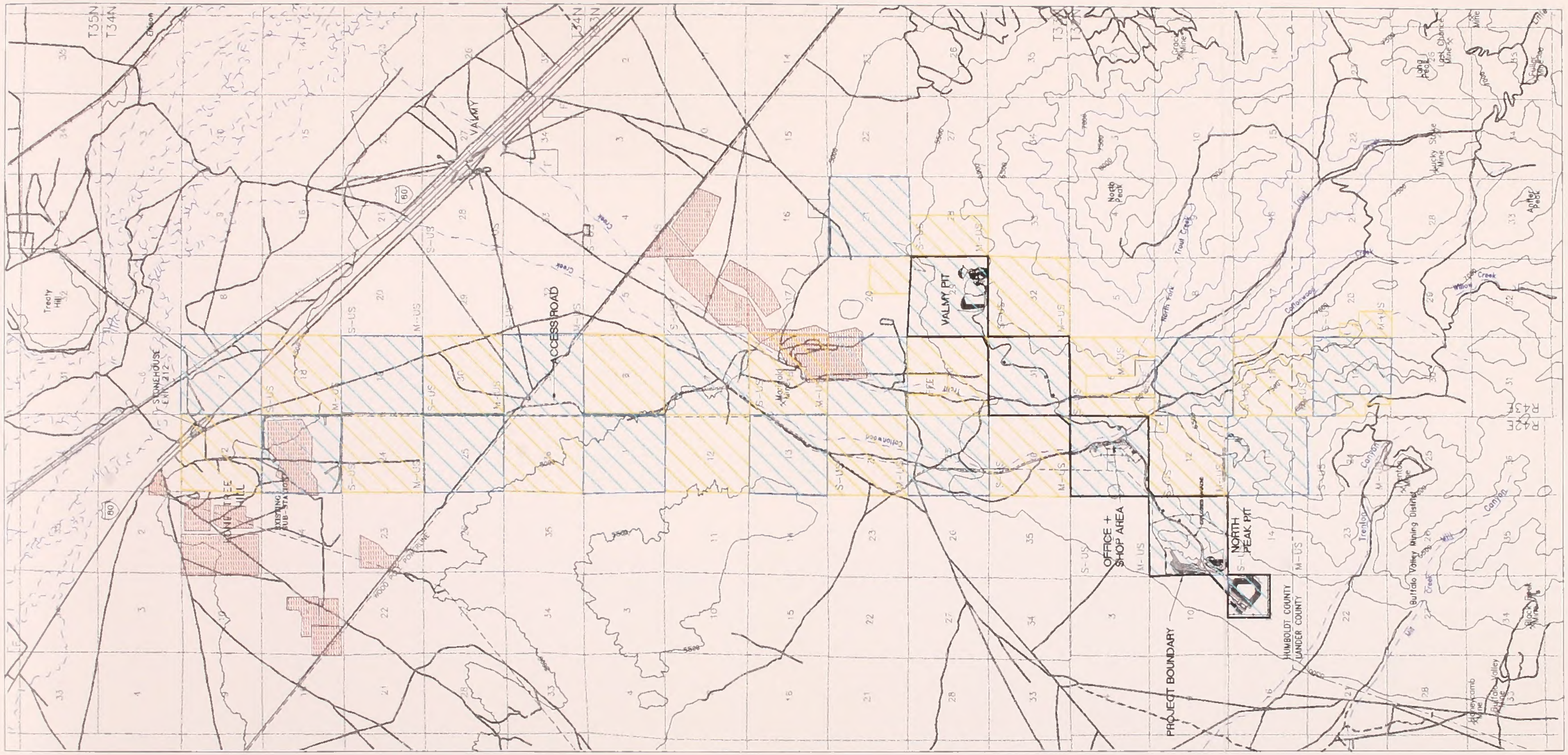
The No Action Alternative does not include development of the Trenton Canyon pits or overburden disposal areas, nor does it include expansion of the Valmy or North Peak pits onto public lands, development of the Section 21 or Section 29 Valmy heap leach pads, or widening and realignment of the primary access road.

2.3.1 Open Pit Mine and Overburden Disposal

Permitted operations at the Valmy area include one open pit mine and two overburden disposal areas (VP-1 and VP-2). The North Peak mining area operations include an open pit mine and one overburden disposal area (NP-1). Under current plans, approximately 10 million tons of overburden material could be placed in NP-1, VP-1, and VP-2.

2.3.2 Primary Access and Haul Roads

Access and haul roads would remain as shown on Figure 2-1. The primary access road is 60-feet wide and was constructed to make maximum use of private lands.



LEGEND

THIS MAP IS FOR CONCEPTUAL USE ONLY AND IS NOT TO BE USED FOR DESIGN PURPOSES.

- HEAP LEACH
- PITS
- OVERBURDEN DISPOSAL AREAS
- GROWTH MEDIUM STOCKPILE
- MINING RELATED DISTURBANCES OF LONETREE AND MARIGOLD MINES

- POWERLINE
- WATERLINE AND COMMUNICATION LINE
- ACCESS ROAD
- EXISTING DIRT ROAD
- HAUL ROAD
- FENCE

*LAND STATUS AS SHOWN IS ONLY APPLICABLE WITHIN THE PROJECT BOUNDARY AND ALONG THE PRIMARY ACCESS AND WATERLINE CORRIDORS FROM LONE TREE.

- PUBLIC LAND – SFPGC CLAIMS
- PRIVATE FEE LANDS (SURFACE AND MINERALS) OWNED OR CONTROLLED BY SFPGC
- OTHER LANDS NOT CLAIMED OR CONTROLLED BY SFPGC

SHADING DOES NOT REFLECT INDIVIDUAL OWNERSHIP OF VARIOUS TRACTS OF LAND.

PREPARED BY

SCALE IN FEET

NO ACTION ALTERNATIVE

EXISTING APPROVED FACILITIES ACCESS ROUTE & FACILITY LAYOUT

TRENTON CANYON PROJECT

ACAD FILE: 3_D_2A.DWG

October 1997 Figure 2-1

Table 2-2
Comparison of Surface Area Disturbance

Project Component	No Action Alternative Currently Permitted (acres)			Proposed Expansion Area (acres)			Proposed Action (combined permitted and expansion acres)		
	Public	Private	Total	Public	Private	Total	Public	Private	Total
Open Pits		52	52	214	82	296	214	134	348
Valmy Deposit		23	23	91	32	123	91	55	146
North Peak Deposit		29	29	2		2	2	29	31
Trenton Canyon Deposit				121	50	171	121	50	171
Overburden Disposal Areas		98	98	208	367	575	208	465	673
Growth Medium Stockpiles (Topsoil)		17	17	39	19	58	39	36	75
Heap Leach Facilities		74	74		150	150		224	224
Valmy Section 29 Leach Pad					37	37		37	37
Valmy Section 21Leach Pad					100	100		100	100
North Peak Section 15 Leach Pad		66	66					66	66
Process Overflow Pond/Solution Pond Areas		8	8		13	13		21	21
Access/Haul Roads [a]	29	176	205	274	335	609	303	511	814
Primary Access (outside boundary)	15	54	69	52	71	123	67	125	192
Primary Access (inside boundary)	2	4	6	6	17	23	8	21	29
Haul Roads	12	118	130	216	247	463	228	365	593
Creek Diversions/Sediment Control		13	13	11	32	43	11	45	56
Ancillary Facilities [b]		26	26					26	26
Exploration Roads and Drill Sites [c]	307	409	716	-114	-146	-260	193	263	456
Water/Communication Line		1	1	1	8	9	1	9	10
Total By Alternative	336	866	1,202	633	847	1,480	969	1,713	2,682

NOTES:

a/ Disturbance acreage for roads includes construction disturbance. Disturbance varies with road location. A portion of the public road disturbance is within approved ROW's.

b/ Ancillary Facilities include an office/shop/warehouse complex, sewage system, electrical distribution system, propane system bioremediation cells, barrel handling facility, explosives magazine, lime storage silo, and other various storage areas.

c/ Approximately 260 acres of the currently permitted exploration falls within the mine plan and is represented as a credit in total surface disturbance.

2.3.3 Heap Leach Facility

The North Peak mine facilities include one existing heap leach pad in Section 15, T32N, R42E covering 66 acres. The heap leach pad would be designed and constructed to accommodate approximately 13 million tons of ore. The heap leach pad has a single layer high density polyethylene (HDPE) liner over a clay liner with a leak collection and recovery system that meets or exceeds engineering design requirements set forth in NAC Chapter 445A. Leachate collection systems are in place to minimize hydraulic head on the liner.

The overflow pond and associated storage facilities (8 acres) are located immediately west of the heap leach pad. The pond meets or exceeds design requirements set forth in NAC 445A.435. The double-lined pond impounds solution and is equipped with a leak collection and recovery system which transmits solution from a potential leak to a central collection point. The collection point is designed to facilitate the measurement of fluid volumes and the collection of solution samples for analysis.

The process overflow pond is designed to contain the normal working inventory of solution, fluid volumes resulting from precipitation, runoff from the heap leach facility during a 25-year, 24-hour storm event, and draindown resulting from 12 hours of power outage.

The heap leach pad at North Peak was constructed in the fall of 1996. Run-of-mine oxide ore from the North Peak pit is hauled directly to the heap leach pads. High grade ore, if encountered, would be transported to the LTM for milling to improve recovery. To maintain desired pH levels, lime would be added to the ore. Ore is placed on the leach pad at an angle of repose in 20- to 50-foot lifts to a maximum height of 140 feet. Ore would be stacked with approximate average overall slopes of 2.4:1.

Ore is leached by drip irrigating and/or sprinkling the heap with a dilute solution of sodium cyanide (200 ppm). As the solution percolates through the heaps, gold is dissolved. The gold-laden, or pregnant, solution flows to the leach pad liners and then to a lined collection ditch. Leaching solutions drain to the pregnant tank. The gold-laden solution is then pumped to a series of columns containing activated carbon, where gold is adsorbed onto the carbon.

The gold-laden carbon is periodically removed and transported to the stripping facility at the LTM for gold recovery. Following removal of gold from solution in the carbon columns, cyanide concentration of the barren solution is adjusted in the barren tank before the solution is returned to the pad to repeat the gold leaching process. Make-up water is added to the heap to replace water lost to evaporation and ore retention. The water used as make up water for the heap leach system is supplied from the LTM pit dewatering system through an existing pipeline. The current processing capacity of the North Peak mining area heap leach system is 2500 gpm of leaching solution. The operating period for these facilities is 365 days per year, 24 hours per day.

The process solution overflow pond is permitted under an Industrial Artificial Pond Permit administered by Nevada Division of Wildlife (NDOW). The heap leach facility is permitted by the NDEP under a water pollution control permit. The overflow pond is also permitted by NDWR.

Two above ground tanks containing barren and pregnant solution are located in Section 15 adjacent to the process overflow pond. Sodium cyanide is stored in a 15,000 gallon tank adjacent to the processing tanks. Other reagents and consumables required for the heap leach facilities include: sodium hydroxide, lime, anti-scalant, and activated carbon. These storage facilities are provided with secondary containment, as appropriate, in accordance with NDEP and federal regulations.

2.3.4 Drainage and Sediment Control

Best Management Practices (BMPs) outlined in the stormwater discharge permit would be used to the fullest extent possible to prevent or limit potential degrading of surface and ground water quality during project operations. Surface water runoff at the North Peak heap leach pad and the North Peak and Valmy pits and overburden disposal sites would be controlled to promote drainage, minimize erosion, restrict drainage into open pits, and limit run-on to the heap leach pads and overburden disposal areas. A culvert would be placed in Trout Creek to provide a road crossing.

During construction of facilities, straw bales, silt fences, and/or other applicable measures would be used to control sediments in runoff from disturbed areas until the surfaces are stabilized through revegetation or other means. Growth medium stockpiles, would be graded and vegetated to minimize erosion by wind and water and would be designated with signs. Dust abatement measures including watering and/or the application of chemical agents would be taken, as appropriate, to suppress dust on the haul roads.

During operations, temporary pipeline diversions may be used to establish runoff control in some areas. As part of reclamation, an open channel diversion system would be used to control surface flows and minimize erosion (Figure 2-2). As required by NAC 445A.380, the diversion structures are sized to control a 100-year, 24-hour precipitation event. Riprap protection may be used at certain locations to minimize erosion. Total diversions are estimated to disturb approximately 13 acres of private land.

2.3.5 Growth Medium Stockpiles

Available quantities of topsoil would be selectively salvaged where possible. The topsoil would be placed on private lands and stockpiled until required for reclamation.

2.3.6 Ancillary Facilities and Utilities

The existing approved ancillary facilities include an office/shop/warehouse complex, water supply system, sewage system, electrical distribution system, propane system, bioremediation cells, barrel handling facility, explosives magazine, lime storage silo, and various other storage areas. The existing bioremediation facility containing three cells is near the area proposed for the office/shop/warehouse complex in Section 1, T32N, R42E. The bioremediation cells are authorized under the NDEP General Mining Bioremediation Facility Permit for construction and management of the bioremediation facility.

2.3.7 Reclamation

Reclamation of the project would take place as outlined in Newmont's reclamation permit (Newmont Gold Company 1997). The goals of the reclamation plan are to:

- Ensure public safety, reduce or eliminate adverse environmental impacts, and minimize unsightly visual effects,
- Return the site to a condition that would support land uses similar to those which existed prior to commencement of mining activities,
- Re-establish a stable environment that would support a diverse self-sustaining vegetation community that is consistent with the land use objectives,
- Minimize off-site impacts by controlling infiltration, erosion, sedimentation, and related degradation of existing drainages, and
- Employ reclamation practices based on standard and proven engineering methods, and provide a technically effective and cost-efficient reclamation plan.

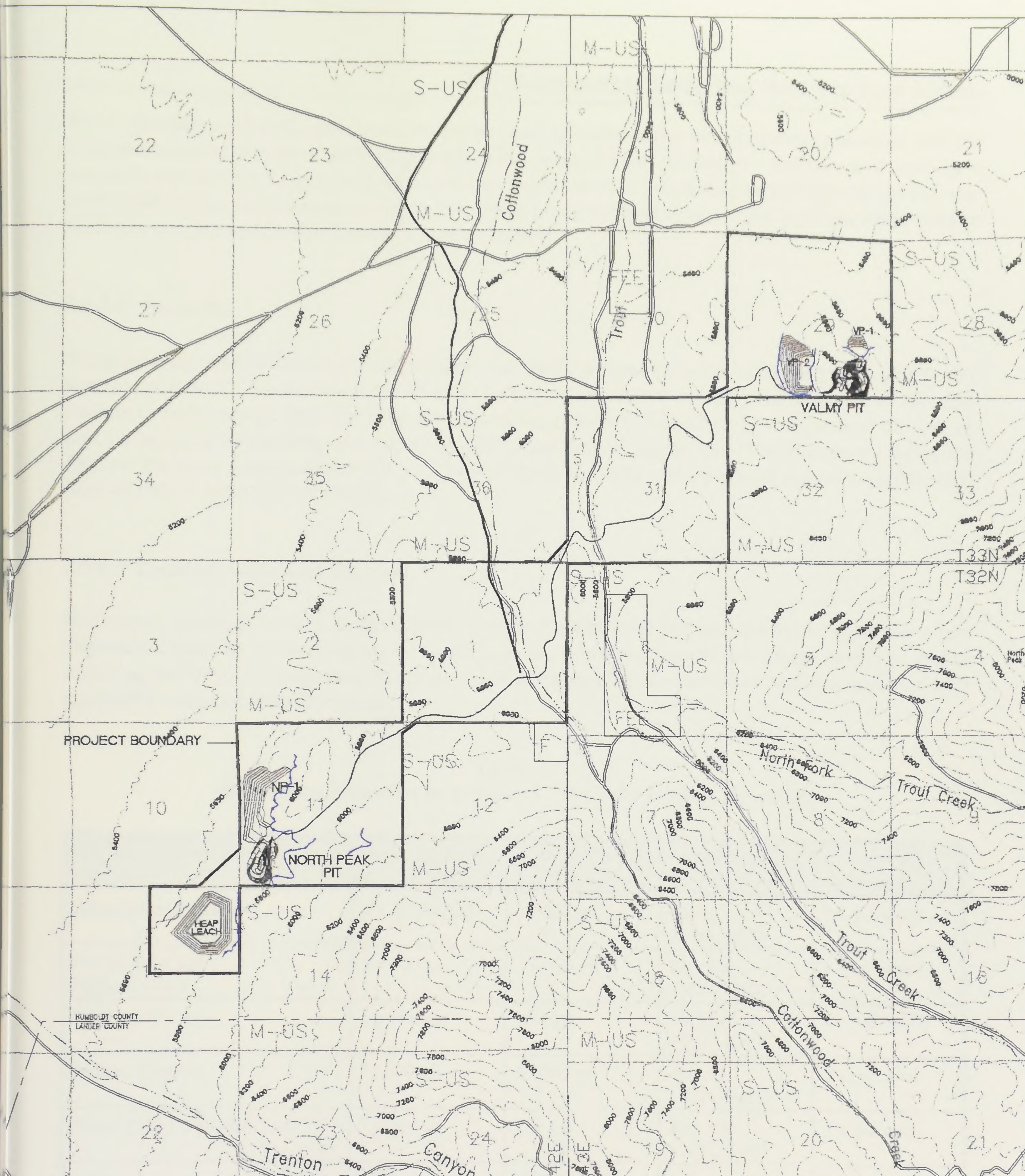
2.3.8 Hazardous Materials Handling and Waste Disposal

Table 2-3 lists the petroleum products and chemicals and their respective quantities that could be stored at the Trenton Canyon Project property.

2.3.8.1 Storage

A portable diesel fueling station would be located in the southwest quarter of Section 11, T32N, R42E at the north end of the ready line between the pit and the overburden disposal areas and would consist of two 10,000 gallon above ground storage tanks (ASTs). An ethylene glycol antifreeze tank, part of the portable facility in the southwest quarter of Section 11, T32N, R42E would be located at the north end of the ready line between the pit and the overburden disposal area and would consist of one 500 gallon AST.

A permanent diesel storage tank (500 gallon) for backup power to the process plant and a sodium cyanide storage tank (15,000 gallon) are located in the northeast quarter of Section 15, T32N, R42E, at the process facility. The ammonium nitrate/fuel oil (ANFO) mixture would be stored in a 60 ton silo located in the southwest quarter of Section 1, T32N, R42E. The silo would be located to make use of topography to shield the shop/office area from direct effects of an accidental detonation at the silo area.



LEGEND

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PITS

OVERBURDEN DISPOSAL AREAS

DIVERSION CHANNEL

EXISTING DIRT ROAD

ACCESS ROAD

N

SCALE IN FEET

1000 0 2000

NO ACTION ALTERNATIVE

EXISTING APPROVED FACILITIES RECLAMATION CONFIGURATION

TRENTON CANYON PROJECT

ACAD FILE: 3_D_2C.DWG

October 1997

Figure 2-2

Small quantities of acids and bases would be used to mediate the pH of process solutions and for emergency neutralization of sodium cyanide in the event of a spill or release. Sulfuric acid, hydrogen peroxide and calcium hypochlorite would be transported in 10 to 20 gallon containers to the project site from bulk storage facilities at the Lone Tree Mine on an as-needed basis. No acid/base bulk storage facilities are planned for the Trenton Canyon Project.

2.3.8.2 Hazards

Hazards associated with the aforementioned chemicals generally would be limited to handling and storage operations. As outlined in the Plan of Operations, secondary containment in the diesel fuel and sodium cyanide storage area would be able to contain at least 110 percent of the volume of the largest tank in the containment area, as required by NDEP and federal regulations. The Emergency Response Plan for the mine addresses potential incidents at the project site and associated rights-of-way (access road ROWs N-59591 and N-59592).

2.3.8.3 Transportation and Disposal

Hazardous wastes generated at the Trenton Canyon Project would be transported to approved waste disposal facilities by licensed, approved waste haulers. When practicable, the wastes would be sent to recycling facilities. All hazardous wastes would be stored, packaged, and manifested in compliance with applicable state and federal regulations.

Table 2-3
Hazardous Materials to be Stored within the Project Boundary

Description	Max Quantity on Site	Average Daily Storage	Storage Location	Delivery Frequency
Diesel Fuel- Portable	2 x 10,000 gal	12,000 gal	Sec. 11, T32N, R42E	2 x per week
Motor, Gear and Hydraulic Oils	3 x 500 gal	500 gal each	Sec. 11, T32N, R42E	1 x per week
Ethylene Glycol	1 x 500 gal	400 gal	Sec. 11, T32N, R42E	1 x per month
Sodium Cyanide	15,000 gal	10,000 gal	Sec. 15, T32N, R42E	1 x per week
Diesel Fuel-Permanent Tank	1 x 500 gal	500 gal	Sec. 15, T32N, R42E	2 x per week
ANFO	60 Tons	40 Tons	Sec. 1, T32N, R42E	2 x per week

2.4 PROPOSED ACTION

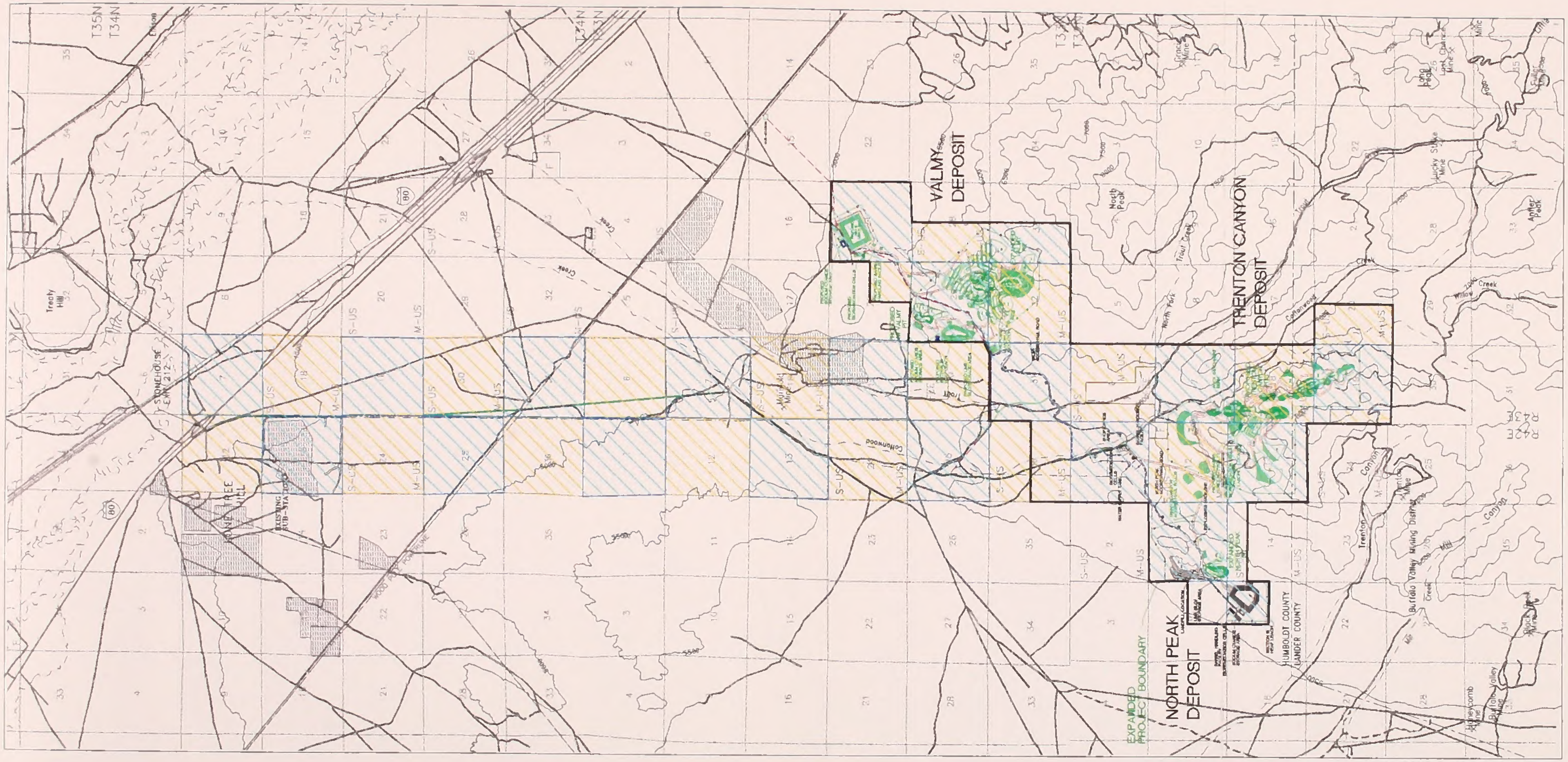
The Proposed Action includes the expansion of the existing approved facilities and the addition of new facilities (Figure 2-3). The exploration Plan of Operations would also become a part of the Proposed Action. The existing approved facilities to be expanded and/or modified include the Valmy pit, the North Peak pit, two overburden disposal areas, the heap leach facility, the access road, and other ancillary facilities. The new proposed facilities include the open pit mining area at Trenton Canyon deposit, 11 overburden disposal areas, two heap leach facilities, and other ancillary facilities. In addition, exploration activities would continue to be conducted. The incremental surface disturbance for modifications of permitted facilities and for proposed new activities would be approximately 1,480 acres, including 633 acres of public land (Table 2-2).

Key features of the Proposed Action include using equipment and personnel from LTM to effect the following:

- Construct overburden disposal areas,
- Construct a Trenton Canyon overburden disposal area (TC-3), 3 growth medium piles, and access/haul roads,
- Mine the Trenton Canyon deposit on the east side of the ridge above Cottonwood Creek and construct overburden disposal area (TC-4), and
- Construct additional overburden disposal areas,
- Realign the access road and widen it to 100 feet,
- Construct a heap leach facility near the Valmy pit,
- Extending the water supply and power line to the Valmy heap leach,
- Construct growth medium piles,
- Construct barrel handling facilities,
- Expand North Peak and Valmy pits,
- Expand shop/office area, barrel handling facilities and bioremediation cells, and
- Install diversion channels.

Under the Proposed Action, mining operations at the Trenton Canyon Project would be expanded, with mining occurring for up to 7 years after the EIS Record of Decision and reclamation and monitoring continuing for 3 years after closure. Mining would proceed 24 hours per day, 365 days per year. Newmont estimates that over 21 million tons of material would be mined annually up to a total of 152 million tons for the life of the mine.

As part of the Proposed Action, open-pit mining would be expanded at the Valmy area onto public lands in Section 32, T33N, R43E and at the North Peak area onto public lands in Section 14, T32N, R42E. The new Trenton Canyon pits would also be constructed on private lands in Sections 7 and 19, T32N, R43E and Section 13, T32, R42, and public lands in Section 18, T32N, R43E and Section 12, T32, R42. As a result of the mine expansion, the existing approved heap leach facility on private land in Section 15, T32N, R42E would be expanded; and two additional heap leach facilities are proposed on private land in Sections 21 and 29, T33N, R43E. Ore from the Trenton Canyon Project would be processed in



LEGEND

THIS MAP IS FOR CONCEPTUAL USE ONLY AND IS NOT TO BE USED FOR DESIGN PURPOSES.

EXISTING APPROVED FACILITIES ARE SHOWN IN BLACK AND PROPOSED FACILITIES ARE SHOWN IN COLOR.

- HEAP LEACH
- PITS
- OVERBURDEN DISPOSAL AREAS
- GROWTH MEDIUM STOCKPILES
- MINING RELATED DISTURBANCES OF LONETREE AND MARIGOLD MINES

- PROPOSED POWERLINE
- PROPOSED WATERLINE AND COMMUNICATION LINE
- PROPOSED ACCESS ROAD
- EXISTING DIRT ROAD
- PROPOSED HAUL ROAD
- FENCE
- PROJECT BOUNDARY

*LAND STATUS AS SHOWN IS ONLY APPLICABLE WITHIN THE PROJECT BOUNDARY AND ALONG THE PRIMARY ACCESS AND WATERLINE CORRIDORS FROM LONE TREE.

- PUBLIC LAND – SFPGC CLAIMS
- PRIVATE FEE LANDS (SURFACE AND MINERALS) OWNED OR CONTROLLED BY SFPGC
- OTHER LANDS NOT CLAIMED OR CONTROLLED BY SFPGC

SHADING DOES NOT REFLECT INDIVIDUAL OWNERSHIP OF VARIOUS TRACTS OF LAND.

SCALE IN FEET

2500 0 5000

PROPOSED ACTION

ACCESS ROUTE AND GENERAL FACILITY LAYOUT

TRENTON CANYON PROJECT

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October 1997

Figure 2-3

the new heap leach facilities using cyanide leaching solutions. Gold would be recovered from the cyanide solution using carbon adsorption.

Loaded carbon from the heap leach process would be hauled to the LTM for final processing. The stripped carbon would then be hauled back to the Trenton Canyon Project. Higher grade ore may be stockpiled on site for hauling to the LTM for mill processing. Overburden would be hauled to one of the proposed overburden disposal areas.

As shown in Table 2-2, Newmont is currently authorized to disturb 1,202 acres associated with the Trenton Canyon Project. Expansion of operations at the mine would result in an additional 1,480 acres of disturbance for a total mining-related surface disturbance of 2,682 acres. Approximately 260 acres of currently authorized surface disturbance related to exploration would become part of the proposed open pit mine.

2.4.1 Open Pit Mine and Overburden Disposal

Under the Proposed Action, open-pit mining of the Trenton Canyon pits would result in removal of an additional 25 million tons of ore and 112 million tons of overburden material for a total of 30 million tons of ore and 122 million tons of overburden material. Approximately 214 acres of public lands and 134 acres of private lands would be disturbed by the mine pits.

The North Valmy pit would have a pit bottom elevation of 5,340 feet above mean sea level (MSL); the Valmy pit would have an elevation of 5,660 feet; the North Peak pit would have an elevation of 5,480 feet; and the Trenton Canyon pits would have pit bottom elevations ranging from 6,300 to 7,460 feet MSL.

Under the Proposed Action, two of the three existing approved overburden areas would be modified and 11 new disposal areas would be constructed. The 14 overburden disposal areas would have a 122 million ton capacity. Surface disturbance for the disposal areas would be 208 acres of public land and 465 acres of private land for a total disturbance of 673 acres associated with overburden disposal.

2.4.2 Primary Access and Haul Roads

The Proposed Action for the access road would widen and straighten the existing 60-foot wide access road. Newmont would submit ROW applications for those locations where the primary access route crosses public lands. The new road would be 100 feet wide and would cross public lands in Section 30, T34N, R43E, Section 12, T34N, R42E, Sections 6 and 18, T33N, R43E, and Section 24 and 36 , T33N, R42E (Figure 2-3).

Mine haul roads would have a useable width of 60 to 100 feet and designed to accommodate mobile mining equipment. The proposed haul roads are shown on Figures 2-4, 2-5, and 2-6 and would cross

LEGEND

- OVERBURDEN DISPOSAL AREAS
- PITS
- GROWTH MEDIUM STOCKPILES
- ACCESS ROAD
- FENCE
- EXISTING POWERLINE
- PROPOSED WATERLINE AND COMMUNICATION LINE
- EXISTING DIRT ROAD
- PROPOSED HAUL ROAD
- STREAM
- DIVERSION CHANNEL
- EXISTING WATERLINE AND COMMUNICATION LINE

SCALE IN FEET
500 0 1000

N

NOTE: EXISTING APPROVED FACILITIES ARE SHOWN IN BLACK AND PROPOSED FACILITIES ARE SHOWN IN COLOR

PROPOSED ACTION

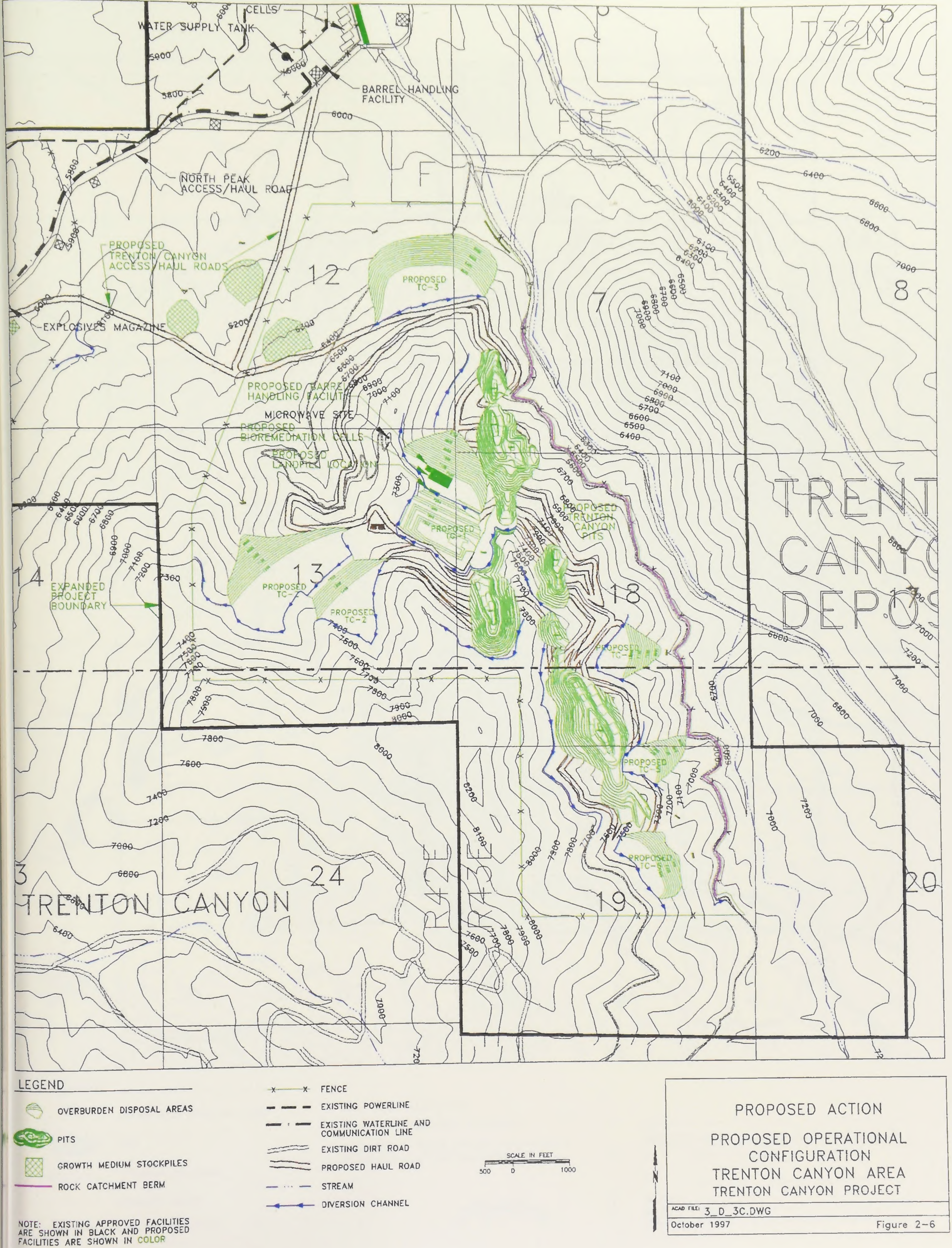
PROPOSED OPERATIONAL CONFIGURATION NORTH PEAK AREA

TRENTON CANYON PROJECT

ACAD FILE: 3_D_3B.DWG

October 1997

Figure 2-5

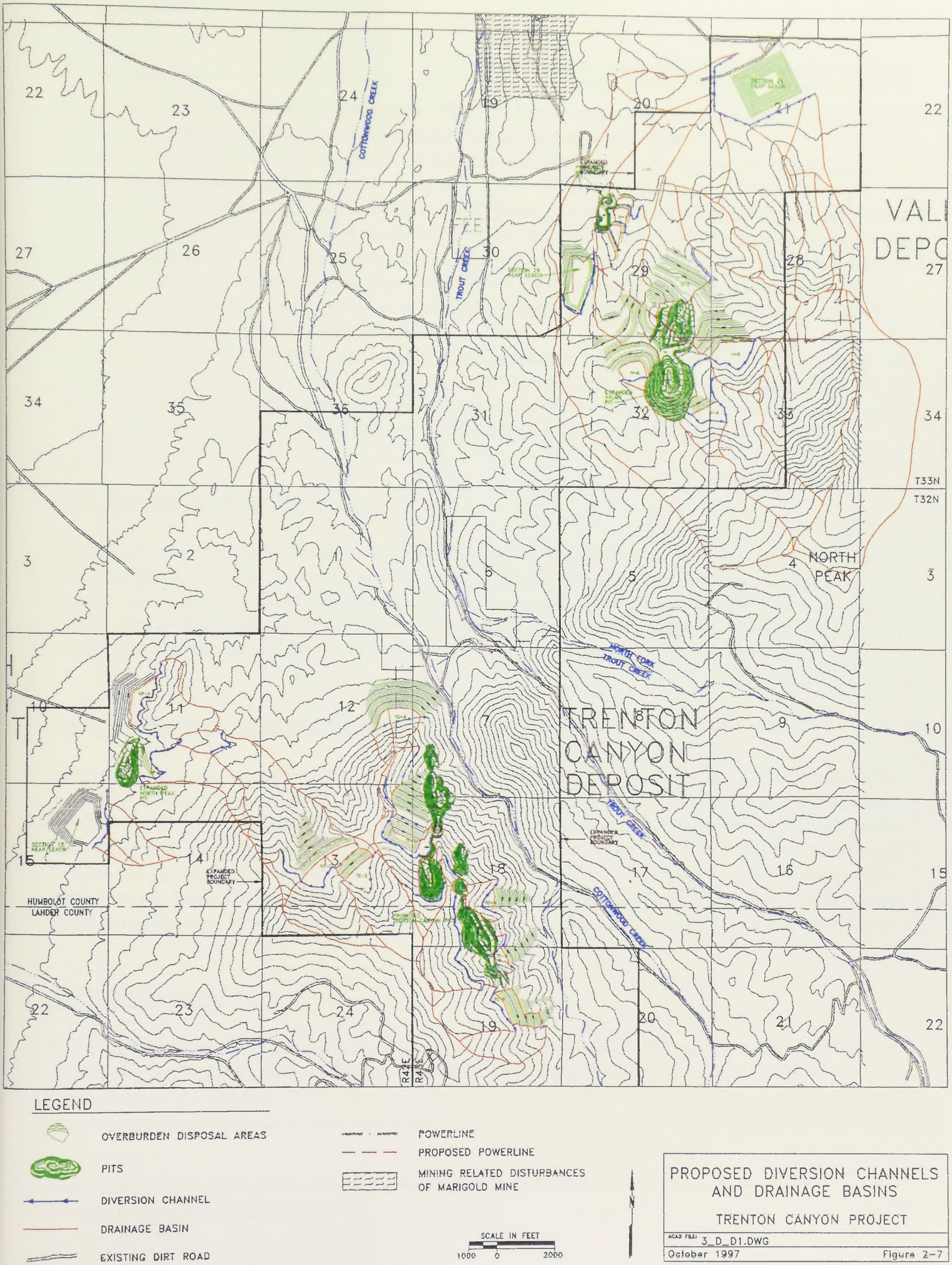


PROPOSED ACTION

PROPOSED OPERATIONAL CONFIGURATION TRENTON CANYON AREA TRENTON CANYON PROJECT

ACAD FILE: 3_D_3C.DWG

October 1997 Figure 2-6



PROPOSED DIVERSION CHANNELS AND DRAINAGE BASINS

TRENTON CANYON PROJECT

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October 1997

Figure 2-7

- Reclaimed slopes are designed to have soil losses under 1 ton per acre per year as runoff is transported along benches to the bottom of the reclaimed slope,
- Bases of reclaimed slopes are to be protected with straw bales and/or silt fences as needed to prevent erosion,
- A berm would be constructed along the existing exploration road that parallels Cottonwood Creek. Culverts would be placed at appropriate locations to allow drainage through the berm and to prevent road washouts. The berm is designed to inhibit rock falls into the creek and prevent sediment transport directly to the creek during mining operations. Sediment impounded against the berm would be salvaged periodically. Following site reclamation, the berm would be removed, and
- To prevent erosion, diversion ditches would be constructed with one or more of the following as necessary: energy dissipation structures, routing into existing drainages, or routing along the zone of coarse rock that would exist at the contact between the toe of waste rock overburden disposal areas and the original ground topography.

2.4.5 Growth Medium Stockpiles

Prior to the construction of the proposed facilities, topsoil would be selectively salvaged. The topsoil and other growth medium would be placed in areas identified as topsoil/growth medium stockpiles on Figures 2-4 through 2-6. If sufficient quantities of topsoil are available, it would be used during reclamation as the growth medium; otherwise, other suitable material would be identified. Additional details concerning this activity are discussed in Sections 3.7.4 and 4.7 of this EIS.

2.4.6 Ancillary Facilities and Utilities

Proposed additional ancillary facilities are shown on Figures 2-3, 2-4, 2-5, and 2-6. The mine areas would be fenced and there would be a lime silo storage area, a sodium cyanide storage area, a barrel handling facility, bioremediation cells, and a landfill. The mine operations would be served by a power line, water line, and communications line. Access across public lands would be required for crossings in Sections 15, 16, 20, and 30, T33N, R43E and in Section 36, T33N, R42E for the proposed power line right-of-way. Additional bioremediation cells or barrel handling facilities that would be located on the overburden disposal areas throughout the project are not included in the surface disturbance estimate.

2.4.7 Reclamation

Following completion of mining and related activities mine disturbance areas would be reclaimed as shown on Figures 2-8, 2-9, and 2-10, following guidelines established in the Reclamation Plan (Newmont Gold Company 1997). To the extent possible, reclamation would occur concurrently with ongoing mining operations in other areas, such as the overburden disposal areas, and associated roads and drainage features. The proposed reclamation schedule is shown on Table 2-4. Reclamation would be initiated as soon as operationally feasible following completion of active operations in a given area.

When feasible, seeding would be scheduled during late fall to allow the seed to winter-over and germinate in the spring when optimal conditions for germination and initial growth exists. Growth media placement should occur immediately before seeding takes place to minimize the potential for loss from erosion of the growth media.

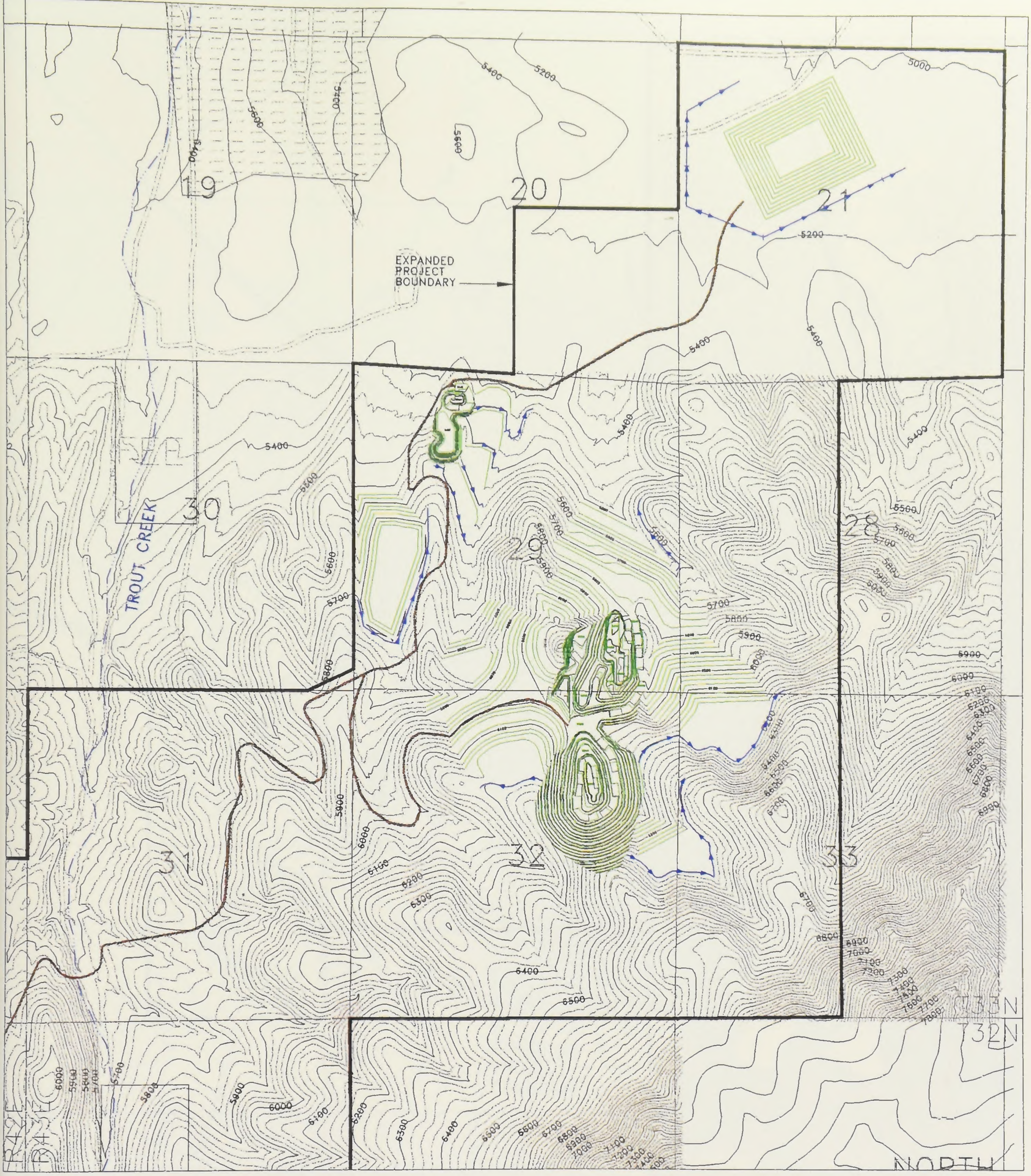
The objectives of the mine reclamation would be to:

- Ensure public safety, reduce or eliminate adverse environmental impacts, and minimize visual effects,
- Return the site to conditions that support land uses similar to those prior to commencement of mining activities,
- Promote a stable environment that would support a diverse, self-sustaining vegetation community consistent with the land use objectives,
- Minimize off-site impacts by controlling infiltration, erosion, sedimentation, and related degradation of existing drainages, and
- Employ reclamation practices based on standard and proven engineering methods and that provide a technically effective and cost-efficient reclamation plan.

Under applicable regulatory provisions as administered by the NDEP and the BLM, Newmont has completed detailed reclamation bonding calculations. Consistent with the calculated reclamation liability, Newmont would provide appropriate reclamation guarantees and supporting financial surety, prior to initiation of operations. The bond calculations reflect a maximum disturbance scenario. As a condition of required permit approvals, adequate financial surety is required to provide for reclamation of all mining related disturbance in the unlikely event that the operator is unable to meet its reclamation commitments and obligations. The bond reclamation calculations are based on the premise that, under a reclamation bond forfeiture situation, bids would be issued for completion of any remaining reclamation work by an independent third-party contractor.

2.4.7.1 Regrading and Drainage and Sediment Control

Regrading requirements are specifically detailed in the Plan of Operations for the proposed facilities that would be reclaimed. These final reclamation configurations are designed to enhance structural stability, promote runoff, prevent ponding, reduce infiltration, control erosion, promote revegetation, and promote the designated post-mining land use.



LEGEND

- DIVERSION CHANNEL
- EXISTING DIRT ROAD
- MINING RELATED DISTURBANCES OF LONETREE AND MARIGOLD MINES
- DOWNSIZED ROADS THAT WILL REMAIN TO PROVIDE ACCESS

SCALE IN FEET
500 0 1000

PROPOSED ACTION

PROPOSED RECLAMATION CONFIGURATION VALMY AREA TRENTON CANYON PROJECT

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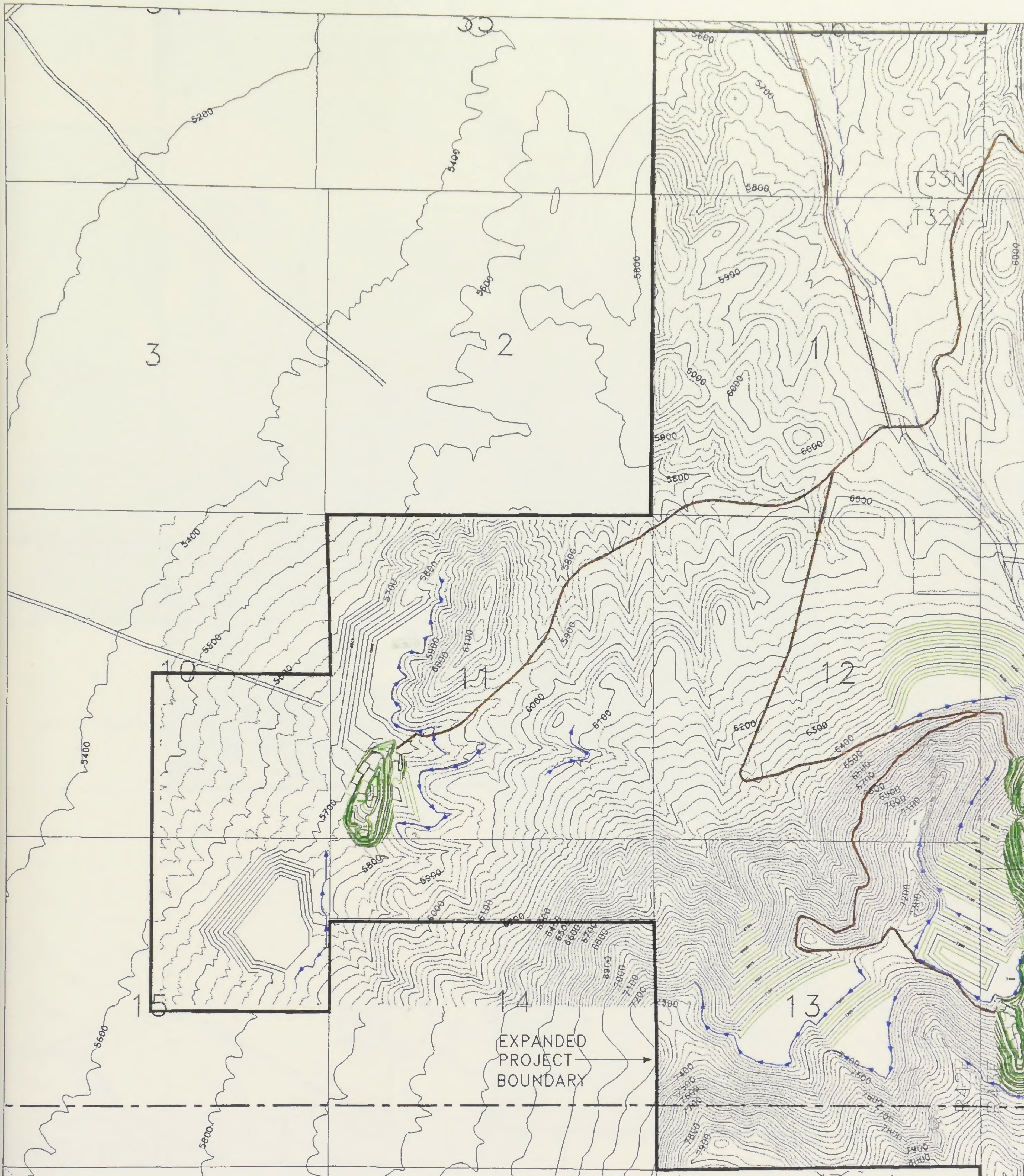
Figure 2-8



LEGEND

DIVERSION CHANNEL

EXISTING DIRT ROAD

DOWNSIZED ROADS THAT WILL REMAIN TO PROVIDE ACCESS

NOTE: EXISTING APPROVED FACILITIES ARE SHOWN IN BLACK AND THE PROPOSED FACILITIES ARE SHOWN IN COLOR.

SCALE IN FEET
500 0 1000

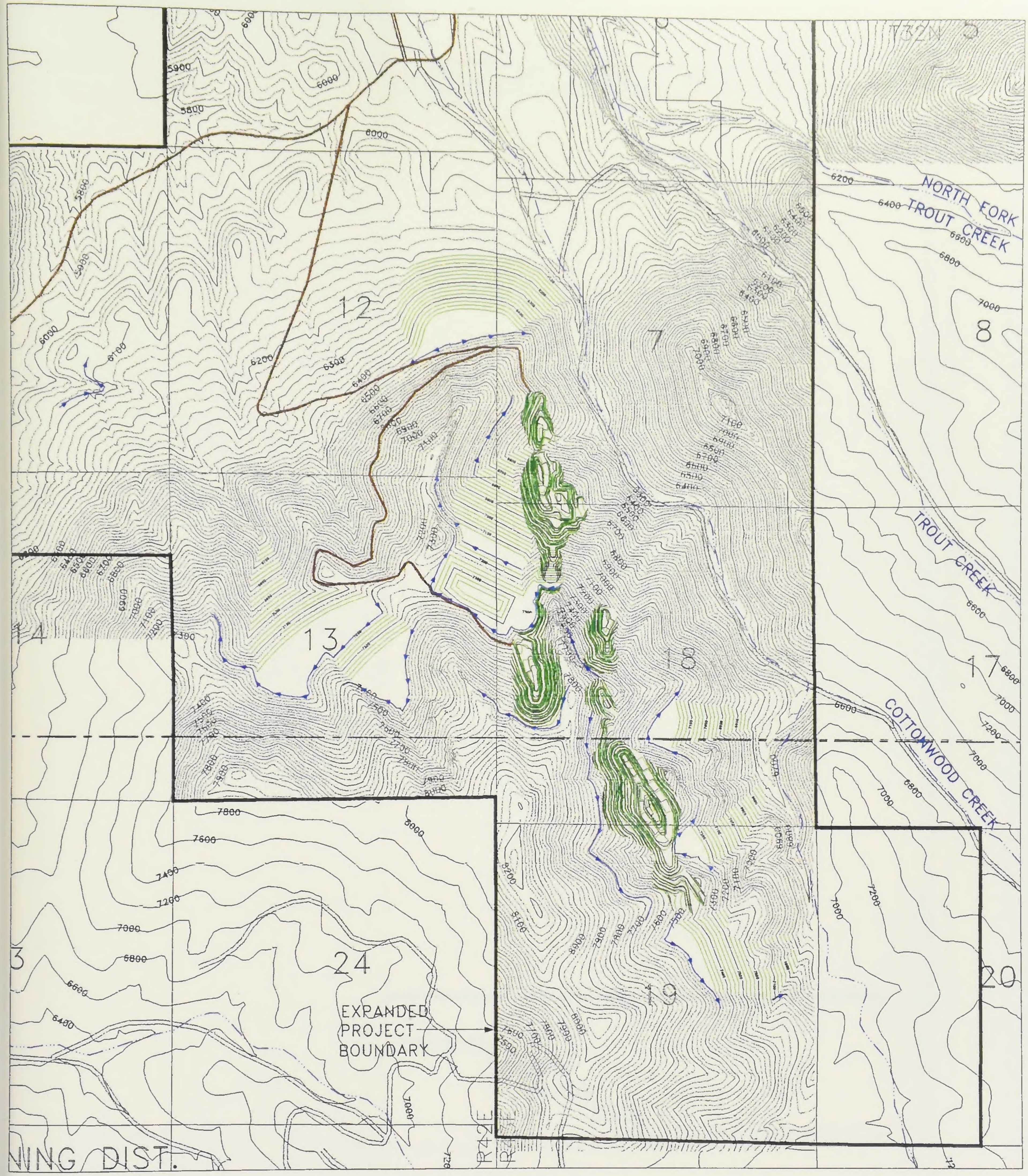
PROPOSED ACTION

PROPOSED RECLAMATION CONFIGURATION NORTH PEAK AREA
TRENTON CANYON PROJECT

ACAD FILE: 3_D_4B.DWG

October 1997

Figure 2-9



LEGEND

DIVERSION CHANNEL

EXISTING DIRT ROAD

DOWNSIZED ROADS THAT WILL REMAIN TO PROVIDE ACCESS

SCALE IN FEET 500 0 1000

PROPOSED ACTION

PROPOSED RECLAMATION CONFIGURATION
TRENTON CANYON AREA
TRENTON CANYON PROJECT

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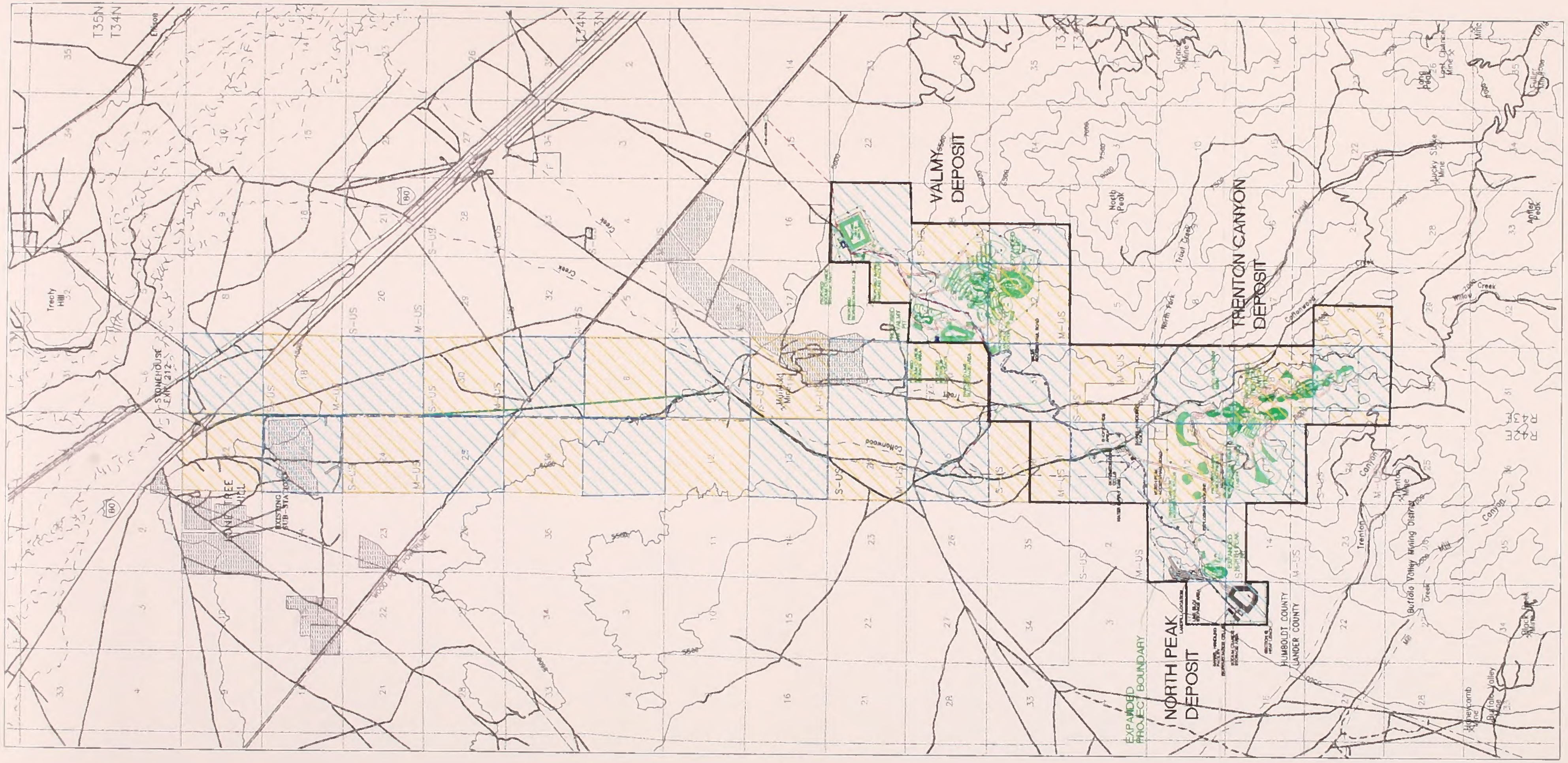
October 1997 Figure 2-10



LEGEND

THIS MAP IS FOR CONCEPTUAL USE ONLY AND IS NOT TO BE USED FOR DESIGN PURPOSES.

EXISTING APPROVED FACILITIES ARE SHOWN IN BLACK AND PROPOSED FACILITIES ARE SHOWN IN COLOR.

- HEAP LEACH
- PITS
- OVERBURDEN DISPOSAL AREAS
- GROWTH MEDIUM STOCKPILES
- MINING RELATED DISTURBANCES OF LONETREE AND MARIGOLD MINES
- PROPOSED POWERLINE
- PROPOSED WATERLINE AND COMMUNICATION LINE
- PROPOSED ACCESS ROAD
- EXISTING DIRT ROAD
- PROPOSED HAUL ROAD
- FENCE
- PROJECT BOUNDARY

*LAND STATUS AS SHOWN IS ONLY APPLICABLE WITHIN THE PROJECT BOUNDARY AND ALONG THE PRIMARY ACCESS AND WATERLINE CORRIDORS FROM LONE TREE.

- PUBLIC LAND – SFPGC CLAIMS
- PRIVATE FEE LANDS (SURFACE AND MINERALS) OWNED OR CONTROLLED BY SFPGC
- OTHER LANDS NOT CLAIMED OR CONTROLLED BY SFPGC

SHADING DOES NOT REFLECT INDIVIDUAL OWNERSHIP OF VARIOUS TRACTS OF LAND.

SCALE IN FEET

PROPOSED ACTION

ACCESS ROUTE AND GENERAL FACILITY LAYOUT

TRENTON CANYON PROJECT

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October 1997

Figure 2-3

Diversion channels would be constructed where necessary to minimize overland flow and erosion of reclaimed areas by intercepting gradient run-on and collecting runoff from reclaimed surfaces and diverting the combined flow into natural drainages. All diversion channels would be designed to convey the flow from a 100-year, 24-hour storm event. Where practical, the diversion channels would follow natural contours at a slope of approximately 0.5 percent and would be designed to reduce flow velocities and to minimize surface erosion. Where necessary, riprap protection would be used to minimize channel erosion.

During operations and reclamation, temporary sediment control measures including silt fences, straw bales, berms, temporary sediment basins, and other applicable measures, would be used where necessary. Care would be taken during construction to minimize sediment production to the extent practical. After reclamation, long-term sediment control would be provided through the following:

- Revegetation of disturbed areas,
- Reclamation slope configurations that provide intermittent slope breaks,
- Diversion of run-on away from reclaimed areas,
- Installation of sediment collection basins in areas requiring sediment and erosion control, and
- Installation of riprap protection in erosion-prone areas of diversion channels and channel outlets.

2.4.7.2 Revegetation

Revegetation would be performed to provide erosional stability, reduce infiltration of precipitation by optimizing evapotranspiration losses, and establish a plant community that is consistent with the post-mining land uses. The revegetation plan includes selecting plant species that are adapted to the site and proven to establish in similar situations.

The following goals have been developed to meet the reclamation objectives:

- Reclaimed areas would be covered with available growth medium. All identifiable and suitable material would be stripped and reapplied for reclamation.
- The proposed reclamation seed mixture is provided in Table 2-5. This seed mixture was developed in coordination with the BLM Winnemucca/Battle Mountain District Reclamation Specialist. Seed application would be conducted by broadcast seeding, followed with a chain harrow. Drought tolerant plants would be used for lower elevation sites and fast growing grasses are proposed for growth medium stockpiles. The mixtures may be altered based on demonstration plot results, with concurrence of the NDEP and the BLM.

Table 2-5
Proposed Reclamation Seed Species

Common Name	Scientific Name	Origin
Crested wheatgrass	*Agropyron cristatum*[a, b]	Introduced
Intermediate wheatgrass	*Agropyron intermedium*[b]	Introduced
Bluebunch wheatgrass	*Agropyron spicatum*	Native
Thickspike wheatgrass	*Agropyron dasystachyum*	Native
Slender wheatgrass	*Agropyron trachycalum*[b]	Native
Sandberg bluegrass	*Poa secunda*[a]	Native
Basin wildrye	*Elymus cinereus*	Native
Indian ricegrass	*Oryzopsis hymenoides*[a]	Native
Gooseberryleaf globemallow	*Sphaeralcea grossulariaefolia*	Native
Ladak Alfalfa	*Medilago sativa*[b]	Introduced
Northern sweetvetch	*Hedysarum boreale*	Native
Palmer penstemon	*Penstemon palmeri*	Native
Western yarrow	*Achillea lanulosa*	Native
Lewis flax	*Linum lewisii*	Native
Small burnet	*Sanguisorba minor*	Introduced
Big sagebrush	*Artemisis tridentata wyomingensis*[a]	Native
Fourwing saltbrush	*Atriplex canescens*[a]	Native
Shadscale saltbush	*Atriplex confertifolia*[a]	Native
Winterfat	*Ceratoides lanata*[a]	Native
Antelope bitterbrush	*Purshia tridentata*	Native

[a]Drought tolerant species for lower elevations
[b]Species to be used to vegetate growth medium stockpiles
Source: Shepherd Miller, Inc. 1997

- The goal is to establish a grass/forb/shrub mix and a perennial vegetation cover similar to pre-existing conditions, consistent with the Nevada Interim Standards for Revegetation. The baseline vegetative inventory establishes perennial cover objectives for the shadscale plant community at 10 percent, Wyoming big sagebrush plant community at 21 percent, mountain big sagebrush plant community at 47 percent, black sagebrush plant community at 23 percent, low sagebrush plant community at 16 percent, and greasewood plant community at 21 percent (Table 3-16).

2.4.7.3 Open Pits

Newmont has requested an exemption from the open pit reclamation requirements of NAC 519A pursuant to NAC 519A.250. A berm would be constructed around the perimeter of each open pit and warning signs would be posted to identify the potential hazard. All access roads to the pits would be eliminated.

2.4.7.4 Overburden Disposal Areas

The overburden disposal areas are designed, where possible, to require minimal regrading to achieve the final reclamation configurations. Regrading would provide gentle transitions and remove sharp or abrupt slope changes to blend the regraded surfaces into the natural surrounding topography and to minimize erosion. Diversion channels would be constructed to intercept upgradient run-on and collect runoff from the reclaimed surfaces and divert the combined flow into natural drainages.

The proposed new and expanded overburden disposal areas would be reclaimed by regrading to the final reclamation configurations fully detailed and illustrated in Figures 2-8, 2-9, and 2-10. On the north and east facing slopes the interbench slopes would be regraded no steeper than 2.3:1 with intermittent slope breaks to reduce sediment transport. The slope configuration on the interbench slopes facing south and west would not exceed 2.4:1 with similar slope breaks. This slope configuration would provide an overall slope of approximately 2.6:1. Overburden disposal areas that have overall operational slope configurations of approximately 3.0:1 would be regraded to provide an interbench slope of approximately 2.9:1 plus slope breaks. To the extent possible, topography would be modified to provide more aesthetically pleasing terrain and increase potential for wildlife habitat by selectively placing truck end dumps and boulder piles on the overburden disposal areas (Newmont Gold Company 1997).

2.4.7.5 Heap Leach and Process Overflow Pond Closure Facilities

Reclamation procedures for the heap leach facility incorporate ore and solution characteristics, site conditions, and climatic conditions. The reclamation phases for the heap leach facility include:

- Heap rinsing,
- Heap regrading, resoiling if necessary, and revegetation,
- Rinse solution management, and
- Pond reclamation.

Details of heap neutralization and closure would be developed two years prior to project closure pursuant to the requirements of Nevada Division of Environmental Protection (Nevada Administrative Code 445A.446 and Nevada Administrative Code 445A.447).

2.4.7.6 Heap Regrading, Resoiling, and Revegetation

The heap grading plan consists of grading to eliminate the benches, reducing the side slopes to an approximate 3:1 grade, and rounding off the heap edges to more natural contours. The top surface and bench surfaces would be regraded to eliminate ponding. After final regrading, a layer of available growth medium would be placed over the surface, and the surface would be seeded with species identified in Table 2-5. The heap leach material would be analyzed to determine suitability for plant growth. If the material is suitable for plant growth, growth medium placement would not be necessary.

2.4.7.7 Pond Reclamation

After the rinse solution is evaporated, the solution pond and storm-event pond would be reclaimed. The pond reclamation plan would include testing pond sediments for hazardous constituents, folding the liners into the pond areas, ripping the liners, and backfilling and grading the ponds to provide free drainage and blend the sites into the adjacent topography. These reclamation activities would be completed in a manner to avoid potential effects to groundwater movement and revegetation. The sites would be revegetated with a seed mix determined through the test plot program. A preliminary mix is listed in Table 2-5. The ponds would be backfilled with the original excavated soil material that would be stockpiled in the pond berms.

The process solution pond also may be used as a biological treatment for heap solutions, if necessary, at final closure.

2.4.7.8 Ancillary Facilities and Miscellaneous Disturbances

All ancillary facilities would be salvaged or demolished prior to reclamation. Concrete foundations would be broken up and buried. The areas would be regraded and compacted surfaces would be scarified and revegetated. Any contaminated or hazardous materials would be sampled to determine the appropriate disposal methods and would be disposed off-site at an appropriate disposal area according to all applicable State and Federal regulations. Also, drill holes within the area of operation would be plugged pursuant to NAC 534.420.

2.4.7.9 Access and Haul Roads

Haul and access roads not necessary for access to private lands would be reclaimed by regrading, ripping of compacted surfaces, replacing topsoil or growth medium, and seeding. Regrading would, to the extent possible, restore the areas to the original contours. Regraded areas would be revegetated in accordance with post-mining proposed land use. Roads providing access to private lands would remain open and would be subject to Newmont obtaining applicable ROWs from the BLM, but would be downsized to a suitable width for lighter duty traffic.

2.4.7.10 Monitoring and Maintenance

Reclamation monitoring would evaluate the project area for erosion stability and revegetation success. Specific monitoring requirements would be developed by the BLM.

Berms and signs would be monitored and maintained annually until all reclamation monitoring is completed, and the operator is released from all reclamation responsibility. Permitting the access road widening and realignment would be handled as an amendment to the existing ROW grant.

2.4.8 Hazardous Materials Handling and Waste Disposal

The Proposed Action would require the same storage facilities for hazardous materials as the No Action Alternative. Please refer to Section 2.3.8 for description of these facilities and materials handling procedures.

2.5 PROCESS OF ALTERNATIVES DEVELOPMENT

Project alternatives were formulated to address significant issues identified through the scoping process. Applicable NEPA provisions (40 CFR Part 1502.14) allow elimination from detailed consideration of options or alternatives which do not meet certain general criteria. The following tests were used to identify a range of potential variations for mining and reclamation activities that resulted in formulation of alternatives:

- Does the alternative provide reasonable protection for or mitigation of project effects on potentially affected natural resources?
- Does the alternative allow the project proponent to exercise its legal rights to recover marketable mineral resources under applicable provisions of the Mining Law of 1872; Federal land management regulations, guidelines and plans; and other applicable regulatory provisions?
- Is the alternative technically, operationally, and economically feasible?

Alternatives which would reduce the potential impacts of the Proposed Action on the physical, natural, and human environment, or could address specific logistical or technical issues were identified and defined by the EIS ID Team. The following alternatives were considered:

- Use Cottonwood Creek as the Overburden Disposal Area for Trenton Canyon pits
- Haul Ore to Lone Tree Mine for Processing
- Establish One Centralized Heap Leach Facility
- Total Backfill Alternative
- Expansion of TC-6 to Eliminate TC-4 and TC-5
- Rehandling of TC-4 and TC-5

- Partial Sequential Pit Backfill
- Underground Mining.

The alternatives defined and described further within this chapter have been developed to reflect the purpose and need as discussed in Chapter 1 and to address issues of concern relative to the environment.

Applicable regulatory provisions require that an EIS present and evaluate a range of alternatives specifically including the Proposed Action and the No Action Alternatives and such additional alternatives as may be necessary and feasible to address significant project issues and concerns. The alternatives identified, described, and analyzed in this EIS document effectively provide agency decision-makers and interested public participants with a full range of project alternatives for consideration.

The first step in the process of formulating alternatives was to define the basic project components that comprise the Trenton Canyon Project. The Trenton Canyon Project components include: open pit mines and overburden disposal areas, haul and access roads, heap leach facilities, drainage, growth medium stockpiles, and ancillary facilities. Technical, economic, and logistical factors were considered in developing an acceptable mine plan. In addition, concepts which could result in major environmental impacts were avoided during the mine planning process.

The second step in the process of formulating alternatives was to identify and select reasonably feasible options for the project components. The options that were determined to be feasible for Trenton Canyon included alternative locations of overburden material disposal, different approaches to sequencing and facility layout.

2.6 ALTERNATIVES TO THE PROPOSED ACTION

Alternatives to the Proposed Action were developed to address the issues and concerns identified during the scoping process. These issues focused primarily on potential slope stability hazards, cumulative impacts of surface disturbance to wildlife habitats and other resources, and protection of the Cottonwood Creek drainage and riparian resources.

2.6.1 Expansion of TC-6 to Eliminate TC-4 and TC-5

During scoping, it was recognized that maintenance of Cottonwood Creek water quality was a high priority and an alternative should be developed that provided for additional stream protection. This alternative was generated because of potential sedimentation impacts that disposal areas TC-4 and TC-5 may cause to the main Cottonwood Creek channel. Therefore, the objective of this alternative is to identify an alternate location for the overburden that was proposed to be deposited in ravines on the west side of Cottonwood Creek.

All elements of this alternative would be identical to the Proposed Action except that overburden designated for disposal in areas TC-4 and TC-5 of the Trenton pit area under the Proposed Action would, instead, be disposed in area TC-6 (Figure 2-11), thereby precluding the need to construct TC-4 and TC-5. This would be accomplished by extending overburden disposal area TC-6 to the south by adding the combined volume of material which would have gone to TC-4 and TC-5. The new disposal area would extend beyond the mapped project area boundary, and would be contained on private land within Section 19, T32N, R43E. Environmental benefits of eliminating disposal areas TC-4 and TC-5 include reduced risk of sediment transport and potentially reduced impacts visual impacts.

Haul distance to the new disposal site would be approximately one to two miles longer, and involve an uphill haul of 100 feet compared to the locations of TC-4 and TC-5 under the Proposed Action. This alternative would require one extra haul truck, driver, and the fuel and maintenance for the truck in order to sustain the same mining rate. The incremental additional cost over the Proposed Action would be approximately $0.15 per ton of material mined or roughly 20% higher. The total amount of material designated for TC-4 and TC-5 was about 5,000,000 tons, causing an additional mining cost of roughly $0.75M.

Because of the new configuration of disposal area TC-6 and the elimination of TC-4 and TC-5, this alternative would result in an estimated 25 acres of additional surface disturbance compared to the Proposed Action. The resulting reclaimed slopes on TC-6 would be farther away from Cottonwood Creek than the reclaimed slopes on TC-4 and TC-5 (Figure 2-12). Because TC-6 is located entirely on Newmont land, about 29 fewer acres of public land (i.e., TC-4 and a portion of TC-5) would be disturbed under this alternative.

2.6.2 Partial Pit Backfill Alternatives

2.6.2.1 Introduction

Two partial pit backfill options which were formulated to protect downslope resources, improve aesthetics, and reduce surface disturbance are described in this section. The economics of open pit gold mining and the flexibility of the mine sequence are the principal factors influencing the feasibility of a backfill alternative. If there are potentially economic reserves in the mineralized zone and they are buried by backfill, the possibility of them being mined in the future is reduced.

The partial backfill alternatives respond to specific BLM concerns including issues of protection of surface water (particularly Cottonwood Creek), reduction of erosion and siltation, long-term stability of reclaimed slopes, and improved post-reclamation aesthetics. The objective in evaluating a backfill alternative for the Trenton Canyon deposit is to determine the environmental, economic, and technical factors that comprise this alternative and compare it with the Proposed Action. Because of its linear configuration of multiple pits, the Trenton Canyon deposit was preferred over North Peak or Valmy mine areas for sequential pit backfilling.

Factors that influence mine planning and the sequence of the pit development process include:

- Gold deposit mineral distribution,
- Total tons mined to recoverable ounces of gold,
- Value of the gold deposit mineralization,
- Location of overburden disposal areas, and
- Logistic issues related to haul distances and proximity to pits and overburden disposal areas.

2.6.2.2 Rehandling of TC-4 and TC-5

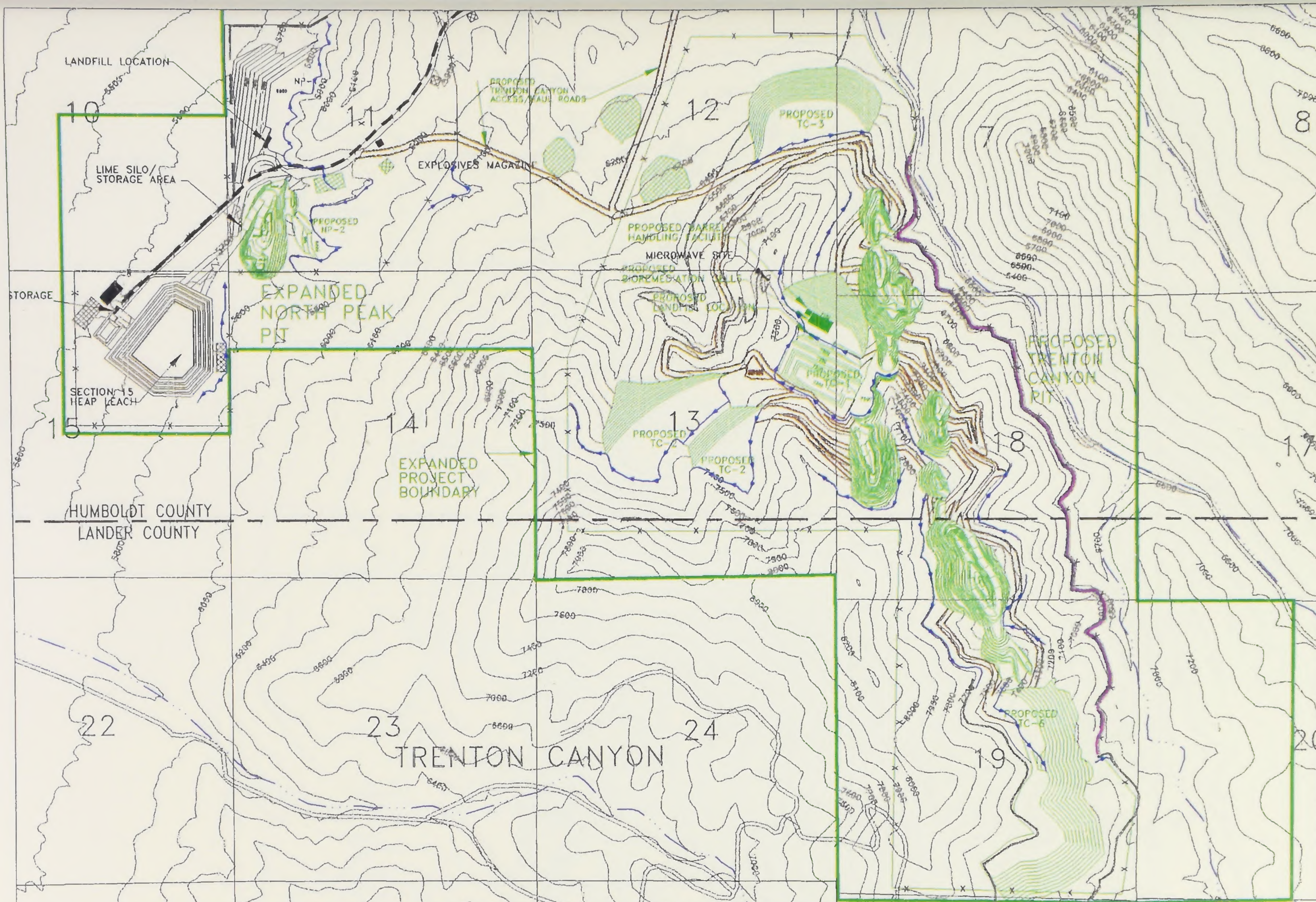
During scoping it was recognized that protection of Cottonwood Creek was a high priority. The focus of this concern was a perceived higher potential for sedimentation of Cottonwood Creek resulting from the location and proximity of overburden disposal areas TC-4 and TC-5. Therefore, the objective of this alternative is to use material in areas TC-4 and TC-5 as pit backfill following completion of the mine sequence.

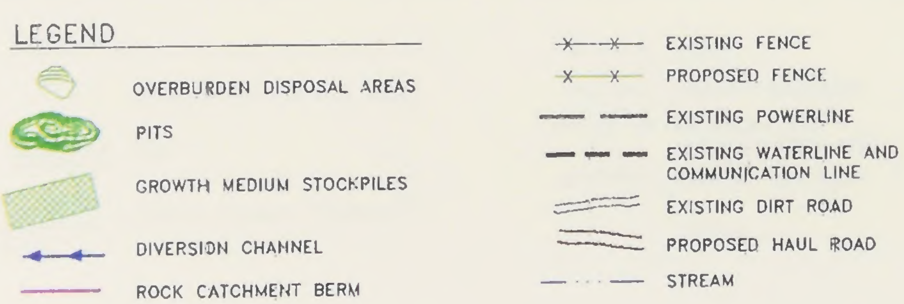
Conceptual Mine Sequence

Under the conceptual mine development sequence shown in Table 2-6, pits adjacent to disposal areas TC-4 and TC-5 (Area E on Figure 2-13) would be mined early in the life of the mine. Mining would be initiated simultaneously within areas A and E on Figure 2-13 and would continue in area E after mining in area A was completed. Because of the long haul distance from area E to area A (as much as three miles) and because of the limited capacity of area A for backfilled material, the disposal of overburden from area E into area A would not be economically or technically feasible. Therefore, overburden disposal areas TC-4 and TC-5 would be constructed as under the Proposed Action. The difference in this alternative is that TC-4 and TC-5 would be temporary, rather than permanent overburden stockpiles. During reclamation, the material in TC-4 and TC-5 would be loaded into haul trucks, hauled uphill to area E, and placed back into the pit.

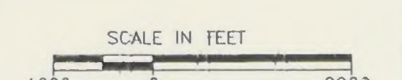
Reclamation

This alternative would be similar to the Proposed Action in all elements except for reclamation activities. During reclamation, the materials contained in overburden disposal areas TC-4 and TC-5 would be returned to the adjacent pit areas. Therefore, these materials would most likely need to be placed in horizontal layers at the bottom of the pit rather than simply dumped from the pit perimeter. Additional haulage costs into, and back out of, the pit would be incurred.





Map Note:
TC-6 would be expanded to include material from TC-4 and TC-5.



EXPANSION OF TC-6
PROPOSED OPERATIONAL CONFIGURATION

TRENTON CANYON PROJECT

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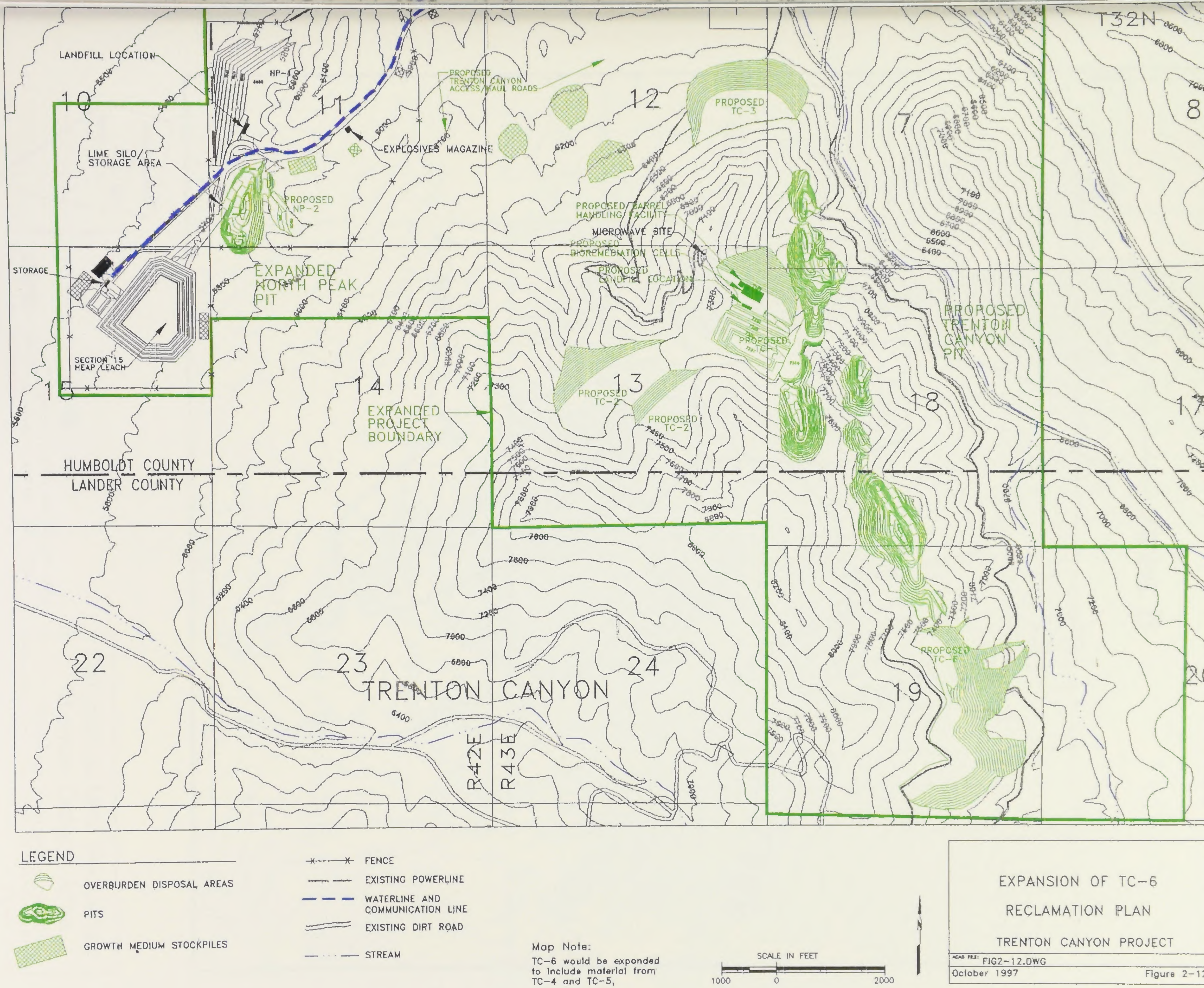
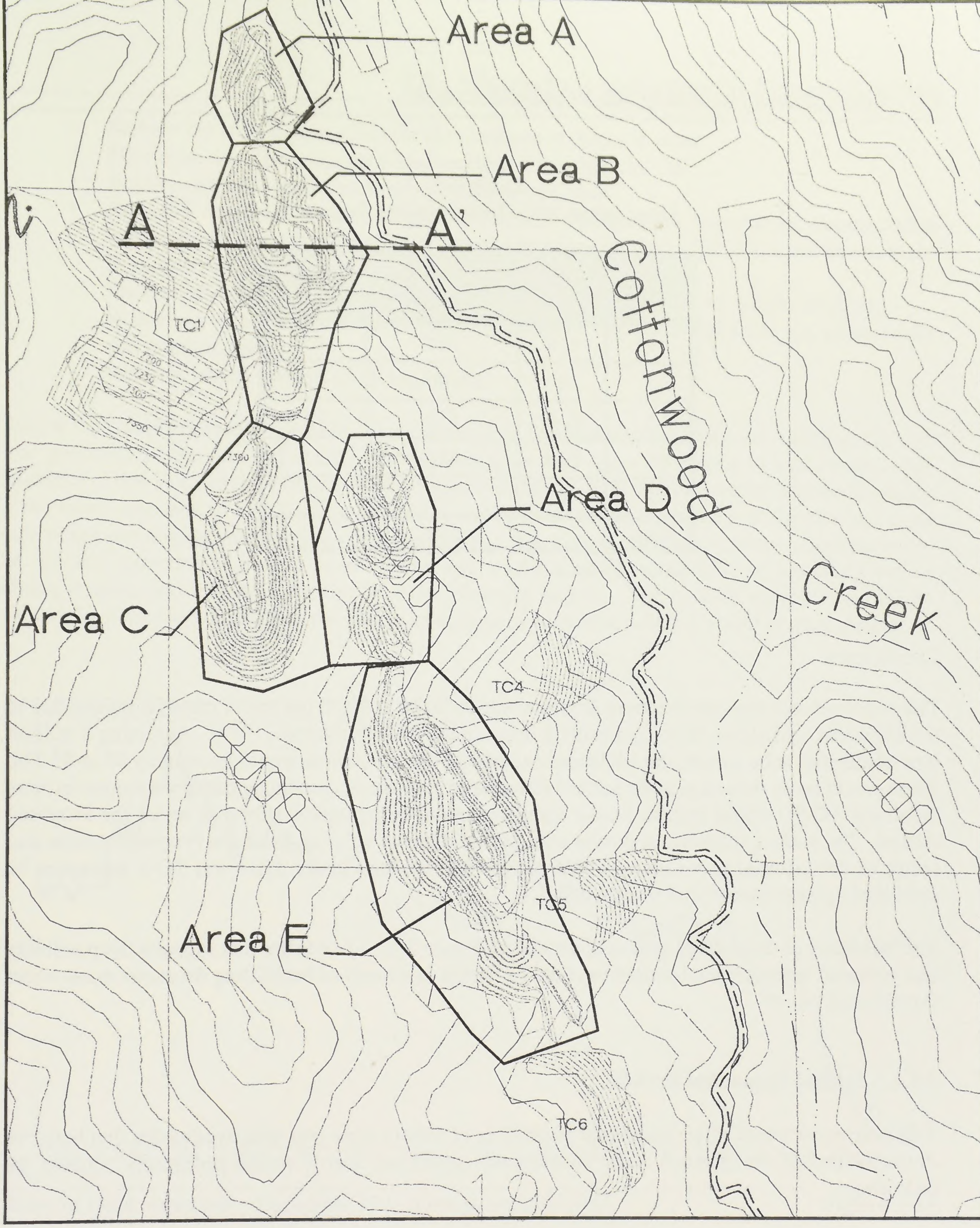
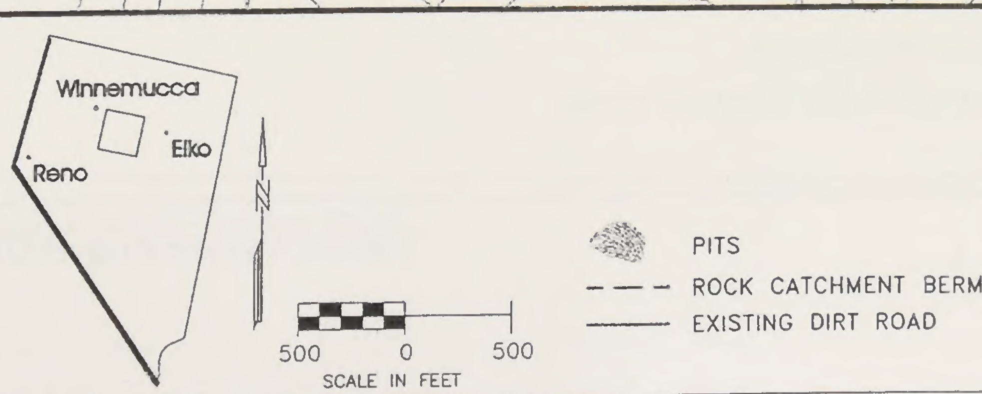
October 1997	Figure 2-11


T32N
LANDFILL LOCATION
LIME SILO/ STORAGE AREA
STORAGE
SECTION 15 HEAP LEACH
NP-1
PROPOSED NP-2
EXPANDED NORTH PEAK PIT
EXPLOSIVES MAGAZINE
PROPOSED TRENTON CANYON ACCESS/HAUL ROADS
PROPOSED TC-3
PROPOSED BARREL HANDLING FACILITY
MICROWAVE SITE
PROPOSED BIOREMEDIATION CELLS
PROPOSED LANDFILL LOCATION
PROPOSED TC-1
PROPOSED TC-2
PROPOSED TC-2
EXPANDED PROJECT BOUNDARY
PROPOSED TRENTON CANYON PIT
PROPOSED TC-6
HUMBOLDT COUNTY
LANDER COUNTY
TRENTON CANYON
R42E
R43E
10
11
12
7
8
15
14
13
18
17
22
23
24
19
20
LEGEND
OVERBURDEN DISPOSAL AREAS
PITS
GROWTH MEDIUM STOCKPILES
FENCE
EXISTING POWERLINE
WATERLINE AND COMMUNICATION LINE
EXISTING DIRT ROAD
STREAM
Map Note:
TC-6 would be expanded to include material from TC-4 and TC-5,
SCALE IN FEET
1000
0
2000
EXPANSION OF TC-6
RECLAMATION PLAN
TRENTON CANYON PROJECT
ACAD FILE: FIG2-12.DWG
October 1997
Figure 2-12





Conceptual Mine Sequence
Trenton Canyon Area
Trenton Canyon Project

Figure 2-13

Table 2-6
Conceptual Mine Development Sequence

Year	Area	Overburden (Mtons)	Ore (Mtons)
1	A, E	12.0	2.5
2	E	12.0	2.5
3	E, C	12.0	2.5
4	C, D	12.0	2.5
5	B	13.3	3.1
Total		61.3	13.1

Mtons = million tons

Conclusions

The increased cost over the Proposed Action would be $0.60 to $0.70 per ton of material moved due to the additional equipment, labor, and hauling distance required (Newmont, 1997). Assuming 5 million tons of material to be moved, the additional expense of this alternative would be roughly $3 to $3.5M. There would be no reduction in the surface disturbance because the remaining disturbed slopes (around TC-4 and TC-5) would require similar stabilization and revegetation efforts as under the Proposed Action. The surface disturbance during mining would be the same as under the Proposed Action and return of the material post-mining would require that the land under TC-4 and TC-5 stockpiles be stabilized against erosion and revegetated.

The variability of the price of gold as illustrated on Figure 2-14 is one factor that supports the possibility that potential future mineral resources could be buried as a result of backfilling decisions made under this alternative.

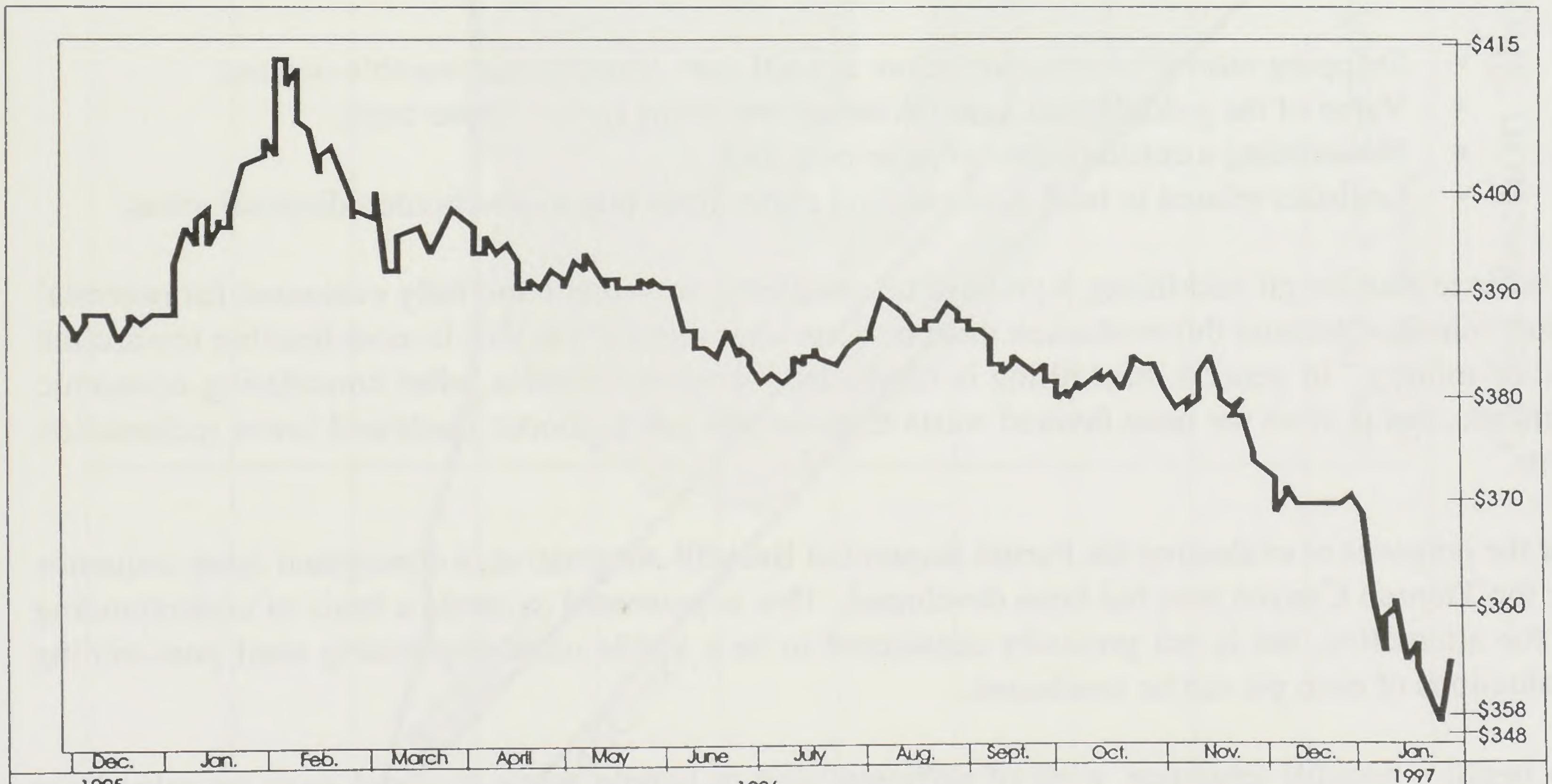
2.6.2.3 Partial Sequential Backfill

This alternative would effect the partial backfilling of certain mine pits with overburden that becomes available during the planned mine development sequence, and it would potentially achieve the following:

- Reduce the total area of mine disturbance,
- Reduce or eliminate some overburden disposal areas,

- Reduce the reclamation effort for the overburden disposal areas,
- Maximize the total amount of land reclaimed to beneficial use,
- Reduce potential sedimentation to Cottonwood Creek,
- Reduced watershed impacts because diversions would not be required for disposal areas within the pit (run-off effects and drainage alterations could be 100-300 acres less than the Proposed Action),
- Shorter haul distances reduce costs to the operator and decrease air quality impacts,
- Reduction of surface area would reduce impacts to vegetation resources and potential for soil erosion, and
- Reduced visual impacts of pit high walls.

Most of the components of this backfill alternative would be similar to the Proposed Action except the final geometry of the pits and overburden disposal areas, and some difference in haul routes. The feasibility of this alternative would depend on a variety of factors including economics and the flexibility of the mine sequence to lend itself to backfilling. The ultimate size and shape of the pits and mine sequencing can change over the life of the project as a function of commodity prices. Consequently, the specific sequence of project development, and resulting ability to backfill are uncertain before mining begins, and rely on a number of mine planning factors. The backfill operation would be continually examined throughout the course of mining to determine when it would be appropriate.



Price of Gold Variations - December 1995 through January 1997. **Figure 2-14**

Pit Geometry and Gold Deposit Mineral Distribution

The actual mined pit geometries as shown on the conceptual mine sequence diagram (Figure 2-13) would be defined by several factors including:

- Forecast price of gold,
- Distribution of mineralization,
- Pit slope stability, and
- Mining and hauling methods.

The variability of pit configuration as a function of the distribution of mineralization and price of gold is illustrated on Figure 2-15. An increase in the price of gold could prompt the mining of areas which were outside the previous economic pit limits; while a decrease would reduce the mining limits (Figure 2-15).

Conceptual Mine Sequence

A mine development sequence for backfilling cannot be designed for the entire mine life. The mine development sequence, and its timing is sensitive to many factors which can change significantly over short periods of time. Some of these factors include:

- Stripping ratio of overburden to ore or total tons mined to recoverable ounces,
- Value of the gold deposit mineralization remaining (price versus cost),
- Maintaining a constant annual mine rate, and
- Logistics related to haul distances and routes from pits to overburden disposal areas.

In order to plan for pit backfilling, a pit must be completely mined out and fully evaluated for potential future mining. Because this evaluation must be done after mining, backfill is most feasible toward the end of mining. In general, backfilling is conducted wherever possible, after considering economic variables, and is often the most favored waste disposal site due to shorter hauls and lower reclamation costs.

For the purposes of evaluating the Partial Sequential Backfill Alternative, a conceptual mine sequence for the Trenton Canyon area has been developed. This is presented to create a basis of understanding of the alternative, but is not presently considered to be a viable mine sequencing until post-mining evaluations of each pit can be conducted.

To begin a backfill sequence, a pit of sufficient size to handle waste material must be mined out completely. Assumptions used to develop this conceptual mine sequence include:

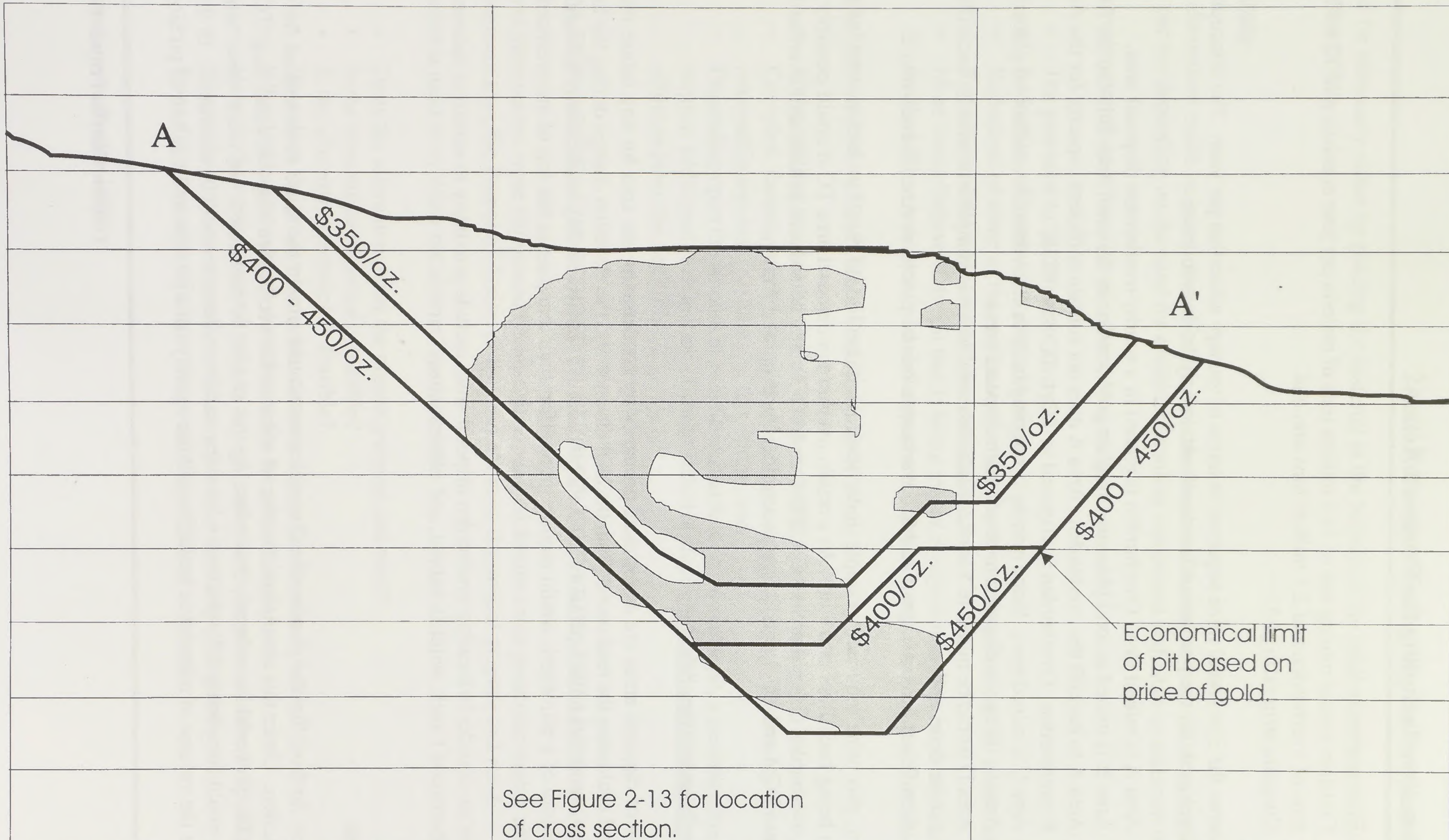


Figure 2-15
Cross Section Showing Mineralized Areas/ Economic Limits

- Five-year mine !ife,
- Constant annual mining rate of 14.5 million tons of materia per year consisting of 12 million tons of overburden and 2.5 million tons ore, and
- Constant strip ratio (4:1).

Table 2-6 shows the conceptual mine sequence in terms of tonnage allocation per year. The conceptual sequence developed, for the purposes of environmental analysis, is as follows:

1) Area A is mined first. Overburden is placed in a nearby overburden disposal area,
2) Area E is mined second because of higher gold content in the ore. Area E is too far from Area A to backfill the overburden. Area A does not contain sufficient capacity for the Area E overburden. Overburden is disposed in TC-4, TC-5 or TC-6,
3) Area C is mined next. Since mining is ongoing in Area E, overburden cannot be placed in Area E. Waste is disposed in overburden disposal areas,
4) Area D would be mined in Year 4. If sufficient evaluation is complete in Area E, backfilling can be done, and
5) Area B is mined in Years 4 and 5. Overburden can be placed in Area A and Area E.

In summary, this mine sequence example under ideal conditions could result in 30% to 40% of the overburden being backfilled into a pit. As a result, overburden disposal area TC-6 could possibly be eliminated, overburden disposal areas TC-1, TC-2, and TC-3 could be reduced in size, and overburden disposal areas TC-4 and TC-5 would remain as under the Proposed Action.

Overburden Disposal Area Selection

The location of disposal areas are determined primarily by condemning the area for any future mine prospects and evaluating the haul costs. Both the haul distance and the elevation change during the haul trip affect the economics of the operation. Under a pit backfill alternative it may be necessary to backfill from the bottom of a pit, which would require more effort than dumping at the top of an overburden disposal area.

Other factors to consider in locating overburden disposal areas include proximity to sensitive resources such as Cottonwood Creek, wildlife habitat, and cultural sites.

Reclamation

Reclamation methods for the overburden disposal areas would remain the same as described for the Proposed Action. Under this alternative, the size of some of the overburden disposal areas (e.g. TC-1, TC-2, and TC-3) would be reduced, thus reducing the area to be reclaimed. In those cases where backfilling would completely fill a pit, long-term slope stability concerns would be alleviated. In those cases where the volume of material to backfill could not entirely fill a pit, the stabilization of pit slopes would be necessary either by placing the material at the bottom of the pit or dumping it from a lower elevation point.

Summary

This alternative could be more cost-effective than the Proposed Action or it could be as high as $0.50 more per ton depending on the need for additional hauling equipment and labor to maintain mine rate.

The environmental benefits with this alternative are summarized by:

- The potential to fill in one or two pits,
- Reduction of overburden disposal areas,
- Reduction of some of the reclamation effort for the overburden disposal areas, and
- Reduction of the total area of mine disturbance, and
- More cost-effective if the pit that is being mined is adjacent to a spent pit that can be used for backfill or reduction in haul distance or equipment usage would reduce operation costs.

Potential costs associated with backfilling pits include:

- Pit backfilling creates the risk of losing potential mineral reserves,
- Complex factors related to mine planning create sufficient uncertainty to affect the reasonableness and feasibility of this option, and
- Depending upon the amount of backfill available for a particular pit, a partially filled pit may require additional reclamation effort to stabilize slopes or additional rehandling and haul effort to place the backfill.

2.7 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Several alternatives were eliminated because they required features that presented higher risks to the environment than the Proposed Action or they did not meet the project purpose and need.

The criteria used to evaluate the alternatives included:

- Does the alternative meet the project purpose and need?
- Is the alternative logistically feasible?
- Is the alternative technically feasible?
- How does the project compare economically to the Proposed Action?
- What is the total surface disturbance for the alternative?
- How do the environmental risks to air, soil and water compare with the Proposed Action?
- Would the alternative conflict with any federal, state or local regulations?
- Does the alternative eliminate the possibility of future reserves?

The rationale for eliminating each of the alternatives is presented within the section.

2.7.1 Use Cottonwood Creek as the Overburden Disposal Area for the Trenton Pits

This alternative was considered early in the mine planning process and although the first five criteria were favorable, the risks to water and conflict with federal regulations led the proponent to consider the Proposed Action. Cottonwood Creek was the obvious location for overburden disposal because of the proximity to the Trenton Canyon deposit which allows short haul distances, maximizing the mining rate. Cottonwood Creek is a jurisdictional water of the United States and it would require a Section 404 Permit from the U.S. Army Corps of Engineers under the Clean Water Act of 1973 with probable design modifications to maintain drainage within the creek bed and to mitigate the loss of wetlands and waters of the U.S. Impacts to riparian resources, wildlife, and fisheries could be high, as Cottonwood Creek is the principal habitat of that type in the project area. The Cottonwood Creek Overburden Disposal Area Alternative did not present positive environmental benefits over the Proposed Action; therefore, it was eliminated from further consideration.

2.7.2 Haul Leach Ore to Lone Tree Mine for Processing

This alternative was identified during scoping to evaluate alternatives to heap leach facilities near the pit sites. In contrast to the Proposed Action, this alternative would eliminate the need for heap leaching facilities and operations including storage and handling of sodium cyanide and other reagents and for spill prevention and pollution controls at the Valmy and North Peak areas. The processing at LTM would increase, however, and likely require additional infrastructure. Stipulations of the NDEP Water Pollution Control Permit would reduce the risk of pollution. For this scenario, the environmental benefit does not outweigh the risks and increased impacts of emissions, noise, and costs for equipment maintenance and operation resulting from additional hauling.

Haul distance to LTM from North Peak, Trenton and Valmy mining areas is 11, 13 and 12.5 miles, respectively. To maintain the projected production rate would require additional haul trips each day with labor and maintenance. The total cost of production would be greater due to increased haul costs, upgrading the access road to support hauling equipment, and the other infrastructure that would need to be constructed at LTM and the North Peak, Trenton Canyon and Valmy mine areas to support this operational change. Therefore, this alternative was eliminated from further consideration.

2.7.3 Establish One Centralized Heap Leach Pad

The original mine plan concept included a single location for the heap leach facility near the center of the project area in Section 1, T32N, R42E. This location had benefits because it was on the main access road to the LTM and it eliminated the need (and cost) for developing two separate heap leach facilities.

However, it was eliminated from further consideration because of the increased haul distance and the proximity to both Trout and Cottonwood creeks with the potential for higher surface and ground water impacts. This alternative was also eliminated due to Native American concern for water quality degradation and the potential to impact historic sage grouse leks in this area. Results of a spring 1995 NDOW survey revealed no active sage grouse leks in this area.

2.7.4 Total Backfill Alternative

This alternative would entail the return of all possible overburden material to the pits. It involves the mining of all pits, then return of overburden material from stockpiles into the nearest pits to completely fill the adjacent pits. There would still be a need to construct overburden disposal areas due to the 30% swell factor and increased costs associated with re-handling of materials would be economically prohibitive. Re-handling ore requires higher operating cost. The cut-off grade for ore under this alternative would have to be higher and a greater amount of lower grade mineralization would be left in place. Therefore, this alternative was considered unreasonable.

2.7.5 Underground Mining

Underground mining of the Trenton Canyon deposits instead of open pit mining was briefly reviewed as an alternative. This alternative would reduce surface disturbance impacts. Underground mining has higher initial capital and operating costs than open pit mining and typically only becomes practical when extracting deep, high-grade ore. The ore within all three mine areas (i.e., North Peak, Valmy and Trenton Canyon) is primarily low-grade oxide ore which requires cyanide leach extraction; therefore, this alternative was eliminated from further consideration because it would be technically infeasible and economically prohibitive.

2.8 COMPARISON OF ALTERNATIVES

Table 2-7 summarizes the potential effects of each of the alternatives relative to issues brought forth during scoping. The summary of impacts assumes those mitigative actions within the Plan of Operations and Reclamation Plan would have been applied to each of the alternatives as appropriate

Generally, the impacts that would be expected to occur under the Proposed Action is similar to the expected impacts of the various action alternatives. Surface water impacts would be somewhat less for the Expansion of TC-6 to Eliminate TC-4 and TC-5 alternative than the Proposed Action. Similarly, the Rehandling of TC-4 and TC-5 alternative and the Partial Sequential Backfill of the Trenton Canyon deposit alternative would have less area removed from the watershed than the Proposed Action. Sediment loading would be expected to be somewhat higher for the Rehandling of TC-4 and TC-5 alternative than the Proposed Action. Conversely, the Partial Sequential Backfill of Trenton Canyon deposit would have somewhat lower sediment loading impacts than the Proposed Action.

For expected impacts to wildlife, the Expansion of TC-6 to Eliminate TC-4 and TC-5 alternative would have fewer acres of mule deer year-long habitat disturbed than the Proposed Action, but would disturb somewhat more low-density mule deer range. The Partial Sequential Backfill of the Trenton Canyon deposit would generally impact less habitat and range of big game and other species than the other action alternatives.

Visual impacts would be slightly less with implementation of the Rehandling of TC-4 and TC-5 alternative and the Partial Sequential Backfill of the Trenton Canyon deposit than those impacts expected with the Proposed Action.

For most resources the No Action Alternative would result in less environmental impact than the Proposed Action or alternatives. Surface disturbance would be lower, acres of pit irreversibly and irretrievably removed would be less, surface drainage alteration would be less, and vegetation and habitat losses would generally be less. Groundwater effects would be similar for the No Action Alternative and all action alternatives. Range resources temporarily disturbed or permanently lost would be lower under the No Action Alternative. The No Action Alternative would not meet the stated purpose and need.

2.9 AGENCY PREFERRED ALTERNATIVE

In accordance with NEPA, the lead agency is required by the Council on Environmental Quality (40 CFR 1502.14) to identify its preferred project alternative in the EIS. The alternatives presented in this DEIS satisfy the BLM's responsibility to protect non-mineral resources to the extent possible, as directed by 43 CFR 3809.0-2(a) and other guidance, while not placing an unreasonable burden on the project proponent nor precluding future use of remaining economic mineral reserves.

The BLM's preferred alternative is the Proposed Action with the sequential backfilling of overburden material and implementing appropriate mitigation for each significant potential resource impact. The preferred alternative provides the best balance between environmental protection and effective resource utilization.

Table 2-7
Impact Summary and Comparison of Alternatives

	ALTERNATIVES				
	No Action	**Proposed Action**	**Expansion of TC-6 to Eliminate TC-4 and TC-5**	**Rehandling of TC-4 and TC-5**	**Partial Sequential Backfill of Trenton Canyon Deposit**
DESIGN FEATURES					
Total No. of Pits	Two	Eight	Eight	Eight	Less than eight
Overburden Disposal Areas	Three	13	11	11 after reclamation	10 - 12 depending on actual mine sequence
AIR QUALITY					
Relative Amt. of PM_{10} from Point Sources and Non-Point Sources	15 $\mu g/m^3$	48.5 $\mu g/m^3$	50.9 $\mu g/m^3$	48.5 $\mu g/m^3$	48.5 $\mu g/m^3$
Relative Amt. of Gaseous Emissions - VOC (TPY) NO_X CO SO_2	Source from trucks and mining equipment using primary access road, operating at North Peak mine area	22.3 151 42.2 16.3	5% higher for each emission than Proposed Action	Slightly higher for each emission than Proposed Action	Slightly lower for each emission than Proposed Action
SOILS					
Surface Disturbance (during mining)	1,202 ac	2,682 ac	2,707 ac	Same as Proposed Action	Same as Proposed Action
Residual Surface Disturbance (after reclamation)	52 ac	348 ac	348 ac	< 348 ac	Approximately 248 ac
WATER RESOURCES					
Surface Drainage Alteration	71 ac	487 ac	< 487 ac	Same as Proposed Action	Same as Proposed Action

Table 2-7
Impact Summary and Comparison of Alternatives

	ALTERNATIVES				
	No Action	**Proposed Action**	**Expansion of TC-6 to Eliminate TC-4 and TC-5**	**Rehandling of TC-4 and TC-5**	**Partial Sequential Backfill of Trenton Canyon Deposit**
Probable Effect on Surface Water Quality	No change from current conditions	Medium potential for sediment loading within 500 feet; increased sulfate concentration from leachate quality	Medium potential for sediment loading within 250 feet; increased sulfate concentration from leachate quality	High potential for sediment loading because of temporary stockpiles at TC-4 and TC-5; increased sulfate concentration from leachate quality	Low potential for sediment loading; increased sulfate concentration from leachate quality
Probable Effect on Groundwater Quality	1500 gpm supplied by Lone Tree Mine	1500 gpm supplied by Lone Tree Mine	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
GEOLOGY/MINERALS					
Future mineral access	No impacts expected	No impacts expected	No impacts expected	Potential to inhibit recovery of identified economic gold mineralization	Potential to inhibit recovery of identified economic gold mineralization
VEGETATION AND WETLANDS					
Loss of Sagebrush Vegetation Type	266 ac	1,870 ac	1,880 ac	1,870 ac	1,870 ac
Discharge of Fill into Wetlands or Other Waters of the U.S.	None	1.97 ac	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
WILDLIFE					
Loss of Habitat for Sensitive Species or Species of Concern	None, bat habitat is in rocky habitat at higher elevation	Loss of rocky cliffs and crevices may displace sensitive bat species	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action

Table 2-7
Impact Summary and Comparison of Alternatives

	ALTERNATIVES				
	No Action	**Proposed Action**	**Expansion of TC-6 to Eliminate TC-4 and TC-5**	**Rehandling of TC-4 and TC-5**	**Partial Sequential Backfill of Trenton Canyon Deposit**
Loss of Habitat for Mule Deer and Other Big Game Species	None, mule deer range is at higher elevation than area affected under this alternative	1,220 ac	1,245 ac	Same as Proposed Action	Same as Proposed Action
Loss of Habitat for Sage Grouse, Chukar, and other Upland Game Species	266 ac of sagebrush would be removed	1,870 ac of sagebrush would be removed	1,880 ac of sagebrush would be removed	Same as Proposed Action	Same as Proposed Action
Loss of Wildlife Water Sources (i.e., Riparian Communities, Seeps, or Springs)	None	None	None	None	None
VISUAL RESOURCES					
Changes to Scenic Quality	Low contrast; exploration roads and drill sites may be noticeable yet indistinct	Moderate to strong contrast	Moderate to strong contrast	Moderate to strong contrast within Valmy pit high wall	Weak to moderate depending on how much pits are filled
RANGE					
Loss of AUMs	None	Temporary loss of AUMs Permanent loss of AUMs	Temporary loss of AUMs Permanent loss of AUMs	Temporary loss of AUMs Permanent loss of AUMs	Temporary loss of AUMs Permanent loss of AUMs

Table 2-7
Impact Summary and Comparison of Alternatives

	ALTERNATIVES				
	No Action	**Proposed Action**	**Expansion of TC-6 to Eliminate TC-4 and TC-5**	**Rehandling of TC-4 and TC-5**	**Partial Sequential Backfill of Trenton Canyon Deposit**
LAND USE AND ACCESS					
Consistency with land use management plans	Activities on private lands do not fall under BLM management guidelines	Mineral extraction is consistent with BLM planning objectives	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
AESTHETICS					
Compatibility with VRM objectives	Management guidelines for VRM Class IV lands would not be exceeded; project related disturbance would occur	Visual contrasts consistent with VRM Class III and IV lands.	Same as Proposed Action	Contrast of pit high walls would be weakened through alternative reclamation design	Contrast of pit high walls would be weakened through alternative reclamation design
SOCIAL AND ECONOMIC VALUES					
Employment	Employees for North Peak and Valmy come from Lone Tree Mine. Revenues would be generated for 2-5 years.	Employees for Trenton Canyon would be provided jobs longer than under No Action. Revenues would be generated for 5-10 years.	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
CULTURAL RESOURCES					
National Register eligible sites affected	No cultural sites would be directly affected.	---NRHP sites would be directly impacted.	---NRHP sites would be directly impacted.	---NRHP sites would be directly impacted.	---NRHP sites would be directly impacted.

Chapter 3

Affected Environment

CHAPTER 3 - AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter contains an overview of the existing environmental resources in the Trenton Canyon Project (The Project) area. Numerous technical baseline reports were prepared as primary supporting documents to this Environmental Impact Statement (EIS) as shown in Chapter 7. Copies of the technical baseline reports are available for review at the Bureau of Land Management (BLM) Winnemucca District Office, 5100 East Winnemucca Blvd., Winnemucca, Nevada.

Additional baseline information was gathered from field and laboratory studies of the project area, file reports and survey data from government agencies and private companies with knowledge of the region. For some resources, such as geology, soils, and vegetation, the affected area was determined to be the physical location and immediate vicinity of the areas to be disturbed by mining in the Valmy, North Peak and Trenton Canyon areas. For other resources, such as water, wildlife, and social and economic values, the affected environment comprised a larger area, e.g., watershed, airshed, county, habitat range, etc.

The affected environment sections discuss the conditions in the human and natural environment which could potentially be affected, beneficially and adversely, by the proposed alternatives. In addition, resources or project elements subject to statutory or regulatory requirements are described.

The resources studied in detail include:

- Water Quantity and Quality
- Geology and Minerals
- Air
- Soils
- Vegetation
- Wetlands
- Wildlife and Fisheries
- Threatened, Endangered and Special Status Species
- Range
- Land Use and Access
- Recreation
- Aesthetics (Noise and Visual)
- Social and Economic
- Cultural and Paleontology

3.2 SURFACE WATER

3.2.1 Surface Water Quantity

The Trenton Canyon Project is located in the Humboldt River Basin in northern Nevada. The hydrologic study area covers approximately 88 square miles and includes portions of Battle Mountain, Buffalo Valley, Buffalo Mountain, and the Humboldt River Valley (Figure 3-1).

Information presented in this section is extracted primarily from the Baseline Hydrology and Geochemistry Report of the Trenton Canyon Project, Humboldt, and Lander Counties, Nevada, by Shepherd Miller, Inc. (1996), as well as results from sampling conducted subsequent to completion of Shepherd Miller, Inc. (1996). Other references were utilized as noted.

Drainages and drainage basin boundaries in the project area are shown in Figure 3-1. Many of these drainages are ephemeral, with the lower reaches dry during much of the year. Reaches of three perennial streams are present within the Trenton Canyon Project hydrology study area: Cottonwood Creek, Trout Creek, and Trenton Canyon Creek. Cottonwood Creek drains the watershed in which the proposed Trenton Canyon pits are located. Trenton Canyon Creek drains the south end of the project area. Trout Creek is west of the proposed Valmy pit location.

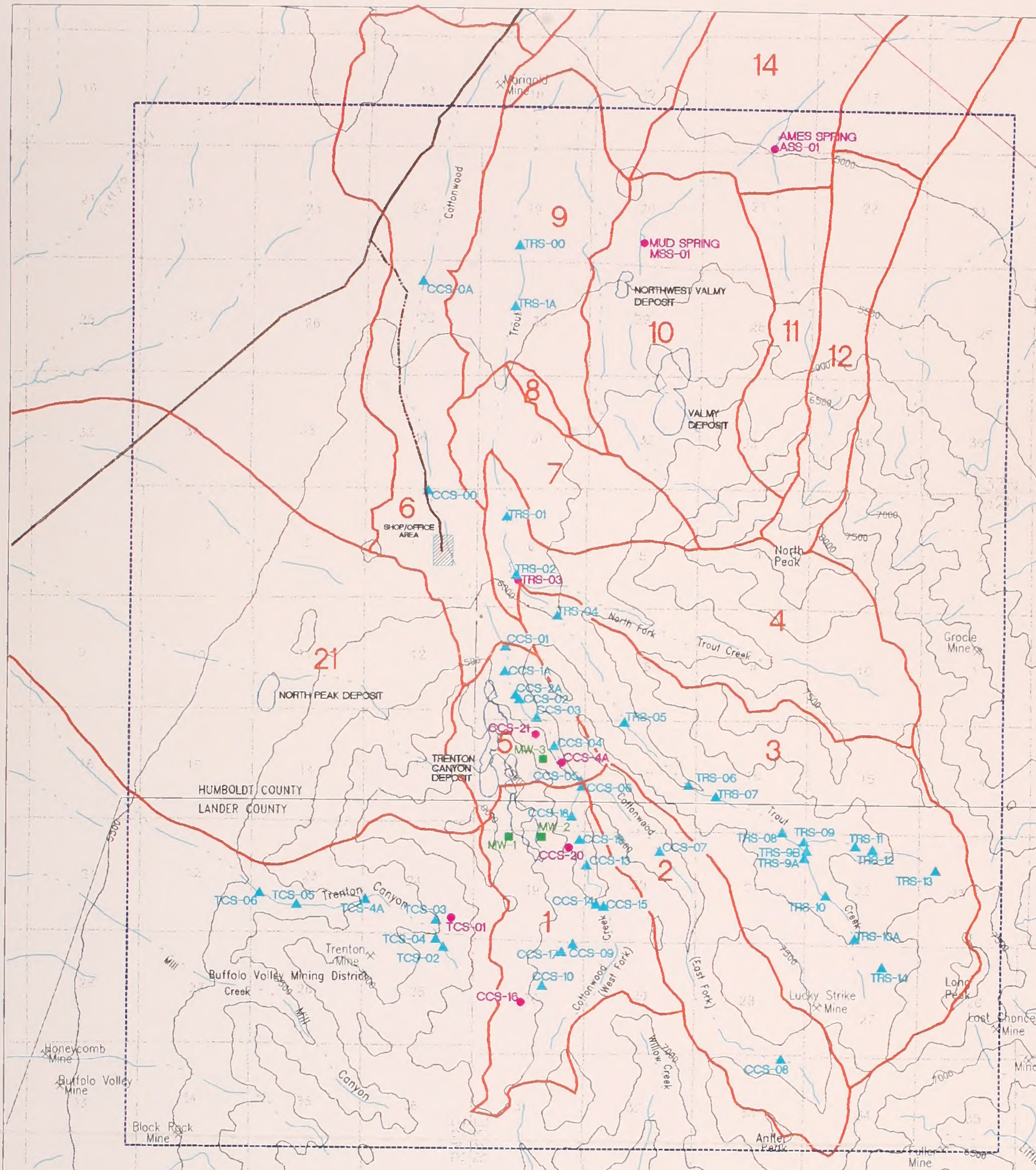
The three creeks mentioned above were sampled during baseline studies for the Trenton Canyon Project (Shepherd Miller, Inc. 1996). Flow measurements were made and water quality samples collected from each of these drainages.

Eight springs were also monitored within the study area (Figure 3-1), five of which flow year-round; flow was observed at the other three during the high-flow runoff event of spring 1995.

3.2.1.1 Precipitation

Precipitation has been measured at the Trenton Canyon Project meteorological station, located near sample location CCS-00 in Figure 3-1, since the third quarter of 1995. Measured precipitation from Trenton Canyon was supplemented by data from the Lone Tree gauge for three months that the data was not available from the Trenton Canyon gauge. Annual precipitation in this series was 9.62 inches in 1995 and 9.45 inches in 1996.

In order to determine whether sampling and flow measurement values were affected by high runoff events, precipitation occurring on each sampling date, along with precipitation occurring two, five, and ten days prior to each sampling event, was tabulated. These values were compared with the mean and mean-plus-one-standard-deviation precipitation values for the same periods. Precipitation of 0.95 inches and 0.33 inches, respectively, were recorded on the sampling dates of May 22 and 23, 1995. These values greatly exceeded the statistical values for that period and are likely to have contributed to recorded high flows in Trout Creek and Trenton Canyon Creek on those days. Other one- and two-day



LEGEND

THIS MAP IS FOR CONCEPTUAL USE ONLY AND IS NOT TO BE USED FOR DESIGN PURPOSES.

- PRIMARY ACCESS ROAD
- PRIMARY ACCESS TO BE RECONSTRUCTED
- EXISTING PAVED ROAD
- WELL
- SPRING
- SURFACE-WATER STATIONS
- STUDY AREA BOUNDARY
- WATER COURSE
- WATERSHED BOUNDARY

BASIN	AREA (ac)	BASIN	AREA (ac)
1	1,974	7	1,108
2	1,871	8	81
3	4,843	9	2,007
4	2,683	10	2,711
5	831	11	921
6	3,335	14	3,773

SCALE IN FEET 2500 0 5000

EXISTING HYDROLOGIC FEATURES AND SAMPLING SITES

TRENTON CANYON PROJECT

OCTOBER 1997

Figure 3–1

rainfalls were within the mean plus one standard deviation. A number of five- and ten-day antecedent precipitation values were above statistical values, but flows on sampling days are not likely to have been affected greatly.

Precipitation versus elevation at the mine location was estimated by Shepherd Miller, Inc. (1996), which presented values from a number of studies. Representative values of annual precipitation as a function of elevation are presented in Table 3-1.

Table 3-1
Estimated Annual Precipitation vs. Elevation

Elevation Range (feet above msl)	Estimated Precipitation (inches/year)
<5,000	8
5,000-6,000	10.1
6,000-7,000	12.4
7,000-8,000	14.7
>8,000	17.0

Source: Shepherd Miller, Inc. 1996

3.2.1.2 Water Rights

Information on current water rights in the project area was obtained from the Nevada Division of Water Resources as shown in Table 3-2. There are no active diversion structures on the creeks.

3.2.1.3 Cottonwood Creek Drainage

Cottonwood Creek flows to the northwest through the center of the project area, and passes near the Trenton Canyon deposit. Cottonwood Creek has two main branches (the east fork and west fork) that join approximately 0.5 mile east of the Trenton Canyon deposit. The west fork, except for the last 50 feet before its confluence with the east fork, is dry most of the year. The east fork is intermittent along most of its length. Flow occurs throughout the year within the canyon below the confluence of the two forks, including the reach adjacent to the Trenton Canyon deposit.

Flows initially increase to the north as drainage area increases but then decrease rapidly near the mouth of Cottonwood Canyon, except during seasonal snowmelt. Flow is intermittent below the mouth of the canyon (Shepherd Miller, Inc. 1996).

Table 3-2
Surface Water Rights in the Project Area

Application #	Owner	Filing Date	Township, Range, Section	Status	Source	Div Rate, cfs	Use	Annual Duty
V03744	Venturacci Ranches	02/82	33N, 43E, 32	VST	Willow Crk	1.00	stock	0
V04636	Venturacci Ranches	02/88	33N, 43E, 20	VST	Ames, Mud Springs	0.50	stock	0
2621	Buffalo Valley Mines Co	01/13	32N, 42E, 16	CER	Mill Canyon Springs	0.16	mining	0
3282	Frank Marker	02/15	32N, 42E, 12	CER	Cottonwood Creek	0.3273	irrig	160 af
01898[1]	Frank Marker	05/25	32N, 42E, 12	VST	Cottonwood Creek	NL	irrig	132 af
2216	Frank Marker	09/11	32N, 43E	CER	Trout Creek	0.1661	irrig	61.84 af
2324	Channing Marker	01/12	33N, 43E, 30	CER	Trout Creek	0.1496	irrig	65.04 af
2513	Amelia Marker	09/12	33N, 43E, 16	CER	Desert Springs	0.10	irrig	40 af
10701	G.C. Partee, trustee	05/37	33N, 43E, 31	CER	Trout Creek	0.05	mining	0

[1] Note: This vested water right (#01898), with 1899 priority, has not yet been adjudicated
Key: af=acre feet, mg=million gallons, CER=certificated, NL=not listed, PER=perfected, RFA=ready for action, VST=vested, UG=underground, DIV=Diversion, cfs=cubic feet per second.
Source: Santa Fe Pacific Gold Corporation Project Files, 1997.

Flows were measured and samples collected quarterly from a network of locations along this drainage, shown in Figure 3-1 and described in Shepherd Miller, Inc. (1996). Measurement and sampling locations are concentrated along the reach adjacent to the Trenton Canyon deposit to allow characterization of pre-mining background conditions. Measured flows in Cottonwood Creek ranged from nonexistent to 3,200 gallons per minute (gpm), depending on location and season. Measured flows were typically greatest east and north of the Trenton Canyon deposit.

Four springs have been observed in the Cottonwood Creek drainage basin. Springs were identified by review of topographic quadrangle maps and through site reconnaissance (Shepherd Miller, Inc. 1996). Spring CCS-4A (BLM ID No. 64-46) is located near the creek (Figure 3-1) at approximately the same elevation of the creek. Water from this spring flows out of the hillside, along a bedrock surface before entering the creek. Measured flow in this spring ranged from 0.36 to 25 gpm with a single event outside that range in May 1995 of 240 gpm. Flow in three other springs (CCS-16, CCS-20, CCS-21) was observed only during May 1995 when rapid snowmelt was occurring from a heavy snow year. These springs were likely fed by temporarily-saturated perched zones.

3.2.1.4 Trout Creek Drainage

Trout Creek flows north approximately parallel to and 0.5 mile east of Cottonwood Creek (Figure 3-1). Trout Creek lies at least one mile from all planned pits.

Flows have been measured and samples collected quarterly from a network of locations along the Trout Creek drainage (Figure 3-1). Trout Creek typically flows throughout the year between Stations TRS-01 and TRS-09, with the flow disappearing during summer, fall, and winter where the stream leaves its canyon and flows across alluvium, north of station TRS-01. Flow is intermittent upstream of TRS-09.

Flows in Trout Creek increase to the north as the drainage area increases. The highest flows are typically recorded during the spring when snowmelt occurs. Measured flows range from less than 1 gpm to 6,300 gpm, depending on location and season. Values of 6200 gpm and 6300 gpm measured on May 22, 1995 coincide with a 0.95-inch rainfall event that occurred during a period of heavy snowmelt, as previously discussed. Aside from these flows, the highest measured flow was 800 gpm on March 5, 1995 at TRS-01, near the mouth of the canyon.

Spring TRS-03 is located near Trout Creek outside the mouth of the canyon. This spring flows perennially and has been developed through construction of a rock retaining wall. This spring supplies a significant fraction of the water flow in the lower reaches of Trout Creek during the dry season.

3.2.1.5 Trenton Canyon Creek Drainage

Trenton Canyon Creek headwaters are approximately a mile southwest of the Trenton Canyon deposit and they flow away from the project to the west (Figure 3-1). This drainage typically flows throughout the year in the upstream reaches near springs, but is ephemeral in other areas within the steep-walled canyon. Surface flow disappears where the stream leaves the canyon and flows across alluvium.

Flow measurement locations in this drainage are shown in Figure 3-1. The highest flows in Trenton Canyon Creek are typically recorded during the spring when snowmelt occurs. A high of 77 gpm was recorded on May 23, 1995 at TCS-02. Flows during other seasons are typically less than 10 gpm.

Spring TCS-01 is a perennial spring located near the headwaters of the Trenton Canyon Creek drainage. Flows measured from this spring have ranged from 0.36 to 2.7 gpm.

3.2.1.6 Valmy Deposit Area

Several unnamed drainages dissect the area near the Valmy deposit. These drainages are dry except following major rainfall or snowmelt events; therefore, no flow measurements have been obtained for any of the unnamed drainages.

Ames Spring and Mud Spring (Figure 3-1) are perennial springs located to the north of the Valmy deposit. Ames Spring is located approximately 1.5 miles northeast of the proposed North Valmy pit. Mud Spring is a developed spring located approximately 1/4 mile north of the North Valmy pit. Both springs have low (1 gpm or less) discharges. A number of seeps have been observed in the area of Ames and Mud Springs, but flow occurs in spring time only.

Mud Spring is not a location where the permanent ground water table intersects the ground surface, but represents the intersection of a perched saturated zone with the ground surface (Shepherd Miller, Inc. 1996). Ames Spring may also be fed by a perched saturated zone in the locally-permeable alluvium overlying bedrock in this area. During the spring, two to three springs within approximately 300 feet along a north-south trending line are sometimes present near Ames Spring (Shepherd Miller, Inc. 1996).

3.2.1.7 North Peak Deposit Area

One unnamed drainage dissects the area near the North Peak deposit. No flow has been observed in the drainage, which carries water only during high precipitation or snowmelt events. No springs have been observed in this area.

3.2.2 Surface Water Quality

This section describes baseline stream and spring quality in the project area. Surface water quality samples were collected from Cottonwood, Trout, and Trenton Canyon Creeks, as well as from springs in these drainages. Particular emphasis was placed on water in the vicinity of the Trenton Canyon deposit, since those waters have the highest potential for water quality impacts from mining activities. Water quality in nearby drainages where previous mining activities have occurred was also investigated.

Water quality standards for the State of Nevada are tabulated in Table 3-3 to allow comparison of observed water quality with potentially applicable standards. Drinking water standards applicable to ground water, and standards for various beneficial uses of surface water are shown in the table. Since waters in the project area are not used as a potable supply, but do support aquatic life and agriculture, measured water quality is compared with the listed aquatic life and agricultural standards. Comparisons are made with the lowest aquatic life standard (96-hour average) and the lower of the two (irrigation and stock water) agriculture standards. Detection limits for cadmium and mercury were typically higher than the standards; those for lead and silver were higher than hardness-based standards in a few cases.

Nine quarterly rounds of water sampling (fourth quarter 1994 through fourth quarter 1996) were conducted. Sampling practices and results were documented in reports prepared for Newmont (Shepherd Miller, Inc. 1996; Hydro-Search, 1996).

Surface and spring water quality was monitored (when flow permitted) at the following locations: (1) up to 18 stream locations and four springs along Cottonwood Creek, (2) up to four stream locations and one spring in the Trout Creek drainage, (3) at one surface water location and one spring in the Trenton Canyon drainage, and (4) at Ames and Mud Springs in the Valmy mine area. Water quality sampling locations are shown on Figure 3-1. Table 3-4 contains a summary of exceedances for all samples and analytes.

A description of analytical procedures and data quality is included in the Baseline Hydrology and Geochemistry Report (Shepherd Miller, Inc. 1996), which states that sufficient acceptable results are available to characterize water quality in the project area. Total concentrations of metals in surface water were, as expected, typically higher than dissolved concentrations. Significantly higher total concentrations, particularly for iron, aluminum, and manganese, indicate that these constituents may be migrating in particles that are too small to settle rapidly but too large to pass through the 0.45 micron filters used to treat samples for dissolved constituent analysis. Total suspended solids (TSS) concentrations were usually low, indicating that most samples were free of large amounts of particulate matter.

3.2.2.1 Cottonwood Creek Drainage

Sample results of Cottonwood Creek allow evaluation of seasonal variations (over the 2-year period of observation) in water quality.

Water quality changes very little and generally meets standards downstream along the drainage (Shepherd Miller, Inc. 1996). A number of exceedances over the lead and phosphorus standards were recorded (Table 3-4). One result exceeded the silver standard, one exceeded the zinc standard, and two exceeded the copper standard. Total concentrations for some samples exceeded the iron, lead, and copper standards, but this is probably due to dissolution of solid constituents during sample preparation, and is not indicative of water concentrations (Shepherd Miller, Inc. 1996). Of the twenty-two sampling locations, two (CCS-00 and CCS-01, located below the canyon) had no analytical results over aquatic life or agriculture standards.

The data do not indicate any strong seasonal trends in water quality, although dissolved concentrations of many constituents at Stations CCS-3 and CCS-1A decreased during the high-flow event sampled in May, 1995. This may have been due to the high influx of relatively clean snowmelt that diluted concentrations normally observed in base flow (Shepherd Miller, Inc. 1996). Waters in Cottonwood Creek were found from field measurements (Shepherd Miller, Inc. 1996) to be well oxygenated and to have no detectable ferrous iron, indicating oxidizing conditions.

Table 3-3
Nevada Water Quality Standards

Parameter[a]	Ground Water Standards		Surface Water Standards				
	Drinking Water		Municipal or Domestic Supply	Aquatic Life		Agriculture	
	Primary	Secondary		1-hr avg	96-hr avg	Irrigation	Stock Water
Aluminum	--	0.05 to 0.2[c]	—	--	--	--	--
Antimony	0.006	—	0.146	--	--	--	--
Arsenic	0.05	--	0.05	0.342 As(III)[f]	0.18 As(III)[f]	0.1	0.2
Barium	2	--	2	--	--	--	--
Beryllium	0.004	--	0	--	--	0.1	--
Boron	--	--	--	--	—	0.75	5
Cadmium	0.005	--	0.005	0.0051[e,f]	0.0013[e,f]	0.01	0.05
Chloride	--	250 (400)[d]	250 (400)[d]	--	--	250	250
Chromium	0.1	--	--	0.015 Cr(VI)[f]	0.01 Cr(VI)[f]	0.1	1
Copper	1.3[b]	1.0	--	0.021[e,f]	0.014[e,f]	0.2	0.5
Fluoride	4	(2)[d]	--	--	--	1	2
Iron	--	0.3 (0.6)[d]	--	1	1	5	--
Lead	0.015[b]	--	0.05	0.065[e,f]	0.0013[e,f]	5	0.1
Magnesium	--	125 (150)[d]	--	--	--	--	--
Manganese	--	0.05 (0.1)[d]	--	--	--	0.2	--
Mercury	0.002	--	0.002	0.002[f]	0.000012	--	0.01
Molybdenum	--	--	--	0.019	0.019	--	--
Nickel	0.1	--	0.0134	1.65[e,f]	0.184[e,f]	0.2	--
Nitrate (as N)	10	--	10	10	10	10	10
Nitrite (as N)	1	--	1	1	1	1	1
Total Phosphorus	--	--	Apr-Nov Average 0.1	Apr-Nov Avg 0.1	Apr-Nov Avg 0.1	Apr-Nov Avg 0.1	Apr-Nov Avg 0.1
Selenium	0.05	--	0.05	0.02	0.005	0.02	0.05
Silver	--	0.1[c]	--	0.0065[e,f]	0.0065[e,f]	--	--
Sulfate	--	250 (500)[d]	250 (500)[d]	--	--	--	--
Thallium	0.002	--	0.013	--	--	--	--
Zinc	--	5	--	0.136[e,f]	0.123[e,f]	2	25
Cyanide	0.2 (free)	--	0.2	0.022	0.0052	--	--
Alkalinity	--	--	--	Less than 25% Change		--	--
Color (PCU)	--	15	--	--	--	--	--
Dissolved Oxygen	--	--	Aerobic	>5.0	>5.0	--	>5.0
pH (SU)	--	6.5 to 8.5	5.0 to 9.0	6.5 to 9.0	6.5 to 9.0	6.5 to 9.0	6.5 to 9.0
TDS	—	500 (1000)[d]	500 (1000)[d]	--	--	500	500
TSS	—	--	--	80	80	--	--

a: Units are mg/l unless otherwise stated. Metals limits are for total recoverable species unless noted "f". PCU = photoelectric color units; SU = std. units; TDS = total dissolved solids; TSS = total suspended solids.
b: Action level for concentrations at tap.
c: Maximum contaminant level.
d: Indicates numbers in ( ) are mandatory secondary standards for public water systems.
e: Indicates numbers dependent on hardness; displayed values are for Hardness = 145 mg/l as; see NAC 445A.144 for equations.
f. Standard applies to dissolved fraction.
Sources: Nevada (1996) NAC 445A.144, LCB File No. R128-95 (surface water) and NAC 445A.206, LCB File No. R127-95 (Humboldt River between Comus Battle Mountain, and tributaries); NAC445A.445, 40 CFR 141 (ground water).

Table 3-4
Summary of Exceedances over Surface Water Quality Standards

Location	TSS	Copper Diss	Copper Total	Iron Diss	Iron Total	Lead Diss	Lead Total	Mercury Diss	Mercury Total	Molybdenum Diss	Molybdenum Total	Selenium Diss	Selenium Total	Silver Diss	Silver Total	Zinc Diss	Zinc Total	Phosphorus Total
TRS-00	1/1	--	--	--	1/1	--	1/1	--	--	--	--	--	--	--	--	--	--	1/1
TRS-1A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRS-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1/1
TRS-02	--	--	--	--	1/4	--	1/4	--	--	--	--	--	--	--	--	--	--	2/2
TRS-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CCS-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CCS-0A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CCS-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1/1
CCS-1A	--	--	--	--	--	--	1/9	--	--	--	--	--	--	--	--	1/9	--	5/5
CCS-2A	--	--	--	--	--	1/1	--	--	--	--	--	--	--	--	--	--	--	1/1
CCS-03	--	--	--	--	--	1/5	1/5	--	--	--	--	--	--	--	--	--	--	1/3
CCS-04	--	1/5	--	--	--	--	1/5	--	--	--	--	--	--	--	--	--	--	2/3
CCS-4A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3/4
CCS-05	--	--	--	--	--	1/9	2/9	--	--	--	--	--	--	--	--	--	--	4/5
CCS-06	--	--	--	--	1/9	2/9	3/9	--	--	--	--	--	--	--	--	--	--	3/6
CCS-07	--	--	--	--	--	1/4	1/4	--	--	--	--	--	--	--	--	--	--	--
CCS-09	--	--	--	--	1/6	2/6	3/6	--	--	--	--	--	--	1/6	--	--	--	--
CCS-10	--	--	--	--	1/1	--	1/1	--	--	--	--	--	--	--	--	--	--	--
CCS-13	--	--	1/1	--	1/1	1/1	1/1	--	--	--	--	--	--	--	--	--	--	1/1
CCS-14	--	--	--	--	1/1	1/1	1/1	--	--	--	--	--	--	--	--	--	--	1/1
CCS-15	--	--	--	--	1/1	--	--	--	--	--	--	--	--	--	--	--	--	1/1
CCS-16	--	1/1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CCS-17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1/1
CCS-18	--	--	--	--	--	1/1	--	--	--	--	--	--	--	--	--	--	--	--
CCS-19	--	--	--	--	--	1/1	--	--	--	--	--	--	--	--	--	--	--	1/1
CCS-20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1/1
CCS-21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1/1
TCS-01	--	--	--	--	--	--	1/1	--	--	--	--	3/7	--	--	--	--	--	--
TCS-02	--	--	--	--	--	--		--	--	5/5	5/5	5/5	--	--	--	--	--	--
MSS-01	1/9	--	--	--	--	--	1/1	--	--	--	--	--	--	--	1/8	4/9	3/8	5/5
ASS-01	4/9	--	--	--	--	--	--	1/9	--	--	--	--	--	--	--	1/9	--	5/5

Notes:
1. "1/9" indicates one exceedence out of nine samples analyzed.
2. Some metals standards are for dissolved species (See Table 3-3). Listed exceedences of total metals are included for comparison.
3. Other constituents that met water quality standards include: arsenic, antimony, cadmium, chloride, chromium, cyanide, nickel, nitrates, pH, and TDS.

Key: Diss = Dissolved Concentration TSS = Total Suspended Solids

3.2.2.2 Trenton Canyon Drainage

Water quality in Trenton Canyon Creek is good. The only measured exceedances over surface water standards were for molybdenum, with a concentration above the aquatic life standard in all five samples analyzed (Table 3-4). Dissolved selenium was recorded above the aquatic life (96-hr average) standard in all five samples analyzed at TCS-01, the spring feeding Trenton Canyon Creek. Total lead was also measured above the aquatic life standard in one sample from the spring. As was observed in Cottonwood Creek, concentrations of many constituents decreased during the May 1995 snowmelt event.

3.2.2.3 Ames Spring and Mud Spring

Measured quality in Ames Spring and Mud Spring was generally good (Table 3-4). Four of nine samples collected from Ames Spring, and one of nine samples collected from Mud Spring, had total suspended solids concentrations above the aquatic life water quality standard, which may have been an artifact of sediment disturbance during sampling of the spring. One sample from Ames Spring had mercury reported at the detection limit of 0.0002 mg/l, sixteen times the aquatic life standard of 0.000012 mg/l. Dissolved zinc levels were measured above the aquatic life standard in one of nine samples from Ames Spring and four of nine samples from Mud Spring. All measured phosphorus levels were above the surface water standards for agriculture and aquatic life. Total silver was measured above the aquatic standard in one sample from Mud Spring.

Analytical results indicate only small seasonal variations in water chemistry. Both springs usually had detectable ferrous iron, which presented a significant fraction of the total iron. This indicates that water in these springs is somewhat reducing (Shepherd Miller Inc. 1996).

3.2.2.4 Comparison of Results Between Drainages

Total dissolved solids (TDS) concentrations are low in all creeks, with an average and standard deviation of 200 mg/l and 65 mg/l, respectively. Samples from Trenton Canyon Creek had slightly higher TDS concentrations, which could be related to the mineralization and previous mining activity in this drainage (Shepherd Miller Inc. 1996).

As analyzed using Stiff and Piper diagrams in Shepherd Miller Inc.'s Baseline Hydrology and Geochemistry Report (1996), surface waters from different drainages in general have slightly different and distinguishable chemistries. These differences may be due to natural differences in bedrock chemical composition or mineralization between the drainages.

The water in Trout Creek (TRS-02) appears to have similar relative amounts of major constituents as Cottonwood Creek, indicating similar watershed chemistry for these two drainages. Water in Trenton Canyon Creek (TCS-02) shows relatively higher amounts of calcium and sulfate than other drainages, suggesting that rocks in this drainage are more reactive.

Comparing spring qualities, water from Mud Spring and Ames Spring has distinct chemistry, with higher natural sodium and potassium concentrations and lower calcium concentrations than other springs. This is probably due to higher clay concentrations in the alluvium that is the source for Ames and Mud Springs relative to the bedrock that is the source for the other springs.

Spring water at CCS-4A is similar to surface water at CCS-1A and CCS-03. This indicates that this spring, which is near the level of the creek, is fed by a connection with surface water. Springs CCS-20 and CCS-21, which were only present during runoff in spring of 1995, are similar to surface water at station CCS-09. This indicates that these springs were fed by snowmelt that caused temporary saturation of perched zones.

3.2.2.5 Summary of Baseline Surface Water Quality

Surface water quality in the project vicinity is generally good. Concentrations of some constituents in surface water at the project site exceeded Nevada surface water quality standards for aquatic life and agriculture. Constituents with exceedances at a number of locations and times were lead, iron, and phosphorus. Those with isolated exceedances were TSS, copper, mercury, molybdenum, selenium, silver, and zinc. The level of exceedance for these constituents was generally low.

No seasonal trends in surface water quality were observed. This indicates that stream base flow, which occurs during the drier seasons, has a composition similar to the higher spring flows that include greater amounts of water from precipitation. No trends could be observed in Cottonwood Creek water quality as the creek flows past the Trenton Canyon deposit (Shepherd Miller Inc., 1996).

3.3 GROUNDWATER

A series of hydrogeologic and hydrochemical investigations have been performed to provide information on the existing groundwater resource in the project area (Shepherd Miller Inc. 1996). These studies included installation of observation wells and piezometers to document the occurrence of groundwater and evaluate groundwater elevations, and to establish baseline water quality conditions. Table 3-5 summarizes piezometer and well completion data and groundwater elevations. Locations of the sampling sites are on Figures 3-2 and 3-2a.

Table 3-5
Summary of Piezometer and Well Completion Data and Ground Water Elevations

Borehole	Top of PVC Elevation[1]	Bottom of Screen Elevation[1] (Depth[2])	Date	Depth To Water Below Top of PVC (feet)	Ground Water Elevation[1]	Elevation of Nearest Pit Bottom(s) (ft)	Depth to Water Below Pit Bottom (ft)	Comments
TRENTON CANYON DEPOSIT								
DNT-381	7145.6	6749.9 (349.9)	11/4/94 5/9/95 9/7/95	372.97 370..73 375.19	6772.6 6774.9 6770.4	7200	427	Water level is representative of level in monitored interval
DNT-382	7331.0	6739.3 (591.7)	11/4/94 5/9/95 9/7/95	392.24 392.04 380.24	6938.8 6939.0 6950.8	7200	261	Water level is representative of level in monitored interval
DNT-383	6586.5	6289.5 (295.5)	11/4/94 3/6/95 5/9/95 9/7/95 1/7/96	167.04 167.43 167.17 166.07 166.44	6419.5 6419.1 6419.3 6420.4 6420.1	NA	NA	Water level is representative of level in monitored interval
DNT-384	6698.5	6401.9 (295.1)	11/4/94 3/6/95 5/9/95 9/7/95 1/7/96	132.00 129.58 130.35 130.84 131.33	6566.5 6568.9 6568.2 6567.7 6567.2	NA	NA	Water level is representative of level in monitored interval
DNT-385	7142.5	6747.6 (393.4)	11/4/94 5/9/95 9/7/95	Dry Dry Dry	<6747.6 <6747.6 <6747.6	7120	>372	Dry piezometer
DNT-386	6957.3	6660.3 (295.5)	11/4/94 5/9/95 9/7/95	264.88 266.50 266.62	6692.4 6690.8 6690.7	6900	208	Water level is representative of level in monitored interval
DNT-387	6988.5	6691.5 (295.5)	11/4/94 5/9/95 9/7/95	294.45 Dry 295.38	6694.1 <6691.5 6693.1	6900	206	Water level is representative of level in monitored interval
DNT-488	7694.3	6783.7 (908.8)	10/3/95	679.15	7015.2	NA	NA	Water level is representative of level in monitored interval
DNT-489	7581.5	6802.5 (777.5)	10/3/95	725.08	6856.4	7000	144	Water level is representative of level in monitored interval
DNT-490	7734.1	6823.5 (909.6)	10/9/95	776.20	6957.9	7460 7120	502 162	Water level is representative of level in monitored interval
DNT-492	7778.9	6850.5 (926.8)	10/24/95	774.28	7004.6	7200	195	Water level is representative of level in monitored interval
DNT-493	7253.8	6547.4 (705.3)	10/6/95	567.31	6686.5	6900	214	Water level is representative of level in monitored interval
DNT-494	7297.9	6730.0 (506.4)	10/3/95	Dry	<6730.0	7300	>570	Dry piezometer
DNT-495	7053.2	6753.0 (298.3)	10/8/95	240.40	6812.8	7040	227	Water level is representative of level in monitored interval
DNT-496	6685.2	6430.0 (253.8)	10/4/95	Dry	<6430.0	6600 6460	>170 > 30	Dry piezometer

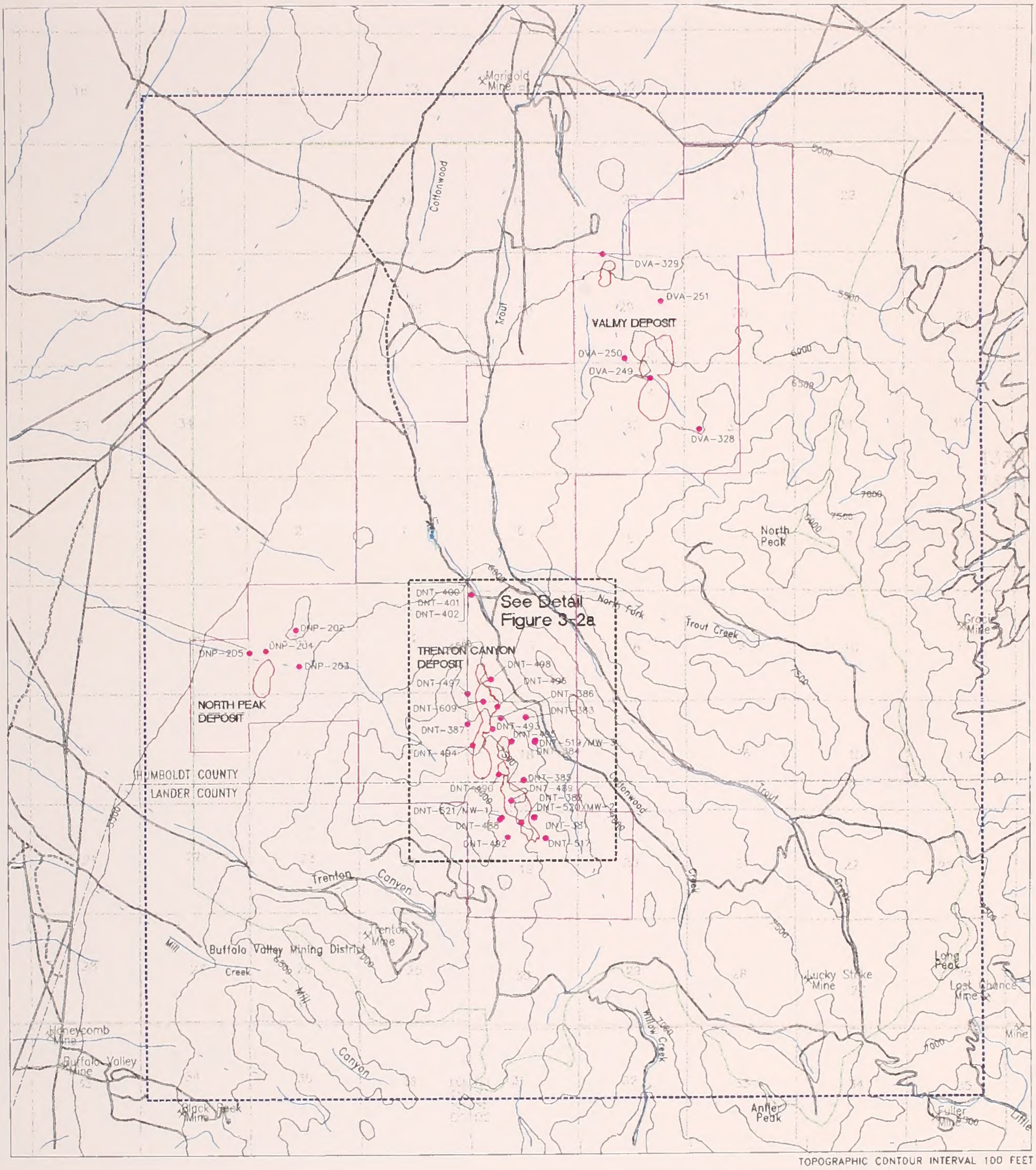
Table 3-5
Summary of Piezometer and Well Completion Data and Ground Water Elevations

Borehole	Top of PVC Elevation[1]	Bottom of Screen Elevation[1] (Depth[2])	Date	Depth To Water Below Top of PVC (feet)	Ground Water Elevation[1]	Elevation of Nearest Pit Bottom(s) (ft)	Depth to Water Below Pit Bottom (ft)	Comments
DNT-497	6647.8	6063.6 (583.4)	10/22/95 1/8/96	Dry (545.7) Dry (545.7)	<6102.1 <6102.1	6340	>238	Bottom 38 feet of piezometer is filled with mud; unable to develop completely
DNT-498	6352.0	6087.0 (263.4)	7/12/95 9/27/95 10/5/95 1/7/96	254.59 254.64 254.74 254.96	6097.4	6300	203	Water level is representative of level in monitored interval
DNT-517	7223.5	6723.3 (499.1)	10/7/95	460.30	6763.2	7340	577	Water level is representative of level in monitored interval
DNT-519	6697.8	6497.2 (199.1)	11/21/95 1/7/96	129.81 129.62	6568.0 6568.2	NA	NA	Monitoring well
DNT-520	7147.5	6725.2 (420.5)	11/21/95	399.30	6748.2	7200	452	Monitoring well
DNT-521	7685.7	6929.6 (754.3)	11/21/95 1/3/96	671.9 674.4	7013.8 7011.3	NA	NA	Monitoring well
DNT-609	6863.9	5883.9 (980.0)	10/17/96	920.0	5943.9	6400	460	Piezometer drilled to establish actual water level and supplement results of DNT-496 and DNT-497
COTTONWOOD CREEK								
DNT-400	6014.9	6453.9 (559.0)	11/29/94	NM	NM	NA	NA	Production well
DNT-401	6018.5	5462.5 (554.0)	12/6/94 5/9/95 1/8/96	117.77 116.62 117.81	5900.7 5901.9 5900.7	NA	NA	Upgradient from production well
DNT-402	6011.8	5458.3 (551.5)	12/6/94 5/9/95 1/8/96	114.80 114.40 114.55	5897.0 5897.4 5897.3	NA	NA	Downgradient from production well
VALMY DEPOSIT								
DVA-249	5997.6	5266.1 (730.4)	3/6/95 5/9/95 9/7/95 1/8/96	Dry (<725.0) Dry Dry Dry	<5272 <5272 <5272 <5272	5660	>388 >388 >388 >388	Dry piezometer
DVA-250	5824.7	5330.2 (493.4)	12/10/94 3/6/95 5/9/95 9/7/95 1/8/96	Dry Dry Dry Dry Dry	<5330.2 <5330.2 <5330.2 <5330.2 <5330.2	5660	>330 >330 >330	Dry piezometer
DVA-251	5479.0	5182.0 (295.8)	12/10/94 3/6/95 5/9/95 9/7/95 1/8/96	Dry Dry Dry Dry Dry	<5182.0 <5182.0 <5182.0 <5182.0 <5182.0	5660	>478	Dry piezometer
DVA-328	6433.5	6075.6 (1003.8)	10/26/95	985.54	5448.0	5660	212	Water level is representative of level in monitored interval

Table 3-5
Summary of Piezometer and Well Completion Data and Ground Water Elevations

Borehole	Top of PVC Elevation[1]	Bottom of Screen Elevation[1] (Depth[2])	Date	Depth To Water Below Top of PVC (feet)	Ground Water Elevation[1]	Elevation of Nearest Pit Bottom(s) (ft)	Depth to Water Below Pit Bottom (ft)	Comments
DVA-329	5392.1	5429.7 (357.9)	11/21/95	339.28	5052.8	5300	247	Water level is representative of level in monitored interval
NORTH PEAK DEPOSIT								
DNP-202	5785.7	5232.0 (552.7)	3/3/95	Dry	<5233.0	5480	>247	Dry piezometer
			5/9/95	Dry	<5233.0		>247	Mud in bottom of casing
			9/7/95	Dry	<5233.0		>247	
			1/8/96	Dry	<5233.0		>247	
DNP-203	5815.0	5263.3 (550.5)	3/3/95	Dry	<5263.3	5480	>217	Dry piezometer
			5/9/95	Dry	<5263.3		>217	
			9/7/95	Dry	<5263.3		>217	
			1/8/96	Dry	<5263.3		>217	
DNP-204	5720.3	5225.7 (493.3)	3/3/95	492.00	5228.3	5480	252	Mud in bottom of casing
			5/9/95	492.15	5228.2		252	
			9/7/95	492.48	5227.8		252	
			1/8/96	492.79	5227.5		>252	
DNP-205	5688.2	5193.8 (493.0)	12/10/94	454.57	5233.6	5480	246	Water level is representative of level in monitored interval
			3/3/95	454.15	5234.1		246	
			5/9/95	454.46	5233.7		246	
			9/7/95	454.14	5234.1		246	
			1/8/96	454.35	5233.8		246	

[1]Feet above mean sea level
[2]Feet below ground surface
NA = Not Applicable
NM = Not Measured



LEGEND

THIS MAP IS FOR CONCEPTUAL USE ONLY AND IS NOT TO BE USED FOR DESIGN PURPOSES.

- • BOREHOLE NUMBER — DNT-520/MW-2 (SFPG DRILLHOLE NO./WELL NO.)
- STUDY AREA BOUNDARY
- PROJECT AREA BOUNDARY
- PIT OUTLINE
- GROUNDWATER BOUNDARY

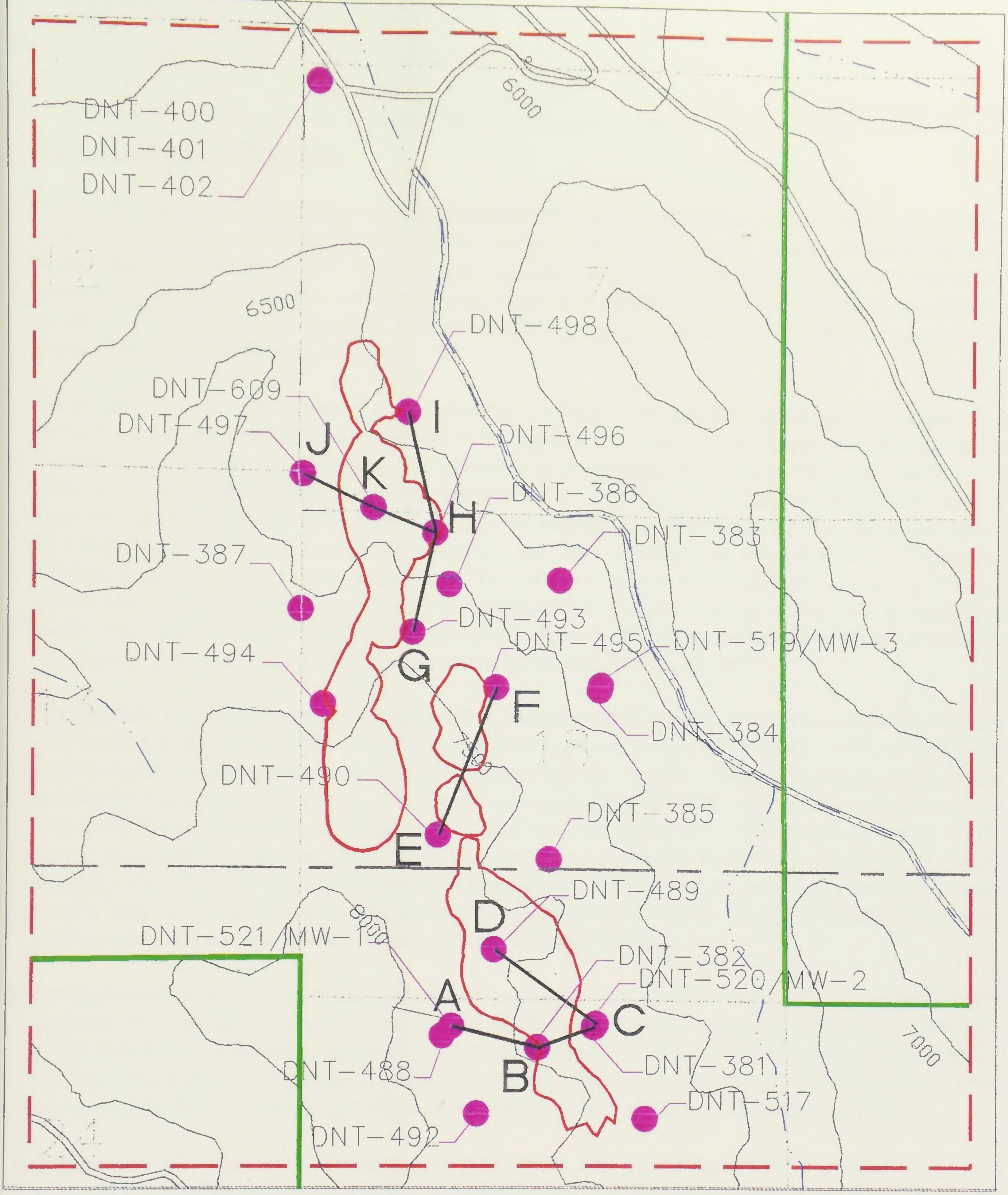
SCALE IN FEET: 2500 0 5000

BOREHOLE AND WELL LOCATIONS

TRENTON CANYON PROJECT

OCTOBER 1997

Figure 3-2



LEGEND

- PROJECT AREA BOUNDARY
- A—B CROSS-SECTION LOCATION (SEE FIGURE 3-2)
- PIT OUTLINE
- DNT-520/MW-2 BOREHOLE NUMBER (SFPG DRILLHOLE NO./WELL NO.)
- STREAM

N

2000 0 SCALE IN FEET 2000

BORROW AND CROSS SECTION

BOREHOLE AND CROSS SECTION LOCATIONS WITHIN TRENTON CANYON DEPOSIT

ACAD FILE: 3-2.DWG

OCTOBER 1997

Figure 3-2A

3.3.1 Hydrogeologic Setting

The project is located along ridges and upland areas of the Battle Mountain massif. This area serves as a recharge zone for the deep alluvial aquifers beneath the adjacent valley floors. Groundwater flow within the project area is toward the northwest, reflecting local topography (Figure 3-2 and 3-2a). The proposed pits are all located in different rock units. The discussion below provides an overview of groundwater occurrence in general, and review of hydrogeology at each of the three proposed mine areas: Valmy, North Peak and Trenton.

Recharge, flow, and discharge of groundwater are influenced primarily by geologic conditions. The general stratigraphic and structural framework throughout the hydrogeologic study area is described in Section 3.5, Geology and Minerals. The principal hydrostratigraphic units in the study area are: 1) a shallow unconfined system of isolated perched water zones in Quaternary Alluvium and shallow bedrock; and 2) a deep unconfined system located in heavily fractured bedrock. The alluvium consists of a heterogeneous mixture of gravel, sand, silt, and clay deposited on alluvial fans adjacent to the uplifted highlands. The bedrock assemblage is subdivided into the Havallah Unit, consisting of basalt flows, chert, argillite, and conglomerate (Mississippian-Permian age); the Antler Unit consisting of Antler Peak Limestone and Battle Formation (Pennsylvanian-Permian age); and the Valmy Formation consisting of quartzite, siltstone, chert, and altered basalt (Ordovician age).

The majority of groundwater flow in the lithified units is through secondary porosity created by folding and faulting of the rock layers. These deformational processes create fault breccias, fractures and joints that facilitate groundwater movement. Geologic structures in the project area that influence groundwater movement include the West Side, 300, Oyarbide, and Buffalo and other high angle fault systems, the Golconda Thrust, and small unmapped structures. With the exception of the Golconda Thrust, all the major structural elements are high angle features. The Golconda Thrust is a relatively low angle structure (less than 20° dip), and would not be intercepted by any of the proposed pits. Because the project area is at high elevations, the subvertical (approximately 75° to 90° from horizontal) fractures provide vertical conduits for downward groundwater movement.

Perched water zones of limited areal extent were encountered at Valmy, North Peak and Trenton Canyon deposits. The perched zones occurred in both alluvium and bedrock material. Preliminary flow tests conducted during the drilling operations indicated that individual perched zone production capability was less than 2 gpm. Interpretation of the observed distribution and productivity of the perched water zones suggest they would not contribute significant amounts of water to the proposed pits.

Comparison of water level elevation data from wells and piezometers with proposed pit profiles indicates that the first regionally continuous water bearing zone beneath the site would not intercept any of the proposed pits.

3.3.1.1 Trenton Canyon Deposit

The Trenton Canyon deposit is hosted in quartzite and siltstone of the Valmy Formation and within conglomerates and sandstones of the Battle Formation. The hydrostratigraphic unit identified in the Trenton Canyon deposit is highly fractured and deformed Valmy Formation. Water level data obtained from measurements at 22 piezometers and three monitoring wells in the vicinity of the deposit indicated stabilized groundwater levels (where measurable) at least 144 feet below the lowest elevation of the proposed pits (Shepherd Miller Inc. 1996). Groundwater level elevation and reference to depth from pit bottom is summarized in Table 3-5. An illustration of the relationship between surface topography, pit geometry, and groundwater surface is in Figure 3-3.

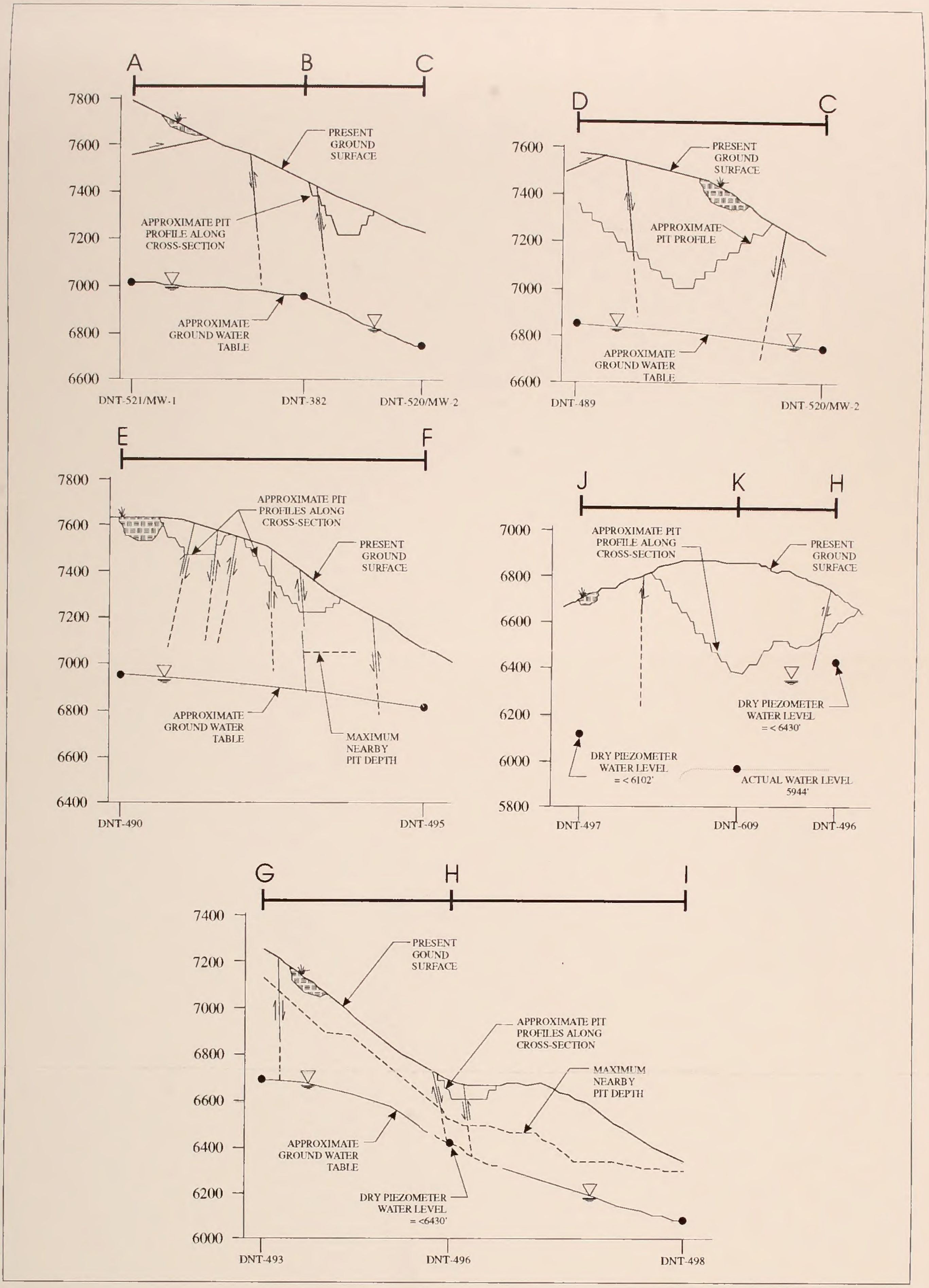
Review of water level elevations in the vicinity of the Trenton Canyon deposit suggests that although the relationship between the water-bearing zones beneath the deposit is not well understood, where measurable, the depth to groundwater below the lowest pit elevation is at least 144 feet. Most of the data points indicate separation of water level and lowest pit level on the order of 200 to 500 feet.

Perched water zones were encountered in seven of the well and piezometer locations. The perched zones produced water at less than 2 gpm during flow testing conducted during drilling activities (Shepherd Miller, Inc. 1996). None of the perched zones are expected to contribute significant water to the pits during or after mining activities. The Trenton Canyon pits would all be located near topographic ridges, and perched water zones intercepted by mining activity would not likely have significant volume due to the limited areal extent of the recharge zones (Shepherd Miller, Inc. 1996).

3.3.1.2 Valmy Deposit

The two proposed pits at the Valmy deposit are hosted entirely within the Valmy Formation. In the vicinity of the proposed pits the Valmy Formation is divided into an upper and lower unit, separated from each other by a low angle thrust fault. Host lithologies include fractured quartzite, siltstone and chert. The hydrostratigraphic unit identified in the Valmy deposit is highly fractured and deformed Valmy Formation. Water level data obtained from measurement of a piezometer installed near the proposed North Valmy pit indicated stabilized groundwater level 248 feet below the lowest elevation of the proposed North Valmy pit (Shepherd Miller, Inc. 1996). Water level data obtained from measurements at four piezometers in the vicinity of the Valmy pit indicated stabilized groundwater levels (where measurable) at least 212 feet below the lowest elevation of the proposed pits (Shepherd Miller, Inc. 1996).

Two perched water zones were observed in one piezometer (DVA-328) above the proposed Valmy pit. This piezometer is located more than 1,600 feet upgradient from the pit. Flow testing conducted during drilling activities indicate production rates of each zone ranged between 0.25 and 2 gpm. The water producing zones are not expected to produce significant inflows to the pit during mining (Shepherd Miller, Inc. 1996).



SCALE:
VERTICAL 1" = 400'
HORIZONTAL 1" = 540'
VERTICAL EXAGGERATION = 1.3x

FAULTS (DIRECTION OF MOVEMENT INDICATED BY ARROWS)

Note: Cross Section Locations are shown on Figure 3-2a.

CROSS-SECTIONS SHOWING WATER LEVELS AND PIT BOTTOMS IN THE TRENTON CANYON DEPOSIT
TRENTON CANYON PROJECT

October 1997

Figure 3-3

The proposed leach pads in Sections 21 and 29 would rest on alluvium. The groundwater occurrence and geotechnical properties of the alluvium in the vicinity of the leach pads were investigated by advancing ten boreholes to depths of approximately 100 feet. Results of the drilling program indicated the presence of perched groundwater zones in three of the ten borings. The perched zones are not likely to contain significant amounts of water, and are considered discontinuous due to the presence of intervening borings in which no water was observed (Shepherd Miller, Inc. 1996).

3.3.1.3 North Peak Deposit

The North Peak deposit is hosted entirely within the Havallah Unit. In the vicinity of the proposed pit expansion the Havallah Unit is divided into three subunits: a basal siltstone/limestone unit; a middle sandstone unit; and an upper chert/siltstone unit. The host lithology of the North Peak deposit is a calcareous sandstone within the middle sandstone unit. The deposit is localized in a heavily fractured zone at the intersection of three high angle Tertiary faults. The hydrostratigraphic unit identified in the North Peak deposit is the highly fractured and deformed Havallah Unit. Water level data obtained from measurement of four piezometers and monitoring wells installed near the deposit indicated stabilized groundwater level 252 feet below the lowest elevation of the proposed pit (Shepherd Miller, Inc. 1996).

A single perched water zone was observed in two of the four piezometers (DNP-202 and DNP-205, Figure 3-2). Flow testing conducted during drilling activities indicated production rates of less than 1 gpm. The water producing zones are not expected to produce significant inflows to the pit during mining (Shepherd Miller, Inc. 1996).

3.3.2 Groundwater Quality

Groundwater quality samples were collected from three wells in the vicinity of the Trenton Canyon deposit. The well locations included monitoring wells upgradient (MW-1), and downgradient (MW-2, MW-3) from the mineralized zone, and one supply well (CCRPW, DNT-400) located near the mouth of Cottonwood Creek in Section 7 T32N, R43E (Figure 3-2a). The monitoring wells are screened in bedrock, the supply well screens both bedrock and alluvium hydrostratigraphic units. Groundwater characterization data are provided from data obtained from quarterly sampling events conducted by Shepherd Miller, Inc. and Hydro-Search, Inc. for Newmont (Shepherd Miller, Inc. 1996).

Water quality standards for the State of Nevada have been tabulated to provide a comparison of reported water quality and potentially applicable standards (Table 3-3). Drinking water standards applicable to groundwater are included in the table.

The water quality data indicate that the groundwater is a calcium bicarbonate dominated system above the ore deposit, and a calcium sulfate-bicarbonate system below the ore deposit. The observed increase in sulfate concentration is probably due to groundwater circulation through the oxidized ore body, however, sulfate concentrations in these waters are significantly below drinking water standards.

Analyses for dissolved metals performed from three sampling events indicated that in upgradient well MW-1 only one metal, manganese, exceeded the drinking water standard. Analyses of groundwater samples obtained from well MW-2 for two sampling events noted dissolved metals concentrations in excess of primary drinking water standards for aluminum, antimony, arsenic, iron, lead, and manganese. Four metals were reported at concentrations above drinking water standards from the downgradient well MW-3 during three sampling events; antimony, arsenic, iron and manganese. Several other constituents, including fluoride, sulfate, aluminum, magnesium, molybdenum, nickel and silver, were also reported at greater concentrations in the downgradient water sample. Other groundwater quality parameter ranges noted from the data include pH (7.10 to 7.33), TDS (180-236 mg/l) and alkalinity (as $CaCO_3$) (115-143 mg/l).

3.4 HAZARDOUS MATERIALS

The affected environment for hazardous materials includes air, water, soil and biological resources that could be potentially affected by an accidental release of hazardous materials during transportation to and from the project areas, and during storage and use at the project areas. Sensitive areas for hazardous materials release would include riparian zones along Cottonwood and Trout Creeks, and areas with direct pathways, usually airborne, to humans, wildlife, or aquatic life.

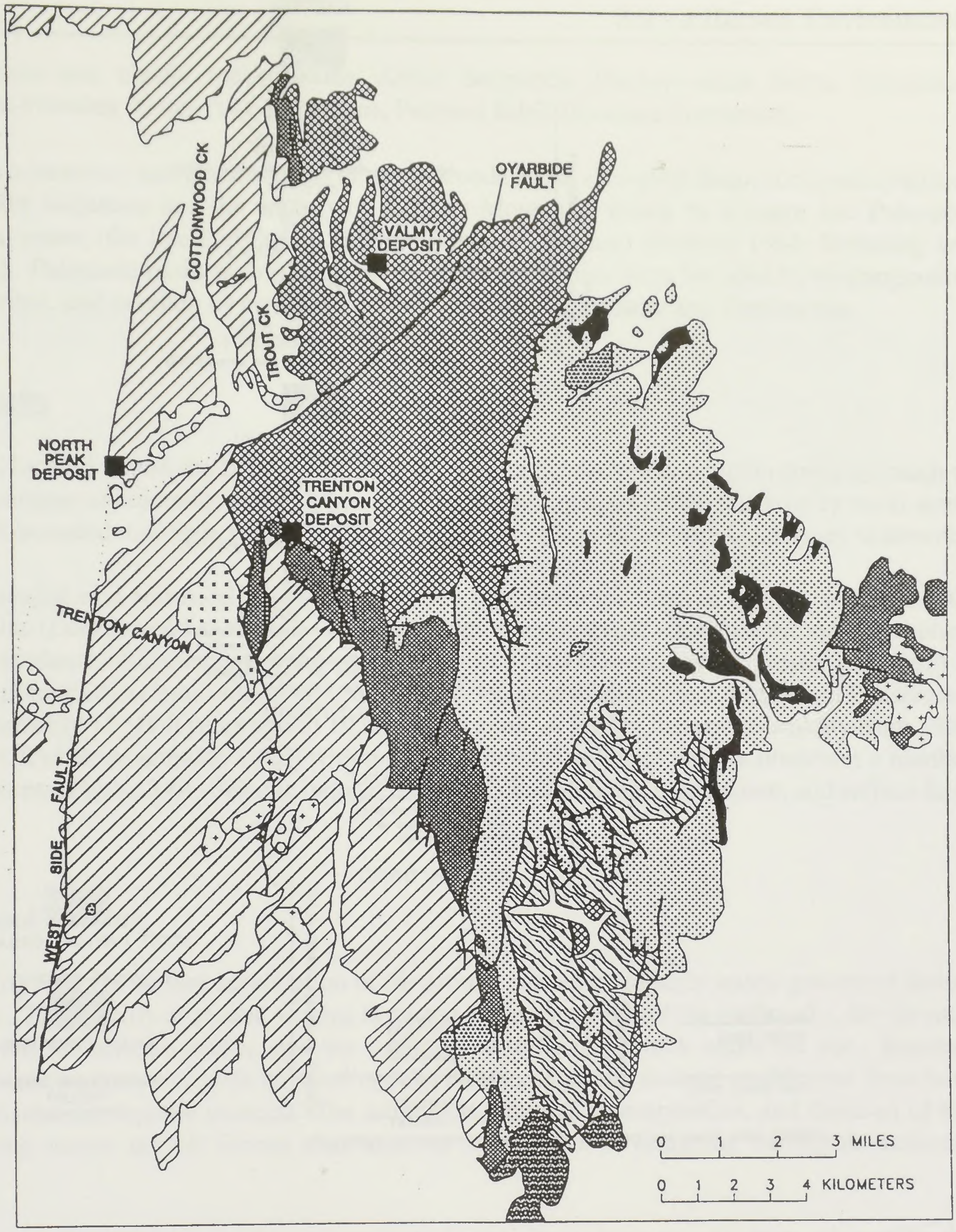
Current permitted mining activity involves the use of hazardous materials including: diesel fuel, motor oil, antifreeze, sodium cyanide, and ANFO in the North Peak pit and ore processing areas (Sections 11 and 15; T32N, R42E). There have been no hazardous materials releases from current operations in the North Peak mine area.

The entire study area is currently subject to drilling and road-building activities associated with mineral exploration. Hazardous materials currently used in conjunction with exploration include petroleum motor fuels and lubricants, antifreeze and solvents to operate and maintain equipment. The hazardous materials are brought on-site in small amounts for daily consumption. No hazardous materials storage facilities are currently located within the project area boundary.

3.5 GEOLOGY AND MINERALS

3.5.1 Regional Geological Setting

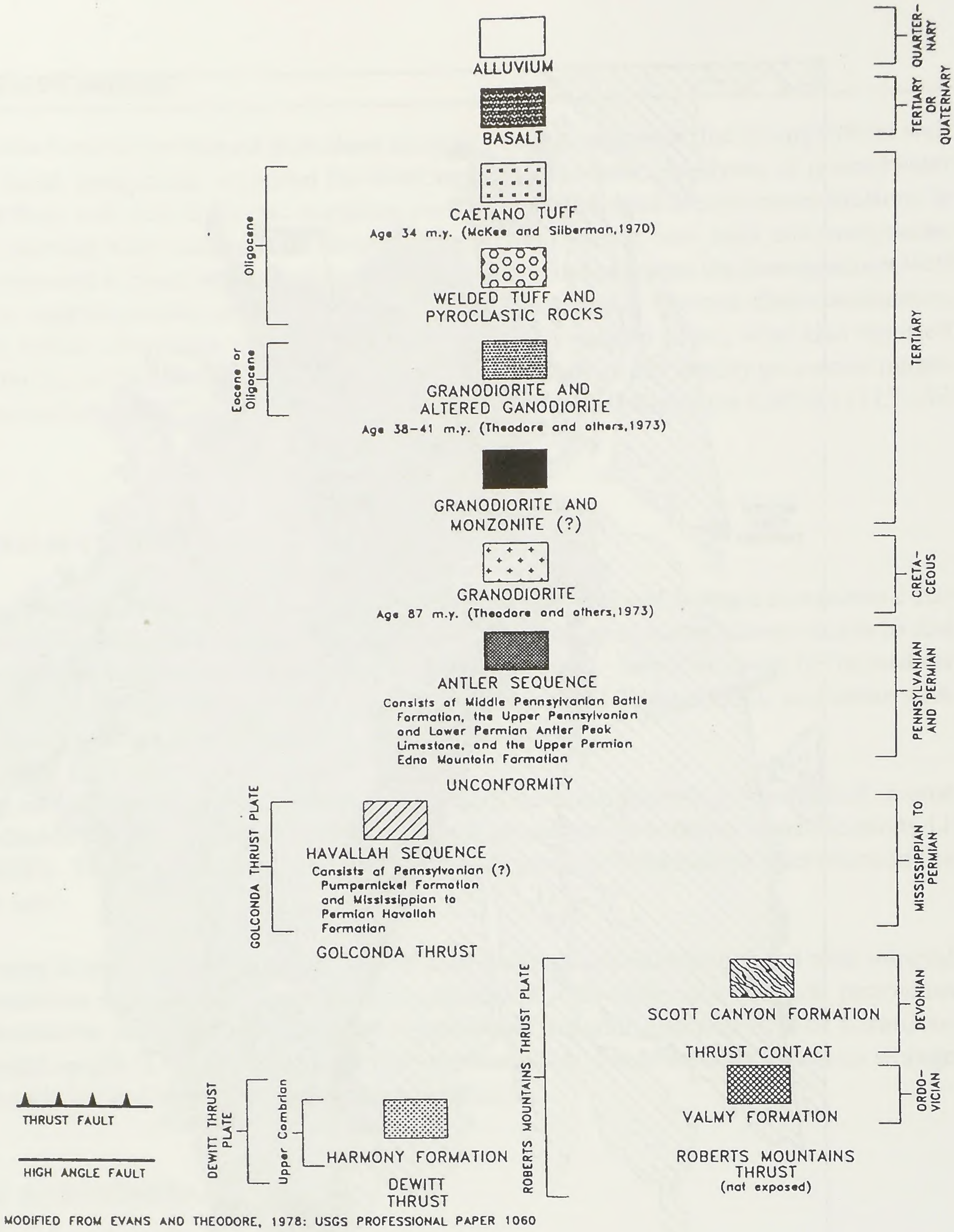
The geology of the Battle Mountain Mining District reflects a complex history of sedimentation, volcanism, and tectonic and intrusive activity (Figures 3-4 and 3-5). Sedimentary and volcanic rocks ranging in age from Late Cambrian to Permian occur in two major blocks. The Roberts Mountains Block (Late Cambrian Harmony Formation, Ordovician Valmy Formation, Devonian Scott Canyon Formation) is made up of a complex sequence of marine sedimentary and associated volcanic rocks transported eastward by a major mid-Paleozoic compressional event (the Late Devonian to Mississippian Antler Orogeny) (Roberts 1964; Madrid 1987). These rocks are unconformably overlain by shallow



See Key in Figure 3-5

Generalized Geology of the Battle Mountain Area

Figure 3-4



Stratigraphy of the Battle Mountain Area

Figure 3-5

water carbonate and clastic rocks of the Antler Sequence (Pennsylvanian Battle Formation, Pennsylvanian-Permian Antler Peak Limestone, Permian Edna Mountain Formation).

Deep marine sedimentary and igneous rocks of the Golconda Block (Havallah Sequence) were emplaced over the Antler Sequence and the underlying Roberts Mountains Block by a major late Paleozoic compressional event (the late Permian to Triassic Sonoma Orogeny) (Roberts 1964; Silberling and Roberts 1962). Paleozoic rocks within the Battle Mountain complex were intruded by monzogranites and granodiorites, and overlain by ash-flow tuffs and basalts of Mesozoic and Tertiary age.

3.5.2 Seismicity

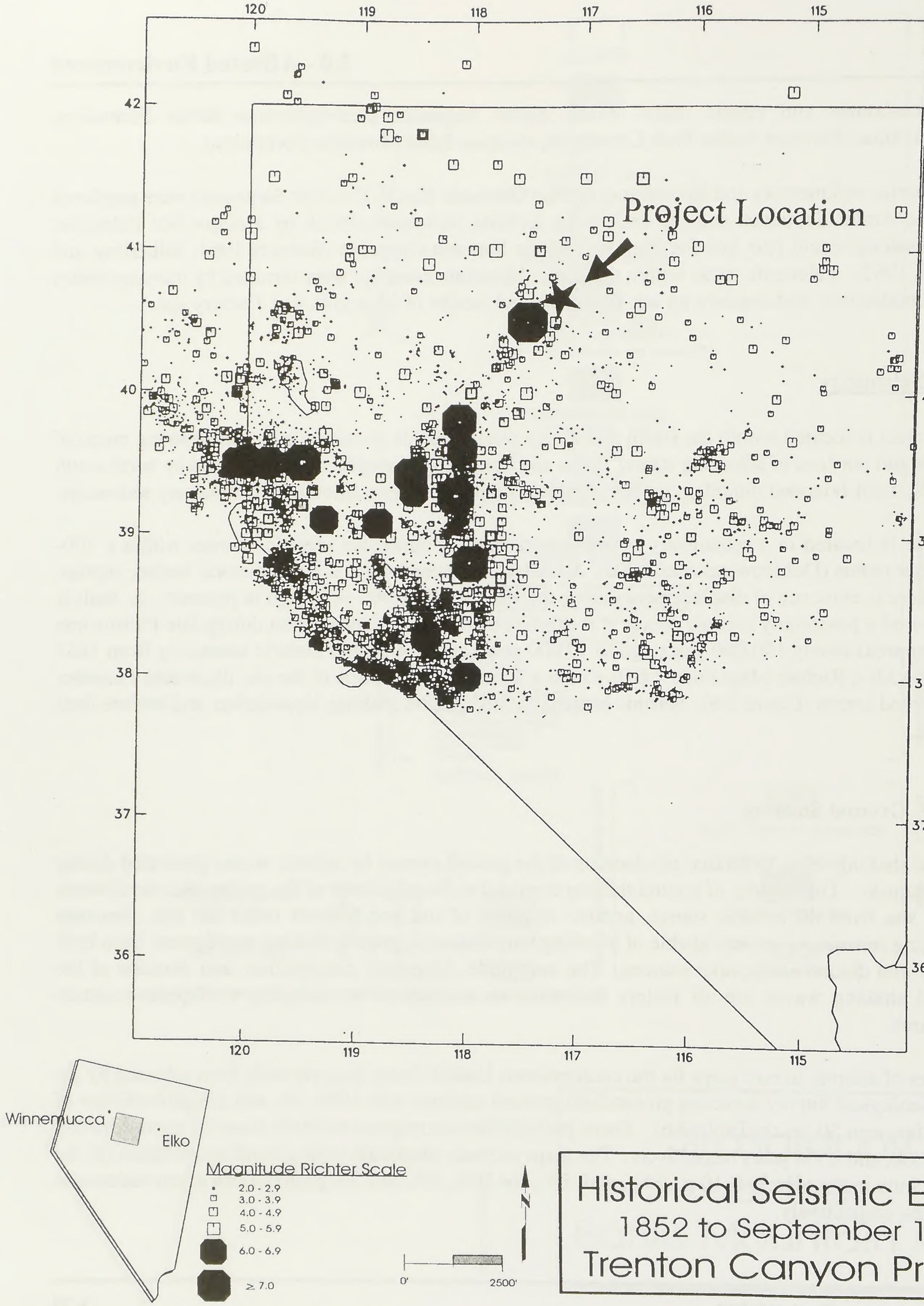
The project is located within the Basin and Range physiographic province, a region covering much of Nevada and portions of adjoining states. Basin and Range physiography is characterized by north-south trending, fault-bounded mountain ranges separated by linear valleys filled with Quaternary sediments.

The site is located in a seismically active region that has numerous seismic sources within a 100-kilometer radius (Dohrenwend *et al.* 1996). A fault is considered active if it has historic surface rupture or if there is evidence of displacement during the Holocene (10,000 years ago to present). A fault is considered a potentially seismic source if it exhibits evidence of displacement during late Pleistocene time (approximately 150,000 years ago to 10,000 years ago). A plot of historic seismicity from 1852 to 1996 (3.0 < Richter Magnitude < 6.0) within a 200-kilometer radius of the site illustrates a number of recorded events (Figure 3-6). Seismic hazards include ground shaking, liquefaction, and surface fault rupture.

3.5.2.1 Ground Shaking

Ground shaking refers to surface acceleration of the ground caused by seismic waves generated during an earthquake. The severity of ground shaking is related to the magnitude of the earthquake, the distance of the site from the seismic source, and the response of soil and bedrock under the site. Because damaging seismic waves are capable of traveling long distances, ground shaking could come from both nearby and distant earthquake sources. The amplitude, frequency composition, and duration of the ground shaking waves are all factors that must be considered in designing earthquake-resistant structures.

A series of seismic hazard maps for the conterminous United States have recently been released by the U.S. Geological Survey depicting probabilistic ground motions with 10%, 5%, and 2% probabilities of exceedance in 50 years (Table 3-6). These probabilities correspond to return times of approximately 500, 1000, and 2500 years respectively. The maps estimate maximum peak ground acceleration for the site vicinity in the realm of .10 g, .20 g, and .30 g for 10%, 5%, and 2% probabilities of exceedance in 50 years, respectively.



Historical Seismic Events
1852 to September 1996
Trenton Canyon Project

Source: Nevada Bureau of Mines and Geology, Diane De Pollow November 1996

Figure 3-6

Because of amplification of seismic waves in unconsolidated sediments, ground shaking generally poses a higher risk to structures built on thick deposits of sand, silt and clay than for sites built on bedrock. Much of the mine area would be within bedrock.

Table 3-6
Seismic Hazard

Assessment Method	Estimated Peak Ground Acceleration
Probability of 10% exceedance in 50 years	0.10 g
Probability of 5% exceedance in 50 years	0.20 g
Probability of 2% exceedance in 50 years	0.30 g

Source: Frankel, *et al.* 1996

3.5.2.2 Liquefaction

Earthquake-induced soil liquefaction is another seismic hazard associated with large earthquakes. Ground shaking may induce soil liquefaction in granular, water-saturated sediments. Soil liquefaction may result in a loss of bearing capacity, or cause lateral spread landslides if the ground surface is sloping. Typically earthquakes of Richter magnitude 5 are generally regarded as the lower threshold for liquefaction. The liquefaction hazard is likely to be quite low for much of the mine area.

3.5.2.3 Surface Fault Rupture

Surface fault rupture is the hazard related to differential movement of the ground surface along a fault zone during large earthquakes. Earthquakes smaller than about Richter magnitude 6 typically do not express rupture at the ground surface. Large earthquakes (Richter magnitudes 7 to 7.5) generated by normal faults have been associated with over two meters of near-vertical rupture. The ground rupture may be expressed either as one large displacement or several smaller ruptures comprising a fault zone. Structures built within the zone of deformation of an active fault may suffer ground tilting, structural damage, and even collapse during a large earthquake.

Although numerous faults have been mapped in the vicinity of the site, no active faults have been mapped through the project area. Given that the hazard from surface fault rupture hazard is typically constrained to a narrow zone along the fault, and that no active faults are present at the site, the surface fault rupture hazard is rated as very low.

3.5.3 Stratigraphy

Rock formations encountered in the Trenton Canyon study area are listed on Table 3-7.

Table 3-7
Rock Formations

Quaternary	Alluvium/Colluvium
Tertiary	Intrusives Caetano Tuff Bates Mountain Tuff (North Peak)
Cretaceous	Intrusives (monzogranite and granodiorite)
Mississippian-Permian	Havallah Sequence
Pennsylvanian - Permian	Antler Peak Limestone
Pennsylvanian	Battle Formation
Ordovician	Valmy Formation

The Ordovician Valmy Formation, which outcrops in the northern and southeastern areas of Battle Mountain (Figure 3-4), is a highly variable sequence of quartzite, siltstone, chert, and greenstone (Roberts *et al.* 1958; Willden 1964).

The Valmy Formation has been highly fractured and folded due to thrust faulting associated with the Antler Orogeny (Roberts *et al.* 1958). Thrust faults form many of the contacts between larger blocks of competent quartzite and the less competent units.

The Battle Formation is composed of a relatively non-deformed sequence of interbedded conglomerate and sandstone with minor siltstone and limestone that rests unconformably over the Valmy Formation (Willden 1964; Stewart 1980).

The Antler Peak Limestone is a gray, sandy limestone. The Battle Formation and Antler Peak Limestone are grouped as the Antler Sequence and outcrop in central and eastern Battle Mountain, and occur at depth within the project area (Stewart and Carlson 1976; Evans and Theodore 1978).

The Mississippian-Permian Havallah Sequence is a metamorphosed sequence of cherts, siltstones, and minor sandstones that outcrops along the western flank of Battle Mountain (Figure 3-4). The Havallah rocks were thrust eastward over the Battle Formation and Antler Peak Limestone as a series of thrust plates within the Golconda Block (Stewart 1980; Brueckner and Snyder 1985).

3.5.4 Intrusive and Extrusive Rocks

Two suites of intrusive rocks occur in the project area. The oldest, and by far the largest, is the 87 m.y. (million years before present) Trenton Canyon Stock (Theodore *et al.* 1973), a medium-grained granodiorite porphyry which outcrops on the south side of the project area (Figure 3-4). A younger (34.9 ± 1.0 m.y.) suite of intermediate composition dikes and sills occur along northerly trending structures in the Trenton Canyon deposit area. The true ages of the dikes are not known, but based on field relations are considered to be Tertiary (Felder 1995).

Extrusive rocks include Tertiary to Quaternary basalt flows on the southern flank of Battle Mountain, and the Caetano ash-flow tuff present in the extreme southern part of the project area (Figure 3-4) (Stewart *et al.* 1977).

3.5.5 Structure

The structural geology of the Trenton Canyon Project study area is complex, having been subjected to multiple igneous and deformational events. The structure of Battle Mountain is dominated by low angle (sub-horizontal) thrust faults and high angle (sub-vertical) Basin and Range normal faults (Figure 3-4). A major thrust fault, the Golconda thrust fault, separates the rocks of the Roberts Mountains Block and Antler Sequence from the rocks of the Golconda Block.

High angle faults cross-cut the thrust faults and are most prominent along the western flank and in the central portions of Battle Mountain (Figure 3-4). Most major normal faults trend north-south, with fewer faults trending east-west, northeast-southwest, or northwest-southeast (Stewart and Carlson 1976). The faulting events folded and fractured the rocks in the project area. These deformation processes formed the conduits along which mineralized fluids migrated to form the ore bodies.

3.5.6 Mineralization at Battle Mountain

Two historic mining districts at Battle Mountain include the Buffalo Valley and the Battle Mountain districts (Stewart *et al.* 1977). The Buffalo Valley district is located on the western flank of Battle Mountain and southwest of the project area. Mining in the Buffalo Valley district occurred between 1870 and 1991, and included four deposits: 1) the Black Rock manganese mine, 2) the Buffalo Valley gold mine, 3) the Honeycomb gold mine, and the 4) Trenton silver-copper mine (Stewart *et al.* 1977). The Black Rock manganese mine is a stratabound deposit, hosted in the chert and quartzite of the Mississippian-Permian Havallah Formation (Stewart *et al.* 1977). The manganese deposits in the Havallah Formation are considered to be sedimentary exhalative deposits (Snyder 1978). The gold, silver, and copper mines are skarn deposits and are hosted at the contact between the Havallah Formation and granodiorite intrusions, such as the Trenton Canyon pluton (Stewart *et al.* 1977).

The Battle Mountain district is located along the eastern and southern flanks of Battle Mountain. From 1866 to 1967, nearly 200 metal mines operated in the Battle Mountain District, producing primarily gold, silver, copper, and lead (Stewart *et al.* 1977). Most deposits were either skarn or vein deposits hosted in the Paleozoic-Mesozoic sedimentary rocks and/or the granodioritic intrusions of Tertiary age. These deposits are considered to be genetically related to emplacement of the granodiorite intrusions (Stewart *et al.* 1977). Placer mines also produced gold from several canyons in the Battle Mountain district. With the development of methods to economically mine lower-grade ores, the Battle Mountain district has, in recent years, again become the site of extensive gold exploration and development activities.

3.5.7 Alteration and Mineralization

The project includes three deposits: the Trenton Canyon, the Valmy, and the North Peak. These gold deposits are structurally controlled and hosted in sedimentary rocks. Formations hosting gold include the Havallah, Valmy, and Battle Formations. Ore-controlling structures in all of the deposits are high-angle normal faults that trend north-south, northeast-southwest, or northwest-southeast.

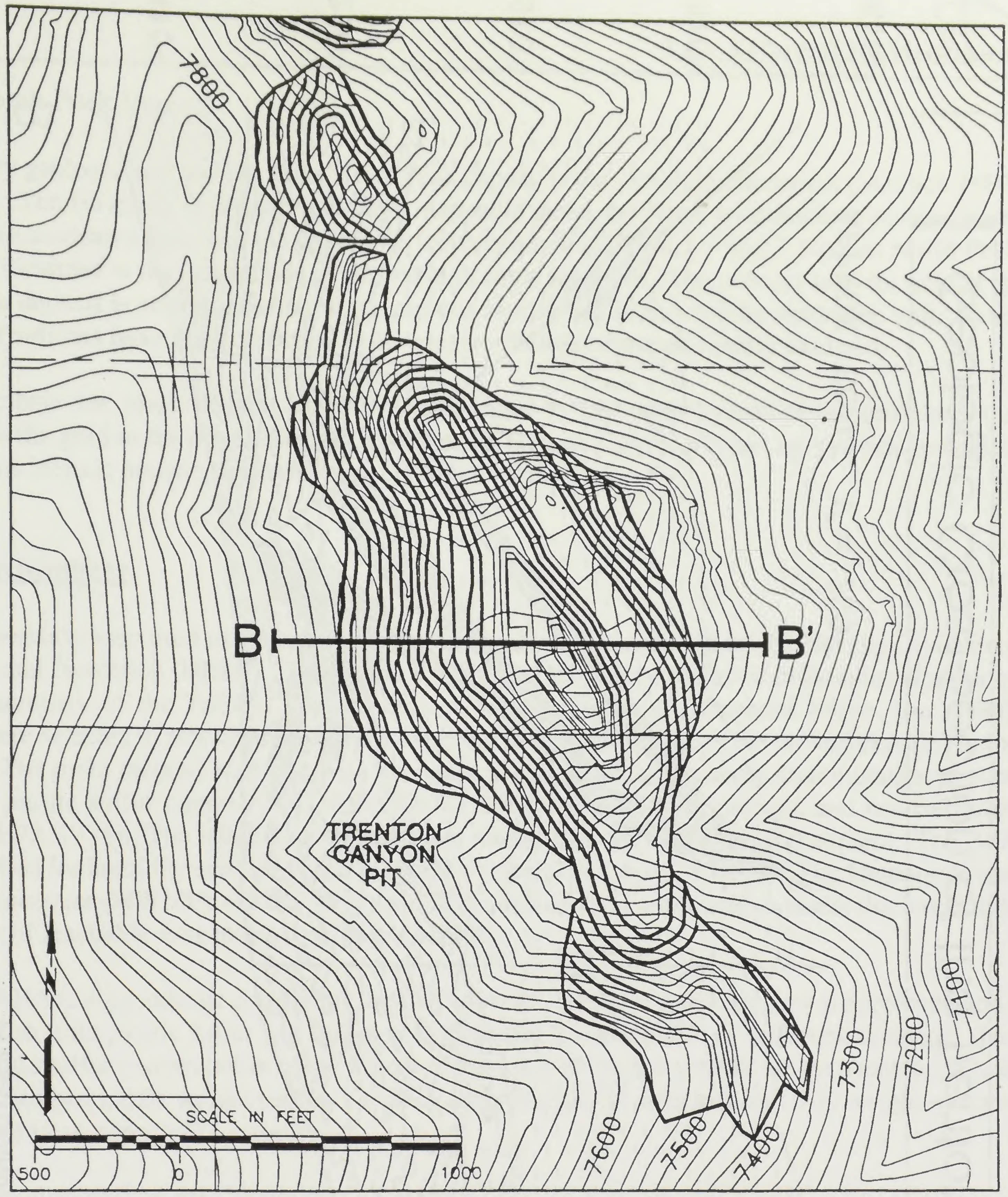
3.5.7.1 Trenton Canyon Deposit

Geological units present in the Trenton Canyon deposit area include the Valmy, Battle, and Havallah formations (Figures 3-7 and 3-8), and extrusive and intrusive igneous rocks (Felder 1992). The Valmy is subdivided between quartzite-dominant, siltstone-dominant, and chert-dominant units. At Trenton Canyon, high-angle north- to northwest-trending and northeast-trending faults tend to control the gold deposits. Gold is hosted within quartzite and siltstone in the Valmy Formation and within conglomerates and sandstones in the Battle Formation.

Mineralization at the Trenton Canyon deposit is controlled by high angle faults that provided conduits for the passage of mineralized fluids to favorable host rock horizons. Mineralization is commonly characterized by strongly limonitic fault-gouge or breccia containing a finely-crushed mixture of iron oxides and silica.

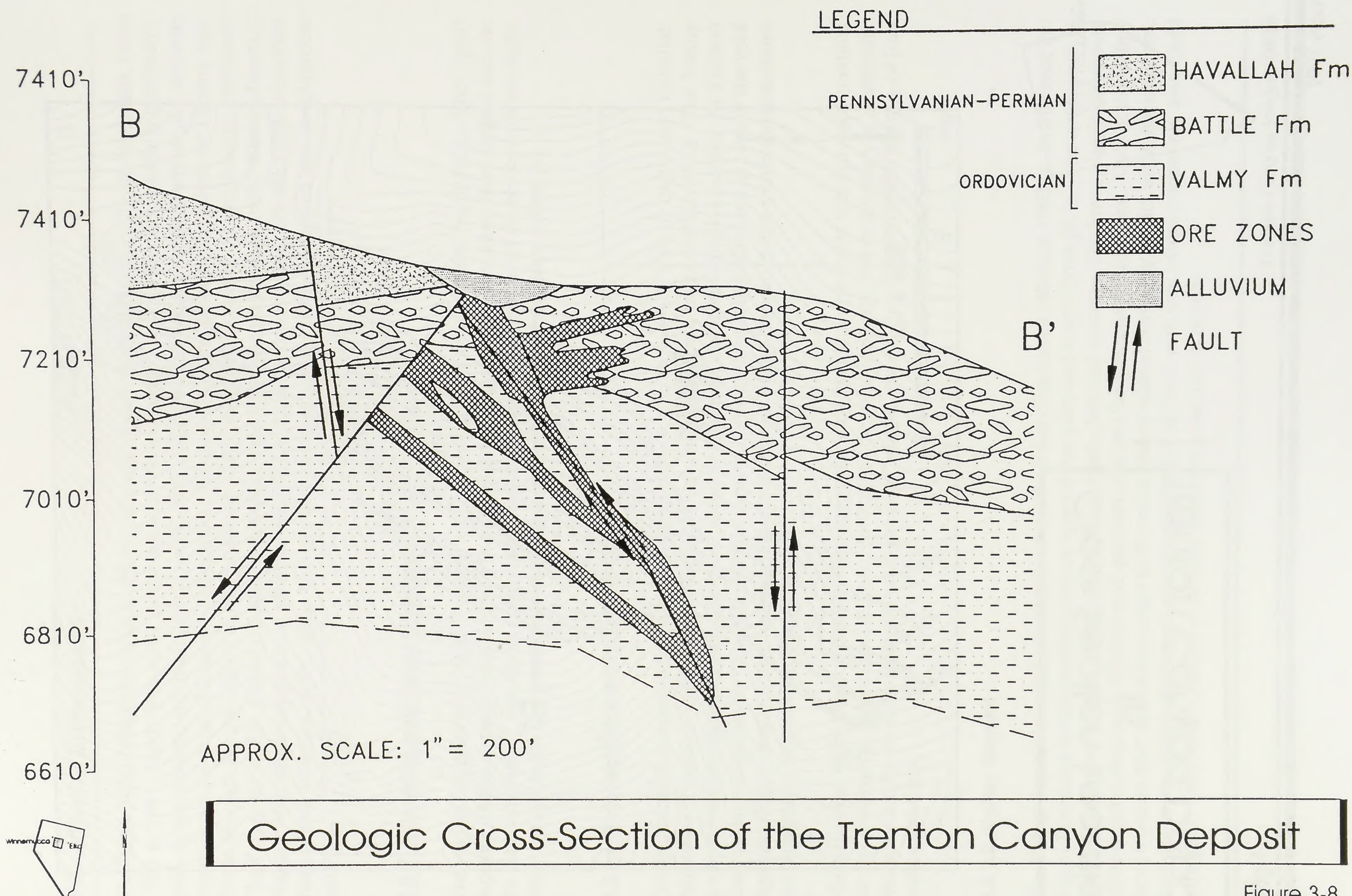
3.5.7.2 Valmy Deposit

The Valmy deposit is hosted completely within the Valmy Formation (Matlack 1993a). In this area the Valmy Formation is differentiated into an upper thrust plate and lower thrust plate. The upper plate is mapped as the sheared unit, composed of sheared black chert and siltstone. The lower plate is composed of the massive chert unit, siltstone unit, quartzite unit, and the quartzite/siltstone unit. Gold at the Valmy deposit occurs near a set of high angle faults and is hosted within fractured quartzite, siltstone, and chert. Sulfides in the Valmy deposit are nearly completely oxidized, with iron oxides commonly associated with gold. Only trace amounts of sulfides have been observed in the ore.



Cross Section Location in Trenton Canyon Deposit

Figure 3-7



Geologic Cross-Section of the Trenton Canyon Deposit

Figure 3-8

3.5.7.3 North Peak Deposit

The primary geologic unit present at the North Peak deposit is the Havallah Formation (Matlack 1993b and 1994). The Havallah is divided into three mappable units: the lower siltstone/limestone unit, the middle main sandstone unit, and the upper chert/siltstone unit (Figures 3-9 and 3-10). At North Peak, the gold is localized at the intersection of several high angle fault sets. The primary host for gold at the North Peak deposit is strongly fractured, calcareous sandstones in the middle sandstone unit. Trace amounts of sulfides have been observed in the ore, but the ore is predominantly oxidized.

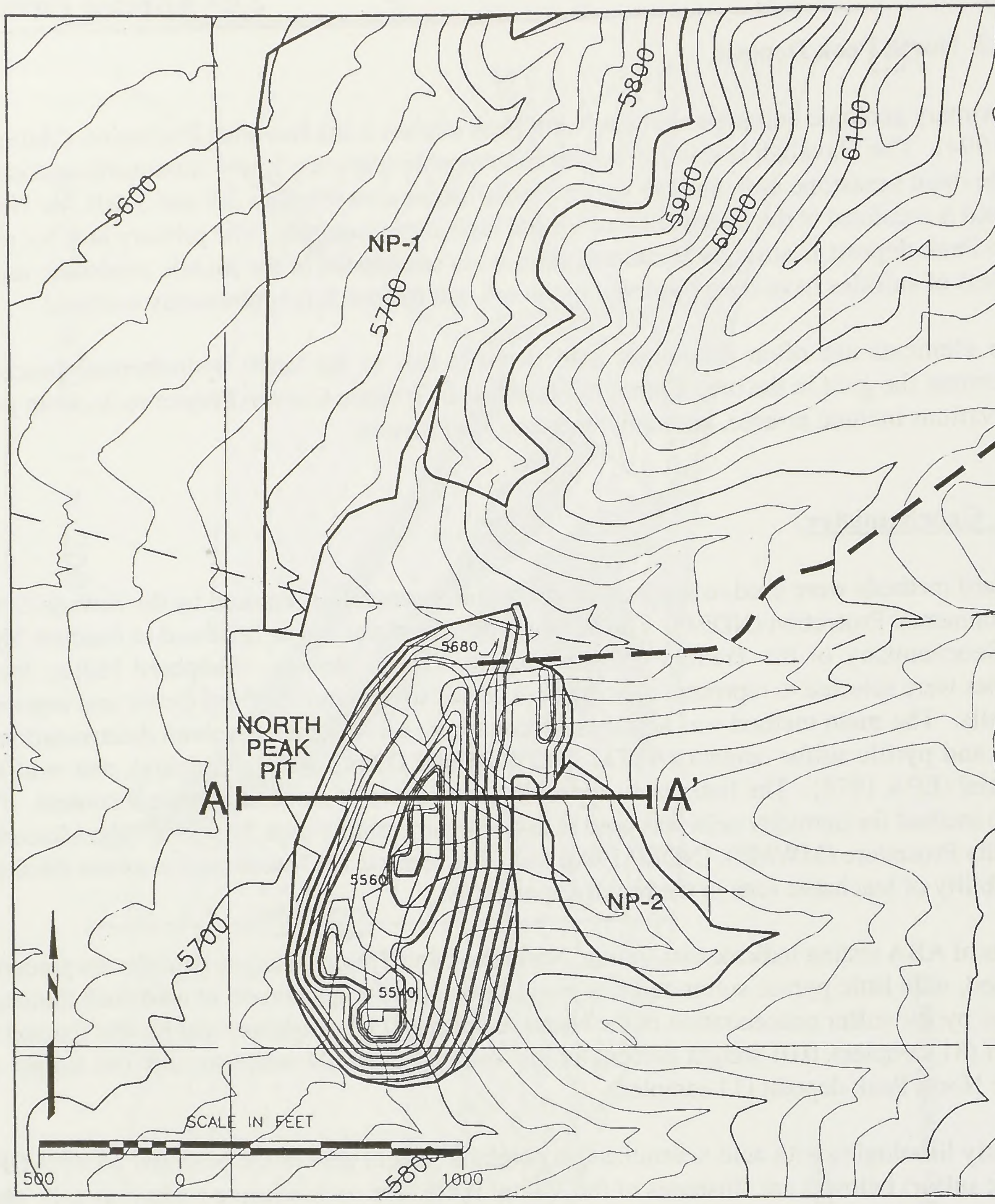
Trace elements are often present in gold deposits due to the same hydrothermal processes that concentrate the gold in the ore. Elements identified in Trenton Canyon Project rocks from geological observations include arsenic, antimony, mercury, and barium.

3.5.8 Geochemistry

Standard methods were used to assess acid generation potential as required by the Nevada Division of Environmental Protection (NDEP). The testing is described and can be reviewed in Baseline Hydrology and Geochemistry of the Trenton Canyon Project, Valmy, Nevada (Shepherd Miller, Inc. 1996). Samples were selected to represent rock types expected to be removed from the pit and exposed in the pit walls. The main method was acid-base accounting (ABA) which involved determination of total sulfur and pyritic sulfur content (ASTM D4239-85 and D2492-90, respectively), and neutralization potential (EPA 1978). The latter is an approximate measure of carbonate mineral content. The EPA (1978) method for humidity cells was used to assess weatherability over 24 weeks. The Meteoric Water Mobility Procedure (MWMP), (NDEP 1990) and EPA Method 1311 were used to assess the immediate availability of leachable ions in the rock (Appendix A).

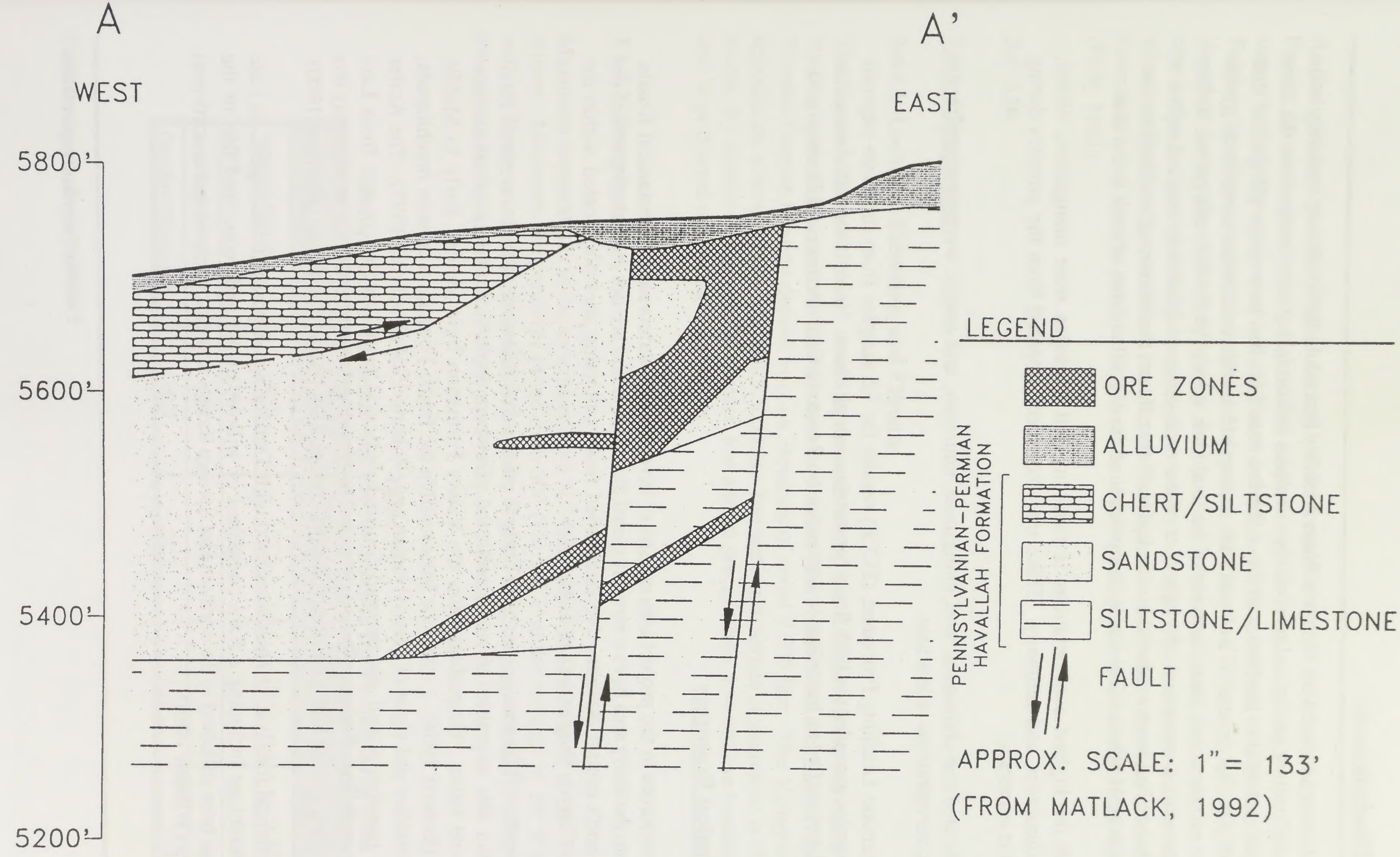
Results of ABA testing indicate that Valmy, North Peak and Trenton Canyon deposits are predominantly oxidized, with little pyritic sulfur and low overall potential for generation of acid-rock drainage. The average pyritic sulfur concentration of the tested samples is 0.10 weight-percent for the Trenton Canyon deposit (81 samples), 0.01 weight-percent for the Valmy deposit (24 samples), and 0.02 weight -percent for the North Peak deposit (11 samples).

The only lithologies with acid neutralization potential to acid generation potential (ANP/AGP) ratios (pyritic sulfur) below 3 are siltstones of the Valmy Formation and intrusive rocks, but only when they contain observable pyrite. Kinetic tests were performed on samples of these and other lithologies to further characterize their acid generation potential. Please refer to Appendix A and Chapter 4, Section 4.3.1.2 for discussion of kinetic tests.



Cross Section Location
North Peak Pit

Figure 3-9



Geologic Cross-Section of the North Peak Deposit

Figure 3-10

Laboratory leach tests conducted were Meteoric Water Mobility Procedure (MWMP) and humidity cells. Kinetic humidity-cell testing performed on rock-type samples indicates that most rocks from the three deposits that had the potential to generate acid (i.e. ABA less than 3.0) had an average pH greater than 6.5. The only samples that generated leachate with a mean pH less than 6.2 were samples of pyritic intrusive rock that represent less than 1 percent of the total rock volume at the site, and pyritic Valmy Siltstone that represents a maximum of 11 percent of the rock volume. However, most samples of pyritic Valmy Siltstone had more moderate kinetic test leachate pH, and the volume of rock represented by the samples with a pH below 6.2 is less than 4 percent of the overall volume of rock at the site.

Constituents with the highest concentrations in humidity cell leachates were manganese, nickel, selenium, iron, aluminum, and antimony. These may have been released from the samples during oxidation of sulfide minerals.

MWMP tests indicated that aluminum, iron, manganese, antimony, and arsenic were the constituents with the highest concentrations in leachate.

Toxicity Characteristic Leaching Procedure (TCLP) results for 32 samples from the three deposits showed that no samples exceeded the EPA limits for metals concentrations. None of the tested materials would therefore be classified as hazardous waste under the Resource Conservation and Recovery Act (RCRA).

3.5.9 Paleontological Resources

Paleontological resources in the project area consist of invertebrate, vertebrate, and botanical fossils. Fossils known from the study area have a broad regional distribution and are not restricted to either the study area or to north central Nevada. No established fossil collecting sites are located within the proposed Trenton Canyon Project area of disturbance.

The marine sediments of Paleozoic age are most likely to contain invertebrate fossils. Invertebrate fossil occurrences within this sequence of rocks collected elsewhere include a variety of commonly-encountered marine fauna. Graptolites from the Valmy Formation have yielded Early to Middle Ordovician ages (Roberts 1964). Limestone lenses within the Battle Formation contain brachiopods, gastropods, foraminifers and algae of Pennsylvanian age (Roberts 1964; Doebrich 1995). The Antler Peak Limestone contains a well documented fusilinid and coral fauna ranging in age from Late Pennsylvanian through Early Permian (Roberts 1964). The Havallah Sequence internal stratigraphy has been established based on identification of radiolarians, sponge spicules and conodonts (Murchey 1990).

Vertebrate and botanical fossils have been associated with Tertiary-age deposits in the region. A Late Miocene age assemblage including a flora comprised of willow, maple and cedar, and fish of the minnow family has been collected in the northern Hot Springs Range, approximately 40 miles northwest of the project area (Willden 1964).

An independent paleontological survey has been conducted for the Battle Mountain Gold Phoenix Project, located approximately eight miles southeast of the Trenton Canyon Project (Firby 1981). The survey included evaluation of units common to both projects, specifically the Quaternary alluvium, the Tertiary igneous intrusive and extrusive deposits, the Havallah Formation and the Antler sequence. Based on the results of the field survey and literature search performed during the investigation, Firby concluded the potential for paleontological resources within the units surveyed was low (Quaternary alluvium, Tertiary igneous intrusive and extrusive deposits, and Antler sequence) to moderate (Havallah Formation), and that the potential significance of paleontological resources within all the units was low (Firby 1981).

3.6 AIR

3.6.1 Climatology

3.6.1.1 Location, Elevation, and Climate

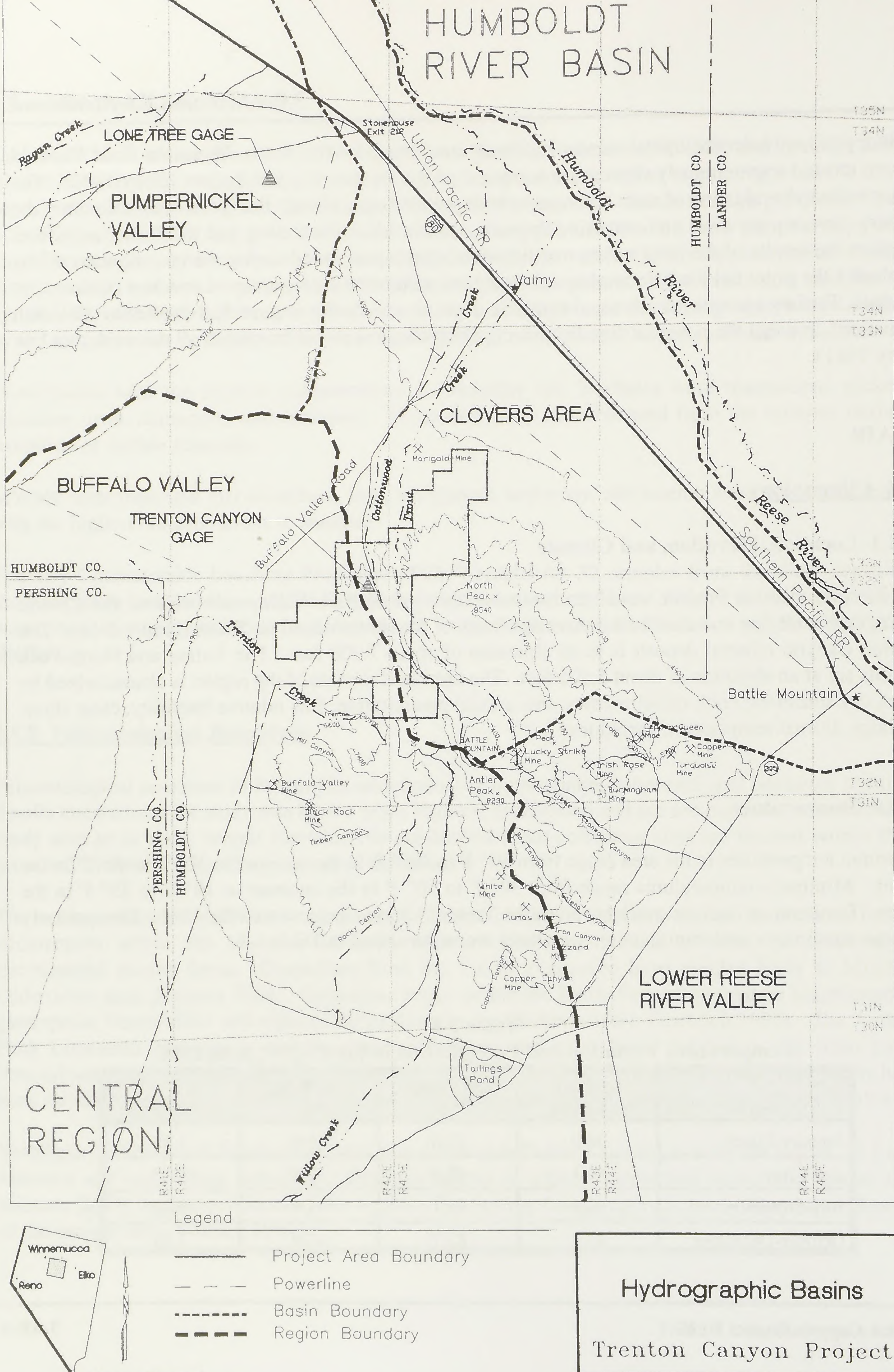
The Trenton Canyon Project would be located within the Buffalo Valley sub-basin of the Central Hydrographic Region and the Clovers Area sub-basin of the Humboldt River Basin (Figure 3-11). The Trenton Canyon mineral deposit is at an elevation of about 7,000 feet. The Valmy and North Peak deposits are at an elevation of about 5,500 feet. The semi-arid climate of the region is characterized by warm, dry summers; cool, moist winters; low annual precipitation; low relative humidity; clear skies; and large diurnal temperature variations.

3.6.1.2 Temperature

Maximum temperatures in the area range from 80° F to 100° F in the summer to 30° F to 40° F in the winter. Minimum temperatures range from 30° F to 50° F in the summer to 10° F to 25° F in the winter. Temperature data are available from the Trenton Canyon project area for 1996. The quarterly average, maximum, and minimum temperatures are summarized in Table 3-8.

Table 3-8
Temperature Variation and Precipitation in the Project Area 1996

Quarter	Average Temp. ° F	Max. Temp. ° F	Min. Temp. ° F	Rainfall (in)
January-March	36.0	63.0	10.6	3.35
April-June	54.1	88.8	22.4	1.87
July-September	69.0	91.1	31.6	0.80
October-December	40.9	82.7	15.9	3.43



Legend

- Project Area Boundary
- Powerline
- Basin Boundary
- Region Boundary

Hydrographic Basins

Trenton Canyon Project

Figure 3-11

3.6.1.3 Precipitation

On-site meteorological data obtained from monitoring at the Trenton Canyon project area shows that the total annual precipitation was 9.62 inches in 1995 and 9.45 inches in 1996. The quarterly precipitation data for 1996 is shown in Table 3-8. Most precipitation occurs in late fall to early spring as snow and rain. Precipitation occurs during the summer months mainly as scattered showers and thunderstorms.

3.6.1.4 Wind

Wind speed and direction data were collected in 1995 and 1996 from a meteorological station in the project area. The location of the station is shown as "Trenton Canyon Gage" on Figure 3-11. The predominant wind direction is from the southwest. The wind blows most of the time at speeds greater than 0.5 miles per hours. The average, maximum, and minimum windspeed data for 1996 are summarized in Table 3-9.

Atmospheric stability is a measure of the atmosphere's ability to disperse pollutants. Unstable atmospheric conditions result in maximum dispersion, stable atmospheric conditions result in minimum dispersion. In 1996, unstable conditions occurred about 30% of the time, stable conditions occurred about 40% of the time, and neutral conditions occurred about 30% of the time.

Table 3-9
Windspeed Data for 1996

Quarter	Average wind speed, mph	Max. wind speed, mph	Min. wind speed, mph
January-March	9.1	35.8	0.4
April-June	9.5	31.0	1.3
July-September	8.2	26.7	1.1
October-December	9.3	34.5	0.7

3.6.2. Ambient Air Quality

3.6.2.1 Air Pollution Potential

Temperature inversions near the project area occur on some nights and during the winter months. These inversions are usually removed during the day by increasing wind speeds and gradual warming of the atmosphere which results in the vertical mixing of pollutants.

3.6.2.2 Air Emissions

The sub-basins where air quality may be affected by the project are Clovers, Buffalo Valley, Pumpernickel, and Lower Reese River Valley.

3.7 SOILS

The study area consists of three major landform types: 1) mountains; 2) foothills; and 3) fan piedmonts. The area soils vary widely, ranging from shallow soil and rock outcrops in the highland reaches to deep alluvial loamy soils in the valleys.

3.7.1 Soil Map Units

An Order II soil survey was conducted in 1995 for the Trenton Canyon Project baseline studies (Resource Concepts, Inc. 1995). Information was used from earlier Order III soil surveys (USDA, 1992a; USDA, 1992b; USDA, unpublished data) in addition to field sampling data and mapping to obtain the soil map units in the baseline study report (Resource Concepts, Inc.). The 18 map units included several associations, or groupings of different soil series, some of which had widely varying characteristics (such as salvageable depth). For this reason, the Soil Survey Map was subsequently revised to differentiate between associations of multiple soil series, so that areas could better be evaluated for topsoil salvage potential (Zielinski, 1997). The revised map units were assigned numbers ranging from 101 to 117 to avoid confusion with soil map units in the baseline studies. The revised soil map units are shown in Figure 3-12.

3.7.2 Soil Salvage Value and Revegetation Potential

The suitability criteria listed in Table 3-10 were used to distinguish between suitable and unsuitable soil material in terms of the soil salvage value. The suitability of soils for salvage and future use in reclamation activities was based on several suitability criteria, including sodium adsorption ratio (SAR), electrical conductivity (EC), pH, soil texture, coarse fragments, and slope. The suitability criteria shown in Table 3-10 were selected on the basis of criteria integrated from the BLM Solid Minerals Reclamation

Handbook (USDI BLM, 1992) and the SCS National Soils Handbook 430-VI Supplement - NV2 (2/27/90). Topsoil salvage depths for each map unit are shown in Table 3-11.

3.7.3 Soil Erosion Characteristics

Soil map units were delineated for water and wind erosion potential. Each map unit was assigned an erosion hazard rating of slight, moderate, or severe as designated by the SCS. A map showing the water erosion potential for *in-situ* soils is shown in Figure 3-13, and a map showing the wind erosion potential for *in-situ* soils is shown in Figure 3-14.

Erosion factors and erosion hazard ratings for each soil map unit are shown in Table 3-12. The soil erodibility factor, K, is determined based on the soil texture (i.e. percentage of sand, silt, clay) while the average annual soil loss, T, is usually determined from the universal soil loss equation. (Schwab *et al.* 1981).

Table 3-10
Soil Suitability Criteria for Salvage and Reclamation

Parameter	Unacceptable Limits	Restrictive Feature
Sodium Adsorption Ratio	> 15	Excessive sodium
Electrical Conductivity	> 15 mmhos/cm	Excessive salinity
pH (reaction)	< 6.1 or > 9	Excessive acidity or excessive alkalinity
Soil Texture	sand, fine sand, very fine sand, silty clay, sandy clay or clay	Excessive sand Excessive clay
Coarse Fragments	> 40%	Excessive gravel/cobblestone
Slope*	> 30%	Excessive slope
Erosion hazard**	water > 8 wind > 100	Excessive erosion

* Topsoil would not be salvaged in the overburden disposal areas where slopes exceed 30%, as excessive erosion could occur until the area was covered. Topsoil would be salvaged from pit areas regardless of slope.

** From Universal Soil Loss Equation
For water: K x S where K = erodibility constant, S = length of slope; K x S = < 4 = Good; K x S = 4 - 8 = Acceptable; K x S > 8 = Unacceptable.
For wind: I x C where I = wind erodibility index, C = climatic factor; I x C < 40 = Good; I x C = 40 - 100 = Acceptable; I x C > 100 = Unacceptable

Table 3-11
Suitability of Soil Map Units for Salvage

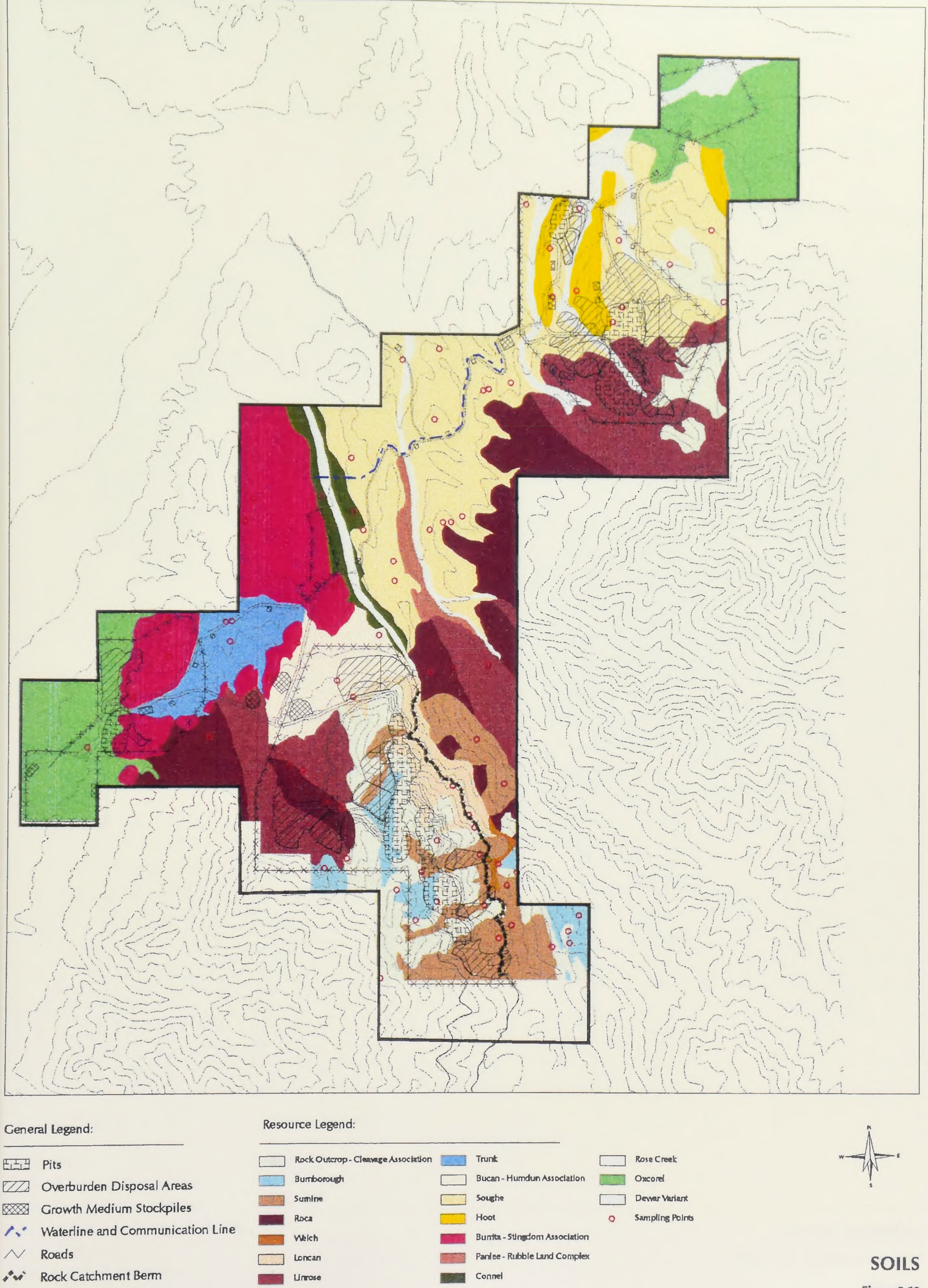
Map Unit	Map Unit Name	Salvage Depth (ft)	Soil Limitations
101	Rock Outcrop - Cleavage Association	5.0	Stones, shallow bedrock
102	Burnborough Very Gravelly Loam	5.0	Small rocks
103	Sumine Very Gravelly Loam	2.5	Stones
104	Roca Very Gravelly Loam	1.0	Too clayey, stones
105	Welch Very Fine Sandy Loam	5.0	Small rocks
106	Loncan Very Gravelly Fine Sandy Loam	2.5	Stones
107	Linrose Very Gravelly Fine Sandy Loam	2.5	Small stones
108	Trunk Very Gravelly Loam	1.0	Too clayey
109	Bucan-Humdun Association	1.0	Too clayey
110	Soughe Very Gravelly Sandy Loam	1.0	Stones
111	Hoot Gravelly Loam	1.0	Stones
112	Burrita-Stingdorn Association	1.0	Stones, shallow bedrock
113	Panlee-Rubble Land Complex	0.0	Stones
114	Connel Silt Loam	5.0	Some stones
115	Rose Creek Fine Sandy Loam	5.0	Small rocks
116	Oxcorel Gravelly Fine Sandy Loam	1.0	Excess Sodium
117	Dewar Variant Fine Sandy Loam	1.5	Cemented Pan

3.7.4 Areas of Disturbance and Topsoil Availability

The area of disturbance relative to each development activity is presented in Chapter 2, Table 2-2. Further analysis was performed to delineate disturbance areas by soil type to estimate topsoil volumes available for reclamation. Disturbance areas and salvageable topsoil volumes for the soil map units are shown in Table 3-13.

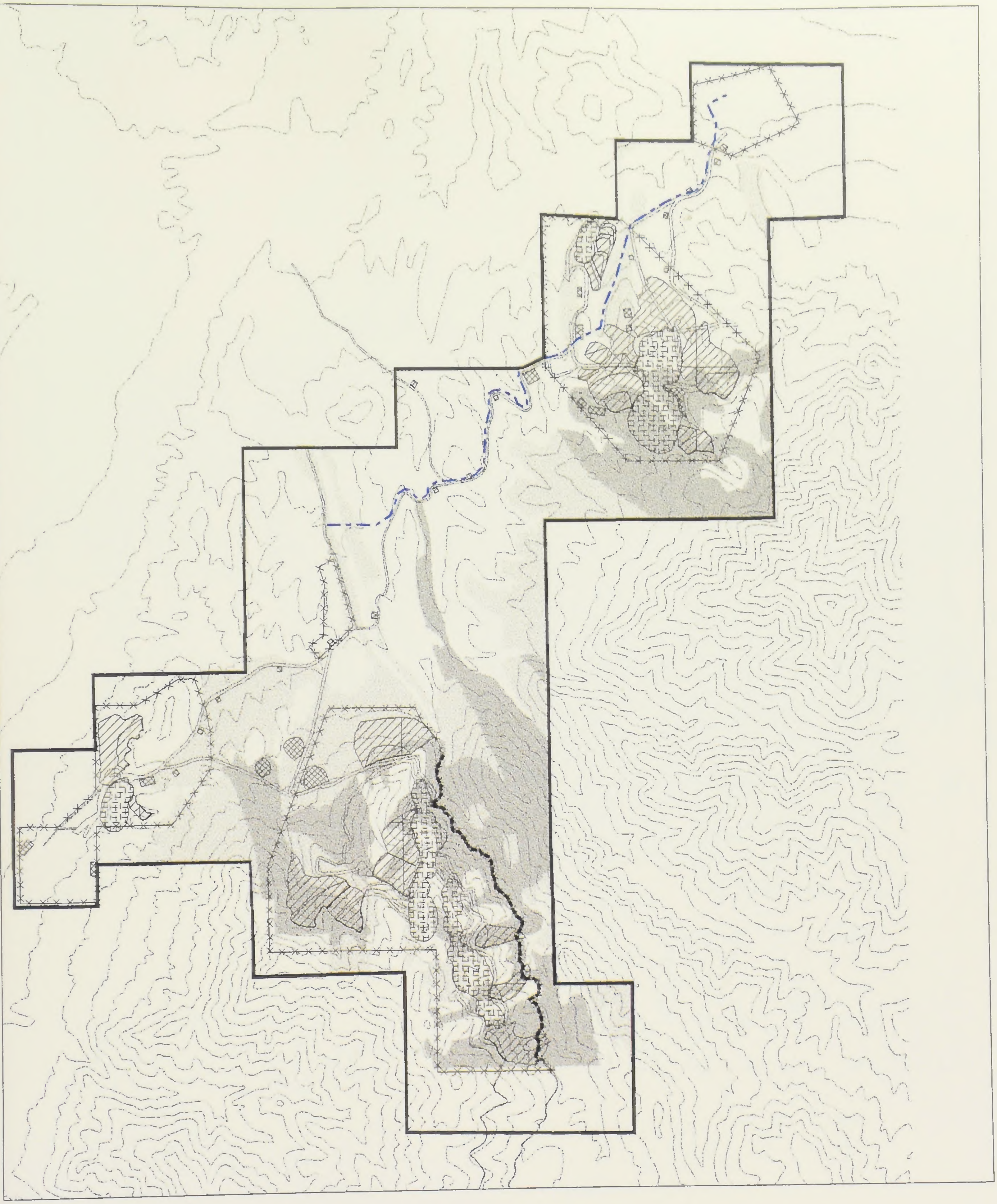
If topsoil were salvaged from all disturbed areas, then an estimated 2.7 million cubic yards of topsoil would be available for reclamation. However, topsoil could not be salvaged from all disturbed areas for the following reasons:

- Salvage of topsoil from the overburden disposal areas where slopes exceed 30% would result in excessive erosion before overburden is placed,
- It would be infeasible to remove topsoil from small disturbance areas of less than one acre, such as from the diversion channels, and
- It would also be infeasible to remove topsoil from beneath the growth medium stockpiles.



SOILS

Figure 3-12



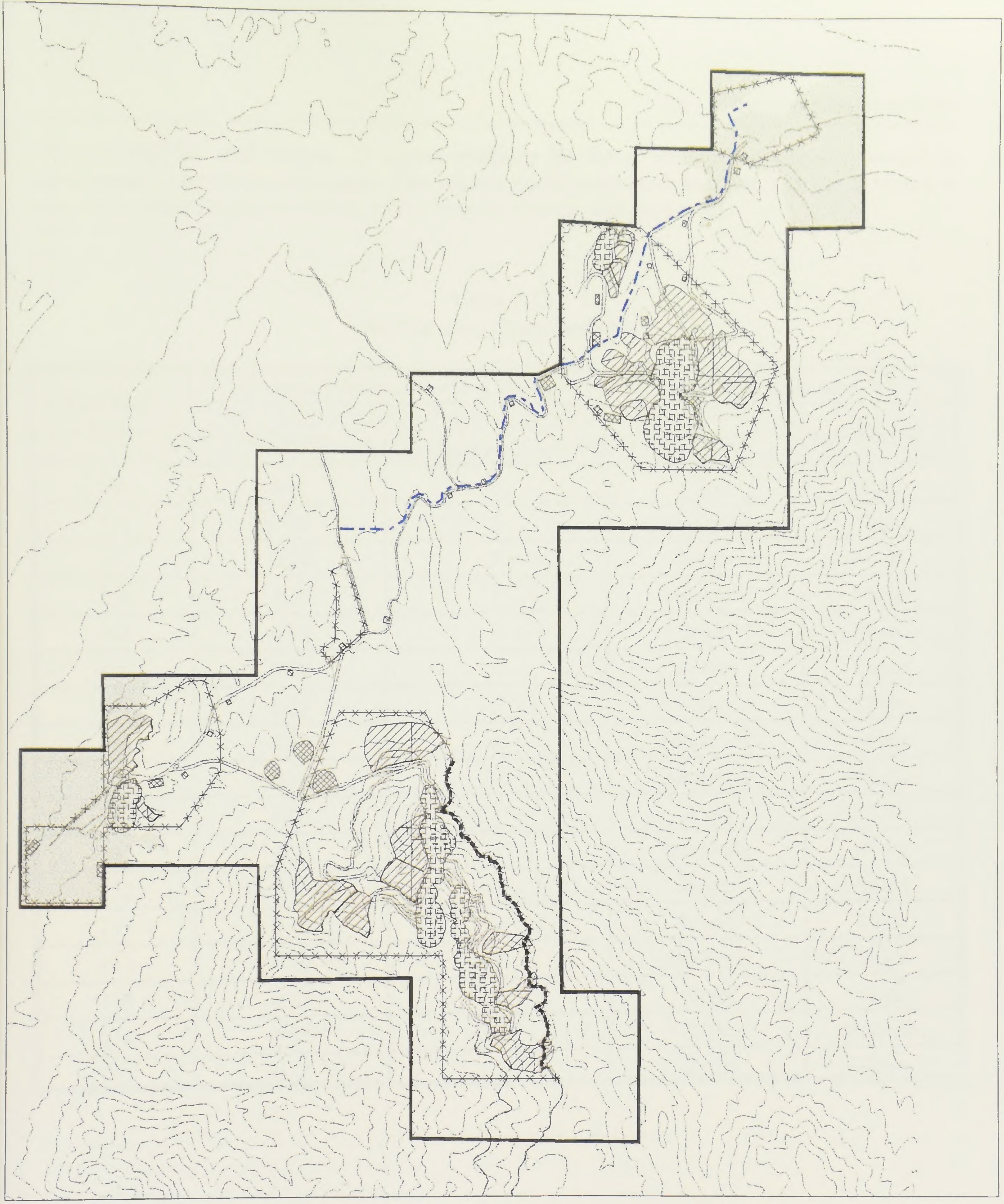
General Legend:

- Pits
- Overburden Disposal Areas
- Growth Medium Stockpiles
- Waterline and Communication Line
- Roads
- Rock Catchment Berm

Resource Legend:

- Slight
- Moderate
- Severe

WATER EROSION
Trenton Canyon Project
Figure 3-13



General Legend:

- Pits
- Overburden Disposal Areas
- Growth Medium Stockpiles
- Waterline and Communication Line
- Roads
- Rock Catchment Berm

Resource Legend:

- Slight
- Moderate

WIND EROSION
Trenton Canyon Project
Figure 3-14

Consequently, the total volume of topsoil available for future reclamation activities would be approximately 1.6 million cubic yards. This volume would make available up to 7 inches of topsoil to cover the overburden disposal areas, roads, heap leach pads, and pond areas.

Table 3-12
Soil Erosion Characteristics

Soil Map Unit	Erosion Factors - Surface Layer		Erosion Hazard	
	K Factor	T Factor (tons/acre-yr)	By Water	By Wind
101	NA	<1	Slight	Slight
102	0.24	5	Moderate	Slight
103	0.24	2	Severe	Slight
104	0.1	2	Moderate	Slight
105	0.32	5	Slight	Slight
106	0.17	2	Severe	Slight
107	0.28	2	Severe	Slight
108	0.24	2	Moderate	Slight
109	0.15-0.49	1-5	Moderate	Slight
110	0.05	1	Slight	Slight
111	0.1	1	Moderate	Slight
112	0.15-0.43	1-5	Slight	Slight
113	0.49	3	Severe	Slight
113	0.49	5	Moderate	Slight
115	0.37	5	Slight	Slight
116	0.28	5	Slight	Moderate
117	0.15	1	Slight	Slight

Table 3-13
Salvageable Topsoil by Development Activity and Soil Map Unit

Development Activity	Soil Map Unit	Area (acres)	Salvage Depth (feet)	Volume (yd^3)
Open Pits	102	34.3	5.0	276,687
	103	32.6	2.5	131,487
	106	28.4	2.5	114,547
	107	82.1	2.5	331,137
Overburden Disposal Areas	102	1.5	5.0	12,100
	103	19.2	2.5	77,440
	105	0.1	5.0	807
	106	0.3	2.5	1,210
	107	37.9	2.5	152,863
Ancillary Facilities	103	0.8	2.5	3,227
	114	5.3	5.0	42,753
Access/Haul Roads	102	6.8	5.0	54,853
	103	15.6	2.5	62,920
	106	21.2	2.5	85,507
	107	50.5	2.5	203,684
	114	9.5	5.0	76,633
	115	1.5	5.0	12,100
Total Available for Salvage		**347.6 acres**		**1,639,955 yd^3**

3.8 VEGETATION AND SPECIAL STATUS PLANT SPECIES

3.8.1 Vegetation

The majority of the field sampling occurred from July 21 through September 1, 1994, and between May 15 and August 24, 1995. Additional field sampling occurred in Sections 20 and 21 from June 3-7, 1996. Field observations and other vegetation notes made during this period were also included in the vegetation descriptions.

Each vegetation cover type was sampled independently. Transects were randomly located within each cover type. The number of sites sampled per type was adequate to assure that the total cover estimate was within 90 percent of the mean with a 90 percent probability. Cover estimates and production measurements were made at each sample site. Photos were taken of each transect. Global positioning system technology (GPS) was used to record transect locations, and the sampled sites were named, mapped, and marked with steel T-posts.

3.8.1.1 Ecological Condition

Species composition based on the air-dry weight was compared to appropriate SCS range site descriptions to assess ecological conditions at each sample site (SCS 1976, 1987a, 1987b). Table 3-14 lists the appropriate ecological sites for each vegetation cover type based on correlation with soils, precipitation zone, and vegetation dominance.

Table 3-14
Vegetation Cover Type and Corresponding Ecological Site

Vegetation Cover Type	Ecological Site
Wyoming Big Sagebrush (*Artemisia tridentata Wyomingensis)*	Loamy 8-10 P.Z. NV 24-05
Mountain Big Sagebrush (*Artemisia tridentata veseyana*)	Loamy Slope 12-16 P.Z. NV25-12
Low Sagebrush (*Artemisia arbuscula*)	Mountain Ridge NV 24-16
Black Sagebrush (*Artemisia nova*)	Shallow Calcareous Loam 10-14 P.Z. NV 24-31
Salt Desert Shrub (Mixed Species)	Loamy 5-8 P.Z. NV 24-02
Greasewood (*Sarcobatus vermiculatus*)	Sodic Terrace 8-10 P.Z. NV 24-22*

* Note: Production data from the greasewood sites more closely resembles Ecological Site NV 24-22 than the range site correlated to the soils mapped in the area (Resource Concepts, Inc. 1996c).

3.8.1.2 Species Present

All plant species observed during reconnaissance and sampling activities were noted. Table 3-15 is a list of species observed within the project area.

Table 3-15
Plants that Occur in the Project Area

Scientific Name	Common Name	Scientific Name	Common Name
	Annual Forb		Perennial Forb
Achillea millefolium	Western Yarrow	*Agastache urticifolia*	Nettleleaf Horsemint
Agoseris spp.	Agoseris	*Agropyron spicatum*	Bluebunch Wheatgrass
Agrostis stolonifera	Redtop	*Allium acuminatum*	Wild Onion
Alyssum desertorum	Desert Alyssum	*Amelachier spp.*	Serviceberry spp.
Amelanchier alnifolia	Serviceberry	*Amelanchier utahensis*	Utah Serviceberry
Amsinckia intermedia	Fiddleneck	*Artemisia arbuscula*	Low Sagebrush
Artemisia arbuscula spp. nova	Black Sagebrush	*Artemisia spinescens*	Bud Sagebrush
Artemisia tridentata spp. tridentata	Basin Big Sagebrush	*Artemisia tridentata spp. vaseyana*	Mountain Big Sagebrush
Artemisia tridentata spp. wyomingensis	Wyoming Big Sagebrush	*Asclepias spp.*	Milkweed
Asclepias eriocarpa	Woolypod Milkweed	*Astragalus spp.*	Milkvetch
Atriplex Conferifolia	Shadscale	*Balsamorhiza hookeri*	Hooker Balsamroot
Balsamorhiza sagittata	Arrowleaf Balsamroot	*Bromus tectorum*	Cheatgrass
Cardaria draba	Whitetop	*Carex spp.*	Sedge
Castillejo spp.	Paintbrush	*Caulanthus crassicaulis*	Spindlestem
Cercocarpus montanus	Mountain mahogany	*Chaenactis douglasii*	Douglas Dusty Daisy
Chrysothamnus spp.	Rabbitbrush	*Chrysothamnus nauseosus*	Rubber Rabbitbrush
Chrysothamnus parryi	Parry Rabbitbrush	*Chrysothamnus viscidiflorus*	Douglas Rabbitbrush
Cirsuim spp.	Thistle	*Collinsia parvifolia*	Littleflower collinsia
Crepis acuminata	Tapertip Hawksbeard	*Cryptantha spp.*	Cryptantha

Table 3-15
Plants that Occur in the Project Area

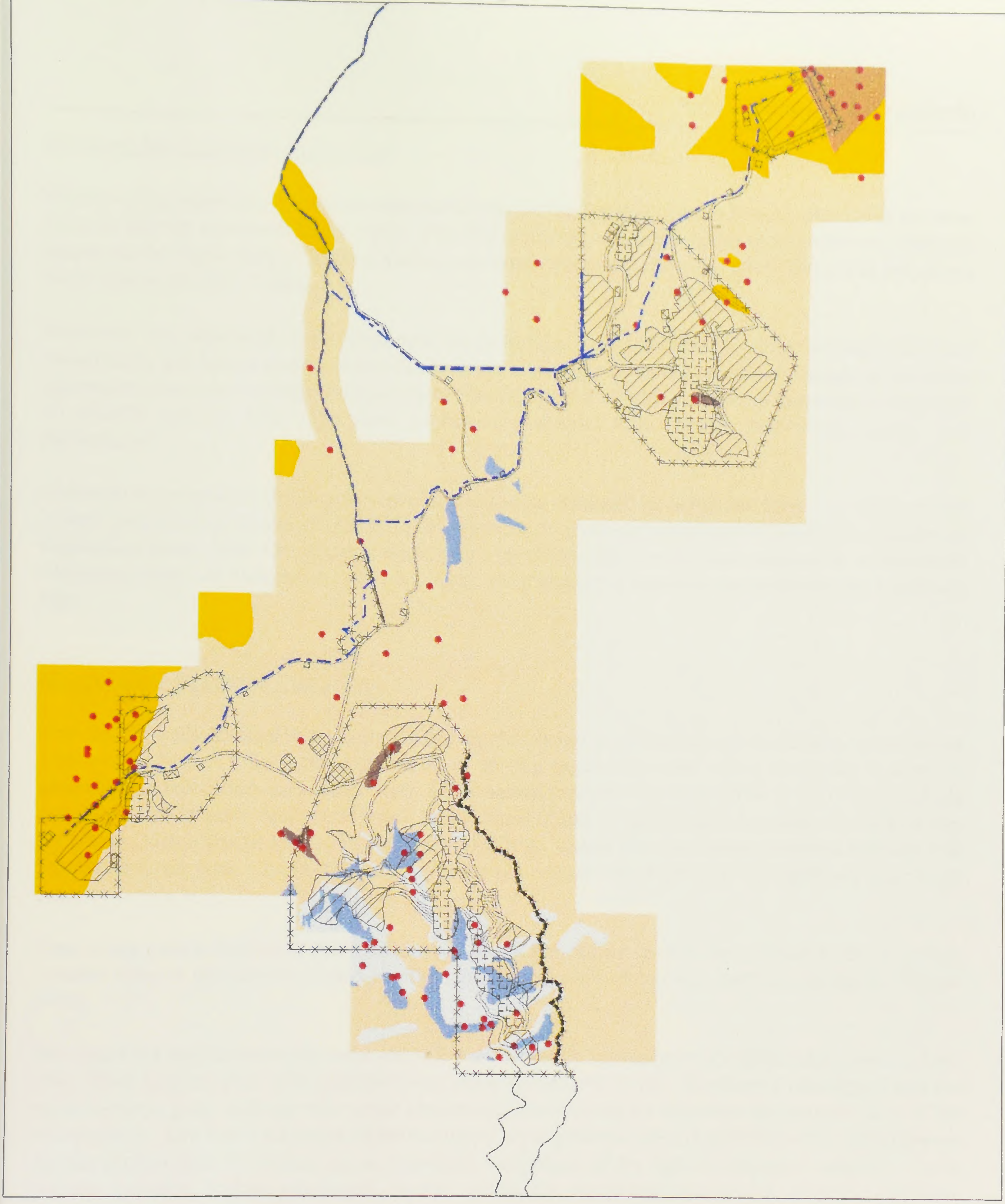
Scientific Name	Common Name	Scientific Name	Common Name
Cryptantha glomerata	Cryptantha	*Descurania sophia*	Flixweed tansymustard
Elymus cinereus	Basin Wildrye	*Ephedra spp.*	Ephedra
Equisetum arvense	Horsetail	*Eriogonum spp.*	Buckwheat
Eriogonum microthecum	Great Basin Buckwheat	*Eriogonum ovalifolium or caespitosum?*	Cushion Buckwheat
Eriogonum umbellatum	Sulphur Buckwheat	*Festuca idahoenisi*	Idaho Fescue
Fritillaria atropurpurea	Leopard Lily	*Grayia spinosa*	Spiny Hopsage
Gutierrezia sarothrae	Broom Snakeweed	*Halogeton glomeratus*	Halogeton
Haplopappus acaulis	Stemless Goldenweed	*Heuchera cylindrica*	Poker Alumroot
Holodiscus dumosus	Ocean Spray	*Hordeum brachyantherum*	Meadow Barley
Hordeum jubatum	Foxtail Barley	*Juncus spp.*	Rush
Juniperus osteosperma	Utah Juniper	*Kochia scoparia*	Summer Cypress
Lactuca serriola	Prickly Lettuce	*Lamiaceae*	Mint
Lappula occidentalis	Annual Stickseed	*Lepidium perfoliatum*	Pepperweed
Lewisia rediviva	Bitter Root	*Lomatium spp.*	Lomatium
Lupinus spp.	Lupine	*Lupinus sericeus*	Silky Lupine
Lycium spp.	Wolfberry	*Melica bulbosa*	Oniongrass
Mertensia longiflora	Bluebells	*Mimulus guttatus*	Monkeyflower
Oenothera spp.	Evening Primrose	*Opuntia polyacantha*	Pricklypear
Penstemon spp.	Penstemon	*Phlox spp.*	Phlox
Phlox hoodii	Carpet Phlox	*Phlox longifolia*	Long-leaf Phlox
Poa spp.	Bluegrass	*Poa nevadensis*	Nevada Bluegrass
Poa pratensis	Kentucky Bluegrass	*Poa scrabella*	Pine Bluegrass
Poa secunda	Sandburg Bluegrass	*Polypogon monspeliensis*	Rabbitfoot Grass

Table 3-15
Plants that Occur in the Project Area

Scientific Name	Common Name	Scientific Name	Common Name
Populus tremuloides	Quaking Aspen	*Prunus virginiana*	Common Chokecherry
Purshia tridentata	Antelope Bitterbrush	*Ranunculus testiculatus*	Bur Buttercup
Ribes spp.	Currant	*Rosa woodsii*	Woods' Rose
Rumex Crispus	Curly Dock	*Salix spp.*	Willow
Salix exigua	Sandbar Willow	*Salix lasiandra*	Pacific Willow
Salsola kali	Russian Thistle	*Sambucus spp.*	Elderberry
Sarcobatus vermiculatus	Greasewood	*Senecio spp.*	Groundsel
Sisymbrium altissimum	Tumblemustard	*Sitanion hystrix*	Squirreltail
Stipa thurberiana	Thurber Needlegrass	*Symphoricarpos albus*	Snowberry
Symphoricarpos longiflorus	Fragrant Snowberry	*Taraxacum officianale*	Dandelion
Tetradymia glabrata	Littleleaf Horsebrush	*Tetradymia spinosa*	Thorny Horsebrush
Tragopogon dubius	Salsify	*Trifolium spp.*	Clover
Wyethia amplexicaulis	Mulesear Wyethia	*Zigandenus venenosus*	Death Camas

3.8.1.3 Vegetation Cover Type Distribution

Six major vegetation cover types were identified within the Trenton Canyon Project area (Figure 3-15). The Wyoming big sagebrush, mountain big sagebrush, low sagebrush, and black sagebrush types occur on foothills and mountains. The salt desert shrub type occupies lower elevations associated with alluvial fans. Greasewood occurs at elevations between 5,000 and 5,200 feet in areas of high alkalinity with shallow groundwater. Data that were used to describe and characterize each cover type, including acreages, mean percent cover, mean production (lbs/acre), ecological condition, and percent cover of primary species (greater than 1% cover) are summarized in Table 3-16.



General Legend:

- Pits
- Overburden Disposal Areas
- Growth Medium Stockpiles
- Waterline and Communication Line
- Roads
- Rock Catchment Berm

Resource Legend:

- Black Sagebrush
- Greasewood
- Low Sagebrush
- Mountain Big Sagebrush
- Salt Desert Shrub
- Wyoming Big Sagebrush
- Sampling Points

VEGETATION TYPES AND SAMPLE TRANSECT LOCATIONS
Trenton Canyon Project
FIGURE 3-15

Wyoming Big Sagebrush Cover Type

Wyoming big sagebrush is the most widespread type in the Trenton Canyon Project area and is the most xeric of the big sagebrush cover types. The Wyoming big sagebrush cover type occurs on mountain slopes, on the higher flats of Buffalo Valley, and along ephemeral drainages which bisect the salt desert shrub type in Buffalo Valley.

Wyoming big sagebrush is the dominant shrub species, with rabbitbrush, spiny hopsage, littleleaf horsebrush, and bluegrasses present. While forbs make up a relatively small percentage of the plant community they play an important part in habitat quality for wildlife and are an important component of wildlife species' diet. The more prominent perennial forbs include buckwheat, lupine, and hawksbeard.

Although no trees were sampled on any of the transects, it should be noted that there is a small area of juniper woodlands in Section 7, T32N, R43E which occur as an inclusion in the Wyoming big sagebrush vegetation cover type. On its xeric edge, this vegetation type meets black sagebrush or shadscale (*Atriplex*) types. At its moister, cooler boundary, the transition is usually to the mountain big sagebrush type.

Mountain Big Sagebrush Cover Type

This cover type is dominated by mountain big sagebrush and a well-developed understory of perennial grasses and forbs. This is the most mesic of the big sagebrush cover types, occurring in areas of relatively high elevation (up to 8,000 feet). Mean annual precipitation ranges from 14 to 18 inches. Soils range from moderate to deep, often with a high content of rock or gravel, and are well drained (Society for Range Management 1994). In areas of variable soil depth this type forms a mosaic with the low sagebrush cover type. Its lower boundary generally borders the Wyoming big sagebrush vegetation type.

This cover type is limited to the southern portion of the project area in the vicinity of the proposed Trenton Canyon pits and associated overburden disposal areas and growth medium stockpiles (Figure 3-15).

Mountain big sagebrush is the main species, with mountain snowberry and rabbitbrush present. Five other shrub species occur infrequently in this cover type (Table 3-16). Bluebunch wheatgrass was the most common grass with six other grass species each accounting for less than one percent (1%) of the composition. The forb component of the mountain big sagebrush type contributes a very rich resource for the project area and makes up an important component of the diet for the area's wildlife. Forbs present included Indian paintbrush, lupine, horsemint, arrowleaf balsamroot, mulesear wyethia, groundsel, phlox, and hawksbeard.

Table 3-16
Species Composition of Project Area Vegetation Types (Average %)

Vegetation Cover Type	Wyoming Big Sagebrush	Mountain Big Sagebrush	Low Sagebrush	Black Sagebrush	Salt Desert Shrub	Greasewood
Acreages Present in Project Area	9,052	459	207	23	1,263	146
Mean Percent Cover	24%	50%	19%	25%	13%	24%
Mean Production (lb/ac)	608	989	520	535	616	559
Percent of Site in Ecological Condition Class						
Early Seral	10%	11%	0%	14%	67%	10%
Mid Seral	73%	84%	60%	86%	21%	60%
Late Seral	17%	5%	40%	0%	13%	30%
PNC	0%	0%	0%	0%	0%	0%
Percent (%) Cover by Species* (Common Name)						
Low Sagebrush			11.4			
Black Sagebrush				18.6		
Bud Sagebrush					1.2	
Mountain Big Sagebrush		24.8				
Wyoming Big Sagebrush	17.2					6.3
Shadscale					7.3	
Douglas Rabbitbrush	1.7	2.0				2.0
Buckwheat		3.0				
Broom Snakeweed		1.4				
Phlox			1.8	2.3		
Bluegrass	2.0		3.0	2.2	1.8	
Antelope Bitterbrush		1.3				
Currant		1.0				
Greasewood						13.6
Snowberry		13.5				
Total	**20.9**	**47.0**	**16.2**	**23.1**	**10.3**	**21.9**

*Includes only species whose percent cover is 1% or greater.

Low Sagebrush Cover Type

The low sagebrush cover type in the Trenton Canyon Project area generally occurs along ridges and on higher slopes with shallow soils. This cover type is found in the vicinity of the proposed Trenton Canyon pits and overburden disposal areas. Small areas also exist along the ridges adjacent to Trout Creek, north of the proposed Trenton Canyon mining area (Figure 3-15).

This vegetation type is characterized by a shrub layer of low sagebrush and a herbaceous layer of perennial bunchgrasses and forbs. The dominant shrubs are low sagebrush, rabbitbrush, and mountain big sagebrush. Sandberg bluegrass was the most common grass. Forbs included phlox, buckwheat, lupine, milkvetch, and hawksbeard.

Black Sagebrush Cover Type

The black sagebrush cover type occurs on ridges and windswept west slopes, at middle elevations, and in an annual precipitation zone of 8 to 12 inches. Climatically, black sagebrush distribution overlaps the range of the low sagebrush and big sagebrush cover types. Compared to big sagebrush sites, black sagebrush sites have shallow, droughty, coarse-textured soils. Black sagebrush sites have a calcareous layer, are less developed, are unlikely to be saturated with moisture in spring, and are generally drier than low sagebrush sites. As a result, the growing season is very short (SRM 1994). This cover type is limited to the vicinity of the proposed Trenton Canyon overburden disposal area and the northeastern corner of the project area, adjacent to the overburden disposal area for the Valmy pit.

Black sagebrush is the characteristic shrub, accompanied by a herbaceous layer of perennial grasses and forbs. Bluegrass and phlox occur as minor subordinates. Infrequently occurring shrubs included rabbitbrush and Great Basin buckwheat. Three forb species, buckwheat, milkvetch, and hawksbeard, total less than one percent of the cover.

Salt Desert Shrub Cover Type

Salt desert shrub vegetation occurs within the project area on the valley floors where it is transitional to the Wyoming big sagebrush cover type in the foothills and along toes of mountain slopes. This cover type is located at the heap leach site for the Valmy pit, as well as along the western edge of the project area in the vicinity of the North Peak mining area.

Shadscale accounted for most of the shrub cover, with budsage and rabbitbrush providing a minor component of the foliage. Four other shrub species were present in this cover type but contributed less than one percent (1%). Grass species characterize the understory with Sandberg bluegrass, squirreltail, and cheatgrass. Perennial forbs occur infrequently in this cover type.

Greasewood Cover Type

The greasewood cover type occurs at elevations between 5,000 and 5,200 feet in the northern half of Section 21. This area is dominated by greasewood with an understory of annual and perennial grasses, forbs, and other shrubs such as Wyoming big sagebrush and Douglas rabbitbrush (Table 3-16). Greasewood shrubs in the project area are of medium stature (24-48 inches) with a moderately open canopy. The greasewood cover type is transitional to the salt desert shrub at upper elevations within the project area. This cover type is found in the northeastern corner of the project area, adjacent to the Valmy heap leach area.

Greasewood grows in areas of high soil alkalinity with shallow groundwater where the plant roots can obtain free water (MacMahon 1988). Greasewood plants start growth in early spring and lose their leaves after frost. The plants are moderately poisonous if the green leaves are consumed in large quantities by cattle or sheep. Sheep are also often poisoned by eating fallen leaves in the fall (Whitson, *et al.* 1992).

3.8.2 Noxious Weeds

A noxious weed is defined as a plant that interferes with management objectives of a given area of land at a given point in time. Weed management is an integral part of BLM's resource management mission of maintaining ecosystem health pursuant to the Carlson-Foley Act (1968) and the Federal Noxious Weed Act (1974) as amended by Sec. 15 of the Management of Undesirable Plants on Federal Lands (1990). Weeds interfere with the BLM's objective to maintain healthy and diverse ecosystems and rangelands on BLM controlled lands. The proliferation of these plants is currently being controlled through the implementation of BLM's integrated weed management program. Tall whitetop is the most common noxious weed within the study area for vegetation and colonies occur in previously disturbed areas along Trout Creek (Section 7, T32N, R43E) and up Cottonwood Creek canyon (Section 18, T32N, R43E).

3.8.3 Threatened, Endangered, or Sensitive Plant Species

Information on threatened and endangered species was obtained from the BLM and from a report prepared by Resource Concepts, Inc. (1995) that summarizes investigations that were conducted on the status of species.

Inquiry was made with the Nevada Natural Heritage Program (NNHP), the US Fish and Wildlife Service (USFWS), and the Battle Mountain and Winnemucca Districts of the BLM regarding the potential for occurrence of Threatened, Endangered, or Sensitive (TES) species in the project area.

A multi-agency data base search was conducted that revealed no threatened, endangered, or candidate plant species occur, or have the potential to occur, within the project area.

3.8.4 Plants with Traditional Cultural Value

In May and June of 1997, several plants with cultural value were collected in the higher elevation areas of the Trenton Canyon Project. Douglas rabbitbrush (*Chrysothamnus viscidiflorus*) has both medicinal and spiritual value for the Western Shoshone. This plant is quite common in the region and is represented in each of the five vegetative cover types within the project area: Wyoming big sagebrush, mountain big sagebrush, low sagebrush, black sagebrush, and salt desert shrub. Buckwheat (*Eriogonum caespitosum*) is used as a salve or as an eye medicine. This plant occurs in higher elevations and is not one of the dominant cover plants. *Monardella odoratissima*, *Senecio integerrimus*, and *Periderdia Gairdneri* were not located during the 1995-96 plant sampling.

3.9 WETLANDS AND RIPARIAN HABITAT

3.9.1 Wetlands

Jurisdictional wetlands were identified along the drainage systems that cross the project area, as well as at a number of springs and seeps where surface water is sufficient to develop wetland conditions.

Approximately 2,125 feet along the upper reach of Cottonwood Creek (Sample Site No. S10, Sections 17 and 18, T32N, R43E) supports wetlands that are dominated by a mature aspen forest with mesic to hydric species in the understory, including Wood's rose, wiregrass, currant, and iris (Table 3-17). Although not all of the species at the site are considered to be indicative of wetland conditions, enough of the cover is dominated by species listed by Reed (1986) as facultative or obligate to wetland conditions. Soils were saturated at 8 inches and were dark in color. The area of jurisdictional wetlands was calculated to be 29 acres.

Areas along Trout Creek that occur as wet meadows were also delineated as jurisdictional wetlands (Sample Site No. 4, Section 6, T32N, R43E). Dominant plant species include meadow barley, buckbrush, nutty ranunculus, monkey flower, dandelion, clover, western yarrow, elderberry, and wiregrass. Of these species, dandelion, clover, and elderberry are not considered to be wetland indicators (Reed 1986), but species that are wetland indicators dominated the vegetation cover (Table 3-17). Soils of these areas were saturated immediately below the surface. The wetland area was calculated to be 9 acres.

Two springs that occur in the south half of Section, 20, T33N, R43E, were delineated as jurisdictional wetlands. Mud Spring is the larger of the two, and calculated to be 3 acres; the smaller, unnamed spring covers approximately 2 acres. The vegetation is similar at each site. The dominant species is wiregrass; the drier perimeter is composed of facultative species (bottlebrush, squirreltail, Sandberg bluegrass); and the wetter central area of the spring is composed of rabbitsfoot grass (Table 3-17).

Ames Spring also supports a relatively large wetland area, which was calculated to be 8 acres. This spring is located between Sections 16 and 21, T33N, R43E. The vegetation is similar to other springs in the area, with wiregrass the dominant species throughout, although rabbitsfoot grass becomes prominent in the inundated central part of the site (Table 3-17). Soils were inundated either at or near the surface throughout the area that was delineated as jurisdictional wetlands.

Table 3-17
Characteristic Wetland Plant Species and Indicator Status at Jurisdictional Wetland Sites

Site No.	Area	Plant Species		FAC	FAC-W[1]	OBL[1]
		Common Name	Scientific Name			
S10	Cottonwood Creek	Aspen	*Populus tremuloides*	X		
		Sandbar Willow	*Salix exigua*			X
		Woods rose	*Rosa woodsii*	X		
		Wiregrass	*Juncus balticus*		X	
		Currant	*Ribes aureum*		X	
		Iris	*Iris missouriensis*			X
S04	Trout Creek	Meadow barley	*Hordeum brachyantherum*		X	
		Monkey flower	*Mimulus guttatus*			X
		Sandbar willow	*Salix exigua*			X
		Wiregrass	*Juncus balticus*		X	
		Buckbrush	*Rhamnus sp.*	X		
		Nutty ranunculus	*Ranunculus repens*		X	
		Clover	*Trifolium microcephalum*	X		
		Wood's rose	*Rosa woodsii*	X		
TCS-2	Mud Spring	Wiregrass	*Juncus balticus*		X	
TCS-1	Unnamed Spring	Rabbitsfoot grass	*Polypogon monospeliensis*			X
TCS-3	Ames Spring					

[1]Facultative Wet (FAC-W) species occur in wet soils 67-99% of the time. Obligate (OBL) species occur in wet soils >99% of the time according to Reed, 1986. Facultative (FAC) species have an equal chance of occurring on wetland or upland sites.

3.9.2 Waters of the United States

Ten stream reaches were identified as Waters of the United States (WOUS) within the project area. Based on estimates of average stream width and length of reach, 14 acres were estimated for WOUS in the project area. These areas include reaches of Cottonwood Creek and Trout Creek and also included a number of tributaries of these drainage systems that contain flow only in response to storm-event runoff or snow melt.

3.9.3 Riparian Community

The wetlands identified in the upper Cottonwood Creek can be classified as a *Populus tremuloides/Salix* c.t. ecological type, one of the recognized riparian communities of Central Nevada (Forest Service, USDA 1996). As described in Section 3.9.1, the plant community is comprised of quaking aspen (*Populus tremuloides*), sandbar willow (*Salix exigua*), wood's rose (*Rosa woodsii*), currant (*Ribes aureum*), and wiregrass (*Juncus balticus*) (Table 3-17). The plants along this portion of Cottonwood Creek represent the potential natural community, the biotic community that would be established if all successional sequences were completed without human-caused disturbance under present environmental conditions, for this ecological type (Forest Service, USDA, 1996).

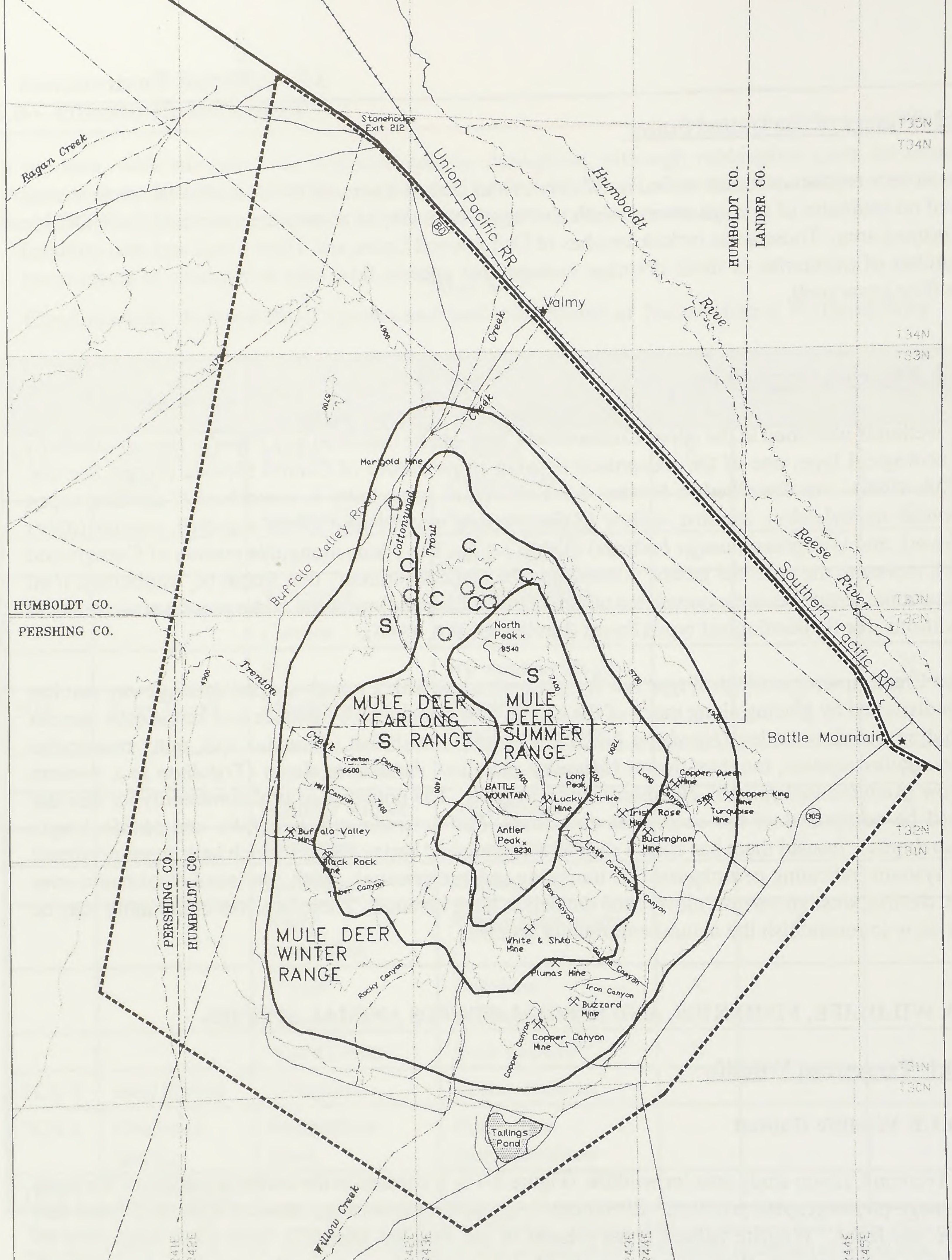
Trout Creek riparian ecological type is a dry grass meadow with a trough-shaped drainageway that has been disturbed by grazing along much of the length. It is dominated by grasses and herbaceous species including meadow barley *(Hordeum brachyantherum*), buckbrush (*Rhamnus* sp.), nutty ranunculus (*Ranunculus repens*), monkey flower (*Mimulus guttatus*), dandelion, clover (*Trifolium sp.*), western yarrow (*Achillea millefolium*), elderberry, and wiregrass. The potential natural community for this site would be comprised of the ecological dominants, *Poa secunda spp. juncifolia* and *Muhlenbergia richardsonis.* Instead there has been a shift to wiregrass and barley species which have more persistent root systems indicating perturbation (i.e. trampling and overgrazing). With continued disturbance over time, the iris, western yarrow, clover, and dandelion have invaded. Therefore, this community may be very slow to reestablish the natural community species.

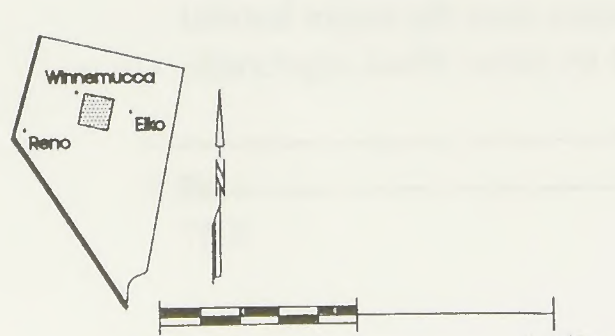
3.10 WILDLIFE, FISHERIES, AND SPECIAL STATUS ANIMAL SPECIES

3.10.1 Terrestrial Wildlife

3.10.1.1 Wildlife Habitat

The Trenton Canyon study area for wildlife (Figure 3-16) is situated in the northern reaches of the basin and range physiographic province. Elevations in the project area range between 4,500 and 8,000 feet above sea level. Wildlife habitat types present in the area are generally open areas dominated by mountain big sagebrush, Wyoming big sagebrush, low sagebrush, or shadscale, and, riparian woodlands along streams and other drainage ways. Habitat inclusions of lesser areal extent than the major habitat types listed above include stands of juniper, rock talus, and areas dominated by either black sagebrush, or greasewood.





Legend

- Study Area Boundary
- Powerline
- C Chukar Sighting
- Q Quail Sighting
- S Sage Grouse Sighting

Wildlife Study Areas
Trenton Canyon Project

Figure 3-16

Riparian habitats are variously dominated by chokecherry and willow, with occurrences of aspen. Larger overstory trees such as cottonwood are generally lacking in the riparian habitats of the project area. Cottonwood and Trout creeks support high quality aquatic and riparian habitats, representing the most complex and diverse ecosystems in the project area. Cottonwood Creek is characterized by an aspen overstory with a shrubby midstory and understory of grasses and forbs.

The number and diversity of animal species within an area is determined by the diversity of vegetation types. Overall, the diversity of vegetation communities in the project area is not great either in structure or composition. Additional limiting factors to wildlife in the area are surface water and riparian vegetation. Surface water for use by wildlife is limited to a few springs and intermittent creeks which drain the area.

Larger species that inhabit the area include mule deer, coyote, badger, bobcat, mountain lion, and several species of game birds and raptors. A variety of small, relatively inconspicuous species of mammals, birds, amphibians, reptiles and fish are also found in the area.

3.10.1.2 Mammals

As part of the biological baseline investigations conducted by Resource Concepts, Inc. (1995), small mammal sampling was conducted in each of the major plant communities including: shadscale, Wyoming big sagebrush, mountain big sagebrush, and riparian. This sampling documented the presence of seven species of small, nocturnal and diurnal mammals; Ord's kangaroo rat, least chipmunk, canyon mouse, long-tailed vole, montane vole, vagrant shrew, and deer mouse. Other species believed to be present in the project area include spotted skunk, water shrew, and jumping mouse.

A total of 45 mammalian species could be present in the project area. Of this total, 11 species were confirmed as present either through small mammal trapping or incidental observation during baseline data collection in 1995 (Resource Concepts, Inc. 1996).

Medium-sized mammals observed in the project area during baseline studies include coyote, black-tailed jack rabbit, and desert cottontail. Although not documented during baseline studies, yellow-bellied marmots have been observed along drill roads in the Trenton Canyon Project area (Johnson, J. 1996).

<u>Big Game</u>

Mule deer and mountain lions are the only big game species that are present within the Battle Mountain Range. The rugged topography in the project area offers both cover and abundant sagebrush and grassland species. Vegetation important to mule deer within the project area is dominated primarily by big sagebrush, low sagebrush, shadscale, and grassland communities. Within the wildlife study area there is approximately 90,480 acres of mule deer winter range, 14,040 acres of summer range, and

51,030 acres of year-long range (Figure 3-16). The limiting habitat component is mule deer summer range.

The project area lies within Management Area 15 and Management Unit 151 administered by NDOW. The annual population of mule deer in 1997 for Management Area 15 was estimated at 3,803. The average buck to doe ratio over the past 20 years has been 21 bucks per 100 does. Fawn mortality for Management Area 15 has ranged from 5 to 37.5 % over the past five years with an average of 25.6%. There is no recognizable trend in existing data for Unit 151, however, two factors related to data collection (i.e., low sample sizes or missing data) could influence trends (L. Teske, Personal Communication, 1997).

In general, Area 15 fawn production has been declining. Fawn production in 1989 was only 57 fawns per 100 does, representing the third consecutive year of low fawn production. The five-year average fawn production prior to 1987 was 75 fawns per 100 does (NDOW 1990). Between 1980's and the present the production of fawns has dropped from 60 fawns per 100 does to as low as 35 fawns per 100 does in 1996 (L. Teske 1997).

Within the boundary of the study area for the Trenton Canyon Project, there were five incidental sightings of mule deer during field studies conducted by Resource Concepts, Inc. (1996) during 1994 and 1995. These sightings involved a total of eight mule deer. A site reconnaissance visit to the Trenton Canyon Project area on November 19, 1996, resulted in the sighting of at least 12 mule deer (10 does/fawns and 2 bucks) in seven different groups of one to four animals (Smith, E. L. 1996). The principal, natural predator of mule deer, the mountain lion, has also been observed in the Battle Mountains.

Bats

Bat species most likely to occur within the project area are shown in Table 3-18. The scientific literature reveals that various bat species have become dependent on abandoned mines for roosting habitat and that seasonal use is a function of the species, the temperature, and the configuration of the mine. There are two critical periods for bats: winter hibernation and the summer maternity season. There are no active underground mines within a five mile radius of the project area. Abandoned mine prospects, adits, and shafts within a 10-mile radius of the Trenton Canyon mine area were identified through a review of the BLM's abandoned mine program data, the State of Nevada's records on abandoned mines, and the U.S. Geological Survey quadrangle maps.

Cold-Season Survey

A cold-season field reconnaissance was conducted for bats in January 1997, to assess the potential for bat roosting and foraging habitat (Brown-Berry Consulting 1997). The survey area had been defined as one mile around the mine, within historic mine workings.

No open underground mines were discovered during the cold-season survey. The shaft in Section 19, T33N, R43E, south of the active Marigold Mine, had recently been closed as had other mine workings in the immediate vicinity. The prospects in Section 1, T32N, R42E are shallow surface scrapes with no underground features that could be used by roosting bats. The same is true of the prospects located in the Trenton Canyon mine area in Sections 23 and 24, T32N, R32E. There is a single historic adit and a shallow prospect near the top of the ridge in Section 19, T32N, R43E. The numerous rock crevices within the project boundaries could shelter bats throughout the year, but these roosts are virtually impossible to identify.

Table 3-18
Bat Species Potentially Occurring in the Trenton Canyon Area

Common Name	Scientific Name
Townsend's big-eared bat*	*Corynorhinus townsendii*
Small-footed myotis**	*Myotis ciliolabrum*
Long-legged myotis**	*Myotis volans*
Long-eared myotis**	*Myotis evotis*
Fringed myotis	*Myotis thysanodes*
Yuma myotis*	*Myotis yumanensis*
California myotis*	*Myotis californicus*
Western pipistrelle	*Pipistrellus hesperus*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Silver-haired bat	*Lasionycteris noctivagans*
Pallid bat**	*Antrozous pallidus*
Spotted bat	*Euderma maculatum*
Mexican free-tailed bat**	*Tadarida brasiliensis*

* Found in the vicinity of Battle Mountain in recent surveys
** Detected at Trenton Canyon Project site during current survey

Warm-Season Survey

In July 1997 a warm-season survey was conducted to assess bat roosting and foraging habitat on lands within and adjacent to the proposed Trenton Canyon Project. Potential bat roosts, such as mines and rock crevices were searched during the day. At night, mist netting and ultrasonic bat detection equipment was used for evidence of bats or bat activity. Five bat species were identified in the Trenton Canyon Project area during the warm-season survey. These species were the Mexican free-tailed bat (*Tadarida brasiliensis*), whose guano was discovered below the cliffs in Cottonwood Canyon; long-eared, hairy-winged, and small-footed myotis (*Myotis evotis, M. volans,* and *M. ciliolabrum*) that were captured in mist nets; and the pallid bat (*Antrozous pallidus*) whose signals were recorded with an ultrasonic detector.

Riparian and/or Spring-Seep Areas - The riparian areas along Cottonwood Creek and in Trenton Canyon (i.e., a creek and canyon southwest of the project area) could provide good foraging habitat and a quality water source for resident bat species. The greatest bat activity was recorded near the stream crossing in Cottonwood Canyon below the aspens, as they provided roosting opportunities for some of the myotis, big brown (*Eptesicus fuscus*), hoary (*Lasiurus cinereus*) and silver-haired (*Lasionycteris noctivagens*) bats. Foraging surveys conducted in Cottonwood Canyon, Trenton Canyon, Mud Spring, Ames Spring, and an unnamed spring to the north of Mud Spring ("Mosquito Spring") recorded populations of long-eared, small-footed, and hairy-winged myotis.

Mines and Caves - Old mines and caves are ideal roosting habitat for bats. There were no mines or caves actively used by bats within the project area boundary. Two small historic mine workings located in the upper reaches of the north fork of Trenton Canyon and the Blackrock Mine (2 miles south of Trenton Canyon) did not contain bats or guano during the survey, but could serve as potential hibernacula. Adjacent mines in the Battle Mountain area have been found to provide roosting habitat for Townsend's big-eared bats (*Corynorhinus townsendii*), and an abandoned mine site in upper Trenton Canyon could provide shelter to hibernating big-eared bats.

Rock Crevices - Some bats (*Antrozous* and most of the *Myotis* species) use rock crevices and could also use mines if available. Many of the myotis species captured in the mist nets as well as pallid bats detected acoustically probably roost year round in the rock crevices on or near the Trenton Canyon Project. Some bat species, such as the spotted bat (*Euderma maculatum*) and the Mexican free-tailed bat would only be found roosting in rock crevices. No spotted bats were captured or detected acoustically in the area. The Mexican free-tailed bat guano found beneath the cliffs in Cottonwood Canyon was not fresh, and probably indicated use at another season (Brown Berry Consulting 1997). Although some Mexican free-tailed bats may be summer residents (since at least one echolocation signal was recorded during the survey), many are migratory and could use the canyons as stopovers during the spring and fall.

3.10.1.3 Birds

Three upland habitat types and two riparian corridors (Cottonwood and Trout Creeks) were sampled by transect; a total of 47 species of non-game birds were detected on these transects. Twenty-six of these species were observed in riparian habitats, compared with eleven in mountain big sagebrush, eight in Wyoming big sagebrush, and five in shadscale habitats. These results are consistent with the higher level of plant species diversity and structure, larger number of nest sites, greater food base, and readily available water associated with riparian habitats. Riparian habitats hosted a number of neotropical migratory species including yellow warbler, western tanager, western kingbird, warbling vireo and solitary vireo. Although not observed during June sampling, Cottonwood Creek is known to provide habitat for valley quail. Mountain big sagebrush and Wyoming big sagebrush shared several species including Brewer's blackbird, Brewer's sparrow, common raven, and sage grouse. Species present in shadscale habitats include horned lark, meadowlark, and sage sparrow (Resource Concepts, Inc. 1995). During site reconnaissance on November 19, several bird species were observed, including western meadowlark, loggerhead shrike, and about 500-750 gray-crowned rosey finches (L. Smith, 1997).

Raptors (birds of prey) were observed in the project area in association with rock outcrops, cliffs, and trees in riparian and juniper habitats. American kestrels were the most common raptor species, with golden eagle, great horned owl, burrowing owl, Cooper's hawk, northern harrier, red-tailed hawk, and turkey vulture also present. Raptors use the area for nesting and foraging, although available habitat is limited in the project area. No active nests were observed, however, previously used nest sites were present (e.g., stick nests in aspen trees and on cliff faces). There is at least one documented golden eagle nest in the project area (R. Lamp, Personal Communication, 1996).

Game birds observed during the 1994-1995 surveys were mourning dove, chukar, and sage grouse. Mourning doves are summer residents inhabiting riparian areas. Chukars prefer rocky ridges and cheatgrass covered slopes. Two coveys of chukars were observed in the Trout Creek drainage during August and September, 1995. Sage grouse are most commonly associated with big sagebrush communities in winter, preferring riparian habitats for brood rearing in the summer.

<u>Sage Grouse</u>

The Battle Mountain Range has been known historically to serve as sage grouse habitat. Few sage grouse were observed during 1994-1995 field baseline studies. The few birds seen were concentrated in upland habitats with only two observations of this species in riparian areas (Resource Concepts, Inc. 1996). The west side of Battle Mountain was surveyed for sage grouse in the spring of 1995, and no sage grouse strutting grounds, or leks, were identified. Three new grounds were observed on the top of the Battle Mountains, east of the project area. As a result of Native Americans reporting strutting grounds within the project area, the NDOW visited the identified sites along with a Native American guide, but were unable to verify any of the sites as active strutting grounds.

The Spring 1996 baseline surveys were conducted on February 8 and March 19 between 0515 and 0830. No sage grouse were observed within more than 100 yards of the access corridor for the Trenton Canyon mine, or on the bench between Trout and Cottonwood Creeks on both survey dates.

Two helicopter surveys were conducted to observe areas formerly used as sage grouse leks. Observations made between 0530 to 0815 hours on April 2, 1997 included low elevation sites of existing disturbance and mine expansion sites as well as alluvial fans and foothills from Ames Spring southwest to Trenton Canyon. No sage grouse were observed.

A second flyover occurred April 8, 1997 between 0630 and 0915 hours that observed the same area as the April 2 flight, as well as the higher elevations in the North Peak mining area south to the Humboldt and Lander County boundary. Sage grouse were observed in three locations within the project area during the two days of flight surveys. Six males were sighted near the N. Fork Trout Creek at around 7420 ft. elevation (Section 10, T32N, R43E); two males flushed from a ridge at about 8000 ft., one quarter to one half mile west of the Proposed TC-6 overburden disposal area (Section 19, T32N, R43E); and one hen flushed from a site between Trout and Cottonwood Creek at about 7260 ft. elevation (Section 19, T32N, R43E).

Native Americans initiated another site visit on May 7, 1997 and investigated old lek sites for current activity. Droppings, approximately 4 to 6 months old were located in the NW ¼ of Section 1, T32N, R42E, approximately one-half mile from the proposed ancillary facility. However, the site did not appear to be a high-use area and there was no evidence of strutting activity.

3.10.1.4 Reptiles and Amphibians

Approximately eighteen reptile and four amphibian species were observed, or are likely to occur, within the project area (Resource Concepts, Inc. 1995). Reptiles include one skink, ten lizards, and seven snakes. Shadscale and Wyoming sagebrush communities are believed to support the greatest diversity of reptile species. Field baseline studies in 1995 verified the presence of six species of lizard: short-horned lizard, northern desert horned lizard, northern sagebrush lizard, Great Basin fence lizard, side-blotched lizard, and desert spiny lizard. Of the seven possible species of snakes that could occur on the project site, only Great Basin rattlesnake and gopher snake were confirmed present. Amphibians, including Great Basin spadefoot, pacific treefrog, spotted frog, and northern leopard frog, are generally limited to aquatic habitats, although the spadefoot is adapted to survival in ephemeral water sources. The spotted frog and leopard frog are highly aquatic species. The treefrog may spend a great deal of time out of the water, but does require permanent water. Of this group of amphibians, only the Great Basin spadefoot toad was observed during field studies in the project area (Resource Concepts, Inc. 1995).

3.10.2 Aquatic Biology

3.10.2.1 Aquatic Habitat

Aquatic habitats are represented by Cottonwood Creek and Trout Creek, two small streams that traverse a portion of the project area. Both streams flow to the north and are part of the Humboldt River drainage system, however, portions of these streams are intermittent in the project area. The headwaters of the perennial reach of Cottonwood Creek are located in the extreme southern part of the project area. Portions of the headwaters of Cottonwood Creek are actually off the project area. Conversely, Trout Creek does not originate in the project area, but flows through it. There are eight springs in the area, five of which are perennial and three which flow in response to storm events. Springs often are an important source of water for wildlife in a relatively dry area.

3.10.2.2 Fish

Cottonwood and Trout Creeks are intermittent along portions of their lengths, limiting their ability to support fish populations. Brook trout were observed in both creeks during site visits in 1994 and 1995 (Resource Concepts, Inc. 1995). Cottonwood Creek supports a viable fish population along 0.5 mile where perennial flows are present and a few deep pools with dense willow cover provide habitat for fish. Spawning substrate is not abundant (Resource Concepts, Inc. 1995).

Trout becomes intermittent about 0.25 miles downstream of the project boundary. A viable fish population exists in the perennial reach of the creek. Macroinvertebrate populations, the primary food source for fish, were apparently healthy in both creeks, although macroinvertebrate productivity is not known.

A detailed description of the stream morphology and aquatic habitat is presented in the baseline report completed by Resource Concepts, Inc. (1995).

3.10.2.3 Macroinvertebrates and Insects

Stream bioassessment surveys were completed for Cottonwood and Trout creeks to determine the biological condition of the habitats (Resource Concepts, Inc. 1995). These surveys included classifying benthic taxa according to their relative sensitivity to pollution. Three sample stations were established on Cottonwood Creek and four on Trout Creek. Both creeks contained a varied benthic community characteristic of a cobble/boulder substrate (Resource Concepts, Inc. 1995). Species present included mayflies, stoneflies, caddisflies, chironomids, and a wide variety of organisms including aquatic earthworms, mollusks, and terrestrial riparian insects. The majority of species found in Cottonwood and Trout Creeks were within the orders Diptera (true flies) and Trichoptera (caddisflies). A wider range of families were represented in Cottonwood Creek samples than within Trout Creek over the same sampling period. Results of these surveys indicate that the water quality of both of these creeks is good. The kinds and numbers of pollution-sensitive invertebrates found indicated that chemical and heavy metal pollutants were not present. The downstream stations on both creeks received scores indicating slight to moderate impairments compared with upstream stations, which fell in the slightly impaired category.

3.10.3 Threatened, Endangered, or Sensitive Animal Species

Several special status species are present within northern Nevada, however, few species have been documented for the project area. Information regarding special status species known or likely to occur within the project area was provided by the USFWS, BLM, and the NNHP.

Special status species are those species which are listed as threatened, or endangered, or proposed for such listing, or candidates for listing by the USFWS, are BLM sensitive species, or are considered species of concern by the state. On February 28, 1996, USFWS revised the federal candidate species lists, omitting the category Candidate 2 listing and developing a candidate list only. Many of those Candidate category 2 species were dropped from consideration for listing. There is still a concern that at some point in the future, they may be eligible for listing. As a result of this new listing, the BLM established guidelines for the protection of these former candidate species and has designated them as BLM sensitive species.

No species federally listed as threatened or endangered were identified as present in the area, nor does suitable habitat for such species exist. Eight mammal, three bird, and one amphibian species were identified by the USFWS as sensitive and potentially occurring within the project area, although appropriate habitat is not present in the project area for all twelve species. The scientific and common names for each species, the typical habitat, status, and potential for occurrence in the project area are presented in Table 3-19.

3.10.3.1 Mammals

Several sensitive bat species have the potential to be present within the project area (Table 3-18). Occurrence and habitat for bats is discussed in Section 3.10.1.2. Although no specific locations are known, foraging habitat and potential roosting sites for spotted bat, small-footed myotis, long-eared myotis, and long-legged myotis are present in the project area.

The pygmy rabbit is distributed throughout sagebrush communities in the northern Great Basin. Areas of dense sagebrush provide food and cover, while deep soils are required for their burrows. Limited habitat for the pygmy rabbit occurs in dense sagebrush areas. This rabbit is a BLM sensitive species and a game species in the State of Nevada.

3.10.3.2 Birds

The northern goshawk is a year round resident in Nevada, occupying various habitats depending upon the season. Northern goshawk generally nest in aspen stands along perennial creeks. It is unlikely that nesting would occur in the area because the creeks within the project area are intermittent and most aspen stands present are of limited areal extent. No nest sites have been identified in the project area.

Ferruginous hawks breed throughout Nevada, nesting typically in pinyon juniper communities, rock outcrops, cut banks, or on the ground (Terres 1991). Potential habitat for ferruginous hawk is located adjacent to Cottonwood Creek where sagebrush is interspersed with scattered juniper. Juniper stands are limited in the area, occurring in the vicinity of the proposed Trenton Canyon pits.

Table 3-19
Special Status Species That May Occur in the Trenton Canyon Project Area

SPECIES NAME		Habitat	Potential for Occurrence in the Project Area
Common Name	**Scientific Name**		
MAMMALS			
Pygmy Rabbit	*Brachylagus idahoensis*	Soft soil in tall, dense sagebrush	Some potential habitat exists, however no individuals have been observed
Spotted Bat	*Euderma maculatum*	Occupy a variety of habitat, forage over meadow or sage; may roost in rock crevices and canyons	Potential habitat exists in the project area
Small-footed Myotis	*Myotis ciliolabrum*	Inhabit juniper, chaparral, and riparian areas; roost in rock crevices and tree bark	Good quality riparian areas and roost sites exist in the project area
Long-eared Myotis	*Myotis evotis*	Prefers juniper and conifer forests; roosts sites include trees, mines, buildings, or rock crevices	Habitat and roost sites are present in the study area
Fringed Myotis	*Myotis thysanodes*	Prefer oak woodlands; but range from low deserts, to grasslands, to ponderosa pine; roost sites include rock crevices, caves, mines, and buildings	Preferred habitat and roost sites are not present in the project area
Long-legged Myotis	*Myotis volans*	Inhabit juniper and coniferous forests; roost in rock crevices, cliffs, and buildings	Habitat and roost sites exist in the project area
Townsend's Big-eared Bat	*Corynorhinus townsendii townsendii* (formerly g. *Plecotus*)	Mines and caves for roosting	Foraging habitat is present One adit may be winter roost
BIRDS			
Northern Goshawk	*Accipiter gentilis*	Prefer older age mixed coniferous and deciduous forest habitat; nest in larger trees, often ponderosa; aspen stringers along perennial streams	No reported observations; aspen along Cottonwood Creek provide limited nesting habitat
Western Burrowing Owl	*Athene cunicularia hypugea*	Level, open, dry habitats with available burrows; perch sites are generally in the vicinity	Project area is within range for this species.
Ferruginous Hawk	*Buteo regalis*	Nest in pinyon and juniper trees near the edge of sagebrush shrublands	Limited suitable habitat exists
AMPHIBIANS			
Spotted Frog	*Rana pretiosa*	Aquatic habitats, prefers ponds and quiet waters; known from the Humboldt River	Creeks within the project area are potential habitat

Source: Johnsgard 1988, Resource Concepts, Inc. 1995, USFWS 1996, NV Natural Heritage Program 1996

Western burrowing owls inhabit open, dry habitats where burrows are available (Johnsgard 1988). This species is tolerant of disturbance and can be induced to use artificial nests. The project area is within the known range for this owl, although no survey data is available.

3.10.3.3 Amphibians

The spotted frog, a federal candidate species, occupies open perennial water. The Humboldt River is the closest known habitat for the spotted frog. Additionally, spotted frogs are found in creeks at elevations typical of those in the project area (Stebbins 1985).

3.11 RANGE

Range resources are described for the project area according to (1) management units or allotments, (2) permittees that are licensed to use these areas, (3) livestock numbers and seasonal use, and (4) features and improvements that facilitate livestock use of these resources.

3.11.1 Allotments and Permittees

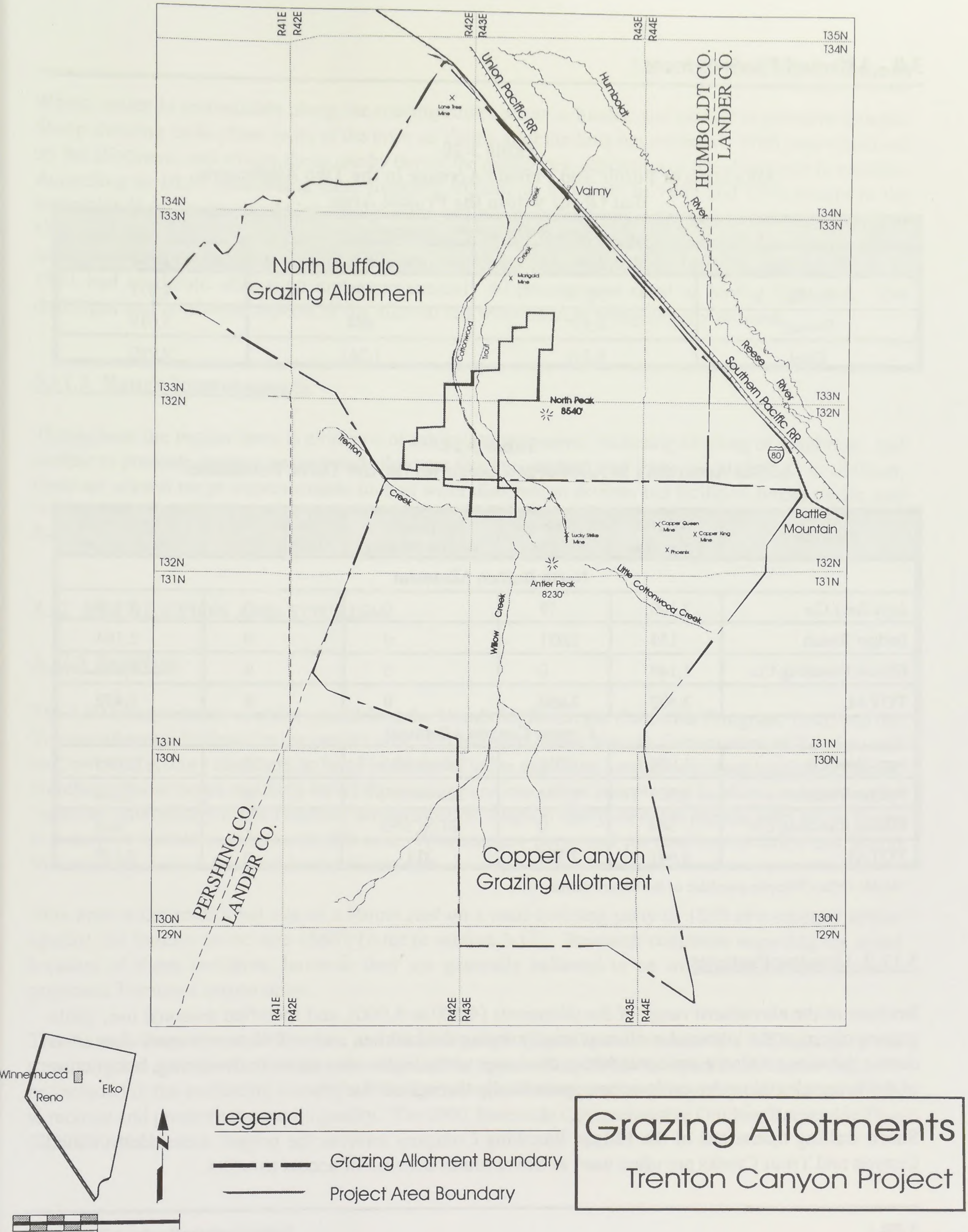
The project area encompasses parts of the North Buffalo and Copper Canyon livestock grazing allotments. The boundary between these allotments occurs at the Humboldt and Lander County line, and also at the boundary between the Winnemucca and Battle Mountain BLM Districts (Figure 3-17). Both allotments are administered by the Battle Mountain BLM District office.

Because private ownership of every other section by the Santa Fe Pacific Gold Corporation occurs in the project area, portions of private sections have been leased to the livestock permittees through an exchange of use with the BLM. The North Buffalo allotment consists of 88,700 acres of which 51,600 acres are on public land. The Copper Canyon allotment consists of 108,300 acres, and 57,400 acres are on public land.

Within the project area, 4,371 acres of the allotments are on public land and 5,619 acres are on private land, with most of this area occurring within the North Buffalo Allotment (Table 3-20).

Three permittees are licensed for livestock grazing within the two allotments. The Badger Ranch is allotted the greatest number of AUMs at 7,594 and operates a year-round cow-calf operation (Table 3-21). The Agri-Beef operation is allotted 4,150 AUMs and conducts limited grazing at lower elevations.

The Ellison Ranching Company has the smallest number of AUMs at 1,578, and they trail sheep through the area in spring and fall. Agri-Beef also trail sheep through the project area, and do not use the area for grazing on a long-term basis. The carrying capacity for the project area has been adjudicated at 14.3 acres per AUM.



Grazing Allotments

Trenton Canyon Project

Figure 3-17

Table 3-20
Allocation of Public and Private Acreage in the Two Allotments that Occur within the Project Area

Acreage of Ownership Allotment			
Ownership	**North Buffalo**	**Copper Canyon**	**Total**
Public	3,814	557	4,371
Private	4,935	684	5,619
Total	8,749	1,241	9,990

Table 3-21
AUMs According to Allotment Categories for the Three Permittees

Permittee	Active Permittee	Exchange of Use	Suspended AUMs Mining	Suspended AUMs Other	Adjudicated Preference
North Buffalo Allotment					
Agri-Beef Co.	2,100	19	0	0	2,119
Badger Ranch	153	2,031	0	0	2,189
Ellison Ranching Co.	1,149	0	0	0	1,149
TOTAL	**3,402**	**2,050**	**0**	**0**	**5,452**
Copper Canyon Allotment					
Agri-Beef Co.	1,020	1,011	64 on 3/93	0	2,095
Badger Ranch[1]	3,637	1,773	224 on 3/93	0	5,634
Ellison Ranching Co.	384	0	24 on 3/93	0	408
TOTAL	**5,041**	**2,784**	**312**	**0**	**8,137**

[1]AUMs reflect Filippini purchase of the Chiara permit.

3.11.2 Grazing Patterns

Because of the elevational range of the allotments (4,500 to 8,000), and specified seasonal use, cattle grazing occurs at the higher elevations primarily during the summer, and at the lower or snow-free areas during the winter. Cattle are herded from the lower to the higher elevations in the spring, but grazing of the lower elevations by cattle occurs sporadically throughout the year.

Sheep trailing operations of the Ellison Ranching Company traverse the project area. Cottonwood Canyon and Trout Creeks are often used as travel routes because of access to water.

Where water is unavailable along the trailing route, water is hauled and placed in portable troughs. Sheep shearing takes place south of the town of Valmy after lambing has occurred. With year-round use on the allotment, and winter sheep use by two of the permittees, utilization of the allotments is variable. According to BLM monitoring data, livestock utilization was light in 1989 and 1990 except in the bottomlands of Trenton and Cottonwood Canyons where utilization was rated as moderate (Resource Concepts, Inc. 1996). In 1991, utilization of the Copper Canyon allotment was rated as light, but was heavy in drainages and bottomlands while approximately 55 percent of the North Buffalo allotment in 1991 had moderate utilization and approximately 40 percent was rated as having light use. The drainages and northwest aspects of the alluvial fan were rated as being heavily utilized.

3.11.3 Range Improvements

Throughout the region there is evidence of range improvements, including clearing of sagebrush and juniper to promote grasses, pasture and allotment fencing, seeding, and prescribed burning. In addition, there are several range improvements such as water distribution devices and facilities, fences, wells, and water tanks. Specific livestock water sources occur at alluvial fan springs in Sections 16 and 20, T33N, R43E.

3.12 RECREATION AND TOURISM

3.12.1 Tourism

The I-80 transportation corridor, paralleling the Humboldt River, the California Emigrant Trail, and the Transcontinental Railroad in the project area, is considered by the Nevada Commission on Tourism and its Cowboy Territory members, to be of exceptional value regarding local and regional tourism potential. Numbers of tour buses regularly travel this corridor and one of the interpretive localities pointed out by "step-on" interpreters is the Trenton Canyon locality. Step-on interpreters are persons who get on buses to interpret certain segments, in this case, Winnemucca personnel for east-bound buses and Battle Mountain personnel for west-bound buses.

This area is the traditional site of a Paiute raid on a road-building party in 1857 or a military action against the Paiutes in the late 1860's (refer to section 3.17). Research continues regarding the exact location of these incidents, however they are generally believed to be within the viewshed of the proposed Trenton Canyon mine.

The Nevada Department of Tourism and BLM are expecting to heavily market the I-80/historic trails transportation corridor for tourism potential with the approaching 2002 Olympics in Salt Lake City. To be included in the marketing material will be the history of mining and contemporary reclamation efforts to recover and preserve the scenic quality. The 1992 Statewide Comprehensive Outdoor Recreation Plan (SCORP) stresses:

"The protection of Nevada's natural, cultural and scenic resources is a critical part of recreation planning throughout the state.

Natural, cultural and scenic resources all contribute to the recreational resource base of Nevada. The proper balance of the natural environment, with the cultural history and scenic beauty of the state are important considerations in recreation planning at all levels."

The SCORP further characterizes the significance of rural scenery:

"In rural areas, open space generally relates to the unique scenic character of Nevada with wide open, undeveloped valleys, dramatic adjacent mountain ranges and outstanding unobstructed vistas."

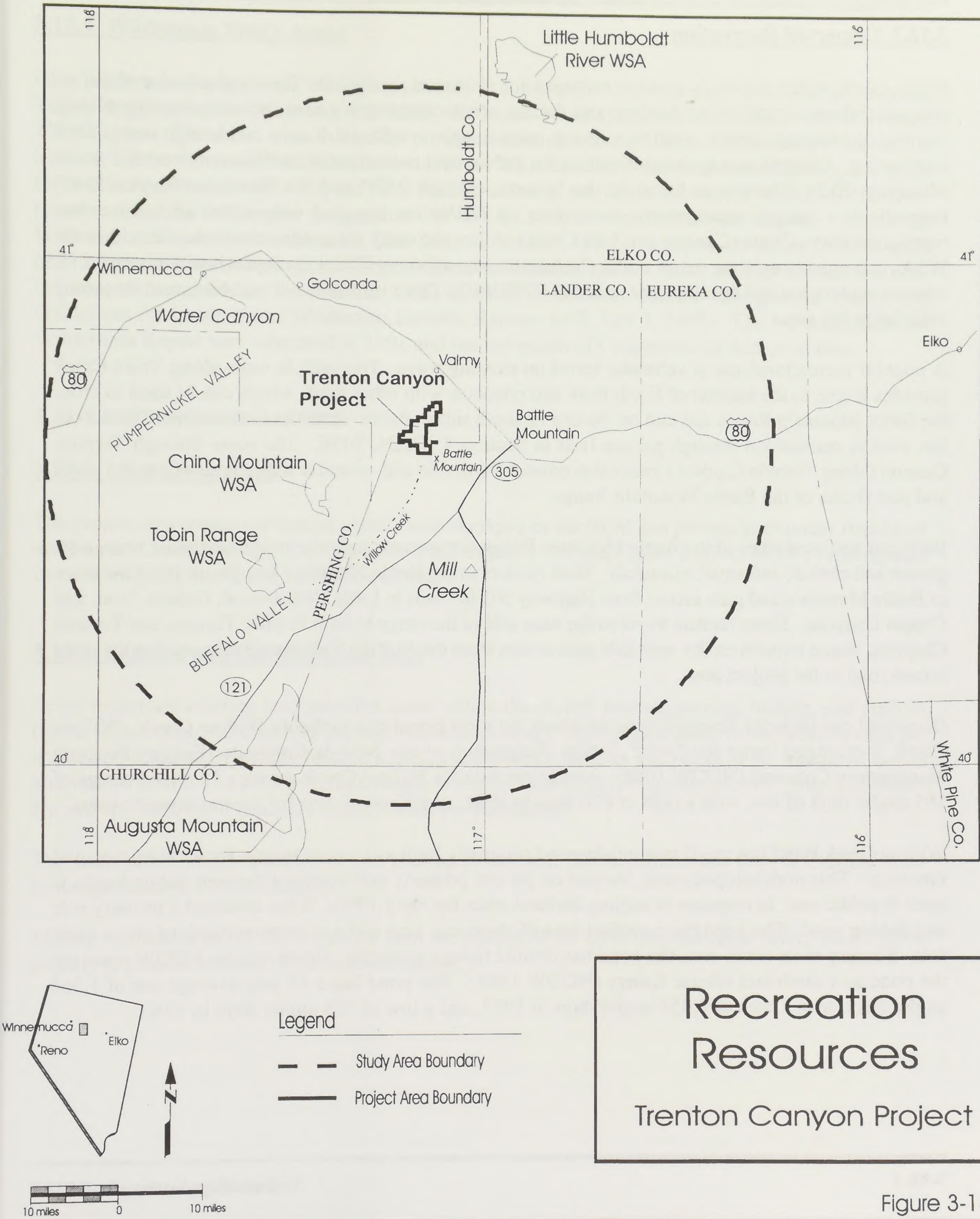
"In both urban and rural areas, river corridors, such as along the Truckee, Carson, Humboldt, and Colorado rivers, are valuable open space resources and help to preserve the scenic character and value of the area."

3.12.2 Developed Recreation Areas

There are two BLM recreation areas within the study area: Mill Creek Recreation Area located 24 miles south of Battle Mountain, and Water Canyon located 2 miles south of Winnemucca (Figure 3-18). Mill Creek is accessed from Highway 305 and is in the Shoshone Range. The area is shaded by tall cottonwoods in a canyon setting. The creek supports brook trout and is a popular fishing area. The fifteen year average use is 733 angler days; a high of 1,502 angler days was recorded in 1980, and a low of 348 angler days was recorded in 1992 (NDOW 1998). The variation in use is due to fluctuations in creek flow caused by annual precipitation levels. The Mill Creek site has ten tent sites with picnic tables, fire rings, and toilets. Recreation opportunities include camping, deer and upland bird hunting, fishing, wildlife viewing, mountain biking, hiking, sightseeing, and rock and flower collecting.

Water Canyon is a secluded mountainous area on public lands along Water Canyon Creek in the Sonoma Range that is frequented by residents of Winnemucca. The perennial stream supports a high-quality riparian environment that is attractive for day-use including picnicking, mountain biking, hiking, hunting, OHV use, and wildlife viewing. Some limited camping use is also made of the canyon although no formal campsites have been developed. At the present time, there are only limited developed facilities, but a Recreational Management Plan for the area has been written and is awaiting implementation (USDI BLM 1993).

The Willow Creek area receives a large amount of recreational use. There is one developed fishing area in the Willow Creek drainage. It is located on the south side of the mountain about four miles from the south end of the project area. Ponds behind two small dams on the creek support a natural shade cover of willow and cottonwood. Camping and fishing are popular at this site.



Recreation Resources

Trenton Canyon Project

Figure 3-18

3.12.3 Dispersed Recreation

Public lands within the study area are managed for dispersed recreation. The most popular dispersed recreational opportunities are hunting and fishing. Non-consumptive uses include camping, hiking, visiting old mining camps, wildlife viewing, photography, rock and flower collecting, and general sightseeing. General management direction for public land recreation in the Winnemucca and Battle Mountain BLM Districts is found in the Sonoma-Gerlach MFP and the Shoshone-Eureka RMP, respectively. Special management restrictions on OHVs are imposed only at the recreation sites mentioned above (Water Canyon and Mill Creek) within the study area. Motor vehicle use within the WSAs is limited to existing routes under the Interim Management Policy, except where authorized for mineral exploration and development under 43 CFR 3802. There is little use of trail bikes and all-terrain vehicles in the area.

A popular recreational use is vehicular travel on existing ways. The vehicle route along Trout Creek provides access to the summit of North Peak and connects with other roads which can be used to cross the Battle Mountain Range and exit on the east or south sides. Public access to Cottonwood Creek from the west is maintained through private land in Section 7, T32N, T43E. The route through Trenton Canyon (along Trenton Canyon Creek) also crosses the divide and connects with routes down the south and east flanks of the Battle Mountain Range.

Both east and west sides of the Battle Mountain Range are used extensively for hunting mule deer, sage grouse and chukar, and small mammals. Most hunters in the Battle Mountain Range are from the town of Battle Mountain and gain access from Highway 305 to roads in Little Cottonwood, Galena, Iron, and Copper Canyons. Some hunters travel to the west side of the range to hunt in Mill, Timber, and Trenton Canyons. Some hunters on the west side gain access from the Buffalo Valley road intersecting the main access road to the project area.

Dispersed use includes stream fishing of which the most popular is probably Willow Creek. Willow Creek is managed under the "wild" fishery designation of the Nevada Coldwater Fishery Program Management Concepts (NDOW 1988). Angler use data for Willow Creek shows a 15-year average of 165 angler days of use, with a high of 870 days in 1981, and a low of zero for several drought years.

Willow Creek Pond is a small man-made pond originally built as a water supply for local mining and ranching. This undeveloped pond, located on private property and accessed through public lands, is open to public use. In response to angling demand since the early 1960s, it has assumed a primary role as a fishing pond. The pond has a surface area of about one acre and a maximum depth of about eight feet. Because of its small size, the pond has limited fishing potential. However, the NDOW manages the pond as a catch and release fishery (NDOW 1988). The pond has a 15 year average use of 1,364 angler days, with a high of 3,358 angler days in 1982, and a low of 728 angler days in 1980.

3.12.4 Wilderness Study Areas

Four Wilderness Study Areas (WSAs) are partially or completely within the study area: China Mountain, Tobin Range, Augusta Mountain 'and Little Humboldt River (Figure 3-18). These WSAs include 155,050 acres of land that were studied for possible inclusion into the National Wilderness Preservation System. Of the four, only the Little Humboldt River WSA contains portions recommended by the BLM for wilderness designation. Of the total 42,213 acres in the Little Humboldt WSA, 29,775 were recommended for wilderness designation (Nevada BLM Statewide Wilderness Report, Volume III, Winnemucca District and Volume IV, Elko District, October, 1991.) However, the entire 155,050 acres of WSAs have been submitted to Congress for consideration and are being managed under the non-impairment standards in the interim. (USDI, BLM, H-8550-1, Interim Management Policy and Guidelines for Lands Under Wilderness Review, Release 8-67, July 5, 1995). The Nevada Statewide Wilderness Report was submitted in 1991 and has not received Congressional Action to date.

3.13 LAND USE AND ACCESS

3.13.1 Land Ownership

The project area consists of federal public lands managed by the BLM and private lands under Humboldt and Lander County jurisdiction. See Table 3-22, Figure 3-19, and Figure 3-20 for ROW, existing land use, and existing ROW and surface ownership.

3.13.2 Existing and Planned Land Uses

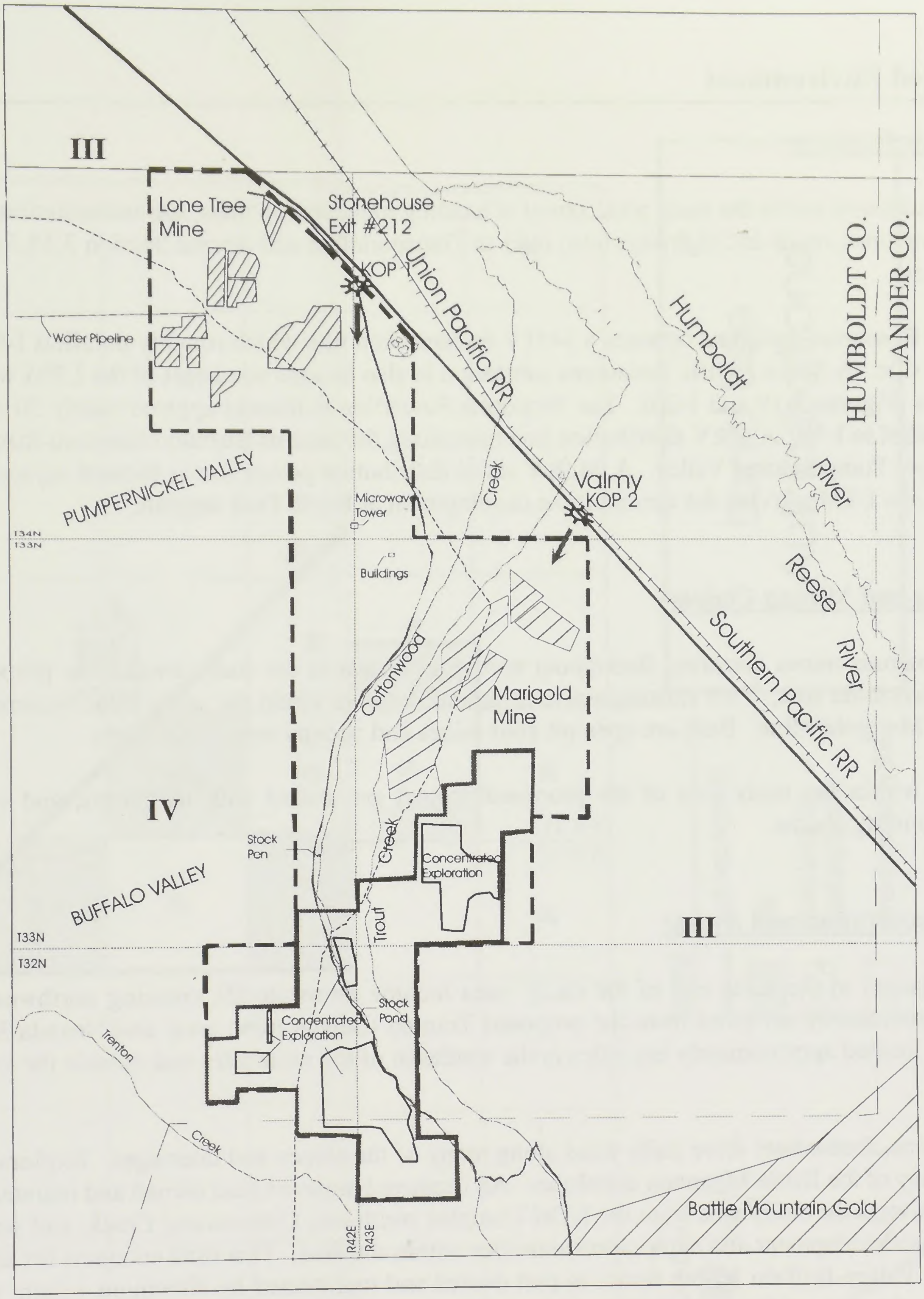
Some important existing land uses that occur within the region include grazing, mining, and utilities (Refer to the Range Section 3.11 for discussion on grazing). Agricultural lands in northern Nevada are sparse and dispersed, typically located adjacent to perennial streams and rivers in the middle of basins and valleys or at the base of mountain ranges where natural runoff or springs provide irrigation water. No actively cultivated lands are found within the study area.

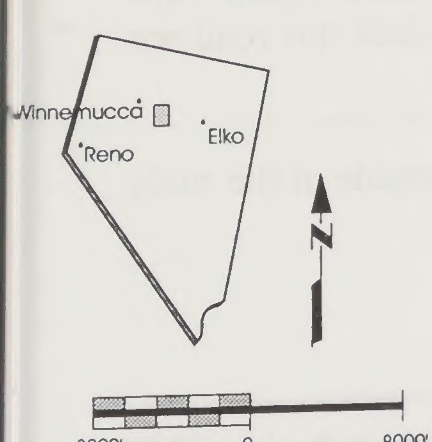
The study area contains portions of two grazing allotments: North Buffalo and Copper Canyon (refer to Range Section 3.11 for details).

Mining operations in the study area for land use consist of the LTM and Marigold Mine. Exploration activity is present in much of the surrounding area.

Table 3-22
Land Use Authorizations Within the Region

ROW No.	ROW Holder	Description
CC-04690	Union Pacific Rail Road	railroad
CC-021136	Nevada Dept. of Transportation	highway
CC-023029	Sierra Pacific Resources	powerline
NEV-043253	Southern Pacific Rail Road	rail road
NEV-058529	Sierra Pacific Power Co.	powerline (7.2kV) (ROW 40')
NEV-059166	Nevada Dept. of Transportation	highway
NEV-066891	Sierra Pacific Power Co.	powerline (120kV) (ROW 75')
N-16360	Nevada Bell	telephone/telegraph line
N-18682	Sierra Pacific Power Co.	powerline (120kV)
N-24394	Sierra Pacific Power Co.	powerline (345kV)
N-24394	Sierra Pacific Resources	powerline
N-25227	Sierra Pacific Power Co.	N. Valmy Station powerline (23kV), water pipeline (18"), patrol road
N-49557	Sierra Pacific Resources	powerline
N-56724	Santa Fe Pacific	access road (40')
N-56779	Santa Fe Pacific	haul road
N-57541	Nevada Bell	telephone/telegraph line
N-57602	Santa Fe Pacific	haul road
N-58636	Santa Fe Pacific	haul road
N-59591	Santa Fe Pacific	access road, haul road, water pipeline (6")
N-59592	Santa Fe Pacific	water pipeline (10"), road and fiber optic comm. cable (ROW 100')
N-59986	Santa Fe Pacific	powerline (24.9kV) (ROW 30')
N-60381	BLM	N. Buffalo Allotment fence
N-7639 A	Sierra Pacific Power Co.	powerline (345kV)
R-4381		fence
R-4384		fence
R-4395		fence





Legend

- Study Area Boundary
- Project Area Boundary
- Key Observation Point
- III Visual Resource Management Class
- Visual Resource Management Class Boundary

Note: All BLM rights-of-ways are illustrated on Figure 3-20

Land Use and Visual

Trenton Canyon Project

Figure 3-19

3.13.3 Linear Features

Linear facilities found within the study area consist of existing transmission lines, sub-transmission lines and distribution lines, roads and highways (also refer to Transportation and Access Section 3.13.5), and water pipelines.

Sierra Pacific Resources owns and operates a 345kV transmission line which roughly parallels I-80 on the southeast side. A Sierra Pacific Resources substation is also located southeast of the LTM within the study area (Figures 3-19 and 3-20). The Woodpile Powerline is located approximately 20 miles south and parallel to I-80. A 12kV distribution line runs along the base of Buffalo Mountain from the LTM into upper Pumpernickel Valley. A 24.9kV aerial distribution power line is located adjacent to the road from the LTM, serving the current mine development at North Peak deposit.

3.13.4 Mines and Mining Claims

There are numerous mines dispersed throughout northern Nevada in the study area of the proposed Trenton Canyon mine area. Two existing active mines are located within the study area: Newmont's LTM and the Marigold Mine. Both are open pit gold mines and occupy over 4,900 acres.

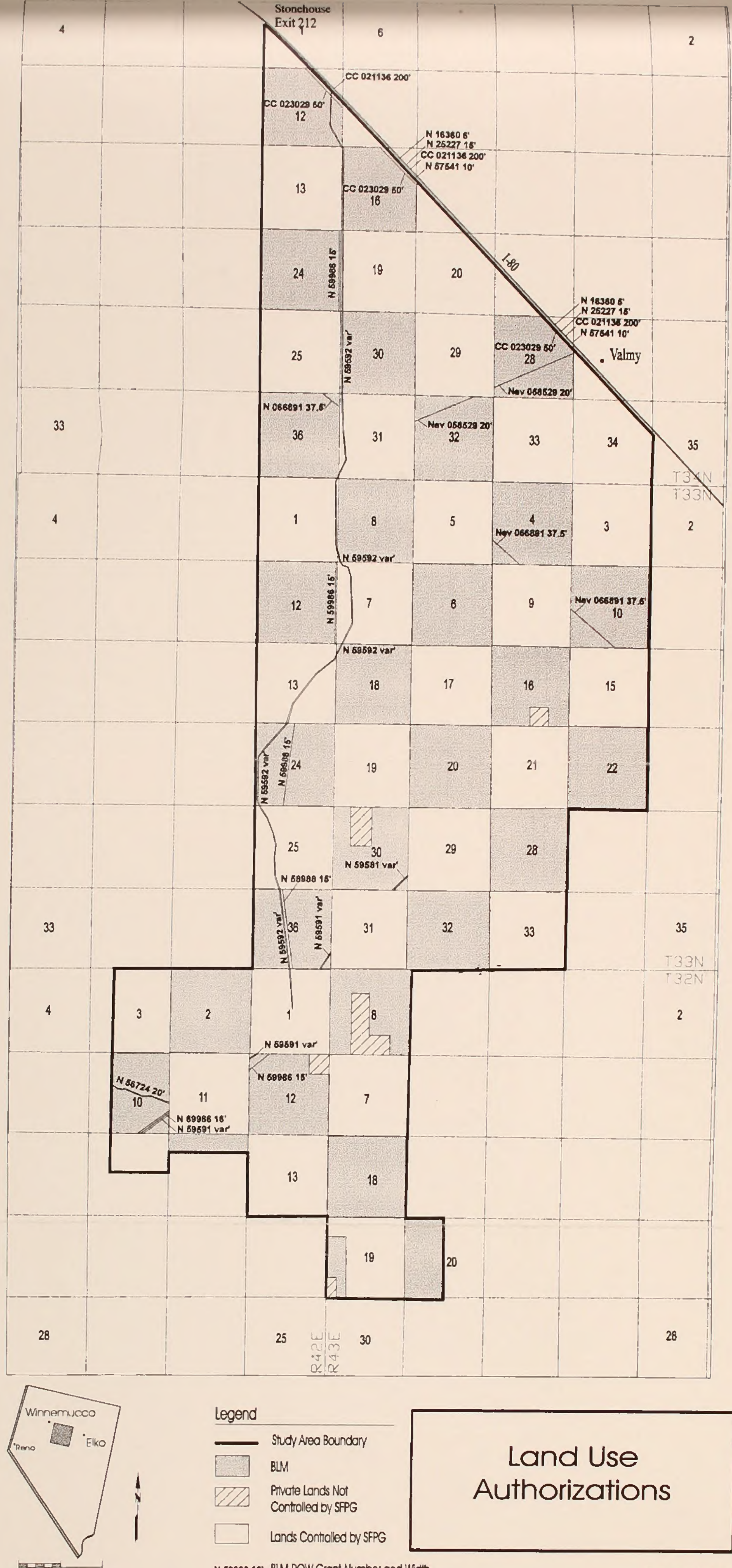
Public lands within the study area of the proposed project are staked with numerous, and often overlapping, mining claims.

3.13.5 Transportation and Access

Highways adjacent to the north end of the study area include Interstate 80, crossing northwest to southeast approximately ten miles from the proposed Trenton Canyon mine area, and Nevada State Highway 305, located approximately ten miles to the southeast of the mine sites and outside the study area.

In the mountains, four-wheel drive trails wind along many of the slopes and drainages. Exploration roads cross many of the Battle Mountain sideslopes. An improved unpaved road owned and maintained by Newmont bisects the study area from the LTM Complex south into Cottonwood Creek, and serves the current mine development and exploration activities within the area. This road connects for about 2 miles to the Valley-Buffalo Valley Road, in part owned and maintained by Newmont which runs southwest from the town of Valmy to Buffalo Valley. Humboldt County does not include this road nor other roads within the study area in their road system.

Union Pacific and Southern Pacific Railroads run parallel and northeast to I-80 and outside of the study area.



Land Use Authorizations

Figure 3-20

January 1997

3.14 VISUAL

The landscapes in the study area of the proposed Trenton Canyon Project are in the Basin and Range physiographic province, which is characterized by open, expansive views and minimal overstory vegetation. Topographically, this landscape is distinguished by isolated, roughly parallel mountain ranges separated by broad valleys draining northeast toward the Humboldt River. The mountains are typically 5 to 10 miles in length and are generally north-south trending. Surrounding the base of the mountains and extending into the broad valleys are distinctive alluvial areas.

The visual resource analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the proposed Trenton Canyon mine expansion.

3.14.1 Scenic Quality

Scenic Quality ratings were interpreted from the existing VRM mapping in BLM files. Scenic quality is rated for homogeneous landscape units. The peak, north-facing and east-facing slopes, of the Battle Mountain were rated in the early 1980s as Scenic Quality level B, which generally means distinctive and with some variety, though somewhat similar to other landscapes within the region. Since BLM's initial inventory, much mineral exploration activity has occurred on and near Battle Mountain. Because of these landscape modifications, scenic quality is currently rated as C. The west-facing slopes of Battle Mountain, lower Cottonwood Creek, and the Buffalo Mountains are all rated as Scenic Quality level C. A Scenic Quality level C rating is for landscapes that are considered common to the region and with little variety or visual interest.

3.14.2 Sensitive Viewpoints and Visibility

Views are open and expansive, as is common throughout the Great Basin Physiographic region. I-80, the only sensitive viewpoint, is classified as a moderate sensitivity viewpoint because the use volume of the traffic indicates high sensitivity, but the user attitude considers low sensitivity. Most of the I-80 traffic is destination-oriented; which generally means the viewers focus primarily on the road. However, a component of the viewers would scan the landscape and consider the visual quality of the landscape as important. Key observation point (KOP) 1 has been identified as the eastbound lane of I-80 from the Stonehouse exit. KOP 2 is the westbound lane of I-80 at the Valmy exit for the town of Valmy and Marigold Mine.

3.14.3 Visual Resource Management (VRM) Class

The current BLM Visual Resource Management (VRM) Manual (Section 8411 - Upland Visual Resource Inventory and Evaluation) formed the basis for developing a consistent methodology for the visual resource inventory, and for assessing visual impacts of the Proposed Action and alternatives. The VRM classes for BLM-administered lands establish the guidelines for the level of acceptable visual change allowed in the landscape (Table 3-23).

Visual Resource Management Classes set limits to the amount of contrast which will be allowed in an area between a management activity (road, powerline, fence, etc.) and the existing landscape. Lands surrounding the Trenton Canyon Project fall into either Class III or IV (Figure 3-19). Class IV is the least restrictive of the two classes. A management activity in this class could draw attention as a dominant feature in terms of scale, but attempts should be made to minimize the contrast by repeating form, line, color, and texture of the characteristic landscape. Buffalo Valley and lands south of I-80 fall into Class IV designation (Figure 3-19).

In a Class III area, contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However the changes should remain subordinate to the existing characteristic landscape (BLM VRM Manual, Section 8411 - Upland Visual Resource Inventory and Evaluation).

The BLM considers scenic quality, visual sensitivity of viewers, and visibility and distance from sensitive viewpoints when designating VRM classes. Data gathered during the inventory was supplemented with other mapped and derived data, including mapping of existing land uses, visibility from sensitive viewpoints, scenic quality, and visual contrast levels. The impact assessment used these data to determine the potential impacts to scenic quality and sensitive viewers, and to determine compliance or noncompliance with the BLM VRM objectives.

The study area is all within VRM Class III and IV (Table 3-23 and Figure 3-19). The majority of the direct impact area is within Class III, with the exception of the North Peak mining area. The objective of VRM Class III is to partially retain the existing character of the landscape. Activities may attract attention, but should not dominate the view.

The management objective of VRM Class IV is to provide for activities that require major modification of the existing character of the landscape. The level of change to the landscape can be high.

Table 3-23
Matrix for Determining Visual Resource Management (VRM) Classes

SCENIC QUALITY	VISUAL SENSITIVITY: High				Moderate			Low
Class A	II	II	II		II	II	II	II
Class B	II	III	III*	IV	III	IV		IV
Class C	III	IV	IV		IV	IV	IV	IV
Distance Zones	**fg/mg**	**bg**	**ss**		**fg/mg**	**ss**	**ss**	**ss**

Scenic Quality

Class A: Outstanding areas where characteristic features are distinctive or unique in the region.

Class B: Above average areas in features provide variety. Although not rare in the surrounding region, they provide sufficient visual diversity to be considered moderately distinctive.

Class C: Common areas where characteristic features have little variation in relation to the region.

VRM Classes

Class I**: Provides primarily for natural ecological changes. Allows very limited activity; any contrast created must not attract attention.

Class II: Changes caused by management activities should not be evident in the characteristic landscape. A contrast may be seen, but should not attract attention.

Class III: Contrasts caused by management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing characteristic landscape.

Class IV: Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the changes repeat the basic elements inherent in the characteristic landscape.

Distance Zones

fg/mg = foreground/middleground (0 to 3 - 5 miles)
bg = background (remaining area up to 15 miles)
ss = seldom seen (unseen or beyond 15 miles)

*If the area being evaluated is adjacent to VRM Class III or higher, select Class III. If lower, select Class IV.
**Does not appear on the chart, but is assigned to specially classified or protected areas.
Source: BLM Visual Resource Management Inventory and Evaluation and Visual Resource Contrast Rating (8400 series, BLM, 1986)

3.15 NOISE

3.15.1 Estimates of Noise Levels

Estimates of noise from the proposed Trenton Canyon Project are based on noise research for mining activities, combined with the number and type of vehicles, machines, and blasting at the three mining areas: Valmy, North Peak and Trenton.

No actual noise measurements have been recorded at the proposed mine sites. Table 3-24 shows average noise levels generated by typical mining equipment and operations as determined by various noise researchers. As indicated in the table, noise generated by trucks, bulldozers, and other equipment typically ranges from 85 to 90 dBA at 50 feet. Sound levels from blasting range from 115 to 125 dBA at 900 feet. This noise is a relatively short-term percussive sound.

Table 3-24
Average Sound Levels for Equipment and Mine Operations

Equipment/ Operation	Noise Level (dBA)[1]	Source of Information
Blasting	115-125 dBA at 900 feet	U.S. Bureau of Mines and Geology 1976
Haul Trucks	90 dBA at 50 feet	U.S. Environmental Protection Agency 1978
Loaders	87 dBA at 50 feet	Reagan and Grant 1977
Blasthole Drilling	86 dBA at 50 feet	Reagan and Grant 1977
Bulldozers	85 dBA at 50 feet	Reagan and Grant 1977

[1] A-weighted decibel sound scale.

3.15.2 Receptors

Certain human activities are commonly more susceptible than others to noise interference. Such activities or land uses, termed sensitive receptors, include residential areas, schools, hospitals, libraries, and certain outdoor gathering places, such as parks and recreation areas. The nearest residential area where noise from the mining activity may be heard is the town of Valmy, Nevada, approximately 6 miles north of the Valmy mining area and as far as 13 miles from the North Peak and Trenton Canyon mining areas. Valmy is subject to significant traffic noise from I-80. Levels of existing mine-generated noise, excluding blasting, were calculated to create a cumulative baseline level of 103 dBA at a distance of 50 feet. Excluding blasting, existing noise levels from the Valmy mining area in the town of Valmy are estimated at 42 to 47 dBA.

3.16 SOCIAL AND ECONOMIC VALUES

3.16.1 Social Setting

The project area's history and development are distinguished by its relatively narrow economic base and dependence on mining, agriculture, gaming/tourism, and transportation. Large-scale gold mining is the dominant economic activity in the region, which has prospered from the influx of skilled workers and expansion of mining support services and supply industries. The social setting for the Trenton Canyon Project is defined by the communities of Winnemucca and Battle Mountain, where most of the workforce resides, and the mines procure a significant share of their operating supplies and services. The towns are characterized by a core of commercial businesses and civic facilities surrounded by traditional residential neighborhoods, which give way to new tracts of conventional and mobile home developments and commercial developments.

3.16.2 Demographics

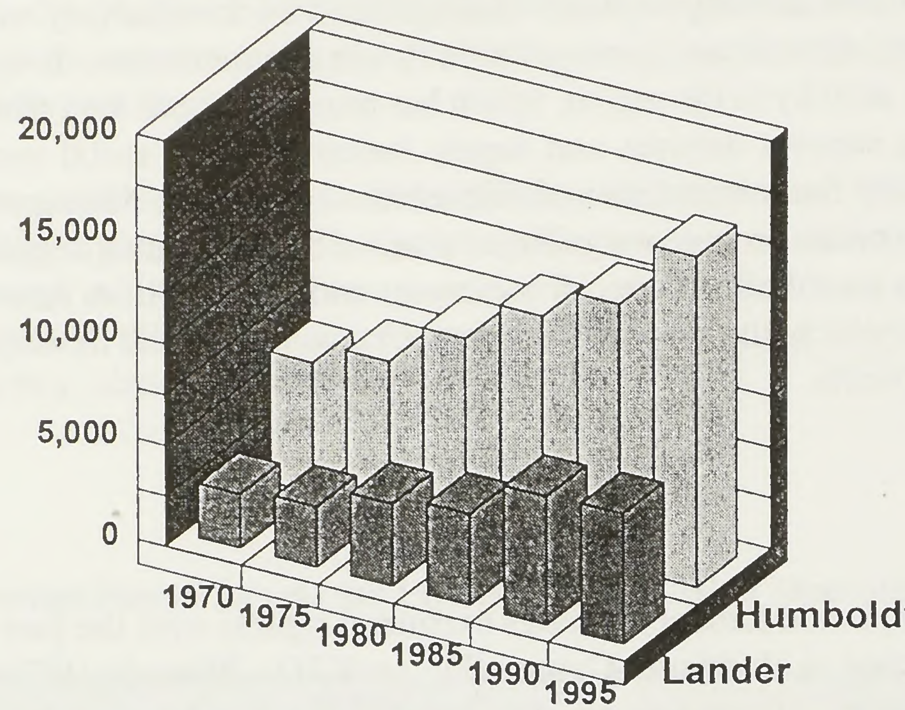
The population of Humboldt and Lander Counties expanded rapidly over the past three decades, with most of the growth occurring in Humboldt County (Figure 3-21). Between 1970 and 1995 Humboldt County grew from 6,375 to 16,270 persons, an increase of 155%. Lander County's residents increased from 2,653 to 6,410 over the same period (142%), although between 1990 and 1995 the trend was virtually flat due to cutbacks in mining employment (U.S. Census 1970, 1980, and 1990; intercensal estimates by Nevada State Demographer's Office 1996a).

Approximately one-half of the study area population is urban. In mid-1996 Winnemucca's population was estimated at 7,890, which represents 47.9 % of the estimated county mid-year total for 1996 of 16,460 (Nevada State Demographer's Office 1996a). Comparable 1996 data for Battle Mountain were not available, but as of the 1990 census, Battle Mountain held 56.5% of Lander County's residents.

One other small community is near the project site, namely Valmy, which is a small hamlet on I-80 about three-fourths of the way between Winnemucca and Battle Mountain, directly north of the project site.

The exact population of the town of Valmy is not known. An unincorporated place in east-central Humboldt County with exit and entrance ramps on I-80, it is the closest habitation to the Lone Tree and Marigold mines as well as the proposed Trenton Canyon mine area. Valmy has a small number of residents living mostly in mobile homes and trailers interspersed with a few small frame houses remaining from construction on the Valmy Power Station, just to the north. There is a service station and a small motel-restaurant on the north side of the highway and a rest area on the south side. Because the commute distances from Winnemucca and Battle Mountain to the Lone Tree and Marigold mines are so short and because there are virtually no urban amenities and infrastructure in Valmy, few if any permanent mine workers have settled there.

Figure 3-21
STUDY AREA POPULATION
Humboldt and Lander Counties, 1970-95



The project area population is predominantly Caucasian and Hispanic (84% in Humboldt County; 90% in Lander in 1990). The next largest category is Native American, at slightly over 5% (U.S. Census 1990).

The Nevada State Demographer is projecting that the populations of Humboldt and Lander counties would continue to increase. Most of the growth would be in Humboldt County in response to immigration stimulated by development of the region's resources (Table 3-25). These forecasts imply average annual growth rates between 1995 and 2015 of 2.72% for Humboldt County and 0.96% for Lander County, for an overall rate for the study area of 2.28% per year.

Table 3-25
Population Forecasts For Humboldt and Lander Counties, 1995-2015

Year	Humboldt County	Lander County	Total
1995	16,270	6,440	22,710
2000	18,675	7,110	25,785
2005	20,756	7,310	28,066
2010	23,868	7,491	31,359
2015	27,849	7,794	35,643

Source: Nevada State Demographer's Office 1996b.

3.16.3 Employment and Income

Mining, wholesale and retail trade, services and government are the principal sources of employment in Humboldt and Lander counties, with mining clearly dominating the job market. As of the third quarter of 1996, (July-September) 8,170 of Humboldt County's residents were employed in non-farm activities while 320 were unemployed, yielding an unemployment rate of 3.8% for the local labor force. Comparable numbers for Lander County were 2,740 employed, 220 unemployed (7.5%) out of a total non-farm labor force of 2,960 (Nevada Employment Security Department 1996). Table 3-26 provides the breakdown of non-farm employment and wages for both counties in March 1996. The data are for jobs held in the two counties, regardless of the employee's county of residence.

Table 3-26
Non-farm Employment and Wage Data For Humboldt and Lander Counties, March 1996

	Humboldt County		Lander County	
Industry	**Employment**	**Avg. Weekly Wage**	**Employment**	**Avg. Weekly Wage**
Mining	2,430	$933	1,080	$996
Construction	450	$540	90	$427
Manufacturing	170	$531	40	$896
Transpt., Comm, Public Utilities	360	$754	80	$596
Trade	1,480	$310	470	$259
Finance, Insur., Real Estate	100	$469	80	$428
Services	1,480	$277	230	$261
Government	1,300	$551	560	$566
Total	7,670	$583	2,570	$662

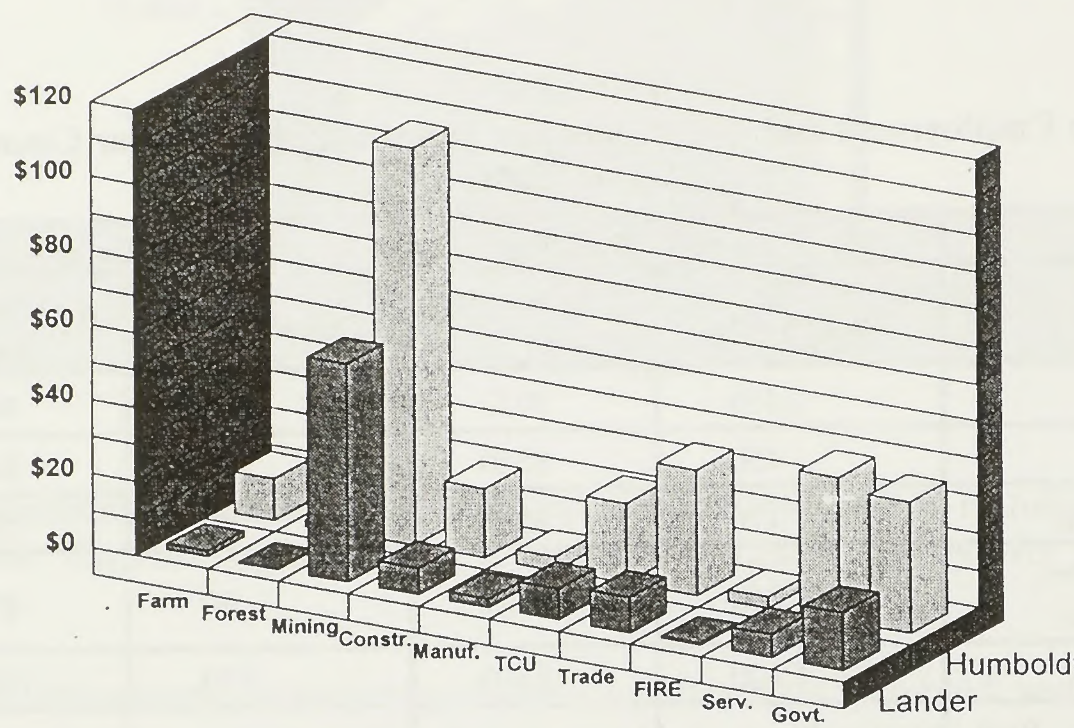
Source: Nevada Employment Security Department 1996

Total personal income of residents of the two counties amounted to $452.2 million (1994 data), of which $319.8 million was in Humboldt County and $132.4 million was in Lander County. Per capita equivalents were $20,958 per Humboldt County resident and $20,151 per Lander County resident (BEA/REIS 1996). In 1989, according to the 1990 Census, 10.3% of Humboldt County households were below the poverty level, while in Lander County the rate was 10.7%.

Households with public assistance in 1989, accounted for 4.6% of Humboldt County's households and 4.4% of Lander County's (U.S. Census 1990) Humboldt County's private and public sector entities generated $274.3 million in earnings (wages, salaries and proprietors' income) in 1994, of which $106.8 million (39%) came from mining. Lander County's private and public entities generated $106.1 million in earnings, of which $58.8 million (55%) came from the mining sector (BEA/REIS 1996). Figure 3-22 compares the relative sizes and distribution of earnings by industry in the two counties in 1994. The dominant role of the mining sector is evident.

Figure 3-22

Sources of Earnings by Industry, 1994
Humboldt and Lander Counties ($mil)



Humboldt and Lander Counties' industries each employ more workers than reside in their respective counties. According to the latest available data on journey-to-work patterns from the 1990 census, Humboldt County had 6,039 employed persons residing in the county that year, but its industries employed 6,437 workers, indicating a net inflow of 398 commuting workers from neighboring counties. Pershing and Lander Counties were the primary sources of non-resident workers for Humboldt County, with mining, construction and trade employing the majority of the commuting workers.

Lander County had 2,610 resident workers in 1990, but the county's industries (including government) employed 2,725 workers, for a net in commuting of 115 workers. Humboldt and Elko Counties were the principal sources of non-resident labor for Lander County, with mining and construction jobs predominating among the commuters. Mining jobs were the largest component in both counties, with

Humboldt County mines employing 1,286 workers that year, and Lander County mines employing 1,105. Table 3-27 shows the counties of residence of workers employed in Humboldt and Lander County mines in 1990.

Table 3-27
Origins of Daily Mining Workforce in Humboldt and Lander Counties, 1990

Origin	to Humboldt	to Lander	Total
from Pershing	61	0	61
from Humboldt	1,158	25	1,183
from Lander	67	1,047	1,114
from Elko	0	33	33
Total	1,286	1,105	2,391

Source: 1990 Census Journey to Work data in BEA/REIS 1996.

This pattern of commuting is continuing as the Winnemucca area business community strives to attract investment and create additional employment. The Tri-County Development Authority's 1996 Overall Economic Development Plan for Humboldt County identifies three key industries upon which development can be leveraged: mining, gaming/tourism and agricultural production. The mining sector provides significant opportunities for suppliers of goods and services to expand their business and replace non-local sources. The gaming/tourism sector already has an established niche in the local economy and efforts are being made to attract a broader clientele through development of additional hotel and casino facilities as well as non-gaming attractions. Agricultural opportunities stem from the county's position as the state's leading agricultural producer.

3.16.4 Housing

At the 1980 census, single family dwellings accounted for 54% of the two counties' 3,754 housing units, with mobile homes accounting for another 28%. Multi-family units made up the balance of 665 units. A decade later, the number of single family homes in the two counties had increased by 22%, reaching 3,404 units (and still the largest component of the housing stock), but mobile homes had doubled to 3,588 units, accounting for 47% of the two counties' combined total housing stock in 1990. The number of multi-family units had actually declined to 502 units (U.S. Census 1980; 1990). Table 3-28 contains the details for Humboldt County and the City of Winnemucca.

Housing trends in Lander County were similar to Humboldt County, except that mobile homes accounted for larger shares of the total stock in 1980 and 1990, as well as having increased by a much greater margin during the 1980s. By 1990, mobile homes accounted for three-fifths of total housing in the county, with much of the expansion occurring on the peripheries of the town of Battle Mountain. Table 3-29 provides the details for Lander County's housing trends.

According to data supplied by the county assessors to the state demographer's office, the housing stock of the two counties (excluding groups quarters) as of July 1, 1996, totaled 7,997 units, which represents an increase of 366 units over the 1990 figure (up 421 in Humboldt County versus a net loss of 55 in Lander County). Both counties showed losses of multi-family units over the period 1990-96 (down 198 units), and Lander County also lost 126 single family units. Increases in mobile homes more than offset the other losses, with much of the expansion having taken place in new subdivisions outside the urban area boundaries. The composition of the mid-1996 housing stock in both counties is tabulated in Table 3-30.

Numerous transient accommodations are available in the project area including hotel/motel accommodations and RV/trailer park facilities.

Table 3-28
Housing in Winnemucca and Humboldt County

Type of Unit	Winnemucca Division, 1990	Humboldt County, 1990	Humboldt County, 1980	Percent Change, 1980-1990
Single Family	1,987	2,548	2,024	25.9%
Multi-Family	488	495	665	-25.6%
Mobile Home	1,630	2,001	1,065	87.9%
Total	4,105	5,044	3,754	34.4%

Sources: JBR, 1996; U.S. Census 1980, 1990

Table 3-29
Housing in Battle Mountain and Lander County

Type of Unit	Battle Mountain Division, 1990	Lander County, 1990	Lander County, 1980	Percent Change, 1980-1990
Single Family	627	856	766	11.7%
Multi-Family	101	143	151	-5.3%
Mobile Home	1,321	1,587	686	131.3%
Total	2,049	2,586	1,603	61.3%

Source: JBR, 1996; U.S. Census 1980, 1990

Table 3-30
Housing in Humboldt and Lander Counties, 1996

Type of Unit	Humboldt County, 1996	Lander County, 1996	Total Housing, 1996	Percent Change, 1990-96
Single Family	2,592	761	3,353	2.0%
Multi-Family	380	60	440	-40.9%
Mobile Home	2,493	1,711	4,204	12.9%
Total	5,465	2,532	7,997	4.8%

Sources: Tables 3-26 and 3-27 and State Demographer's Office 1996c.

3.16.5 Public Services

3.16.5.1 Education--Humboldt County

The Humboldt County School District had an enrollment of over 4,000 pupils at the beginning of the 1996-97 school year. The District operates 12 facilities. In Winnemucca there are one high school, one junior high, one middle school, three elementary schools, and a detention center. There are five other schools in unincorporated parts of the county: one K-12 in McDermitt; two 1-8 in Orovada; and two K-8, one in Denio and the other in Paradise Valley (Humboldt County School District 1996). The distribution of students among the schools in 1996-97 is shown in Table 3-31.

Between 1986 and 1996 enrollment rose by over 80%, and to accommodate the growth, the District has had to use portable modular classrooms at several schools as well as expand its plant. The French Ford Middle School was opened in 1995 and was filled to capacity immediately. Albert Lowry High School added a new gymnasium in 1996, which released space for conversion to classrooms (Lords 1996).

The school system is operating at maximum capacity and would have to construct additional buildings as well as add modular classrooms to keep pace with the area's growing student population. Another 600-student school would be required within the next 5-6 years, according to the District Superintendent, for which a $10+ million bond issue would need to be approved. Most of the current expansion in student load is in the elementary and middle school grades, due to the relocation and permanent settling of young families (Lords 1996).

Table 3-31
Humboldt County School Enrollment, 1991-92 and 1996-97

School	No. of Students
Albert Lowry High	986
Winnemucca Jr. High	553
French Ford Middle	602
Winnemucca Grammar	408
Sonoma Heights Elem.	519
Grass Valley Elem.	587
McDermitt Combined	225
Orovada	48
Denio	12
Paradise Valley	52
Other	52
Total	4,044

Source: Humboldt County School District 1996

3.16.5.2 Education--Lander County

The Lander County School District administers two public schools in the town of Austin, and four in Battle Mountain. As of October 1996, 84 students were enrolled in the Austin schools and 1,726 were in the Battle Mountain schools (Lander County School District 1996). Enrollments in the two towns' schools were distributed as shown in (Table 3-32).

Over the past several years, the District's student load has been expanding moderately slowly (1-2% per year), except that for the school year 1996-97 enrollments rose by approximately 200 (11%). The reason for the jump was expansion of employment at the Cortez Mine in the east-central part of the county. The Battle Mountain schools are operating at capacity, and the high school is using block (split-shift) scheduling and modular classrooms to accommodate overflows. The District plans to add a wing to the high school and it would complete an additional elementary school in Battle Mountain for 350 pupils by Spring 1998. Funds from a previous bond issue would be used to finance the construction work (Lander County School District 1996).

Table 3-32
Lander County School Enrollment, October 1996

Grade\ Town	Austin	Battle Mountain	Total
K-8	59	1,307	1,366
9-12	25	419	444
Total	84	1,726	1,810

Source: Lander County School District 1996

3.16.5.3 Law Enforcement--Humboldt County

Law enforcement in Humboldt County is administered by the County Sheriff's Office in unincorporated areas and by the Winnemucca Police Department in the city. The Nevada Highway Patrol handles highway traffic and accidents and performs vehicle inspections. The Sheriff's Office is headquartered in Winnemucca and has 38 personnel, including 17 deputies on patrol (some of whom work out of Golconda and McDermitt), a lieutenant, an undersheriff, the Sheriff, an animal control officer, staff for the Humboldt County Detention Center, and office staff. The Sheriff's Office is reported to be capable of handling an increase in its case load as the population grows (JBR 1996).

The Winnemucca Police Department has a staff of 19, including the Chief, 15 officers, an animal control officer and office staff. The department is reported to be operating at capacity for the volume of criminal activity in the area, and increases in population and case load would be difficult to absorb without additional staff (JBR 1996).

The Highway Patrol has a station in Winnemucca with 11 personnel there plus troopers in Orvada and in Austin (Lander County). The Winnemucca station staff comprises two sergeants, eight troopers and a commercial officer (JBR 1996).

3.16.5.4 Law Enforcement--Lander County

Law enforcement in Lander County is administered by the Lander County Sheriff's Department, which is headquartered in Battle Mountain, with a substation in Austin. The Battle Mountain office has 31 personnel: the Sheriff, an undersheriff, a lieutenant, three sergeants, ten deputies, five jail personnel, a full-time and a part-time animal control officer, five full-time and one part-time dispatchers, and two secretaries. The Austin substation has four personnel: three deputies and a secretary (JBR 1996). The Department is reported to be working at capacity, and due to inadequate jail facilities must contract with neighboring counties for detention services. Additional caseload reportedly would be difficult to absorb without additional personnel and facilities (JBR 1996). The Nevada State Highway Patrol maintains an unstaffed office in the Sheriff's Department in Battle Mountain as well as an attended substation in Austin (JBR 1996).

3.16.5.5 Fire Protection--Humboldt County

Fire protection services in Humboldt County are provided by the Winnemucca City Fire Department, the Winnemucca Rural Fire Protection District (FPD), the Golconda Fire Protection District and the Gold Run Fire Protection District (in Valmy). These are all volunteer operations. The City department consists of 24 volunteers, including one with emergency medical technician (EMT) training, and it has three Class A pumpers, an equipment van and a brush truck. The Winnemucca Rural FPD has 25 volunteer fire-fighters (two with EMT training), ten trucks and two support units. Its service area covers some 230 square miles around Winnemucca and it has a mutual aid agreement with the BLM (JBR 1996). The Golconda FPD had 12 volunteer fire-fighters in 1994, while the Gold Run FPD had six volunteers (USDI/BLM 1995). The organizations are reported to be able to serve adequately their current levels of demand, but increases in population would eventually require additional staff and equipment.

3.16.5.6 Fire Protection--Lander County

The Battle Mountain Volunteer Fire Department is the primary fire protector in the county. It has 25 volunteer fire-fighters of whom 20 are certified EMTs, and of these ten are also certified first responders. The department has five trucks and four ambulances, and has a mutual aid agreement with the BLM. It was reported to not be working at full capacity in 1996, and moreover was planning to add 12 new volunteers and acquire another truck and ambulance in 1997. With these capabilities, the department could comfortably accommodate future population growth (JBR 1996).

3.16.5.7 Medical/Health Resources

In general, the medical and health care systems in Humboldt and Lander Counties are adequately staffed and equipped to meet current and foreseen near-term caseload levels. Significant increases in the resident population would require expansion of capacities, however.

A summary tabulation of the project area's principal medical and health care services is provided in Table 3-33.

3.16.5.8 Water, Sewer and Solid Waste--Humboldt County

According to the Tri-County Development Authority, about one-half of Humboldt County's households are served by either a public or private water company, and approximately two-thirds are connected to a wastewater treatment facility (WWTF). Rural households not connected to centralized systems use individual water wells and septic tanks. The majority of services are provided by the City of Winnemucca, but town water service is also provided in McDermitt and Orovada, and McDermitt provides primary sewage treatment (sewage ponds) (Applied Development Economics 1996). Winnemucca's city water service supplies about 3,000 connections with an average demand of 2.8 million gallons per day (mgd). The system has a storage capacity of 7.85 million gallons and a summer peak of 6.5 mgd. The water system has ample capacity and resources for expansion (Applied Development Economics 1996).

Table 3-33
Medical/Health Resources of Humboldt and Lander Counties

	Humboldt County	Lander County
Hospitals	Humboldt General: • 18 acute care beds • 12 long-term care beds • Emergency, intensive care and obstetric units plus mobile C.T. and M.R.I services • Family physicians: 5 • Surgeons: 5 • Internist: 1 • Registered nurses: 24 • Licensed Practical nurses: 9	Battle Mountain General: • 4 acute care beds • 14 long-term beds • Full time emergency room, laboratory and X-ray • 2 full-time and 4 rotating doctors • Registered nurses: 8 • Licensed Practical nurses: 2
Clinics/Health Centers	Winnemucca Mental Health Care Center	Battle Mountain Medical Center Battle Mountain Mental Health Center Battle Mountain Dental
Private Practice	13 physician and surgeon practices 7 dental practices	none listed 3 dental practices
Ambulance	Humboldt County Volunteer Ambulance Corps: 28 volunteers (all EMT), 3 ambulances, 1 rescue truck, 1 quick response vehicle	Battle Mountain Ambulance Service: 25 volunteers (all EMT), 3 ambulances

Sources: USDI/BLM 1995; JBR 1996; Winnemucca 1996-97 Telephone Directory

Winnemucca's wastewater treatment requirements are served by the Winnemucca WWTF, which has an average daily capacity of 1.50 mgd. The Paradise Valley facility can treat up to 0.03 mgd while the McDermitt facility can treat up to 0.045 mgd (Applied Development Economics 1996). In 1996 the Winnemucca city system was treating approximately 1.2 mgd and an engineering study of the sewage treatment plant was underway as basis for deciding whether to expand the facility (JBR 1996).

Solid waste disposal in Humboldt County is provided at several county landfills, with most (outside of the Winnemucca area) being limited to individual collection and hauling. The Winnemucca area is serviced by two private operators, one of which is under contract from the Winnemucca Area Solid Waste Management District (Applied Development Economics 1996). The District has a 240-acre Class 1 landfill site with a 20-ton per day capacity. At current growth rates the facility has an estimated life of 20 years (JBR 1996).

The site is adjacent to BLM land that may be obtainable for expansion when the need arises (USDI/BLM 1995).

3.16.5.9 Water, Sewer and Solid Waste--Lander County

The Battle Mountain area's water and wastewater treatment service needs are met by the Battle Mountain Water and Sewer Departments. They serve approximately 4,300 persons. Residents of the area not connected to the system use individual water wells and septic tank systems. Peak water demand in summer is around 2.0 mgd, but the average flow is around 1.0 mgd. Water is taken from three wells, and a fourth is scheduled to come on line in the latter half of 1997, providing additional capacity for future growth (JBR 1996). The wastewater treatment system handles an average of 0.64 mgd and has a capacity of 1.2 mgd. Expansion of lagoon facilities can be accommodated, so future growth of the community should not be constrained by inadequate wastewater treatment capacity (JBR 1996).

Solid waste disposal in the Battle Mountain area is handled by a Class 1 industrial/municipal facility that can process up to 20 tons per day.

A private contractor provides collection and hauling services to the township. The landfill is projected to operate for at least 20 years at current growth rates (JBR 1996).

3.16.6 Government and Public Finances

3.16.6.1 Humboldt County Governments

Local governments in Humboldt County include the Humboldt County Commissioners, the Regional Planning Commission, the Humboldt County School District, and the City of Winnemucca. There are three elected County Commissioners, who serve four-year terms. Elected county officials include the Assessor, Clerk, District Attorney, two District Judges, four Justices-of-the-Peace, Public Administrator, Recorder-Auditor, Sheriff and Treasurer. Appointed officials include the Building Inspector, Civil Defense Director, County Administrator, Juvenile Officer and the Regional Planning Commissioners (Applied Development Economics 1996; Winnemucca & Tri-County Area 1996-97 Telephone Directory).

The Regional Planning Commission has county-wide planning authority. Four of the commissioners are appointed by the City of Winnemucca and four by the County. The School District is governed by a five-member Board of Education and is administered by the Superintendent of Schools. The City of Winnemucca is governed by five councilpersons and the mayor, who are elected for four-year terms, with day-to-day operations run by an appointed City Manager.

Non-governing bodies playing key roles in the area's development include the Tri-County Development Authority and the Humboldt County Chamber of Commerce.

The county government relies primarily on *ad valorem* (imposed at a rate percent of the value as stated in an invoice) and sales tax revenues for its funds. In Fiscal Year (FY) 1994-95, 30% of revenues came from property taxes while another 57% came from intergovernmental transfers, of which sales taxes rebated by the state government comprised the majority (Kafoury, Armstrong & Co. 1995). Mining activities are a major source of revenues to local governments due the companies owning or having possessory interests in large tracts of land with substantial investments in equipment and facilities and making large annual outlays for supplies. Also, the minerals industry is the only industry in Nevada that pays *ad valorem* taxes based on net sales proceeds to state and local governments.

In FY 1992-93, the total assessed value of all property in Humboldt County was $481.86 million of which $148.59 million (31%) was from *ad valorem* taxes on mining properties and facilities. Thus, the mining sector's real and personal properties yielded approximately $1.40 million in property taxes to the county. In addition, the net proceeds *ad valorem* tax, after netting out direct costs of production (mining and milling expenses) from gross proceeds, left an assessed value of net proceeds of $111.10 million, upon which $5.49 million in taxes were collected and distributed to the state and the county (USDI/BLM 1995). Table 3-34 presents the sources and uses of funds by Humboldt County in FY 1994-95.

The county government's principal expense categories are general government, public safety and public works, which accounted for nearly two-thirds of total outlays in FY 1994-95.

Based on data from the 1990 Census and enrollment data from the school district, the Humboldt County School District had a budget of approximately $22.6 million in FY 1995-96 of which about 35% ($7.9 million) was funded from local property taxes. The majority of the District's budget is funded by state subventions.

The City of Winnemucca had a budget of approximately $6 million in FY 1994-95, of which the majority ($3.63 million, or 61%) was funded by sales taxes and other subventions from the state government. Local property taxes supplied 13.7% ($814,395) of total revenues. Public safety and public works accounted for the majority of expenses ($1.44 million and $3.26 million, respectively) (Applied Development Economics 1996). The county's and the business community's interests in attracting "export" industries like mining, tourism, and distribution that serve broad regional and even national markets would broaden the area's economic and fiscal base, thus providing increased tax revenues for local public services.

Table 3-34
Humboldt County Revenues and Expenditures, FY 1994-95

Account	Amount	Percent
Revenues:		
Property taxes	4,525,346	30.3%
Licenses, permits, fees	694,369	4.7%
Intergovernmental transfers	8,460,215	56.7%
Charges for services	274,606	1.8%
Fines and forfeitures	383,890	2.6%
Miscellaneous	592,193	4.0%
Total Revenues	14,930,619	100.0%
Expenditures:		
General government	2,371,583	20.3%
Judicial	1,207,536	10.3%
Public safety	3,611,680	30.9%
Public works	1,701,160	14.5%
Intergovernmental	395,143	4.0%
Welfare	462,993	4.0%
Culture and recreation	983,993	8.3%
Miscellaneous	566,280	4.8%
Debt service	402,880	3.4%
Total Expenditures	11,703,248	100.0%

Source: Kafoury, Armstrong & Co. 1995

3.16.6.2 Lander County Governments

Local governments in Lander County include the Lander County Commission, the Regional Planning Commission, and the Lander County School District. Battle Mountain and Austin are unincorporated townships, and are administered by the county government. There are three elected County Commissioners, who serve four-year terms. Elected county officials include the Assessor, Clerk, District Attorney, District Judge, Recorder-Auditor, Sheriff and Treasurer. Appointed officials include the Public Administrator, Budget Director, Building Inspector, Juvenile Officer, seven Regional Planning Commissioners and the Battle Mountain Town Clerk (Sierra Pacific Power, no date; Winnemucca & Tri-County Area 1996-97 Telephone Directory).

The Regional Planning Commission has county-wide authority to regulate land uses, and is funded by county revenues. The School District is administered by a District Superintendent appointed by the elected Board of Trustees. Non-government organizations involved in the county's economic development include the Battle Mountain and Austin Chambers of Commerce and the Tri-County Development Authority (in Winnemucca).

The county government relies primarily on *ad valorem* and sales tax revenues for its funds. In FY 1993-94, 25% of revenues came from property taxes while another 54% came from inter-governmental transfers, of which sales taxes rebated by the state government comprised the majority (Lander County Auditor 1993). As in Humboldt County, mining activities are a major source of revenues to Lander County. In FY 1992-93, the total assessed value of all property in Lander County was $193.39 million upon which $2.4 million in property taxes were collected (USDI/BLM 1995). The assessed value of mining properties was $82.72 million (43% of the total). Thus, the county's mining sector generated about $1.0 million in real and personal property taxes. In addition, the net proceeds *ad valorem* tax yielded an assessed value of $58.14 million, upon which $2.79 million in taxes were collected and distributed to the state and the county (USDI/BLM 1995).

Table 3-35 presents the sources and uses of funds by Lander County in FY 1993-94. The county government's principal expense categories are general government, public safety and public works, which accounted for nearly three-fourths of total outlays in FY 1993-94.

The Lander County School District had a budget of approximately $8.5 million in FY 1995-96, of which about 40% ($3.5 million) was funded from local property taxes (Lander County School District 1996). The majority of the District's budget is funded by state subventions.

The town of Battle Mountain is unincorporated and its municipal activities are funded out of the county government budget.

Table 3-35
Lander County Revenues and Expenditures, FY 1993-94

Account	Amount	Percent
Revenues:		
Property taxes	1,863,484	24.7%
Licenses, permits, fees	77,882	1.0%
Intergovernmental transfers	4,053,896	53.8%
Charges for services	470,535	6.2%
Fines and forfeitures	227,000	3.0%
Miscellaneous	847,423	11.2%
Total Revenues	7,540,220	100.0%
Expenditures:		
General government	2,198	0.0%
Judicial	705,847	9.5%
Public safety	1,762,217	23.7%
Public works	1,540,315	20.7%
Intergovernmental	255,495	3.4%
Welfare	263,624	3.5%
Culture and recreation	469,672	6.3%
Miscellaneous	47,299	0.6%
Debt service	204,311	2.7%
Total Expenditures	7,447,162	100.0%

Source: Lander County Auditor 1993

3.17 CULTURAL RESOURCES

3.17.1 Prehistoric Background

The Trenton Canyon Project is within the central subregion of the Great Basin where the earliest unambiguous evidence suggests human occupation began about 11,500 years ago. Several sources are available which provide an overview of the prehistoric, ethnographic, and historic context for the region including the Trenton Canyon mine Technical Report for Cultural Resources (Resource Concepts, Inc., 1997), the Lone Tree Mine FEIS (USDI BLM 1996), and the Twin Creeks Mine FEIS (USDI BLM 1996). The climate and environmental influences, assemblages and subsistence practices of the Pre-Archaic, Early Archaic, Middle Archaic, and Late Archaic Period as determined by the archaeological record are described in each of those sources. One of the most important regional developments during the Late Archaic Period (1,500 B.P. to first Euro-American contact) was the apparent expansion of Numic groups throughout most of the Great Basin. Sometime around 1,000 B.P. the Numa spread eastward from a homeland in the southwestern Great Basin, possibly Death Valley (Lamb 1958) or the Owens Valley (Bettinger and Baumhoff 1982). While there is little dispute that the Numic spread occurred, there is disagreement over its mechanics and timing (see Madsen and Rhode 1995). It is apparent, however, that the ethnographic Paiute are the manifestation of the entry of Numic speakers into Nevada sometime late in the prehistoric era after 1,000 B.P.

3.17.2 Ethnographic Context

The project area was apparently used both by Northern Paiute and Western Shoshone people in the late historic times remembered by people who spoke with ethnographers Stewart and Steward in the 1930s. People speaking with ethnographer Quick in the 1990s acknowledge that both Northern Paiute and Western Shoshone knew the area, but indicate that Western Shoshone used the area more regularly than Northern Paiute.

Stewart (1939:Map 1) shows a Northern Paiute *makuha* area ranging to within about 10 miles west of Battle Mountain. He was unable to locate any individual from the *makuha* area and so used information from people from neighboring areas to set the northern, southern, and western boundaries. He includes Buffalo Valley within *makuha* although living Western Shoshone people also have ties to Buffalo Valley, as specified in the Battle Mountain Band resolution regarding the Trenton Canyon Right of Way and Exploration Projects. The Northern Paiute tribal history (ITCN 1976b:11) does not show a name in the project area. It lists no band name similar to *makuha*, although it shows the band names *koop* and *yamosopo* which correspond in name and location to the areas mapped by Stewart as bounding *makuha* on the south and north. Park (1938) shows no name in the project area but Fowler and Liljeblad (1986:13) interpret his map to include the project area within the territory within which Northern Paiute language was spoken. Because of the scale of Park's map, it is difficult to determine where the boundary between Paiute and Shoshone was intended. In any case, none of these sources provide named Northern Paiute villages or wintering places for the project area.

Stewart's boundary of Paiute territory in the vicinity of the project area may be slightly too far to the east. Stewart (1939:136) cites a 1936 Steward article in setting the westernmost boundary of the Western Shoshone (and, by implication, the easternmost boundary of the Northern Paiute) as "just west of Battle Mountain and the mountains west of Reese River." These mountains west of Reese River are where the southern portion of the project area falls, above and east of the Cottonwood Creek drainage and below North Peak of the Battle Mountain range. However, Steward elsewhere asserts that Western Shoshone people lived as far west of Battle Mountain as Iron Point: "East of Iron Point the Humboldt River Valley was entirely Shoshoni" (1938:152). Iron Point is about 20 miles northwest of Battle Mountain and 5-10 miles northwest of the northern end of the Trenton Canyon Project area.

Steward (1938:161) describes this westernmost Shoshone area as follows:

One area of concentration was along the fertile lowlands of the Humboldt River between Battle Mountain and Iron Point. The population was fairly dense (one estimate is 500 persons in 1,280 square miles) but the winter encampments were somewhat smaller and less permanent than those of most Shoshoni and lacked headmen. There were few large winter villages. Instead, related families associated in groups of three to five. They generally foraged together during the year and chose a winter camp site where seeds and fish were plentiful. These sites varied from year to year.

Steward (1938:161, 163) indicates that Northern Paiute and Western Shoshone in this area intermarried. They sometimes participated together in antelope hunts at *pu:wunuk:* (translated as "plain against the foothill") near Iron Point, under direction of a Northern Paiute shaman (Steward 1941:219).

Two named wintering areas were Pagowe, along the Humboldt River upstream from Herrin, where 20-30 people stayed; and Bohowia (translated as "sagebrush pass") near Iron Point where perhaps 10 families wintered (Steward 1938:162). Steward (1938:163) mentions a rabbit drive center at Rock House, Pagawi (probably same as the wintering place Pagowe, since rabbit hunts in this part of Western Shoshone territory were held in the winter [Steward 1941:222]).

Other relevant information in the ethnography applies to the behavior of the sage hen (Western Shoshone identified a sage grouse "strutting" area in the project area). Steward's Western Shoshone informant from the Battle Mountain area reported that sage hens were caught in nets early in the morning, when the roosters "danced" (1941:222). Stewart's informant from the Northern Paiute *atsakudokwa* area around McDermitt (north of the project area) reported that fences were constructed, with "nooses in fence gaps used for sage hens in mating season. The sage grouse are said to have a dance at this time and it is on 'dance ground' that fences were built" (Stewart 1941:423).

3.17.3 Historic Background

Early Exploration: Prior to 1826, present-day Nevada remained largely unexplored. The expeditions of Father Francisco Garces and the Dominques-Escalante party approached southern Nevada in 1776, and American fur trapper Jedediah Smith made the first successful crossing of southern Nevada in 1826. Smith's return in 1827 parallels portions of US Route 6 through central Nevada (Bowers and Muessig 1982). In 1828, Peter Skene Ogden of the Hudson's Bay Company opened the Humboldt Trail across the Great Basin along "Ogden's River," later the Humboldt River. Joseph Walker led an expedition through the area in 1833, as did John C. Fremont (1843, 1845, and 1853). James Simpson and Howard Egan traversed central Nevada in 1859 and their "Central Route" was immortalized by the Pony Express the following year.

Settlement and the Humboldt Trail: Beginning during the early 1840s, emigrant "trains" of wagon-borne pioneers began crossing the plains heading toward the west coast. The Santa Fe Trail lagged in popularity, when the Humboldt Trail was found to have less rugged terrain, a more ample water supply, and a milder climate. With the Treaty of Guadalupe Hidalgo in 1848 and the spread of "manifest destiny" through the 1850s, more and more emigrants decided to penetrate the "Indian Barrier" of the

Great Basin. Stations, later to become towns, were founded along the Humboldt River (Hulse 1991). The earliest was Genoa Station, founded in 1850. The Humboldt Trail crossed the Humboldt River in the Lone Tree Hill vicinity. Ranching in the region also began about this time. Cattle and sheep were driven from New Mexico to California, and some were used to establish ranches along the way (Elliott 1973). Both agriculture and ranching expanded as transportation to outside markets improved.

The Gold Rush: With the 1848 discovery of gold at Sutter's Mill on the American River near Sacramento, California, the great western gold rush began. Prospectors flooded California by sea, while as many as 25,000 people per year crossed overland along the Humboldt Trail (Hulse 1991). Prospectors fanned out, exploring throughout the far west. The Comstock Lode in western Nevada was discovered in 1859 by Henry Comstock. A pattern of discovery, prosperity and decline (Lincoln and Horton 1966) occurred, as each discovery site was occupied and then either determined to be a sham or the deposit was depleted. Discoveries of various precious metals occurred throughout the early 1860s, including those at Reese River, Austin, Eureka, and White Pine. The Battle Mountain Mining District, formed in 1867, rose to regional prominence during the 1870s.

Following this initial period of prosperity between 1860 and 1880, mining in Nevada languished. As noted by Bowers and Muessig (1982) "there were a few free gold deposits in central Nevada, [but] most deposits had much more complex mineralization...[and] were hard rock, not placer deposits...[which] required complex technological solutions to problems of extraction and reduction" that would not be developed until the twentieth century. Due to the general decline and depression of the 1880s and 1890s, the economy of Nevada "gradually shifted...from the mining camps to cattle raising, and from western to central and then eastern Nevada" (Hulse 1991). The Marigold Mine, located just north of the project area, was first recorded in 1938. While gold panning occurred infrequently, hardrock mining for copper dominated, later to be replaced during the 1960s with open-pit gold mining.

Transportation and Communication: The earliest communication and transportation networks in central and southern Nevada followed the earlier explorer's routes. These included George Chorpenning's overland mail route in 1851, the Pony Express (1860-1861) and Butterfields Overland Mail and Stage Company. Stonehouse, or Stone House, located at the northeast end of Lone Tree Hill developed as a stage stop during this time.

With the emergence of stations/towns and economic centers, companies sought to develop improved transportation networks to and from marketing centers, particularly in California and Virginia City. The population boom, as a result of the Comstock Lode and later the Union's need for silver bullion led not only to the completion of the transcontinental and local railroads, but also to the creation of the Territory of Nevada (1861) and eventual statehood (1864). The Central Pacific Railroad extended the length of the Humboldt River and was completed in 1869. The railroad provided a cost effective means for local ranchers to expand their production by tapping into more distant markets. The Battle Mountain railroad station was established during this period.

The advent of the automobile was hailed as a great innovation for the prospector as well. Initially, the cars used wagon routes, and "gradually, as travel increased, the companies built toll roads" (Carpenter, et al. 1953). After World War I, the "Victory Highway" (US Route 40), was constructed; the present Interstate 80 replaced US 40, taking much the same route (Smith et al. 1983).

3.17.4 Previous Cultural Resource Studies

The types of cultural resources included in this assessment are: prehistoric, ethnographic, and historical. Each type has a somewhat distinct sensitivity and is treated separately. Herein, prehistoric resources reflect activities that occurred prior to the introduction of written records or the time of first Euro-American contact. Prehistoric sites may include Native American villages, temporary camps, artifact scatters, and rock art, among others. Ethnographic resources include sites or areas of concern to Native American groups either for heritage or religious reasons. They may include burials or locations where medicinal and subsistence resources are gathered. Historic resources include historic buildings, mines, and roads, the locations of historic events, and historic archaeological sites (e.g. debris scatters, foundations, etc.). These resources relate primarily to the Euro-American and Asian-American occupation of the study area, especially after the mid-nineteenth century.

Typically, prehistoric resources are important due to the information they contain. The scientific value of this information relates to its potential to inform on how human societies operate and change. Since written documentation is absent regarding the prehistoric record, archaeological sites are the only source of data concerning prehistoric societies.

In addition to their scientific value, cultural resources also may have aesthetic and cultural value. Aesthetic values may be expressed in rock art sites that are found throughout Nevada and neighboring states (Heizer and Baumhoff 1962), or in standing structures of architectural significance. A site may have a cultural value if it serves as a link between a living community and places that convey a sense of cultural identity (Loomis 1983), or if a particular social or religious concern has been expressed regarding the site (ACHP 1985). Cultural values are considered in this EIS as a component of the ethnographic resources section. Cultural values also may be present in historic sites, when these sites are associated with events or individuals that have been important in the development of national, state or local history.

3.17.4.1 Prehistoric and Historic Resource Inventories

Numerous archaeological studies have been conducted in the vicinity over the past 20 years. Figure 3-23 depicts the location of cultural resource inventories that have been conducted within or adjacent to the Trenton Canyon, North Peak, and Valmy mine areas and the Lone Tree Mine. Twelve Class III inventories fall within or overlap some portion of the existing and proposed operations for the Trenton Canyon Project and an additional eleven inventories were conducted on the lands surrounding the immediate project area. These inventories address all of the areas proposed for mining activities except: 1) segments of the proposed access road realignment located in Sections 6 and 7 of T33N, R43E and in

Sections 30 and 31 of T34N, R43E; Sections; and 2) areas for proposed haul roads in Sections 25 and 36 of T33N, R42E and Section 31 of T33N, R43E (Figure 3-23).

In an attempt to identify sites that might be impacted, a two-mile wide area was delineated that surrounds the project boundary as identified on Figure 2-3 of the EIS. Cultural resources located in these lands surrounding the footprint of the proposed facilities were reviewed to determine if any would be subject to impacts that may affect their eligibility based on National Register Criteria A through C (Refer to Section 4.17). Of the 96 cultural resources inventoried, 68 are prehistoric period sites, 22 are historic sites, and 6 contain evidence of both periods. Seventeen of the single component sites are National Register eligible, including two historic period sites; a water tank (22-6084) and a corral (22-6219). The historic component at two mixed component sites (22-5556 [railroad grade] and 22-6095 [a homestead]) is National Register eligible. The eligibility of the prehistoric portion of a mixed component site (22-6090) remains pending and whether or not eligibility has been determined for nine sites is uncertain. Sixty-five sites have been determined not eligible.

In addition, the Trenton Canyon locality is the traditional site of a Paiute raid on a road-building party in 1857 (Carlson, 1974) and a military action against the Paiutes in the late 1860's, and from which the place name "Battle Mountain" was apparently derived (Snodgrass, 1997; Barrett, 1998; and Bilbo, 1997-98). Paiute informants have also corroborated this setting to be that of the military action in question (Smith, 1997-98).

3.17.4.2 Native American Information Collection

The Winnemucca District office of the BLM has sent notification letters to chairpersons of the following groups: Te-Moak Tribes of Western Shoshone (Battle Mountain, Elko, and Wells bands); Winnemucca Tribal Council (Northern Paiute and Western Shoshone), Fort McDermitt Tribal Council (Northern Paiute), Shoshone-Bannock Tribes of Fort Hall, and Duck Valley Shoshone-Paiute Tribes. The BLM also has sent notification letters to the Western Shoshone National Council, Western Shoshone Historic Preservation Society, and Carrie Dann (Western Shoshone from Crescent Valley). BLM personnel, and an anthropologist working on behalf of the BLM, made follow up contacts by telephone.

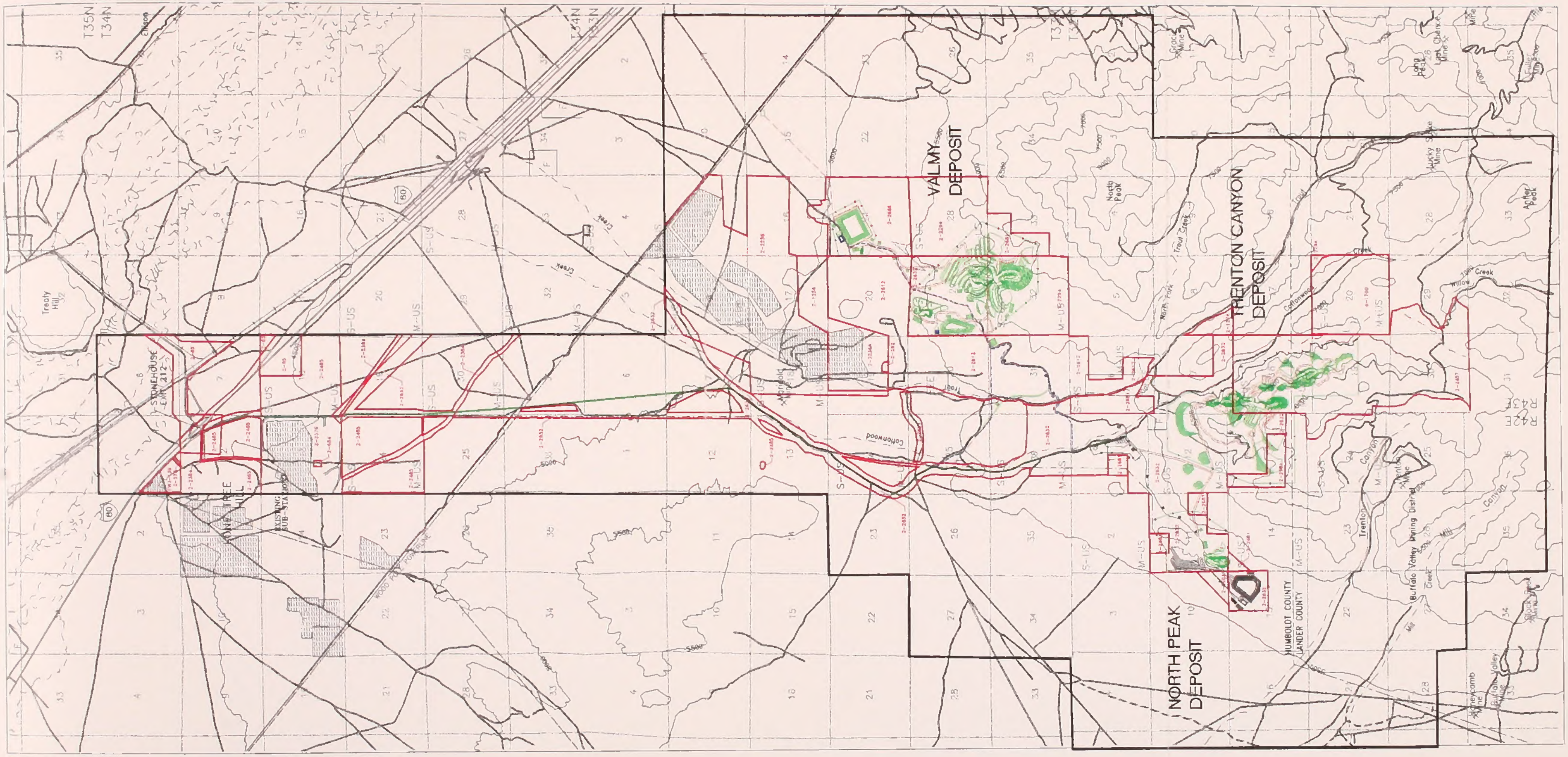
Individuals from Battle Mountain, Crescent Valley, and Duck Valley have attended tours of the project area. Those tours were conducted as a means of gathering information on sites, resources, and issues of concern to Native Americans. Trip reports are on file at the Winnemucca District office regarding tours conducted in October 1996 and May 1997. The following discussion is based on those trip reports. Subsequent tours were held in May and June. Information gathered to date indicates that the Western Shoshone are concerned regarding a number of issues.

The general issues include:

- The Western Shoshone are a sovereign nation and the Treaty of Ruby Valley did not cede lands. Therefore, the Western Shoshone feel that "private" and "public" lands are Indian lands.
- The Western Shoshone are concerned about the inter-relatedness of impacts to water, land, and air, especially in light of similar impacts prompted by other projects in the region. Rather than focus on identifying impacts to specific places, the Western Shoshone would prefer that the BLM address major issues and basic values.
- The Western Shoshone identified sage grouse strutting as an issue during preparation of the 1996 Trenton Canyon Right-of-Way environmental assessment. The Western Shoshone remain concerned that past and current activities have caused some sage grouse to move out of the area. They are concerned that increased activities associated with the project would cause additional impacts to sage grouse and to the potential for strutting behavior that once occurred in the area.
- The Western Shoshone state that revegetation plans should include a consideration of animal and plant species that have diminished over the past decades.

Expressed concerns specific to a class of discrete locations, to resource areas, or to specific locations include the following:

- The Western Shoshone are concerned that the Trenton Canyon Project may affect springs. These resources traditionally provided areas for past human use. In addition there is a concern regarding the potential for continued wildlife use, water quality, and the continued viability of important plant species.
- Populations of plant species that are of subsistence and/or cultural value may be present in the general project area and project related disturbance may impact some such populations.
- Burial markers which occur in the general project area as well as any associated burials or burial grounds may be impacted by surface disturbance and/or human intrusion into the area.



LEGEND

THIS MAP IS FOR CONCEPTUAL USE ONLY AND IS NOT TO BE USED FOR DESIGN PURPOSES.

EXISTING APPROVED FACILITIES ARE SHOWN IN BLACK AND PROPOSED FACILITIES ARE SHOWN IN COLOR.

- HEAP LEACH
- PITS
- OVERBURDEN DISPOSAL AREAS
- GROWTH MEDIUM STOCKPILES
- MINING RELATED DISTURBANCES OF LONETREE AND MARIGOLD MINES
- PROPOSED POWERLINE
- PROPOSED WATERLINE AND COMMUNICATION LINE
- PROPOSED ACCESS ROAD
- EXISTING DIRT ROAD
- PROPOSED HAUL ROAD
- FENCE
- SURROUNDING AREA OF POTENTIAL EFFECT
- ARCHAEOLOGICAL INVENTORY BOUNDARY
- 2-2685 BLM REPORT NUMBER

SCALE IN FEET
2500 0 5000

CULTURAL RESOURCES SURVEYS
TRENTON CANYON AND LONE TREE MINES

TRENTON CANYON PROJECT

ACAD FILE: 3_D_1.DWG

January 1998

Figure 3-23

Chapter 4

Environmental Consequences

CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

This chapter describes the anticipated direct, indirect, and cumulative impacts of the Proposed Action and the project alternatives, including the No Action Alternative. The impact analysis is organized by environmental resource in Sections 4.2 through 4.17. This analysis also identifies mitigation and monitoring measures to reduce or minimize impacts; residual adverse effects, i.e., the effects that would remain following the implementation of mitigation measures; and the irreversible or irretrievable commitment of resources. The proposed project may result in impacts interrelated with past, present, and reasonably foreseeable future actions in the area. For resources where project-specific impacts are identified, the potential cumulative impacts are evaluated in Section 4.18. The period of time used for assessment of cumulative effects is defined as the life of the project (i.e., 1998 through 2005 for mining activities and to 2009 for reclamation). The short-term use of the human environment relative to the long-term productivity of resources is discussed in Section 4.19.

4.1 IMPACT ASSESSMENT GUIDELINES

The impact assessment/mitigation planning process (IA/MPP) employed in this EIS addresses pertinent issues by using the Data Adequacy Standards as well as scoping comments to establish the basis for evaluation of impacts. The objective of the IA/MPP was to conduct an interdisciplinary analysis of the potential impacts to the environment within each alternative including the No Action Alternative.

Through the use of the IA/MPP, potential direct, indirect, and cumulative impacts were defined. The intensity, duration and magnitude of impacts were compared to regulatory standards and regulatory guidance as appropriate to the particular resource being evaluated.

The Plan of Operations and Reclamation Plan contain numerous design features and planning elements which would effectively mitigate potential impacts of the mine development. Additional monitoring and mitigation measures developed in response to the impacts identified in this EIS are recommended by the BLM for individual resources. These measures are not part of Newmont's Plan of Operations and Reclamation Plan for the proposed project but could be required by the BLM or other regulatory agencies as conditions or stipulations of approval and authorization of the Plan of Operations and Reclamation Plan. Finally, residual impacts were determined and became the basis on which the alternatives were compared for environmental preference.

4.2 SURFACE WATER

The primary issues related to surface water resources identified through public scoping and agency review include:

- Reduction in surface water quantity, especially in perennial streams and springs due to diversions and changes in land use,

- Impacts to surface water quality from meteoric water infiltrating through stockpiles, operational spills, surface erosion leading to increased sediment loading, or runoff from haul roads.

Potential impacts to wetlands, riparian areas, and wildlife due to changes in water resources are discussed in Sections 4.9 and 4.10.

4.2.1 Direct and Indirect Impacts

Drainage and water quality impacts were analyzed by individual watershed and drainage basins. Cottonwood Creek is the receiving water for the Trenton Canyon mine area and Trout Creek is the receiving water for the Valmy mine area. The North Peak mine area drains to the north and west and has no receiving watercourse.

The construction and operation of mining facilities, including pits and stockpiles within the studied watersheds, could potentially have the following impacts on surface water flow and quantity:

- Alteration in flows within established waterways due to diversion channels,
- Long-term reduction in surface water runoff and watershed area due to mine pits, and
- Change in surface runoff characteristics due to surface disturbance.

Potential effects on water quality related to the mining activities would include:

- Alteration of water quality due to long-term meteoric water infiltrating through stockpiles,
- Increased sediment loads due to erosion from roads, stockpiles, and disturbed surfaces, and
- Affect on water quality from spills, leaks, or overflows from a heap leach facility or other mining activities.

Neither the Trenton, North Peak nor Valmy pits would require pit dewatering; therefore, there would be no discharge to surface water as a result of current or proposed operations.

The Plan of Operations and Reclamation Plan contain specific design features which would protect surface waters from sediment loading impacts associated with water erosion.

4.2.1.1 No Action Alternative

Impacts to Surface Water Quantity

Diversions

In the North Peak mine area, runoff would be diverted upslope from the heap leach facility and the pits. Runoff from the watershed draining into the existing permitted area within the Valmy drainage areas would be diverted under the No Action Alternative to avoid run-on into the open pits or stockpiles.

Changes in Land Use

Table 4-1 shows the changes in surface disturbance from a natural condition for the No Action Alternative. Land used for open pits, process ponds, and heap leach pads are areas that would be removed from the watershed during operation, producing no runoff. In the long-term, the pond and leach pad areas would be reclaimed so that only the mine pit areas would be removed from the watershed after reclamation. The roads, water/communication line, diversions, and ancillary facilities prior to reclamation would produce greater runoff than natural surfaces. The overburden disposal areas and growth medium stockpiles are likely to have less runoff from the flat top surfaces and possibly more runoff from the steepened slopes than comparable natural areas.

The disturbed area increasing runoff within the Cottonwood Creek watershed would be approximately 30 acres. In the Valmy area, approximately 50 acres of roads and diversions would have increased runoff relative to a natural condition. In the Trout Creek drainage, the disturbed area increasing runoff would be approximately 19 acres (Table 4-1).

In the North Peak drainage area, approximately 55 disturbed acres are estimated to have increased runoff. The total area removed from the watershed during operation would be the heap leach and overflow pond plus the pit, or approximately 105 acres. The disturbed area that could lead to increased runoff is approximately 296 acres. The total area removed from the watershed following reclamation would be approximately 34 acres (Table 4-1).

Therefore, under the No Action Alternative, the total area removed from the watershed during operation is approximately 105 acres. The total area removed from the watershed following reclamation is approximately 34 acres. The area of otherwise disturbed surfaces leading to increased runoff is approximately 155 acres (Table 4-1).

Table 4-1
Summary of Disturbed Area by Watershed

WATERSHED			FACILITIES									TOTAL AREA REMOVED FROM WATERSHED			
Watershed Name	Basin No.(a)	Area (acres)	Ancillary Facilities	Diver-sions	Over-burden Disposal	Growth Medium Stockpile	Heap Leach Facility	Open Pit	Road	Process/ Solution Pond	Water/ Comm. Line	During Operation (Pits, heap leach pads and pond)	Post-Reclamation (pits only)	Total Disturbed Area Increasing Runoff (b)	Total Stockpile Area (c)
NO ACTION (EXISTING/PERMITTED CONDITION)															
Cottonwood Creek	1	1,974										0.0	0.0	0.0	0.0
	5	831										0.0	0.0	0.0	0.0
	6	3,335	15.2			2.0			13.8		0.8	0.0	0.0	29.8	2.0
subtotal		6,140	15.2	0.0	0.0	2.0	0.0	0.0	13.8	0.0	0.8	0.0	0.0	29.8	2.0
No.drainage from Valmy Pit	10	2,711		1.1	56.1	6.8	0.0		49.6	0.0		0.0	0.0	50.7	62.9
	11	921										0.0	0.0	0.0	0.0
	14	3,773										0.0	0.0	0.0	0.0
subtotal		7,405	0.0	1.1	56.1	6.8	0.0	0.0	49.6	0.0	0.0	0.0	0.0	50.7	62.9
Trout Creek	4	2,683							1.6		0.5	0.0	0.0	2.1	0.0
	7	1,108				1.2			7.0		1.8	0.0	0.0	8.8	1.2
	8	81				0.3			1.7		0.6	0.0	0.0	2.3	0.3
	9	2,007				0.3			4.8		1.2	0.0	0.0	6.0	0.3
subtotal		5,879	0.0	0.0	0.0	1.8	0.0	0.0	15.1	0.0	4.1	0.0	0.0	19.2	1.8
North Peak	21	N/A	2.9	3.0	56.0	7.0	66.0	34.0	49.0	5.0		105.0	34.0	54.9	63.0
subtotal			2.9	3.0	56.0	7.0	66.0	34.0	49.0	5.0	0.0	105.0	34.0	54.9	63.0
TOTAL NO ACTION		19,424	18.1	4.1	112.1	17.6	66.0	34.0	127.5	5.0	4.9	105.0	34.0	154.6	129.7
PROPOSED ACTION															
Cottonwood Creek	1	1,974		2.1	73.8			74.3	25.1			74.3	74.3	27.2	73.8
	5	831	2.3	2.8	71.3			118.8	51.2			118.8	118.8	56.3	71.3
	6	3,335	15.2	0.1	50.0	2.0			22.5		0.9	0.0	0.0	38.6	52.0
subtotal		6,140	17.5	4.9	195.1	2.0	0.0	193.1	98.8	0.0	0.9	193.1	193.1	122.1	197.0
No.drainage from Valmy Pit	10	2,711	2.4	4.4	294.7	22.3	70.9	160.3	80.3	6.8	4.6	238.0	160.3	91.7	317.0
	11	921		0.6			13.2					13.2	0.0	0.6	0.0
	14	3,773	0.1	0.2			37.4			5.7		43.1	0.0	0.4	0.0
subtotal		7,405	2.6	5.3	294.7	22.3	121.5	160.3	80.3	12.5	4.6	294.3	160.3	92.7	317.0
Trout Creek	4	2,683							1.6		0.5	0.0	0.0	2.1	0.0
	7	1,108				2.1			12.8		2.3	0.0	0.0	15.1	2.1
	8	81				0.3			1.7		0.6	0.0	0.0	2.3	0.3
	9	2,007				4.4			5.2		1.2	0.0	0.0	6.4	4.4
subtotal		5,879	0.0	0.0	0.0	6.7	0.0	0.0	21.3	0.0	4.6	0.0	0.0	25.9	6.7
North Peak	21	N/A	2.9	3.0	62.0	7.0	66.0	34.0	49.0	5.0		105.0	34.0	54.9	69.0
subtotal			2.9	3.0	62.0	7.0	66.0	34.0	49.0	5.0	0.0	105.0	34.0	54.9	69.0
TOTAL PROPOSED ACTION (d)		19,424	23.0	13.2	551.7	38.0	187.5	387.4	249.4	17.5	10.1	592.4	387.4	295.6	589.8

NOTES:

a) Please refer to Figure 3-1 for drainage basins locations.

b) Includes area for ancillary facilities, diversions, roads and pipelines.

c) Includes area for overburden disposal areas and topsoil stockpiles.

d) Acreage calculations for mine features were measured with ArcINFO GIS software from AutoCAD base maps. Discrepancies from Table 2-2 acreage is due to operator technique and within a 5-8% margin.

e) Expansion of TC-6 Alternative would have 25 more acres within Basin 1 (Figure 3-1) that would contribute to runoff. The Partial Backfill Alternatives would be essentially the same as the Proposed Action.

Impacts to Surface Water Quality

Meteoric Water Infiltration through Stockpiles

Under the No Action Alternative, approximately 63 acres would be used for overburden disposal or topsoil stockpiles within the drainage north from the Valmy mine area (Basins 10, 11, and 14, Figure 3-1) and an additional 63 acres within the drainage northwest from North Peak mine area (Basin 21). As there is no current natural surface expression from the Valmy mine area to surface waters (other than slight seeps at Ames Spring and Mud Spring), infiltration of meteoric waters through these 63 acres is expected to go completely to groundwater. It is probable that infiltration of meteoric waters through the overburden piles at North Peak would infiltrate to groundwater as well, since there are no seeps, springs, or drainages downslope of the piles. Four additional acres would be used within the Trout Creek (Basins 7, 8, and 9) and Cottonwood Creek (Basin 6) drainage areas for topsoil stockpiles. Therefore, a total of 130 acres under these disposal areas and temporary stockpiles would continue to infiltrate meteoric waters to groundwater. Under this alternative, meteoric waters infiltrating through the stockpiles would be expected to report to the groundwater system.

Erosion Potential

Diversion channels would be designed to divert flows from the 100-year, 24-hour storm event. There would be no risk of sediment loading to riparian areas and aquatic habitats, because, in addition to design features in the existing operating plan, the disturbed areas are not directly upslope of any creeks or riparian habitat.

Impacts from Spills, Leaks, and Overflows

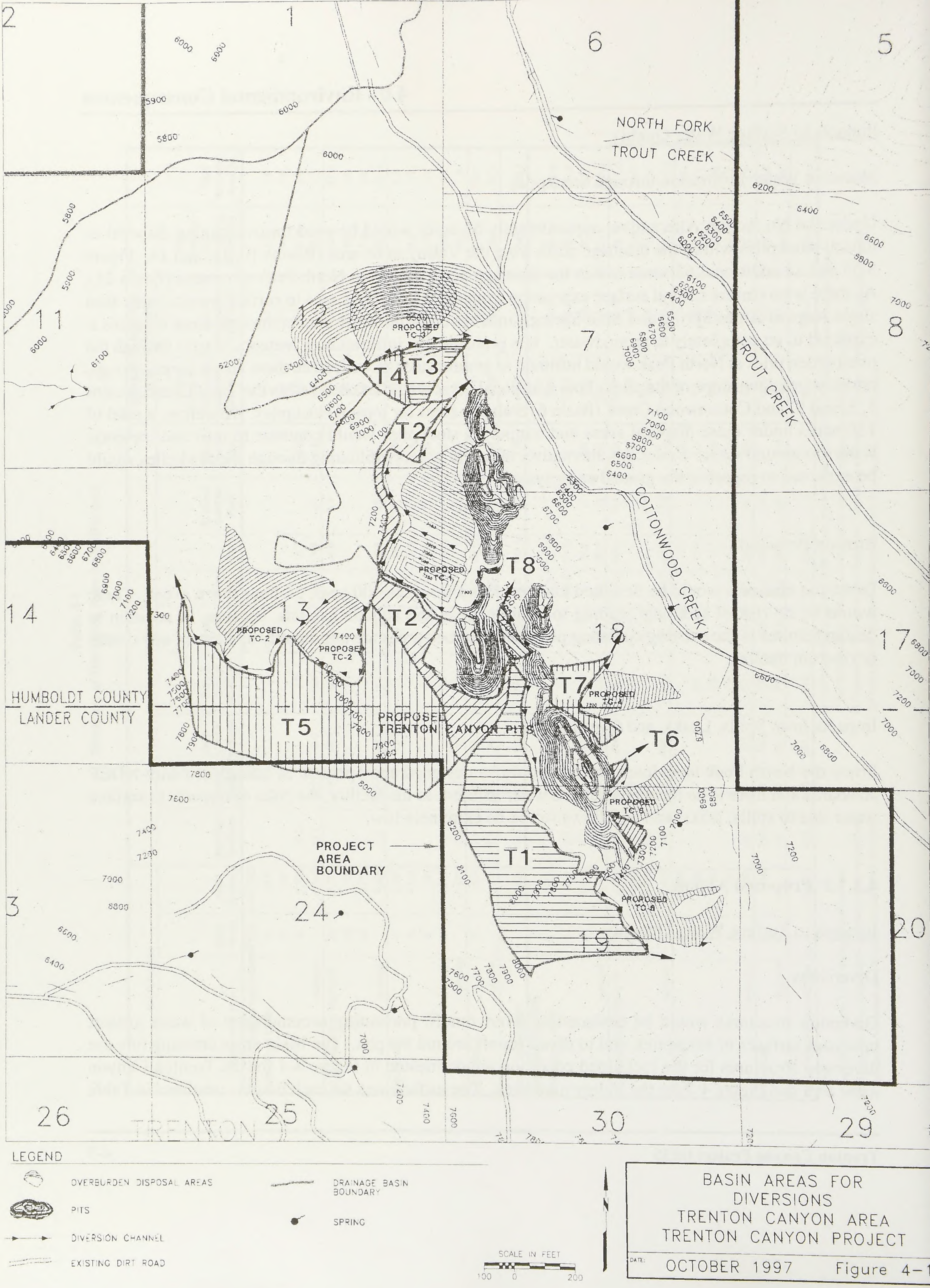
Since the North Peak heap leach facility would be designed and operated in accordance with NDEP standards and there is no receiving surface water adjacent to the facility, the risks of impacts to surface water due to spills, leaks, and overflows would be extremely low.

4.2.1.2 Proposed Action

Impacts to Surface Water Quantity

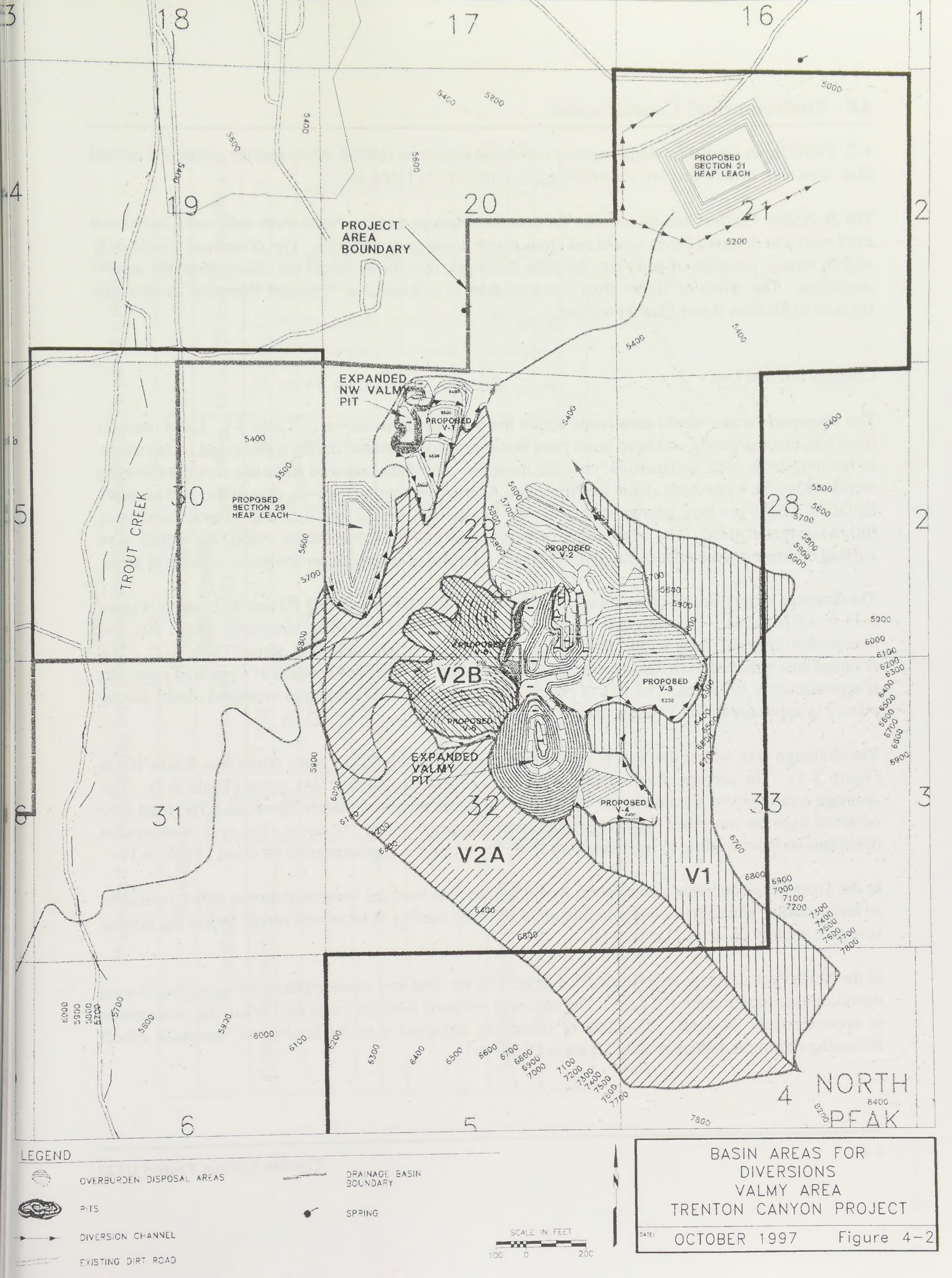
Diversions

Diversion structures would be designed to divert runoff, preventing accumulation of water against upstream surfaces of stockpiles, and to divert runoff around the pits. The basin areas draining into the diversion structures for the reclaimed condition are delineated in Figure 4-1 for the Trenton Canyon mine area and Figure 4-2 for the Valmy mine area. The surface area for each basin is tabulated in Table



BASIN AREAS FOR DIVERSIONS
TRENTON CANYON AREA
TRENTON CANYON PROJECT

DATE: OCTOBER 1997 Figure 4-1



BASIN AREAS FOR DIVERSIONS
VALMY AREA
TRENTON CANYON PROJECT

DATE: OCTOBER 1997

Figure 4-2

4-2. Flood flows computed using regional regression equations (USGS 1994) and the estimated annual flow diversion in acre-feet are shown for each of the areas (Table 4-2).

The diversions for the Cottonwood and Trout creek drainage and the North Peak mine area have been sited such that diverted flows would not cross major drainage boundaries. The diversions would only slightly change the point-of-entry into the same drainages; thus, flows would not change from the natural condition. The effect of higher flow concentration is addressed in "Erosion Potential" within the Impacts to Surface Water Quality section.

Changes in Land Use

The Proposed Action would alter lands within the watersheds as shown in Table 4-1. Land used for open pits, process ponds, and heap leach pads would produce no runoff during mining and reclamation. In the long-term, after reclamation, only the mine pits would be removed from the area contributing runoff within the watersheds. As in the No Action Alternative, roads, pipelines, diversions, and ancillary facilities would produce greater runoff during mining but would approximate natural conditions following reclamation. The overburden disposal areas and growth medium stockpiles would have varying drainage characteristics based on slope and intensity of precipitation compared to natural areas.

The drainage area upstream of the mouth of Cottonwood Creek representing Basins 1, 2, and 5 (Figure 3-1) is 4,676 acres. The area that would drain into proposed diversion structures above pits and overburden disposal areas within Basins 1, 5, and 6, is approximately 502 acres (Table 4-2). The drainage area removed from the watershed during operation and after reclamation as a result of mine pits is approximately 193 acres. The area of otherwise disturbed surfaces leading to increased runoff during mining is approximately 122 acres (Table 4-1).

The drainage area within the Valmy mine area is approximately 2,711 acres (shown as Basin 10 on Figure 3-1). The acreage diverted within that area is approximately 1,241 acres (Table 4-2). The drainage area removed from the watershed during operation is approximately 294 acres. The total area removed from the watershed following reclamation is approximately 160 acres. The area of otherwise disturbed surfaces leading to increased runoff during mining is approximately 93 acres (Table 4-1).

In the Trout Creek drainage area no acres would be removed from the watershed during either operation or reclamation. The area of otherwise disturbed surfaces leading to increased runoff following mining is approximately 26 acres (Table 4-1).

In the North Peak drainage area (Basin 21, Figure 3-1), the total area removed from the watershed during operation is approximately 105 acres. The total area removed from the watershed following reclamation is approximately 34 acres. The area of otherwise disturbed surfaces leading to increased runoff following mining is approximately 55 acres (Table 4-1).

Table 4-2
Watershed Areas Draining into Diversion Structures under the Proposed Action

Watershed			Approximate annual runoff (ac-ft)	Flood (cfs) for recurrence interval					
Watershed	Basin No.	Area (acres)		2 yrs	5 yrs	10 yrs	25 yrs	50 yrs	100 yrs
Cottonwood Creek	T1	158	13	5	8	10	12	14	15
	T2	70	6	3	5	6	7	8	9
	T3	17	1	1	2	2	3	3	3
	T4	11	1	1	1	1	2	2	2
	T5	217	18	6	10	12	16	18	20
	T6	5	0	0	1	1	1	1	1
	T7	18	1	1	2	2	3	3	3
	T8	5	0	0	1	1	1	1	1
	Subtotal	502							
North drainage from Valmy Pit	V1	371	31	9	15	19	25	29	33
	V2A	768	64	15	26	33	43	50	57
	V2B	102	8	4	6	8	10	11	13
	Subtotal	1241							

See Figures 4-1 and 4-2 for basin locations.
North Peak mine area has no receiving water for drainage; therefore, it is not analyzed by watershed

Therefore, under the Proposed Action, the total area removed from the watershed during operation is approximately 592 acres. The total area removed from the watershed following reclamation is approximately 387 acres. The area of otherwise disturbed surfaces leading to increased runoff is approximately 296 acres (Table 4-1).

Surface water runoff would increase flow within Cottonwood and Trout creeks especially during high precipitation periods for the 7 years of mining. The long-term effect after reclamation would be minor. The intensity of the change would be slight to moderate depending on the total area disturbed at any one time within a single watershed. No change would occur to channel geometry and the risk of sedimentation would be minimized by design features and management practices as proposed in the Plan of Operations and Reclamation Plan (Section 2.4.7).

Impacts to Surface Water Quality

Meteoric Water Infiltration through Stockpiles

Seepage from an overburden disposal area resulting from meteoric water infiltration could potentially enter existing surface waters (via shallow groundwater or a spring from the base of the stockpile) and impact existing surface water quality. This potential impact was estimated as follows:

- Expected long-term infiltration rates were derived for selected individual stockpiles. Seepage rates to surface waters were estimated based upon these rates in conjunction with analysis of base flows measured during the baseline sampling period,
- Water quality of the meteoric water infiltration was assumed to be that derived through geochemical study,
- A calculation was performed to mix flow from each stockpile with the potential recipient natural watershed flow (i.e., natural flows and corresponding quality were those measured in the baseline monitoring program), and
- The resulting estimated proposed project flows and quality were compared to state and federal standards and baseline water quality.

Estimate of Flow from Stockpiles to Surface Waters

The seepage from overburden disposal areas into surface waters was estimated by SMI (Shepherd Miller, Inc. 1997a) as follows, for selected sampling points:

- Analyze measured flow rates during the October 1994 to December 1996 sampling periods to estimate average base flow and interflow (combined) for the entire watershed,
- Calculate the percent of watershed to be covered by the proposed overburden disposal areas,

- Calculate the expected average base flow and interflow (combined) from the overburden disposal areas by applying the percent (based upon watershed area) to the expected average base flow and interflow (combined) for the entire watershed, and
- Compare the derived numbers to the calculated infiltration rates to check for reasonableness.

The selected sampling points in the Cottonwood Creek watershed were CCS-06, CCS-1A, CCS-0A, and CCS-00. The reaches of the channel represented by CCS-0A and CCS-00 were found to not carry base flows, and therefore were not expected to carry long-term surface flow from the overburden disposal areas. The summary of the analyses for the other two stations is provided in Table 4-3 and the full analysis is provided in Appendix A. The proposed open pits are to be constructed between proposed disposal area TC-1 and Cottonwood Creek, which would allow the meteoric water infiltrating through TC-1 to enter only the groundwater. Flows into the pits, if any, would be lost to evaporation and/or groundwater (Shepherd Miller, Inc. 1997a).

The aggregate flow from the 295 acres of proposed disposal areas within the Valmy area, using the flow per acre derived in the study of proposed disposal areas near Cottonwood Creek, is estimated at 12 gpm for the Cottonwood Creek drainage. The reach of drainage channel downstream of these areas, however, is dry except for periods of active storm run-off. Therefore, using the same logic as was applied above in the Cottonwood Creek drainage to sampling locations CCS-0A and CCS-00, seepage from the proposed Valmy overburden disposal areas is not expected to impact surface waters in the project area. Likewise, for North Peak, there would be no surface expression of meteoric water infiltration through NP-1 and NP-2.

Estimate of Infiltration Water Quality

The water quality associated with meteoric water infiltration through the overburden disposal areas was derived through analysis of geochemical baseline data (see Appendix A) and is summarized by location in Table 4-4. The proposed stockpile locations are shown on Figures 2-8, 2-9, and 2-10. The flow rates and quality for baseline or background waters are represented in the data collected during baseline monitoring period 1995-96. The water sampling station locations (see Figure 3-1) potentially affected by seepage are shown in Table 4-5 in downstream to upstream order along Cottonwood Creek. TC-1 is not considered within the analysis as it is separated from Cottonwood Creek by a pit; therefore, flow would go to groundwater or evaporate.

Beside the Valmy mine area, Trout Creek has no measurable flow. Any infiltration would flow from the stockpiles north; however, it would probably go directly to groundwater and result in no surface flow. The flows from stockpile TC-2 and from the North Peak overburden disposal areas, NP-1 and NP-2, also would not flow into any surface water.

Table 4-3
Predicted Water Quality Impacts in Cottonwood Creek

Station		Flow Rate (gpm)	pH	Aluminum mg/l	Sb mg/l	As mg/l	Cu mg/l	Fe mg/l	Mn mg/l	Se mg/l	Zn mg/l	Cu mg/l	Ni mg/l	Zn mg/l	Ca mg/l	Mg mg/l	SO4 mg/l	Hardness mg/l
Drinking Water Standard			6.5	0.05-0.2	0.146	0.050	1.0	0.3	0.05	0.01	5	STANDARDS for HARDNESS DEPENDENT ELEMENTS				125	250	
Aquatic Life Standard (96 hr)			6.5			0.180	f(hardness)	1		0.005	f(hardness)							
Agricultural Standard (irrigation)			6.5			0.1	0.2	5	0.20	0.020	2							
Agricultural Standard (stock)			6.5			0.2	0.5				25							
CCS-1A																		
	High	3103	8.3	0.099	0.024	0.021	0.008	0.056	0.017	0.006	0.137	0.040	0.527	0.355	154	29	224	504.9
	Low	11	7.2	0.016	0.001	0.012	0.002	0.006	0.002	0.001	0.002	0.008	0.105	0.071	21	5	29	75.3
CCS-06																		
	High	1103	7.9	0.146	0.023	0.017	0.008	0.076	0.021	0.006	0.007	0.047	0.617	0.416	190	33	155	608.4
	Low	5	6.8	0.019	0.001	0.009	0.002	0.008	0.003	0.001	0.002	0.006	0.078	0.053	16	3	33	52.9

NOTES:

NV= No value measured

a) Most selenium concentrations shown in excess of the 96-hour aquatic life standard are due to the use of non-detect analytical results with relatively high (0.005 mg/l) detection limits in the mix calculations. The selenium exceedance shown in bold uses a measured (I.e. above the test detection limit) creek concentration.

b) High and low values are estimates based on field measurements. Actual observations may differ.

c) See Table A-8 for full report.

Table 4-4
Predicted Water Quality of Infiltration through Overburden Disposal Areas from Leachate Tests

	pH	Al	As	Sb	Cu	Fe	Mn	Ni	Se	Zn	SO_4	Ca	Mg
WATER QUALITY STANDARDS	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Drinking Water Standard	6.5-8.5	0.05-0.2	0.050	0.146	1.0	0.3	0.05		0.01	5	250(500)a		125(150)a
Aquatic Life Standard (96 hr)	6.5-9.0		0.180		0.014 f(H)b	1			0.005	0.123 f(H)b			
Agricultural Standard (irrigation)	6.5-9.0		0.1		0.2	5	0.20		0.020	2			
Agricultural Standard (stock)	6.5-9.0		0.2		0.5					25			
OVERBURDEN DISPOSAL AREA													
TRENTON CANYON DEPOSIT													
South (TC-4, TC-5, TC-6)	6.4	0.07	0.01	0.005	0.005	0.03	0.05	0.011	0.009	0.005	1059	441	75
Central (TC-1, TC-2)	6.6	0.07	0.01	0.005	0.003	0.03	0.04	0.008	0.009	0.003	1059	441	75
North (TC-3)	6.7	0.07	0.01	0.005	0.002	0.03	0.03	0.007	0.009	0.003	1059	441	75
VALMY DEPOSIT													
Main Pit (V-2, V-3, V-4, V-5)	7.0	0.07	0.01	0.005	0.001	0.03	0.02	0.005	0.009	0.002	1059	441	75
North Pit (V-1)	7.0	0.07	0.01	0.005	0.001	0.03	0.02	0.005	0.009	0.002	1059	441	75
NORTH PEAK DEPOSIT													
NP-1, NP-2	7.0	0.07	0.01	0.005	0.001	0.03	0.02	0.005	0.009	0.002	1059	441	75
BASELINE	7-8.5c	0.01-0.14	.01-.03	<0.01	<0.003	<0.02	<0.02	<0.021	<0.05	<0.004d	1059	441	75

NOTES:

Refer to Figures2-8, 2-9, and 2-10 for overburden disposal area locations.

a) Numbers in ( ) are mandatory secondary standards for public water systems.

b) Numbers are dependent on hardness; displayed values are for Hardness = 145mg/L (see NAC445A.144 for equations)

c) pH range of 6.6-7.2 for Ames and Mud Springs

d) Measured up to 0.13 mg/L in Ames and Mud Springs

Source: Santa Fe Pacific Gold Corporation, Baseline Hydrology and Geochemistry of the Trenton Canyon Project, Valmy, Nevada, September 1996.

Table 4-5
Water Sampling Locations Potentially Affected by Surface Flows from Infiltration through Overburden Areas

Station	Overburden Disposal Areas Upgradient from Water Station
CCS-00	TC-3, TC-4, TC-5, TC-6
CCS-01	TC-4, TC-5, TC-6
CCS-1A	TC-4, TC-5, TC-6
CCS-2A	TC-4, TC-5, TC-6
CCS-03	TC-4, TC-5, TC-6
CCS-04	TC-4, TC-5, TC-6
CCS-04A	TC-4, TC-5, TC-6
CCS-05	TC-4, TC-5, TC-6
CCS-06	TC-4, TC-5, TC-6
CCS-18	TC-5, TC-6
CCS-19	TC-6
CCS-13	TC-6

Note: Sampling stations are shown in Figure 3-1.

A summary of the changes in Cottonwood Creek surface water quality due to infiltration through the overburden disposal areas is presented in Table 4-4. Mixing calculations were developed using a conservative method and no accounting was made for possible soil attenuation as the water migrates toward Cottonwood Creek. Appendix A, Surface Water further explains the method used to predict future water quality in the basin.

Infiltration of meteoric waters through the proposed overburden disposal areas within both the North Peak and Valmy mine areas are not expected to impact surface waters as the current watershed does not produce perennial flows. Infiltration through the proposed overburden disposal areas is therefore, unlikely to produce perennial flows.

Comparison to State and Federal Standards

State and federal drinking water, agricultural water, and aquatic life standards are shown for comparison to predicted water quality values (Table 4-3). The long-term concentrations for water quality would be within state and federal standards for the average conditions for most of the studied parameters. There are predicted to be periodic exceedances of the secondary drinking water standards of 250 mg/L for sulfate. This effect is due to the relatively high values of sulfate in the water infiltrating through the overburden disposal areas when mixed with low flow values of the creek waters. When baseflow in the creek is greater than 1 gpm, the sulfate concentration would be within the federal and state standards. Typical flow measurements within the creek range between 1 and 10 gpm; low flow periods measured typically 4 gpm or higher.

The seepage waters would not significantly affect baseflow water quality; slight increases in concentrations would be within state and federal water quality standards under average to high flows (Table 4-3). Heavy metals in the seepage would be approximately the same or less than those in the natural waters, with the possible exception of selenium, which may rise slightly in concentration but would remain within water quality standards.

Impacts from Spills, Leaks, and Overflows

The probability of release in hauling fuels and reagents is low and is discussed in detail Section 4.4, Hazardous Materials. There are no stream crossings along the haul route to the North Peak or the Trenton Canyon mine areas. Reagents would be hauled across both Cottonwood and Trout creeks for storage near the Valmy heap leach facility. Since the North Peak and Valmy heap leach facilities would be designed and operated in accordance with NDEP standards, the risks of impacts to surface water due to spills, leaks, and overflows is extremely low.

Erosion Potential

The concentration of flows in diversion ditches and along benches within reclaimed slopes could potentially lead to increased erosion relative to natural conditions and delivery of concentrated volumes of sediments at channel discharge locations (Figures 4-1 and 4-2). Increased direct run-off from disturbed project area slopes also could lead to increased erosion, with direct delivery of sediment to streams. Increased sediment loading to streams could alter flow regime and habitat quality. The primary area of potential effect is along Cottonwood Creek, because of the proximity of the proposed mining operations and mine facilities to the creek channel.

Design features that are included in the Proposed Action that would control soil erosion during mine operation and post-reclamation include:

- Diversion channels prevent run-on to overburden disposal areas and prevent erosion of disturbed surfaces from upstream flows,
- Channels are to have riprap in areas with design velocities exceeding 4 feet per second and channels with design velocities less than 4 feet per second are to be revegetated with grasses to inhibit in-channel erosion,

- Reclaimed slopes are designed to have soil losses under 1 ton per acre per year as runoff is transported along benches to the bottom of the reclaimed slope,
- Bases of reclaimed slopes are to be protected with straw bales and/or silt fences as needed to prevent erosion,
- A berm would be constructed along the existing exploration road that parallels Cottonwood Creek. Culverts would be placed at appropriate locations to allow drainage through the berm and to prevent road washouts. The berm is designed to inhibit rock falls into the creek and prevent sediment transport directly to the creek during mining operations. Sediment impounded against the berm would be salvaged periodically. Following site reclamation, the berm would be removed, and
- To prevent erosion, diversion ditches would be constructed with one or more of the following as necessary: energy dissipation structures, routing into existing drainages, or routing along the zone of coarse rock that would exist at the contact between the toe of waste rock overburden disposal area and the original ground topography.

4.2.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

Impacts to Surface Water Quantity

Surface water quantity impacts for this alternative would be negligible, similar to the Proposed Action.

Diversions

Under this alternative, there are no interbasin transfers. The expansion of stockpile TC-6 would extend the length of the diversion channel uphill of TC-6. All other areas shown in Table 4-1 would correspond to those for the Proposed Action. The area draining into the TC-6 diversion channel would expand approximately 60%, leading to greater concentration of flows at the discharge for drainage area T-1 as shown in Figure 4-1. A beneficial impact would result from a reduction in surface flows to TC-1. The drainage area would increase with this alternative from 81 acres to 106 acres, all within Basin 1 from Figure 3-1. The acreage of diversion channel disturbance would slightly increase, also all within Basin 1 from Figure 3-1.

Changes in Land Use

In this alternative, TC-6 would extend over 2,000 feet further up the valley of the west fork of Cottonwood Creek. The total aggregate volume for TC-4, TC-5, and TC-6 would remain the same, while the aggregate footprint of the overburden disposal areas would expand by 25 acres at the TC-6 location. The slopes on the expanded TC-6 overburden disposal area would be flatter than those on the TC-4, TC-5, and TC-6 overburden disposal areas. This would likely lead to less direct run-off from overburden disposal area slopes in this alternative than in the Proposed Action. The overburden disposal area slopes make up less than one percent of the Cottonwood Creek watershed.

Impacts to Surface Water Quality

Meteoric Water Infiltration through Overburden Disposal Areas

The 25-acre increase in aggregate surface area of the overburden disposal areas could potentially lead to an increase in estimated long-term seepage from the overburden disposal areas. At CCS-06, the increase, using a simple area ratio, would be from 1.1 gpm to 1.4 gpm. At CCS-1A, the increase would be from 3.18 gpm to 4.16 gpm. Given the small overall flow, the predicted water quality for this alternative would not be materially different than that described for the Proposed Action.

Erosion Potential

The flattening of the overburden disposal area slopes, as noted above, would reduce direct run-off, and would also lower flow velocities off the slopes. Therefore, erosion should be less from overburden disposal area slopes in this alternative than in the Proposed Action after reclamation.

4.2.1.4 Partial Backfill Alternatives - Rehandling of TC-4 and TC-5

Impacts to Surface Water Quantity

Diversions

The diversion channel disturbance would be the same as in the Proposed Action. Drainage basin area T6 and T7 (Figure 4-1 and Table 4-2) would be temporarily in place during mining and then would be eliminated after reclamation.

Changes in Land Use

Under this alternative, the overburden disposal areas TC-4 and TC-5 would be stockpiled temporarily with resultant risks of sedimentation and meteoric water infiltration during mining; however, there would be no run-off following reclamation as the material would be backfilled into the adjacent pit. The long-term alteration of drainage area would be 23 acres less than the Proposed Action within Basin 1 of the Cottonwood Creek drainage (Figure 4-1).

As under the Proposed Action, the total area removed from the watershed during mining and following reclamation would be approximately 592 acres and 387 acres, respectively (Table 4-1). The area of disturbed surfaces due to ancillary facilities, diversion, pipelines, and roads would also be the same as the Proposed Action.

After reclamation, the surface contributing to run-off would be approximately 594 acres (i.e., elimination of overburden disposal areas TC-4 and TC-5 and their diversions) or 134 acres less than the Proposed Action.

Impacts to Surface Water Quality

Meteoric Infiltration through Stockpiles

There would be no long-term effect to surface water quality from infiltration of meteoric waters through TC-4 and TC-5 to surface water quality as these materials would be within a pit and any seepage would contribute entirely to the groundwater. The surface expression of flow through TC-3 and TC-6 would be negligible and dispersed.

Erosion Potential

For TC-4 and TC-5, diversion channels would be required during mining and would be designed to divert flows from the 100-year, 24-hour storm event. As the disturbed areas are upslope and within 250 feet of the mainstem Cottonwood Creek, there would be a risk of sediment loading to riparian areas and aquatic habitat during mining. In addition, the risk would remain for a longer period of time compared to the Proposed Action because of having to re-handle the overburden from TC-4 and TC-5 back into the pit.

Impacts from Spills, Leaks, and Overflows

Magnitude of the risks from spills, leaks, or overflows would be similar to those described for the Proposed Action; however, the duration of transporting and storage of fuels would be longer.

4.2.1.5 Partial Sequential Backfill of Trenton Canyon Pits

This alternative includes construction of some overburden disposal areas in the pits rather than on-land. There would be no diversions required for the disposal areas within the pit; therefore, run-off effects and alteration of drainage could be 100 - 300 acres less than under the Proposed Action, depending on the final configuration. Less surface disturbance implies less risk of erosion; however, the sedimentation risks within the Proposed Action would be minor because of the proposed protection measures which are part of the Plan of Operations and Reclamation Plan. Therefore, this alternative's surface water impacts would be similar to the Proposed Action.

4.2.2 Potential Mitigation and Monitoring

The proposed sediment control features that are design features of the Proposed Action and other action alternatives are described in Section 2.4.7.1 and 4.2.1.2. Any additional erosion and sediment loss from roads, overburden disposal areas, and other project features with steep slopes would be controlled by implementing temporary siltation berms, run-off interceptor trenches, small sediment catch basins, or other approaches as consistent with Nevada Best Management Practices. Such measures would be applied as appropriate.

Monitoring of Cottonwood Creek for suspended solids and turbidity would be advisable on a semi-annual basis. No additional mitigation or monitoring measures beyond those in the Plan of Operations and Reclamation Plan would be required.

4.2.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

The Proposed Action and alternatives would not require any discharge to surface water and flow and run-off characteristics would not be measurably different from the existing condition. There would be no residual adverse effect on surface water quality within the project area under any of the action alternatives.

4.3 GROUNDWATER

Issues related to groundwater include the:

- Potential for the pits to intercept laterally continuous water bearing zones,
- Potential for the pits to intercept perched water zones of limited areal extent and production capability,
- Potential for leaching of metals from overburden disposal areas and pits,
- Potential risks to small springs and seeps due to leaks from fuel and reagent storage tanks, and
- Potential release of toxic or hazardous compounds.

4.3.1 Direct and Indirect Impacts

The Proposed Action, No Action and each of the other alternatives have similarities of construction and operation which would result in similar groundwater effects. No additional water supply would need to be developed, as any water needed for the heap leaching facility and other aspects of ore processing under any of the alternatives would be adequately supplied by pipeline from the LTM. There is no expected pit dewatering required under any of the alternatives, as the pit design elevations are above the predicted groundwater table in all three mining areas. Some surficial weathering of pit walls and overburden disposal areas would occur under any of the alternatives, potentially resulting in metals leaching into the groundwater.

The Proposed Action, No Action and each of the other alternatives would not encounter laterally continuous water bearing zones, but may intercept discontinuous perched groundwater zones. Groundwater seeping into the pits from the perched zones would be lost to evaporation. The extent that these perched zones connect with deeper aquifers is unknown. The impact of the loss of the perched zone recharge to groundwater quantity is unknown, but is believed to be insignificant.

4.3.1.1 No Action Alternative

Potential Effects on Groundwater Quantity

The No Action Alternative would have no impact on groundwater quantity. All the water for the Proposed Action would originate from LTM, which would continue the dewatering process under any alternative under consideration. Since all process and dust suppression water would be lost to evaporation under the Proposed Action, the No Action Alternative would not impact groundwater recharge.

Potential Effects on Groundwater Quality

Leaching Potential

Exposure of the mineralized zone under the No Action Alternative would increase the infiltration from rain and snowmelt, and decrease the distance from surface to groundwater. The overburden areas also provide a greater surface area from which to leach metals to groundwater. The MWMT data in Table 4-4 and acid/base accounting data in Table 4-6 indicate the potential for metal leaching from the exposed pit faces or overburden materials is very low.

Hazardous Materials

Indirect impacts of the No Action Alternative could include the potential for groundwater degradation as a result of toxic or hazardous chemical release from the North Peak heap leach facility, storage tanks, or transportation routes. Engineering and construction controls such as overflow ponds, secondary containment structures, and level switches incorporated during design of the leach pads, tanks and structures reduce the likelihood of chemical releases. Spill Prevention, Control and Countermeasure (SPCC) Plans, Emergency Response Plans (ERPs), and employee safety training minimize the likelihood of a release and provide direct immediate remedial activity to limit the size of the release.

Table 4-6
Summary of Acid-Base Accounting by Mining Area

Location	Total Interval Sampled	Total Samples	Weighted Values S(py)	ANP	AGP	ANP/AGP	NNP	Core Interval with AGP >10 and ANP/AGP <2
Units	Feet	Number	%	kg/t	kg/t	Ratio	kg/t	% of total
TRENTON CANYON DEPOSIT								
South TC-4, TC-5, TC-6	85.8	39	0.12	44	4	12	40	7
Central TC-1, TC-2	117.7	36	0.05	10	2	6	9	2
North TC-3	11.3	6	0.03	7	1	8	6	0
VALMY DEPOSIT								
V-1	73.4	19	0.01	12	0	29	11	0
V-2, V-3, V-4, V-5	9.2	5	0.01	2	0	5	1	0
NORTH PEAK DEPOSIT								
NP-1, NP-2	43.1	11	0.01	11	0	30	11	0

NOTE:
Units of kg/t in calcium carbonate equivalents

4.3.1.2 Proposed Action

Potential Effects on Groundwater Quantity

Mine process water for all of the project alternatives would be necessary to support the existing permitted facilities, but would be less than 1,500 gpm, the amount projected for use during full operation of the Trenton Canyon Project. This would have no direct impact on groundwater because the process water is supplied from the LTM dewatering well system which would continue to function regardless of the decision to permit the Trenton Canyon Project. A discussion of the impacts to groundwater from operation of the LTM dewatering system is included in the LTM DEIS (USDI BLM 1995).

Potential Effects on Groundwater Quality

Risk of Release of Toxic or Hazardous Substances

Indirect impacts of the Proposed Action could include the potential for groundwater degradation as a result of toxic or hazardous chemical release from the leach pads, ore processing areas, storage tanks, or transportation routes. Please refer to Section 4.4.1.2 for a discussion of the probability of this occurrence. If the impacted groundwater body supplies flow to a seep or spring, surface water quality could be impacted. Both North Peak and Valmy mine areas would have a leaching facility; thereby requiring leach pads, storage, and provision for ponding of cyanide solution in the event of an overflow. Engineering and construction controls would be as already established for the North Peak facility. The overflow ponds, secondary containment structures, and level switches reduce the likelihood of chemical releases. As under the No Action Alternative, SPCC Plans, ERPs, and employee safety training minimize the likelihood of a release and provide direct immediate remedial activity to limit the size of the release.

Acid Base Accounting

Based on the rock type analytical results which indicated mostly low sulfur content and elevated carbonate, the potential for impact due to sulfur oxidation and acid release appears to be minimal. Refer to Appendix A, Acid Base Accounting, for the methods used to determine this conclusion.

Weighted ANP/AGP were in the range of 4.9 to 30.4 for all samples taken within the Trenton, Valmy, and North Peak mine areas (Table 4-6). From these ratios, it can be concluded that the potential for metal leaching due to acidic conditions is extremely low for tested overburden material and pit excavations.

Effects of Weathering of Overburden Disposal Areas and Pits

Long-term effects of the Proposed Action include the potential change in groundwater chemistry due to the infiltration of precipitation through the overburden disposal areas and pit excavations. Moisture within the overburden piles could chemically release higher concentrations of metals as products of weathering of ore and other rock material. The destination of these higher concentrations of metal ions would be primarily to the groundwater (Shepherd Miller, Inc. 1997)

Leachate Tests

Leachate from the overburden disposal areas and pits would be non-acidic and contain metal concentrations generally limited by pH and the low solubility of metal hydroxides and carbonates. MWMT sampling results were evaluated in detail; however, since pH values were in the near neutral range, metals mobilization within the overburden disposal area would be severely limited (Appendix A).

The predicted overburden disposal area leachate concentrations (Table 4-4) are well within the drinking water standards except for sulfur where the predicted concentration was 1059 mg/L compared with the maximum secondary standard (for public water supply) is 500 mg/L. Other possible indirect impacts could result from segregation of isolated rock types containing elevated sulfur content; however, waste management procedures keeps the possibility of this effect extremely low.

4.3.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

This alternative would relocate the overburden disposal area on a tributary of the Cottonwood Creek drainage. Development of this alternative would increase the thickness of the material through which water must percolate to reach the water table in the vicinity of the new overburden disposal area. This impact is expected to be offset by the maintenance of the existing thickness of material and relationship to the water table in the TC-4 and TC-5 overburden disposal areas. This alternative would not change impacts previously described for continuous or perched water bearing zones, metals leaching potential, or hazardous materials releases. Development of the alternate location of TC-4 and TC-5 would not have an adverse impact on the groundwater quality or quantity.

4.3.1.4 Partial Backfill Alternatives

<u>Re-handling of TC-4 and TC-5</u>

Leachate from backfill at Trenton Canyon would be expected to be pH-neutral; therefore, metal solubility would be limited. Re-handling of the overburden material has the potential to result in short-term changes in groundwater chemistry, particularly if the overburden material had been stockpiled for several years prior to being returned to the pits. The leaching of metals impact is a result of the buildup of weathering products in the overburden material because infiltrating precipitation does not remove all products accumulated in the overburden material. Simulations of physical flow in overburden material show that as much as 80% of the rock mass may not be leached (Day and Harpley 1993; Morin, *et al.* 1991). Hence, when the rock is re-handled, the unleached weathering products can be dissolved by precipitation resulting in impacts to surface water or infiltration to the groundwater. The infiltration rate of leachate through the overburden material in the pits has the potential to be faster and of slightly greater volume because there would be less lost to evapotranspiration and run-off and would contribute only to the groundwater.

The final geometry of the backfilled pits may change the snow capture area. If the pits are filled from bottom to top, the snow capture area would remain the same. If the pits are backfilled by dumping from the pit rim, the pit aperture area would decrease, thus decreasing the snow capture zone. Decreasing the snow capture zone would decrease the volume of snowmelt infiltration through the pit floor to groundwater.

Partial Sequential Backfill of Trenton Canyon Pits

Sequential backfilling would have no adverse effect on the groundwater resource after reclamation. The weathering and leaching effects on groundwater quality would be similar to the Proposed Action. The final geometry of the backfilled pits may change the snow capture area. If the pits are filled from bottom to top, the snow capture area would remain the same. If the pits are backfilled by dumping from the pit rim, the pit aperture area would decrease, thus decreasing the snow capture zone. Decreasing the snow capture zone would decrease the volume of snowmelt infiltration through the pit floor to groundwater.

4.3.2 Potential Mitigation and Monitoring Measures

Negligible groundwater impacts are expected under the Proposed Action or other alternatives; therefore, no mitigation is proposed. Periodic groundwater monitoring in the vicinity of the mine would continue in order to assess groundwater quality. If results of the monitoring program indicate significant impact to groundwater, mitigation measures would be implemented consistent with NDEP requirements.

4.3.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

The proposed project is not anticipated to have any residual adverse effects to the local or regional groundwater resource. The total volume of groundwater consumed during the period from 1998 through 2005 would be 1,216.3 acre feet per year maximum (per application for water appropriation). All of this water is expected to be lost through evaporation. This water would be supplied from the LTM dewatering wells. Diversion of the water for use at the Trenton Canyon Project would decrease the amount available for return to the Humboldt River through the LTM discharge system. The proposed project would not alter the dewatering volume or extend the time period over which the LTM dewatering system is operational.

4.4 HAZARDOUS MATERIALS

Issues related to hazardous materials include:

- Potential for and effects of spills, leaks, or overflows of mining-related contaminants,
- Detrimental effect of releases of hazardous materials on sensitive receptors within the natural environment including vegetation, wildlife, and humans, and
- Potential for release of fuel or petroleum products into the soil or surface waters of the project area.

4.4.1 Direct and Indirect Impacts

Direct and indirect impacts would be experienced in the event of a release of hazardous substances to the environment. The likelihood of such impacts is low and is further discussed within this section. The releases could occur during transportation to and from the project, or from use or storage of the materials on the project site. The environmental effects of a release would depend on the substance, amount, timing and location of the release. Hazardous materials releases could reach sensitive receptors, primarily via migration through air and water transport mechanisms. The impact of hazardous material exposure to sensitive receptors ranges from slight, transient effects to severe chronic systemic dysfunction or death. In general, the two materials of greatest concern are diesel fuel and sodium cyanide.

Diesel Fuel Release - A diesel fuel release would kill vegetation if in direct contact for extended periods. Although unlikely, a diesel spill could ignite from the accident and cause a range fire. A spill into a water body would contaminate water and sediments, possibly impacting local aquatic populations. Due to the anticipated rapid response and cleanup of a diesel spill, long-term exposures to diesel fuel in soil or groundwater are not expected.

Sodium Cyanide Release - The effects of sodium cyanide release would vary greatly depending on the amount released, the location (dry hillside, wetland or flowing stream), the organisms exposed, and the chemical conditions at the release location. The most likely effect of a release of sodium cyanide would be the immediate poisoning. Animal species that drink contaminated water would suffer severe effects or death, depending on the concentrations and volume ingested. Sodium cyanide in the atmosphere decomposes rapidly into hydrogen cyanide gas which is poisonous and flammable at high concentrations. Animals that breathe sodium cyanide would suffer severe effects or death, depending on the concentration and duration of exposure. Animals that survive would recover rapidly due to the natural detoxification processes within the body that remove the contaminant from the body. Environmental effects of cyanide spill or leak would be limited in extent and time of contamination due to the rapid degradation of cyanide into non-toxic compounds when exposed to either direct sunlight or oxygen.

<u>Probability of Release</u> - The release of a hazardous material or waste into a sensitive area such as a stream, wetland or populated area, is judged to be very unlikely. Depending on the type of material, amount, and location released, an accident resulting in the release could impact soil, water, biological resources or people.

<u>Handling and Management Procedures</u> - All hazardous substances would be transported by commercial carriers or vendors in accordance with Title 49 of the Code of Federal Regulations. Carriers would be licensed and inspected as required by the Nevada Department of Transportation and the USDOT. Shipping papers must be accessible and must contain information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, fire-fighting information, procedures for handling leaks and spills, first aid measures, and emergency response telephone numbers. In the event of a release off the project site, the transportation company would be responsible for response and cleanup. Each company is required to develop a Spill Prevention, Control, and Countermeasure Plan (SPCC) to address the materials it would be transporting. The Emergency Response Plan for the mine addresses potential incidents at the project site and associated rights-of-way (access road ROWs N-59591 and N-59592).

4.4.1.1 No Action Alternative

The existing permitted operations require transporting, handling, using and disposing of petroleum based fuels and lubricants, sodium cyanide and acids and bases for use in the gold extraction process, ammonium nitrate/fuel oil (ANFO) and explosives used in rock blasting. A permanent diesel storage tank (500 gallon) for backup power to the process plant and a sodium cyanide storage (15,000 gallon) are located in the northeast quarter of Section 15, T32N, R42E, at the process facility. A portable diesel fueling station is located in the southwest quarter of Section 11, T32N, R42E at the north end of the ready line between the pit and the overburden disposal areas and consists of two 10,000 gallon above ground storage tanks (ASTs). The ANFO mixture is stored in a 60 ton silo located in the southwest quarter of Section 1, T32N, R42E. The storage locations for these materials are indicated on Figure 2-5.

Due to the anticipated rapid response and cleanup of a diesel spill, long-term exposures to diesel fuel in soil or groundwater are not expected.

4.4.1.2 Proposed Action

Hazardous materials releases could occur during transportation to the site, or as a result of storage or use at the site. Trucks would be used to transport hazardous materials to and from the project site. Trucks transporting materials to the Valmy mine area are required to cross both Cottonwood and Trout creeks.

The probability of an accident occurring during transport was calculated using the following assumptions:

- Hazardous material delivery frequency data from Table 2-3,
- Travel distance of 51 miles, equivalent to the distance from Winnemucca to the Trenton Canyon mine area,
- Frequency rate of truck accidents resulting in release of hazardous materials of 0.28 accidents per million miles (2.8×10^{-7} accidents per mile). This figure was determined using national statistics for truck accidents resulting in hazardous materials releases compiled by the Transportation Research Board (Abkowitz *et al.*, 1984), and
- Estimated mine operations duration of seven years.

Multiplication of the frequency of delivery (i.e. 428 deliveries per year) **x** the number of miles traveled **x** the expected mine life of seven years yields an aggregate total of 152,796 hazardous materials transport miles for all the materials listed in Table 2-3. Multiplication of 152,796 miles **x** 2.8×10^{-7} accidents per mile yields an accident probability estimate of 0.03 accidents involving release of hazardous materials over the anticipated mining operation at Valmy, North Peak, and Trenton Canyon deposits. This analysis indicates the probability of an accident during transport of hazardous materials is very low.

Once on site, Newmont would be responsible for hazardous materials use and storage. Newmont has developed SPCC and Emergency Response Contingency Plans in accordance with 40 Code of Federal Regulations for handling of these materials. Over the life of the project, the likelihood of minor spills of diesel fuel, oils or antifreeze is relatively high. Operation in accordance with the SPCC would ensure that spills would be localized, contained, and removed.

The design of the processing facilities minimizes the potential for an upset that could result in a major spill. The facilities would be designed to prevent discharge to the soil and groundwater. Permanent hazardous materials storage tanks would have secondary containment sufficient to hold the volume of the largest tank in the system, and still have additional freeboard. All tanks and vessels would comply with manufacturers recommendation, state and Federal regulations, and best management practices.

All hazardous materials would be handled in accordance with applicable Mine Safety and Health Administration or Occupation Safety and Health Administration regulations. The hazardous substances to be used in the Proposed Action would be handled as recommended in the manufacturer Material Safety Data Sheets.

4.4.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

This Alternative would result in similar risks of spills as the Proposed Action; however, by eliminating TC-4 and TC-5, there would be fewer haul trips on the slopes immediately above Cottonwood Creek. The probability of spills from equipment hauling diesel and hydraulic fluids to sensitive areas would be lowered.

4.4.1.4 Partial Backfill Alternatives

The Partial Backfill Alternatives would result in similar impacts as the Proposed Action.

4.4.2 Potential Mitigation and Monitoring Measures

The probability of release is low and the spill prevention and emergency response plans would be sufficient to mitigate adverse effects.

No additional mitigation or monitoring measures would be required beyond those proposed in the Plan of Operations, Reclamation Plan, or required by NDEP.

4.4.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

No residual adverse effects or irreversible and irretrievable commitment of resources are anticipated as a result of the Proposed Action or other alternatives.

4.5 GEOLOGY AND MINERALS

Issues related to geology and minerals include:

- Potential to create geologic hazards from the project development,
- Potential threat to fossil remains,
- Alteration of the exposed bedrock, and
- Effects on future resource availability.

4.5.1 Direct and Indirect Impacts

4.5.1.1 No Action Alternative

Under the No Action Alternative, mining would continue on Newmont land until 2002 in the North Peak and Valmy mine areas under existing permits where the total ore extracted is estimated to be up to five (5) million tons. There would be no extraction of 30 million tons of ore as proposed; it could be mined at a later time, but may not be as economic in the future since the mining infrastructure currently exists.

4.5.1.2 Proposed Action

Geologic and mineral resources within the proposed project area would be directly impacted by the relocation of approximately 122 million tons of overburden and extraction of 30 million tons of ore.

Mining activities in the proposed disturbance area would cause direct impacts to fossils if they are encountered. The potential for significant fossil localities in the bedrock is low. The discovery of a vertebrate fossil in Quaternary alluvium south of the Marigold Mine, in the vicinity of the Valmy mine area, indicates a potential for similar occurrences in this strata.

The Proposed Action would allow disturbance and redistribution of 152 million tons of rock. After mining, the displaced materials would reside in an oxidizing environment that, under certain conditions, may leach metals and convey them to the subsurface by infiltration. Geochemical profiling of the ore and overburden material is described in Section 3.5.8 and Section 4.3.1.2. The tests indicate that nearly the entire rock mass is pervasively oxidized. The potential for significant alteration of the already oxidized material is low.

The design features and construction techniques planned to ensure stability of the Trenton Canyon mine facilities are described in the Plan of Operations (revised in October 1997). All facilities would be designed in accordance with NDEP and BLM criteria. Overburden disposal areas and mine pit slopes would be designed and constructed to accommodate wet climate cycles, designed storm events, and earthquakes.

4.5.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

Ore and overburden removal would proceed as described in Section 2.4. This alternative only considers redistribution of the disturbed material. The consolidation of the overburden designated for TC-4 and TC-5 into TC-6 would have no different impacts to the geologic and mineral resources than the Proposed Action.

4.5.1.4 Partial Backfill Alternatives

<u>Rehandling of TC-4 and TC-5</u>

This alternative would place an undetermined volume of backfill in the Trenton Canyon central pit, Area E on Figure 2-13. The result of this action would be the loss of potential mineral resources beneath the backfill material. The pit limits, as defined in the Proposed Action, reflect recovery of current economically recoverable reserves, but do not reflect recovery of lower grade ore that cannot be economically recovered at present. Changes in mineral market prices or mining and processing costs may change the economically recoverable reserve base. Partial backfilling would eliminate access to remaining low grade ore in the pits and may preclude future recovery since the value of the remaining ore would have to be sufficiently great as to support re-excavation of the backfilled materials.

Partial Sequential Backfill of Trenton Canyon Pits

This alternative would place overburden material in Areas A and E (Figure 2-13). This alternative could result in the loss of potential mineral resources on the basis of rationale similar to the rehandling backfill alternative.

4.5.2 Potential Mitigation and Monitoring Measures

Activities that disturb Quaternary sediments should be conducted with an awareness that vertebrate fossils may be present. If fossils are discovered during mining activities, the operators would contact BLM to determine the procedures necessary for recovery or avoidance of fossil remains. Mineral economics would be carefully scrutinized to minimize the likelihood of burying potentially economic gold reserves. Waste rock would be sampled quarterly in accordance with a State permit. If sulfide material is encountered, it would be handled in accordance with an approved waste management plan.

4.5.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

No adverse effects to the geologic resource are anticipated as a result of the Proposed Action. Approximately 30 million tons of ore would be removed from the geologic resource during mining. The gold from that ore would be irretrievably removed from the geologic resource, but would remain in circulation indefinitely.

4.6 AIR

The primary issue related to air quality is the increase in fugitive particulate and fugitive gaseous emissions related to operating mining equipment and increased surface disturbance.

4.6.1 Direct and Indirect Impacts

Air emissions would result from exploration activities and the construction, operation, closure and reclamation phases of the Proposed Action and any of the alternatives. Mining, ore-processing, and construction activities associated with the Proposed Action and other alternatives would be a source of particulate that are 10 microns or smaller in diameter (PM_{10}), and hazardous air pollutants (fine airborne metal dust as components of particulate matter and as components of volatile organic compounds). Gasoline and diesel-powered vehicles and equipment would be primary sources of gaseous pollutants such as sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), and volatile organic compounds (VOCs).

Nature of Air Emissions - Background levels for criteria pollutants (i.e., PM_{10}, SO_2, NO_x, CO, and VOCs) in the Clovers Area, Buffalo Valley, and Pumpernickel Valley air basins (Figure 3-11) are low with no significant emission sources. Ambient particulate from wind erosion, traffic on unpaved roads, mining and ore processing, agricultural operations, and other sources exist within the region. Measures currently being implemented to reduce emissions include watering and/or chemical stabilization of haul roads and stockpiles.

Particulate emissions associated with the Proposed Action and other alternatives may potentially result in temporary decreases in visibility near the operations, especially during dust storms. The only point source of particulate emissions would result from handling of lime during ore processing.

The emission sources for gaseous criteria pollutants resulting from any of the project alternatives would be from storage of hydrocarbon fuels and mobile sources such as vehicles. Emissions would include SO_2, NO_x, CO, and VOCs.

Sodium cyanide solution is maintained at a basic pH through the use of lime and caustic soda in the heap leaching process. The potential for hydrogen cyanide gas (HCN) generation is therefore minimized. HCN decays rapidly in the presence of oxygen and sunlight and is not expected to have a measurable impact on air quality in the project area.

Overburden material at the Trenton Canyon, Valmy, and North Peak mine areas contains small amounts of numerous metals. Air-borne metals are released through mining and construction activities, and are associated with PM_{10} particulate emissions. Measures used to reduce particulate emissions are also effective in reducing concentrations of air-borne metals.

Air Quality Effect - The effect of particulate emissions depends on the quantity and drift potential of the dust particles released into the atmosphere. The larger dust particles settle out near the source, while fine particles are dispersed over much greater distances. Theoretical drift distances, as a function of particulate diameter and mean wind speed, have been computed for fugitive dust emissions. For a typical wind speed of 10 miles per hour, particles larger than 100 micrometers are likely to settle out within 20 to 30 feet from the source. (For comparison, a human hair has a thickness of about 100 micrometers). Particles 30 to 100 micrometers are likely to settle within a few hundred feet, depending on the extent of atmospheric turbulence. Dust particles smaller than 30 micrometers are generally recognized as emissions that may remain suspended for an indefinite period of time.

The quantity of gaseous emissions would be small compared to the fugitive particulate and would dissipate faster. It is unlikely that any of the gaseous emissions would influence the air quality beyond the project area boundary under any of the alternatives.

Most of the emissions that would be transported beyond the project area boundary would move in the prevailing wind direction, which is north and east of the project area. The closest receptor for these emissions would be town of Valmy which is 13 miles north of the Trenton Canyon mine area and 6 miles north of the Valmy mine area.

Standards for the Impact Analysis - Potential impacts to air quality were compared against the National Ambient Air Quality Standards (NAAQS). These standards represent the maximum air concentrations of a given pollutant determined to have no detrimental effects on public health and/or the environment. NAAQS levels are also recognized by the State of Nevada. Standards for particulate matter (PM_{10}) are annual PM_{10} levels above 50 micrograms per cubic meter ($\mu g/m^3$) or 150 $\mu g/m^3$ in a 24-hour period.

4.6.1.1. No Action Alternative

Under the No Action Alternative, Newmont is currently authorized to disturb 1,202 acres (including 336 acres of public land) associated with mining at North Peak and Valmy and exploration activities for the Trenton Canyon Project (Table 2-2). Impacts from the activities under this alternative have been previously evaluated and are permitted under the NDEP Air Quality Operating Permit.

Monitoring data from the vicinity of the project (Santa Fe Pacific Gold Corporation 1995) indicate that 25 $\mu g/m^3$ is the concentration of PM_{10} value below which 85% of all 24-hour PM_{10} concentrations were monitored in 1995. The top 15% of the concentrations can be attributed to strong winds that cause dust storms in semi-arid regions and are not representative of current conditions. An average annual PM_{10} of approximately 15 $\mu g/m^3$ would result from existing and permitted operations under the No Action Alternative given an average annual PM_{10} background concentration of 9.75 $\mu g/m^3$. The NAAQS standard is 150 $\mu g/m^3$. Given the distance from the Valmy mine area to the closest receptors, it can be presumed that only a portion of the fugitive particulate and none of the gaseous emissions would impact the ambient air quality in the town of Valmy.

4.6.1.2 Proposed Action

Expansion of operations in the mine as described in the Proposed Action would result in 1,480 acres of disturbance more than the currently permitted activities, for a total mining-related surface disturbance of 2,682 acres.

Air emissions during road and facility construction would be of a relatively short duration and would include:

- Fugitive dust emissions from widening or realigning the existing access road and from constructing new haul roads,

- Fugitive dust emissions from construction activities at the shop/office area, barrel handling facilities, and bioremediation cells,
- Fugitive dust emissions from construction of a heap leach facility near the Valmy pit in either Section 29 or 21; and
- Tail-pipe emissions from mobile sources.

During mining operations and the reclamation phase, there would be daily generation of particulate and gaseous emissions from the following activities:

- Expansion of North Peak pit and a new overburden disposal area,
- Expansion of the Valmy pits, overburden disposal areas, and growth medium stockpiles,
- Development of Trenton Canyon pits, overburden disposal areas, growth medium stockpiles, and access/haul roads,
- Tail-pipe emissions from mobile sources,
- Emissions from reclamation activities, including slope grading,
- Emissions from the lime silo, and
- Emissions from hydrocarbon fuel storage.

Quantity of Air Emissions

Future air emissions have been quantified by using emission factors from EPA document - AP-42, Compilation of Air Pollutant Emission Factors, and from other sources according to standard practices followed by the mining industry.

Table 4-7 shows the estimated increase over current approved emissions that would result from the Proposed Action for the Trenton Canyon Project. The fugitive source emissions would be from drilling, blasting, loading and unloading of ore and overburden material, haul roads, wind erosion of overburden disposal areas, leach heaps, disturbed areas, and loading and unloading of the lime silo.

Table 4-7
Estimated Controlled Emissions from the Proposed Action (tons per year)

Emissions	PM_{10}	SO_2	NO_x	CO	VOC
Point/Lime Solo	1.18	n/a	n/a	n/a	n/a
Non-process/ fugitive*	29.56	n/a	n/a	n/a	n/a
Mobile	5.4	16.3	151.0	42.2	22.3
Total	36.1	16.3	151.0	42.2	22.3

n/a = Not Applicable
* Fugitive source emissions consist of wind erosion, wet drilling, and truck hauling.

The only point source emission would be the loading and unloading of calcium carbonate to the lime silo. The total PM_{10} emissions from the Proposed Action is estimated to be 36.1 tons per year (Table 4-7). The fugitive PM_{10} emissions may include small quantities of airborne metal which may be classified as Hazardous Air Pollutants (HAPs). The effect of airborne metal emissions is expected to be negligible. Mobile source combustion emissions result from haul trucks, loaders, graders, dozers, and water trucks. Total estimated emissions from those sources are shown in Table 4-7.

Air Quality Effect

The total project emissions for the Proposed Action represent less than 20% of the total projected emissions from the Lone Tree Mine (LTM) which is within the same air basin. Air dispersion modeling at LTM resulted in concentrations of these constituents that are far below the NAAQS for PM_{10}, SO_2, NO_x, and CO. For PM_{10}, the modeled concentration was 48.5 $\mu g/m^3$ for 24-hour and 17.5 $\mu g/m^3$ for annual projection as compared to 150 $\mu g/m^3$ and 50 $\mu g/m^3$, respectively for the NAAQS. This model is conservative by nature, therefore, since the Trenton Canyon Project represents only a portion of the total annual emissions of LTM, the direct effect of the Trenton Canyon Project would not exceed the NAAQS.

Given the distance from the mining areas to the closest receptors, it can be presumed that only a portion of the fugitive particulate (30 micrometers or less fraction) and none of the gaseous emissions may influence the ambient air quality in the town of Valmy. Particulate emissions resulting from the operations at the Trenton Canyon mine area may influence the air quality at Marigold Mine. Emissions from the Proposed Action would not cause NAAQS exceedances at Valmy or Marigold Mine.

4.6.1.3. Expansion of TC-6 to Eliminate TC-4 and TC-5

This alternative would involve an overburden haul distance 1-2 miles longer and 25 acres more surface disturbance than the Proposed Action. This would result in less than a 5% increase in air emissions when compared to the Proposed Action. The projected impacts from the Proposed Action were well below the NAAQS; therefore, the impacts from this alternative would also be below the NAAQS.

4.6.1.4 Partial Backfill Alternatives

Rehandling of TC-4 and TC-5

The impacts associated with this alternative would be similar to those for the Proposed Action; however, additional particulate (PM_{10}) could result from wind erosion of the stockpiled material. The duration of the air impacts would be longer than the Proposed Action because after the ore has been extracted, additional fugitive particulate and gaseous emissions from equipment would occur during the placement of overburden material back into the pits.

Partial Sequential Backfill of Trenton Canyon Pits

Pit backfilling can occur within the same pit or in adjacent pits and it can eliminate material rehandle if backfilling is done during the mining sequence. The shorter haul distance for handling the same volume of material would result in less PM_{10} and gaseous emissions than the Proposed Action, Expansion of TC-6, or Rehandling of TC-4 and TC-5 alternatives.

4.6.2 Potential Mitigation and Monitoring Measures

As part of the air quality operating permit, fugitive emissions for the Proposed Action and any of the alternatives would be minimized by clearing only as much land as can be adequately controlled by watering, chemical stabilization or other controls approved by the Nevada Bureau of Air Quality. Specific dust control measures would include watering or stabilizing unpaved haul roads, access roads and ore stockpiles with chemicals.

Concurrent reclamation and revegetating with bunch grasses and shrubs as part of the proposed reclamation plan mitigates long-term fugitive dust emissions from disturbed areas.

No additional mitigation or monitoring measures would be required beyond those proposed in the Plan of Operations and Reclamation Plan or required by the Bureau of Air Quality.

4.6.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

The emission sources from the Proposed Action and any of the alternatives would not be present when the mining activities cease and mine closure and reclamation activities are completed (expected by 2009).

4.7 SOILS

Potential impacts to soils would include soil loss and changes in productivity of the soil as a result of mining and reclamation activities. Reclamation effectiveness, as expressed by availability of suitable growth medium, and erosion potential are the key issues for the analysis of mining and reclamation activity impacts.

4.7.1 Direct and Indirect Impacts

Reclamation activities for any of the alternatives could require close to 12 inches of topsoil to cover the overburden disposal areas, roads, heap leach pads, and pond areas at a sufficient depth for successful vegetation growth. For all alternatives, the amount of available soil salvaged from disturbed areas would be less than necessary to achieve the desired cover depth, resulting in a shortage. Alternate sources of growth medium would need to be developed to make up for the shortage.

During operations, a program would be implemented to identify and test appropriate growth medium. Items to be evaluated during the program would include:

- Soil depth requirements,
- Amendments and/or fertilizer requirements,
- Appropriate vegetation species for site reclamation, and
- Identification of alternate sources to be used as growth medium.

Newmont proposes to salvage growth medium from disturbed areas that are not too steep for reasonable stripping and hauling.

An additional consideration for all alternatives is that some soil losses to water or wind erosion are irretrievable and irreversible. Some of the topsoil would also be lost that cannot be salvaged before being buried under overburden disposal areas and leach pads. Mitigation measures would minimize this loss of topsoil during salvage, stockpiling, or reclamation activities to ensure revegetation success.

4.7.1.1 No Action Alternative

Under the No Action Alternative, Newmont is currently authorized to disturb 1,202 acres (including 336 acres of public land). It is estimated that approximately 101,000 cubic yards (yd^3) of topsoil could be salvaged and stockpiled from pits, access and haul roads, overburden disposal areas, heap leach pads and overflow ponds, and other facilities over 486 acres of disturbed mining area. This analysis assumes that roads and drill sites (up to 716 additional acres) disturbed for exploration would be concurrently reclaimed with available soil at each location. A total of 434 acres would have to be reclaimed; therefore, based upon the depth of affected soil types, three inches of topsoil would be available to cover disturbed areas. Given the fact that more than 3 inches topsoil is required for adequate revegetation and that 12 inch coverage is desired, there would be a need to develop new sources of growth medium under the current permitted operations

4.7.1.2 Proposed Action

The expansion of operations in the mine, as described in the Plan of Operations, would result in an additional 1,480 acres of disturbance over the currently permitted activities, for a total mining-related surface disturbance of 2,682 acres. For the Proposed Action, up to 1.6 million cubic yards (M yd^3) of growth medium, covering approximately 2,226 acres, would be stripped and stockpiled for future use in reclamation activities. This calculation excludes any growth medium that may have been or would be salvaged from exploration roads or drill sites. The soil type cannot be determined for these areas since they are not placed in a fixed location.

The 1.6 M yd^3 of growth medium would provide an average growth medium application depth of 7 inches to cover the heap leach pads, pond areas, roads, and overburden disposal areas after mine closure. For this alternative, a total of 2.6 M yd^3 of topsoil would be necessary to install the full 12 inch depth of topsoil, which represents a shortfall of 1.0 M yd^3.

The effective use of sediment control structures, blocking natural drainages, and revegetation efforts would help prevent erosion of disturbances on reclaimed sites. Shepherd Miller, Inc. performed a conceptual hydrologic analysis and hydraulic design for control surface water drainage (SFPG 1996). The plan called for diversion channels being placed above overburden disposal areas and heap leach pads. The channels would prevent run on to these areas thereby reducing the potential for erosion from the overburden disposal areas. The channeled water would be routed away from the facilities joined with either the natural drainage or spilled onto the natural slope. Diversion channels would be planted with hardy grasses where flow velocities of less than 4.0 feet per second are expected. Velocities greater than 4.0 feet per second would require riprap at the channel outlets.

An erosional stability analysis was also performed as part of the reclamation design for the overburden disposal areas and heap leach facilities (Newmont 1997). The slopes were designed to a soil loss limit of 1.0 ton acre^{-1} year^{-1} such that it would effectively protect plant productivity. The computerized version of the Revised Universal Soil Loss Equation (RUSLE) was used to estimate erosion losses from slopes of varying configurations. Modeling was performed using alternating flat benches and benches with backslopes (referred to as "routing" benches). Based on the RUSLE results, it was determined that a routing bench would be required between each 100-foot lift. Three reclamation slope configurations were examined (Table 4-8). North and east facing slopes would be reclaimed using the first slope configuration. South and west facing slopes would be reclaimed using the second slope configuration. Areas with flatter slopes would be reclaimed using the third slope configuration (Newmont 1997).

Table 4-8
Estimated Soil Loss on Each Slope Type

Proposed Reclamation Slope Configuration	Face Slope	Overall Slope	Slope Length (feet)	Slope Height (feet)	Soil Loss (tons/acre-yr)
North and East Facing Slopes 50-ft lifts @ 2.3H:1V with alternating backsloped and flat benches (backsloped bench at every other lift)	2.3:1	2.5:1	240	100	0.91
South and West Facing Slopes 50-ft lifts @ 2.4H:1V with alternating backsloped and flat benches (backsloped bench at every other lift)	2.4:1	2.6:1	250	100	0.90
100-ft lifts @ 2.9H:1V with a backsloped bench at each lift	2.9:1	3.0:1	290	100	0.85

The routing benches would intercept water and eroded sediment as it would run down the slope and convey the water across the slope. Diversion channels would then closely follow the natural contours to the point where the run-off is transported at the desired gradients to the bottom of the slope. In the conceptual design, routing benches were designed to handle run-off from the 100-year, 24-hour recurrence interval storm event.

Erosion control measures would also be provided at the base of the overburden disposal areas. These measures would include straw bales and/or silt fences. In addition to the erosion control measures, a berm would be constructed on the existing exploration road that parallels Cottonwood Creek. The berm would be an added measure designed to reduce the potential for sloughed sediment material to enter Cottonwood Creek during mining and would be approximately five feet high.

4.7.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

This alternative would result in 25 acres more surface disturbance than the Proposed Action. The additional acreage would be used for an expanded overburden disposal between the 7,400 ft. and 7,600 ft. elevation, south of TC-6. It would also eliminate two smaller overburden disposal areas (approximately 25 acres) located in ravines between 6,700 ft. and 7,200 ft. elevations. The distance from the expanded TC-6 overburden disposal area to the main stem perennial Cottonwood Creek would be greater than 5,000 feet (as compared with 1,500-2,500 ft. for the Proposed Action). This would decrease the risk of sediment transport to Cottonwood Creek, since the longer travel distance would provide additional time and opportunity for deposition of sediment before reaching the creek. Similar to the Proposed Action, this alternative action would include the erosion control measures at the base of the overburden disposal areas and the berm constructed on the existing exploration road that parallels Cottonwood Creek.

4.7.1.4 Partial Backfill Alternatives

<u>Rehandling of TC-4 and TC-5</u>

As a modification to the Proposed Action, this alternative would return the material in the TC-4 and TC-5 overburden disposal areas to the adjacent pit areas during reclamation. The removal of overburden from these areas would disturb the original ground surface, and would require stabilization using similar techniques as for the Proposed Action. This alternative would result in increased short-term erosion potential during excavation activities and re-handling of the materials. Long-term erosion and sedimentation effects for this alternative would be similar to those of the Proposed Action.

Partial Sequential Backfill of Trenton Canyon Pits

As a modification to the Proposed Action, this alternative would have the same pit or adjacent pits partially backfilled with the overburden material. The pit backfilling operation would eliminate material re-handling if done during the active mining period. This would result in shorter haul distances and smaller overburden disposal areas, meaning less potential for erosion than for the Proposed Action. The smaller overburden disposal areas would also reduce the likelihood of covering suitable growth material areas before the topsoil could be stripped and stockpiled for reclamation use, thereby allowing growth medium to be available for application to other facilities. Only a small overburden disposal area would be required to hold the material to be used in the reclamation of the final pit area before closure of the site. Long-term erosion and sedimentation effects for this disposal area would be similar to those of the Proposed Action.

4.7.2 Potential Mitigation And Monitoring Measures

To prevent erosion during mining, flat surfaces on overburden disposal area tops could be sloped back. This would prevent water from flowing over the overburden disposal area crest. During mining, angle of repose disposing results in course material on the outside of the overburden disposal areas, especially at the toe of the slope. This results in energy dissipation and prevents the water from flowing in streams or rills.

After reclamation, the establishment of vegetation on overburden disposal area surfaces prevents erosion. Interslope benches can be sloped back to prevent water going over the crest.

4.7.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

The Proposed Action and the project alternatives would result in alterations of the natural topography and changes to the short-term erodibility and suitability of soils for use as a medium for growing plants. Reclamation activities, which would include grading and revegetating slopes, however, would promote the long-term reestablishment of soil and plant communities to the impacted areas.

The Proposed Action would result in an estimated 937,000 yd^3. of topsoil, covering 208 acres, to be buried and lost beneath overburden disposal areas and other facilities where slopes exceed 30% and in small areas where risks of erosion would exceed the benefits of salvaging topsoil.

4.8 VEGETATION AND SPECIAL STATUS PLANT SPECIES

4.8.1 Direct and Indirect Impacts

Potential effects on vegetation at the site can be classified as direct and indirect, as well as short-term (i.e., during the life of the project) or long-term. Direct impacts are those which would result in the loss or removal of vegetation due to the construction of facilities and haul roads, pit development, and overburden disposal. Indirect impacts include the degradation of vegetation due to trampling and soil compaction. Both of these types of impacts would only be expected to occur in those areas already permitted for facilities and mining operations or would be expected to be included as part of the alternatives.

Short-term loss of habitat would result in those areas where facilities would be removed and revegetation is planned following closure of the mine. Long-term loss of vegetation would occur in the vicinity of the pits, which would not be backfilled or revegetated.

4.8.1.1 No Action Alternative

Under the No Action Alternative, Newmont is currently authorized to disturb 1,202 acres (including 336 acres of public land). Facilities and mining operations that have been permitted, but not yet completed, would have impacts on vegetation. The construction of facilities for existing mining activities would result in the loss of vegetation during the life of the project. There would be continued activity and expansion at the Valmy and North Peak mine sites and new facilities would be constructed. There would be no additional disturbance to vegetation as a result of mining the Trenton Canyon deposit. Vegetation at the proposed Trenton Canyon mine area would remain as it currently exists.

Reclamation of lands disturbed by the existing and permitted facilities would follow guidelines set forth in the permit for current operations. The goal of this program is the reestablishment of vegetation communities which are comparable to those in the area prior to mining activities. Revegetation would result in the establishment of self-sustaining communities which would prevent further erosion and loss of additional plants. This program is also designed to prevent the invasion of noxious weeds.

4.8.1.2 Proposed Action

Expansion of operations in the mine, as described in the Proposed Action Plan, would result in an additional 1,480 acres of disturbance over the currently permitted activities, for a total mining-related surface disturbance of 2,682 acres.

Impacts to Vegetation Cover

Table 4-9 presents the number of acres of each vegetation type that would be lost or disturbed as a result of facilities associated with the existing and Proposed Action disturbance. Approximately 2,100 acres (19 percent of the project area) would be temporarily disturbed or lost due to existing and Proposed Actions, exclusive of exploration roads and drill sites. This percentage is based upon a vegetation study area of 11,150 acres (Figure 3-15) which includes lands adjacent to the primary access road.

Communities dominated by Wyoming big sagebrush are the most common vegetation cover in the area and this is reflected in the number of acres that would be lost (1,615 acres) relative to the other vegetation types. The Valmy complex is situated almost exclusively within this vegetation type. The new operation at Trenton Canyon would result in the loss of Wyoming big sagebrush, as well as mountain big sagebrush, low sagebrush, and a limited amount of black sagebrush. Because there is a limited amount of black sagebrush, mountain big sagebrush, and low sagebrush in the project area, the percentages lost as a result of the project are greater than for more extensive vegetation types. However, these three habitat types are common outside the project area boundary and do not represent a unique site habitat for wildlife.

Impacts to Special Status Species

No plant populations of listed threatened, endangered, or candidate species or BLM sensitive species are within the boundary of the project. No habitat for any listed species would be lost or degraded as a result of the Proposed Action plan.

The project area is within the distribution range for the windloving buckwheat (*Eriogonum amemophilum*), a BLM classified sensitive species, although this species has not been identified during surveys of the project area. This plant grows on rocky, windswept ledges and there is potential for some loss of suitable habitat as a result of the Proposed Action excavation and fill activities.

Impacts to Plants with Cultural Value

Ravines on the side slopes of the Trenton Canyon deposit contain chokecherry and other woody plants and rocky ridges above 5,000 feet elevation provide micro-habitats for several species of plants with a variety of traditional religious or medicinal uses. The disturbance of lands for pit development and overburden disposal could directly affect these plants and their habitats. Rabbitbrush is a common plant throughout the sagebrush plant associations in the project area; therefore, the mining activities would not adversely affect this species.

Table 4-9
Vegetation Disturbed by Proposed Action

Facility	Vegetation Type (a)						
	BS	GW	LS	MS	SDS	WS	Total (b)
Open Pits (c)	6.5		27.6	52.3	10.3	291.0	**388**
Overburden Disposal	6.8		42.6	81.5	35.6	504.7	**671**
Growth Medium Stockpile	1.6		0.6		4.8	60.3	**67**
Heap Leach Facility		3.4			126.9	57.1	**187**
Process/Solution Pond					12.3	5.2	**18**
Access/Haul Roads	1.5		6.3	22.3	37.8	663.0	**731**
Diversions	0.1	0.2	1.3	1.8	2.4	7.8	**14**
Ancillary Facilities			1.0		4.4	17.5	**23**
Water/Communication Lines			0.2		1.4	8.6	**10**
Total Disturbed Area (acres)	**16.5**	**3.6**	**79.6**	**157.9**	**235.9**	**1615.2**	**2,109**
Vegetation Type Study Area (acres) (d)	**23**	**146**	**207**	**459**	**1,263**	**9,052**	**11,150**
Percent of Vegetation Type Disturbed	**72%**	**3%**	**38%**	**34%**	**17%**	**17%**	**19%**

NOTES:

(a) Vegetation Types Key:

BS	Black Sagebrush
GW	Greasewood
LS	Low Sagebrush
MS	Mountain Big Sagebrush
SDS	Salt Desert Shrub
WS	Wyoming Big Sagebrush

(b) Discrepancies in the individual acreage by mine feature is due to operator technique and within a 5% margin of error.

(c) Includes Valmy, North Peak, and Trenton Canyon Deposits.

(d) Vegetation Type Study Area includes approximately 2,000 acres outside the project area boundary.

Potential for Establishment of Noxious Weeds

One potential adverse effect to the vegetation within the region includes the opportunity for the invasion and establishment of noxious weeds, which would change the composition of native vegetation communities. The potential for establishment of noxious weeds is linked to the level of success of revegetation efforts following the closure of the mine. Disturbed areas in northern Nevada are characterized by non-native species, such as white top. Noxious species establish themselves rapidly and are difficult to eradicate. Revegetating disturbed areas and controlling any invasions through careful monitoring are the principal means of reducing the potential for this impact.

Reclamation Mitigation and Monitoring

A revegetation plan has been completed as part of the Plan of Operations for the proposed mine expansion at Trenton Canyon. This plan identifies the steps that would be taken to prepare the area for seeding, provides a list of the seed mixtures that would be used at the various locations, and describes the monitoring plan that would be used to ensure that goals of the plan are being met. It outlines actions that must be taken if revegetation of the area is not meeting standards set forth in the permit.

The plan is based on ecological and engineering principles to establish stable land forms that would support diverse and self-sustaining plant communities that would be structurally and functionally similar to surrounding undisturbed communities (Shepherd Miller, Inc. 1996). Another goal of the reclamation plan is to prevent the establishment of noxious weeds as defined by the State of Nevada. All seed mixes would be approved by the NDEP and BLM prior to their use at the site.

The long-term reclamation goal is consistent with NDEP and BLM interim standards and is to establish a Reclaimed Desired Plant Community (RDPC) which would assist in the establishment of the designated post-operation land use for the area.

It is anticipated that the proposed revegetation plan would result in the establishment of stable communities that would be able to sustain wildlife and livestock levels comparable to pre-mine conditions.

4.8.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

As a modification to the Proposed Action, this alternative would relocate overburden disposal areas TC-4 and TC-5 and combined them with area TC-6 to the south. This alternative would result in the surface disturbance of 25 acres more than that estimated for the Proposed Action. The increased haul distance to the expanded disposal area would be 1-2 miles longer than the Proposed Action. Vegetation types that would be affected by the enlargement of TC-6 would be generally similar to those affected by TC-4 and TC-5.

4.8.1.4 Partial Pit Backfill Alternatives

Rehandling of TC-4 and TC-5

As a modification to the Proposed Action, this alternative would have the material in the TC-4 and TC-5 overburden disposal areas returned to the adjacent pit areas during reclamation. This alternative would reduce the long-term erosion and sedimentation impacts at disposal areas TC-4 and TC-5. Short-term erosion impacts would be the same as the Proposed Action, with the exception that erosion would be more likely to occur during removal operations.

Partial Sequential Backfill of Trenton Canyon Deposit Pits

As a modification to the Proposed Action, this alternative would have the same pit or adjacent pits partially backfilled with overburden material. This alternative, in contrast to the other pit backfill alternative, does not allow for the temporary storage and rehandling of overburden material. Since this is a partial backfill of mined pits, some overburden disposal areas would exist, however, the size and number of these overburden areas would be reduced and would result in a reduction of the total surface area by approximately 30-50 acres. Furthermore, erosion and sedimentation impacts would be reduced, as compared to the other alternatives, as a result of the reduction of disturbed surface areas and exposed soils (i.e., overburden disposal areas). This would also reduce the impacts to vegetation due to the decrease in the destruction of plant habitats and areas that would have to undergo reclamation. This would in turn reduce the potential for invasion by noxious weed species.

4.8.2 Potential Mitigation and Monitoring

The primary mitigation measure for the loss and degradation of vegetative cover is implementation of the reclamation program during mining, wherever possible, and following closure of the mine. The reclamation plan has been developed as part of the Plan of Operations. This program describes preparation of disturbed sites for revegetation, the seed mix which shall be used for each site, and a monitoring plan designed to determine the success of the reclamation effort. Native Americans will be included in selecting native species that may be of traditional value.

No additional mitigation or monitoring measures would be required beyond those proposed in the Plan of Operations and Reclamation Plan.

4.8.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

The Proposed Action and all other alternatives would result in alterations of the natural topography and changes to the short-term nature of the vegetation at the site due to facilities and mining operations. Reclamation activities, which would include grading and revegetating slopes, however, would promote the long-term reestablishment of soil and plant communities to the impacted areas. Approximately 388 acres of vegetation loss would occur under the Proposed Action as a result of the open pit areas. If reclamation efforts are successful, there should be no residual adverse effects to the site outside the pit areas after mine closure

4.9 WETLANDS AND RIPARIAN HABITAT

4.9.1 Direct and Indirect Impacts

An analysis of mining and reclamation activities reveal no direct impacts to wetlands or riparian habitat as a result of the Proposed Action or any of the alternatives considered for the site.

Indirect impacts for all alternatives could result from interference with drainage into the wetlands, water source degradation within the project area as a result of sedimentation, especially during earthmoving activities, or from input of toxic materials as a result of an accidental spill or leak.

4.9.1.1 No Action Alternative

Construction and operation of currently permitted facilities and activities would result in the surface disturbance of 1,202 acres (including 336 acres of public land). The surface disturbances for the facilities at the Valmy mine area would include an open pit, haul roads, and two overburden disposal areas (161 acres), and an open pit, heap leach facility, haul roads, and an overburden disposal area (325 acres). Other facilities would include access and haul roads as well as a heap leach pad in the North Peak mine area. Additional short-term surface disturbance impacts would occur from exploration drilling activities (716 acres). Indirect water quality changes in the wetlands and feeding drainages could occur in all of these areas through increased erosion and sedimentation decreasing the wetland quality and functional value. Existing facilities as part of the No Action Alternative would potentially cross drainages which are hydrologically connected to the wetlands in 12 locations, for a total direct impact of 0.14 acres. Most of these areas of conflict are with the Valmy pit area and include one overburden disposal area and six road crossings. There are five road crossings in the Trenton Canyon mine area.

4.9.1.2 Proposed Action

The Proposed Action would result in an additional 1,480 acres of disturbance over the currently permitted activities, for a total mining-related surface disturbance of 2,682 acres.

The closest wetland to the Proposed Action facilities is Ames Spring (Section 16, T33N, R43E) that occurs immediately north of the proposed Valmy heap leach facility in Section 21, and has been degraded by past uses. Mining activities have the potential to further decrease flows that support the wetlands and decrease wetland quality and functional value through changes in water quality from sedimentation, especially from earthmoving during construction.

Mud Spring occurs to the northeast and upgradient of the Valmy mine area. It is more likely to be affected by mining facilities in the northwest Valmy pit area (Section 29) which drains toward this wetland. Mud Spring is dependent on flows from an unnamed drainage (Reach 5), which would be affected by overburden disposal areas, haul road, and placement of a waterline for the Valmy pit area.

The riparian wetlands along Cottonwood Creek (Site S10; Sections 17,18, T32N, R43E) and those along Trout Creek (Site S04; Section 6, T32N, R43E) are upstream of the proposed alternative, and they are unlikely to be affected by construction and operation of the mine.

None of the jurisdictional wetlands would be directly impacted by the Proposed Action. All of the impacts identified for the jurisdictional wetlands would be indirect. Project facilities would potentially cross ephemeral drainages which provide water to the wetlands in 25 locations, for a total direct impact of 1.97 acres. Most of these areas of conflict are associated with the Valmy pit area and include four overburden disposal areas, 11 road crossings, four water line crossings, one storage facility, two heap leaches, and three power lines.

There are 6 locations for areas of conflict within the drainages associated with the Trenton Canyon mine area and these include five road crossings and one overburden disposal area. Most of these areas of conflict with ephemeral drainages would be a result of mining operations, as opposed to reclamation activities.

4.9.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

All elements of this alternative would be similar to the Proposed Action with the exception of the surface disturbance of approximately 25 acres more than the Proposed Action for overburden disposal areas and an additional area of conflict in the Trenton Canyon area which would potentially cross the drainages which feed Cottonwood Creek (at an overburden disposal area TC-6). The distance from the overburden disposal area to the main stem perennial Cottonwood Creek would be much greater than under the Proposed Action, thereby decreasing the potential indirect effects of sedimentation.

This alternative would have lower potential to provide sediment to the perennial portion of Cottonwood Creek than the Proposed Action. This alternative action would still include the erosion control measures at the base of the overburden disposal areas and the berm constructed on the existing exploration road that parallels Cottonwood Creek.

4.9.1.4 Partial Backfill Alternatives

Rehandling of TC-4 and TC-5

As a modification to the Proposed Action, this alternative would have the material in the TC-4 and TC-5 overburden disposal areas returned to the adjacent pit areas during reclamation. This alternative would reduce the long-term erosion and sedimentation impacts at disposal areas TC-4 and TC-5. Short-term erosion impacts would be the same as the Proposed Action, with the exception that erosion would be more likely to occur during excavation and removal operations. Sedimentation impacts during the temporary storage and removal operations would affect ephemeral drainages through degradation of surface water run off. Thus, an additional short-term impact to water quality of the tributary drainage of Cottonwood Creek may occur during removal operations as described in Section 4.2.

Partial Sequential Backfill of Trenton Canyon Deposit Pits

As a modification to the Proposed Action, this alternative would have the same pit or adjacent pits partially backfilled with overburden material. The pit backfilling operation would result in shorter haul distances and smaller overburden disposal areas, meaning less potential for erosion than for the Proposed Action. The impacts of this alternative would be the same as described within Section 4.8.1.4.

4.9.2 Potential Mitigation and Monitoring Measures

To reduce the impact of sediment erosion during mining operations under the Proposed Action, sediment control structures could be placed at the toe of each overburden disposal area. Minor design changes would be implemented where possible to maintain existing drainage patterns and to minimize the effect on the drainage into site wetlands.

No additional mitigation or monitoring measures would be required beyond those proposed in the Plan of Operations and Reclamation Plan.

4.9.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

The Proposed Action and all of the other alternatives would result in alterations of the natural topography and changes to the short-term erodibility of soils. Some reduction in wetland function is possible as a result of dredge and fill activities and altered stream flows. The extent and magnitude of such impacts depends on the effective control of erosion and maintaining ground and surface water hydrology which is part of the Plan of Operations.

Implementation of the Proposed Action and other alternatives would result in no irreversible and irretrievable loss of wetland or riparian habitat.

4.10 WILDLIFE, FISHERIES, AND SPECIAL STATUS ANIMAL SPECIES

Issues related to terrestrial wildlife, fisheries, special status animal species, or any habitat for such species include:

- Potential loss or harm to an individual species,
- Potential loss of any federal candidate or BLM sensitive species, or loss or degradation of habitat for such species which could result in their listing as federally threatened or endangered,
- Potential disturbance to habitat for bat species in the area which results in the loss or abandonment of a communal roost site,
- Potential loss or degradation of aquatic habitat which may support important fish species,
- Potential loss or degradation of vegetation which results in altering population trends of species dependent on such vegetation types for forage and shelter or which forces wildlife onto adjacent habitat which is of lower or marginal quality,
- Potential loss or degradation of riparian habitat which would result in the displacement of species, such as migratory and game birds, to less desirable or already occupied habitat, and
- Potential risk of a hazardous materials spill into a sensitive resource (e.g., drainage) resulting in direct mortality of wildlife or reduced reproductive success.

4.10.1 Direct and Indirect Impacts

No impacts have been identified as significant as a result of the Proposed Action or the other project alternatives. Proposed activities under any of the alternatives may result in the loss or degradation of habitat for wildlife. No riparian habitat, springs or seeps would be directly removed under any of the alternatives. Most of the types of impacts on wildlife would occur with any of the alternatives; however, the magnitude and intensity of the effects would vary between the No Action and the Proposed Action and other alternatives.

Possible effects on wildlife and wildlife habitat include decreased forage and cover, reduction in prey base due to decreased vegetative habitat, the creation of barriers to wildlife movement, increased human presence in the area, and risks from the presence of cyanide or other hazardous materials. Additionally, some species of wildlife are likely to avoid the area due to increased noise and activity levels. By contrast, some species may use the area more frequently because the fences exclude hunters and forage is not grazed.

Open pits and overburden disposal areas may create a barrier to wildlife movement resulting in habitat fragmentation. New and upgraded access roads and the subsequent increase in traffic would increase the potential for direct mortality of small animals, such as mammals, birds, and reptiles on a local basis. Roadkill would be minimal because access roads would be located away from the most critical habitats and would occur primarily during construction of the road. Loss of these smaller animals represents the loss of prey species for predators (i.e., bobcats and coyotes) and raptors (i.e., golden eagles and ferruginous hawks). The probability of animal mortality due to spills or leaks of sodium cyanide or hazardous materials would be extremely low (refer to Section 4.4.1.2 for discussion of spill probability and countermeasures).

4.10.1.1 No Action Alternative

Under the No Action Alternative, currently permitted operations at Valmy and North Peak mine areas would continue and permitted facilities would be constructed at some point during the life of the project. A total loss of 1,202 acres of habitat could occur. There would be some loss of habitat in the vicinity of these deposits and in areas where new ancillary facilities would be located. Habitats lost would be primarily sagebrush shrub and salt desert shrub; there would be no additional loss of habitat on the west slope of Battle Mountain. There is a potential for harm or mortality to wildlife, primarily birds and bats, associated with the leach facilities. There would be no change to access roads and traffic levels would remain at current levels; therefore, the potential for mortality of wildlife due to collisions with vehicles would not increase.

4.10.1.2 Proposed Action

The Proposed Action would result in approximately 2,682 acres of surface disturbance. Of this, 1,480 acres would be newly disturbed and 1,202 acres would be disturbed as a result of the No Action Alternative. Of the 2,682 acres total disturbance, approximately 456 acres would be related to exploration and habitat loss would be in varied and dispersed cover types.

Sagebrush shrub habitats throughout the project area and shadscale on broader alluvial valleys to the north would be removed. Of the total area of native habitat disturbance, the loss of 0.8% of black sagebrush, 0.2% of greasewood, 3.4% of low sagebrush, 7.5% of mountain big sagebrush, 11.2% of salt desert shrub, and 76.6% of Wyoming big sagebrush would be considered a long-term loss of woody habitat for wildlife cover, foraging, and breeding use. Areas adjacent to the existing pits at Valmy and North Peak reflect some disturbance due to existing operations. The proposed Trenton Canyon pits and overburden disposal areas would also be located in an area which has experienced some degree of disturbance as a result of exploration activities.

Impacts to Mammals

Potential impacts to small and medium-sized mammals are as discussed in Section 4.10.1 including loss of forage and cover and subsequent decline in populations.

Big Game

Mule deer and mountain lion use the project area. Although no crucial seasonal habitats are present, mule deer consistently use the area throughout the year. Summer habitat in the Battle Mountains is very limited. Most of the impacts from the Proposed Action would occur in year-long and winter habitat. The Proposed Action would result in the loss of 1,615.2 acres of Wyoming Big Sagebrush, 157.9 acres of Mountain Big Sagebrush, and 16.5 acres of Black Sagebrush.

As a result of the Proposed Action, mule deer would be displaced from the areas where operations and facilities associated with the mine are located. Displacement implies that the removal of the disturbed wildlife is temporary and that the displaced animals can return to the disturbed habitat once the disturbance has ceased and the habitat has returned to a vegetated condition. Displacement also implies that the surrounding undisturbed habitat is not at carrying capacity and can accommodate the displaced animals.

There would also be a loss of forage at the pit and overburden disposal areas. The new and expanded mine pits and overburden disposal areas represent barriers to movement, although the riparian corridors would provide movement corridors through the area. To some extent, mule deer are able to acclimate to an increased level of activity over time, as evidenced by their presence in the vicinity of existing mining operations. However, loss of habitat in the disturbed areas would result in habitat fragmentation during the life of the project.

Reclamation of these areas, provided it maintains similar habitat features following disturbance, would enhance forage and maintain wildlife habitat value after completion of the mining operation. However, if the reclamation of the disturbance does not reproduce similar habitat, the Proposed Action could cause a reduction in the mule deer population in this area, and if the habitat cannot be restored to the pre-activity condition, the reduction could be permanent.

Bats

The greatest bat activity occurs in riparian areas which would not be affected by the Proposed Action. Bats may roost in rock crevices and feed over seeps within the project area. During the summer survey, no bats were found using mines or caves within the project boundary. However, many of the myotis species and the pallid bats detected probably roost year round in the rock crevices likely to be affected on or near the project site. It is virtually impossible to find small colonies or single bats roosting in rock crevices. The project area provides considerable roosting habitat outside of that affected by the proposed facilities, therefore, the bats using the rock crevices would have alternate roosts.

Impacts to Birds

Raptors are generally associated with rock outcrops, cliffs, riparian woodlands, and juniper stands. Although no nesting activity has been observed, there could be a loss of potential nest sites where rock outcrops, cliffs, and small trees or shrubs are buried. The heap leach facility at North Peak and Valmy may attract raptors to the area when the overflow pond is full. The probability of mortality is low. Increased human presence in the area may have a minimal effect on raptors except for a loss of foraging habitat. There would likely be a decline in the number of small mammals due to increased traffic along access roads and the removal of small mammal habitat which translates to a loss of prey base for raptors. Non-game birds in the project area include neotropical migrants associated with riparian areas and species associated with mountain big sagebrush, Wyoming big sagebrush, and shadscale habitat. The species associated with upland habitat have the potential to be affected by project disturbance. Access/haul roads may contribute to habitat fragmentation and increased disturbance in the area.

The Proposed Action would result in the loss of 1,615.2 acres of Wyoming big sagebrush, 157.9 acres of mountain big sagebrush, and 16.5 acres of black sagebrush. It is likely that some of the sagebrush disturbed by the Proposed Action is sage grouse habitat. These sagebrush communities provide the primary source of forage for sage grouse during the winter months. Riparian habitat which chukars, valley quail, mourning doves, and sage grouse typically associate with would not be lost as a result of the Proposed Action. There may be some disturbance to these species from increased human presence and activity levels in the area. The only sage grouse activity within the project area was discovered above 7,200 feet elevation in T32N, R43E, Sections 10 and 19 and T32N, R42E, Section 1. One area north of the Marigold Mine purportedly served as a sage grouse strutting area in the past, however, observations during the breeding season over the past three years revealed no use of this site by sage grouse.

Impacts to Reptiles and Amphibians

Shadscale and Wyoming sagebrush communities support six species of lizards on the project site. The Proposed Action would have no impact to reptiles and amphibians.

Impacts to Aquatic Habitat and Fisheries

The Proposed Action would have no direct impact to aquatic habitat and fisheries. The drainages in the area support limited fish populations. Macroinvertebrates and insects and aquatic habitat may be impacted by sedimentation; however, erosion control measures would be implemented as part of the Plan of Operations to reduce increased sediment loads into Cottonwood and Trout Creeks.

Impacts to Special Status Species

No federally-listed threatened or endangered species are present within the project area and no habitat for such species would be modified or removed as a result of the Proposed Action. Therefore, the Proposed Action and other project alternatives would have no impacts on federally-listed species.

Twelve species of concern listed as federal candidate and BLM sensitive species may be found within the area. The western burrowing owl is the only special status species which was observed on the project site during baseline surveys (Resource Concepts, Inc. 1995). The western burrowing owl is a BLM sensitive species and a state protected species in Nevada. Increased human activity and noise levels may affect burrowing owls, particularly during the breeding season, although this species is noted for nesting in close proximity to human activity.

Similarly, the pygmy rabbit, although not observed at the project site, lives in burrows, a habitat type which could be disturbed by mining. There would be loss of potential habitat for this species which nests in burrows in open sagebrush and shadscale associations. Direct impacts could occur during the construction of facilities and roads.

Impacts to bat species are discussed in Section 4.10.1.2, Impacts to Mammals. There would be habitat destroyed for rock crevice-dwellers such as the spotted bats, Mexican free-tailed bats, pallid bats, and most of the myotis species. Townsend's big-eared bat were not observed within the Project area during the winter and summer surveys. They are known to roost within a five-mile radius of the project, and they potentially forage in the vicinity of Cottonwood Canyon. Direct loss of their roost habitat is unlikely.

There is potential habitat for two raptor species, both of which are federal candidates and state protected species and are further afforded protection through the Migratory Bird Treaty Act of 1918 (MBTA) (16 US Code 703-1). Northern goshawk prefer aspen trees which are limited to small individual trees along Cottonwood Creek. These would not be disturbed. Ferruginous hawks nest in juniper trees at the edge of sagebrush shrublands, some of which occur adjacent to the project area. Although not directly affected, hawks may avoid use of these potential nests sites due to mining activity. There would be a loss of prey base for both the northern goshawk and ferruginous hawk, as well as for other raptors protected by the MBTA (USFWS 1997; 50 CFR Section 10.13).

4.10.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

The effects of this alternative would be similar to those of the Proposed Action. However, by consolidating the overburden disposal for Trenton Canyon pits into a single large area on the southern ridge of the project area, the two ravines that would have been filled by TC-4 and TC-5 are effectively maintained. These ravines provide potential habitat for bats and forage and access for livestock and other wildlife, thus some of the wildlife habitat values are maintained. The new location of TC-6 is 2,500 feet distant from the perennial portion of Cottonwood Creek which reduces the risk of sedimentation in the stream and riparian habitat. The sage grouse lek in Section 19 would be indirectly affected by the construction of the expanded TC-6.

4.10.1.4 Partial Backfill Alternatives

The backfill alternatives as described in Section 2.6.2.3 could, after reclamation, reduce the total amount of wildlife habitat disturbed by 30-50 acres less than that disturbed by the Proposed Action. This assumes that replacing the overburden material to the pits would not provide for enhanced wildlife habitat following reclamation.

4.10.2 Potential Mitigation and Monitoring Measures

Many of the mitigation measures designed to reduce potential impacts to wildlife resources are contained within the Plan of Operations and Reclamation Plan. It would be necessary to design a monitoring program to ensure that the mitigation measures are effective in reducing the potential impacts which are associated with mining operations. Such monitoring may include recording wildlife mortality in the project area due to vehicle collisions and other injuries associated with mining operations or equipment. The resulting data would be provided to the BLM and NDOW to determine whether additional protective measures are needed. Surveys for sage grouse would be conducted in T32N, R43E, Sections 19 and T32N, R42E, Section 1. during the breeding season (March 1 - May 15) and protective measures would be implemented to protect any leks or brood areas, if present.

To mitigate for potential disturbance to bats, Newmont would seal the adit at the head of Trenton Canyon during the warm-season to prevent bats from entering or using it as a hibernaculum. While no roosting bats were encountered during the baseline surveys, in the event that bat colonies are discovered during mining, other appropriate mitigation measures could be considered by the BLM. These additional measures include:

- Limiting mining disturbance to periods in the spring before the maternity season, or in the fall prior to hibernation. It is recommended that disturbance to bats be avoided during the summer maternity period or during winter hibernation,
- Providing replacement bat habitat (under the direction of a bat biologist) by burying culverts under overburden disposal areas in the new mine area and gating and monitoring for bat activity; and
- Situating water tanks away from the zones of impact (i.e. at Mud Spring and Cottonwood Canyon).

Reclamation of the area following completion of mining operation is described in the Reclamation Plan. Successful reclamation at the mine sites would result in returning much of the disturbed area to a condition suitable for wildlife. Seed species to be used for reclamation must be approved by the NDEP and BLM and be free from weeds and exotic plant species.

4.10.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

Under any of the alternatives, there would be residual loss of habitat for terrestrial wildlife at pit sites, which would not be refilled and reclaimed. Other potential residual effects include the loss of animals displaced by mining which do not return to the disturbance area or which concentrate all large herbivores onto already marginal range affected by drought and overuse. The competition for a decreasing forage base coupled with degraded winter range could result in increased deer mortalities, particularly for overwintering fawns. This effect would be magnified during periods of drought and heavy snow accumulation.

4.11 RANGE

Range issues identified during the scoping period include:

- Risk of reducing animal unit months,
- Safety of mine traffic, and
- Mine roads and fences blocking natural cattle trails and rancher movements.

4.11.1 Direct and Indirect Impacts

Direct impacts to range resources from the proposed project include the loss of grazing land due to construction of open pits, roads, and other facilities.

Since grazing generally occurs throughout the project area, any surface disturbances could affect range resources. Surface disturbances of bottom lands and gentle slopes of the project area would affect forage for cattle and sheep.

Indirect impacts that could result from the proposed project include increased vehicle traffic on access and haul roads which could result in further disturbance of grazing patterns and trailing operations. Additionally, increased traffic could increase the potential for animal-vehicle collisions.

Other indirect impacts could result from the potential invasion of noxious weeds in disturbed areas. Noxious weeds reduce rangeland value to cattle by out-competing preferred forage species. Severe infestations can result if weeds are not controlled, reducing the usefulness of rangelands for grazing. Additionally, some weed species are poisonous to cattle, causing illness, or death when ingested.

4.11.1.1 No Action Alternative

Construction and operation of currently permitted facilities and exploration activities would result in the surface disturbance of a total of 1,202 acres. These facilities would include an open pit mine and two overburden disposal areas at the Valmy Area and an open pit mine and overburden disposal area at the North Peak Area. Other facilities would include access and haul roads as well as a heap leach pad in the North Peak Area. Full build out of all permitted activities would result in the loss of land available to support 84 Animal Unit Months (AUMs).

Indirect impacts would occur from increased vehicle traffic beyond existing levels, although effects are expected to be less than the Proposed Action, and may result in disturbance of grazing patterns and trailing operations. Additionally, increased traffic may result in increased animal-vehicle collisions.

All facilities and activities associated with the No Action Alternative would occur in the North Buffalo allotment; none would occur in the Copper Canyon allotment.

4.11.1.2 Proposed Action

The total surface disturbance of 2,682 acres would result in the loss of 188 AUMs, of which approximately 969 acres would occur on public land (i.e., loss of 68 AUMs) and 1,713 acres (loss of 120 AUMs) would occur on private land. Approximately 2,512 acres of surface disturbance would result in the loss of 174 AUMs in the North Buffalo allotment. Approximately 170 acres of surface disturbances would result in the loss of 12 AUMs in the Copper Canyon allotment.

As stated in the previous section, livestock water sources that exist on the alluvial fan (Sections 20, 21, T33N, R43E) of the North Buffalo allotment may be impacted as a result of the construction of the Section 21 heap leach pad and associated diversion channels.

4.11.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

This alternative would result in the surface disturbance of approximately 25 acres (loss of additional 1.75 AUMs) more than that estimated for the Proposed Action. The increased haul distance to the new disposal area would be 1-2 miles longer than the Proposed Action.

By moving these overburden disposal areas further from the perennial portion of Cottonwood Creek, this alternative has potential to have less sedimentation to Cottonwood Creek than would the Proposed Action. Cattle and sheep currently utilize seeps that occur near the mouth of Cottonwood Canyon. The increased surface disturbance of 25 acres for this alternative is considered to be negligible effect on these water sources and grazing patterns.

4.11.1.4 Partial Pit Backfill Alternatives

Rehandling of TC-4 and TC-5

This alternative would reduce the long-term erosion and sedimentation impacts at disposal areas TC-4 and TC-5. Short-term erosion impacts would be the same as the Proposed Action, with the exception that erosion would be more likely to occur during removal operations. Sedimentation impacts during the temporary storage period and removal operations would affect Waters of the United States (WOUS) through degradation of water quality, although this is expected to cause only negligible effects to range water sources (i.e., seeps) that occur in Cottonwood Canyon.

Partial Sequential Backfill of Trenton Canyon Pits

The impact of this alternative on range would be slight changes in erosion potential and surface disturbance as previously described for vegetation in Section 4.8.1.4.

4.11.2 Potential Mitigation and Monitoring Measures

To reduce the impacts under any of the alternatives, livestock watering troughs could be developed to allow grazing to occur over a greater portion of the North Buffalo and Copper Canyon allotments thereby reducing impacts on livestock.

4.11.3 Residual Adverse Impacts and Irreversible and Irretrievable Commitment of Resources

A reduction in livestock numbers may occur as a result of loss of foraging areas from unreclaimed open pits under the Proposed Action and any of the alternatives.

Implementation of the Proposed Action and any of the alternatives would result in the irreversible and irretrievable loss of grazing potential until reclamation of disturbed areas is able to support livestock. Foraging areas and AUMs (348 acres; 24 AUMs) would be lost as a result of unreclaimed open pits.

4.12 RECREATION

4.12.1 Direct and Indirect Impacts

The project area is not used extensively for recreation and does not offer unique recreational opportunities that are not found elsewhere in the vicinity. Public access to the immediate area proposed for the mining activities could be restricted temporarily for safety and security reasons; however, it would be open to the public as soon as the safety risk is passed. Public access through the project area to Trout Creek and the Battle Mountain Range would be ensured.

Primary hunting access is reached from the Battle Mountain Exit off Interstate 80. Highway 305 offers several access roads into Little Cottonwood, Galena, Copper, and Iron Canyons where hunters from the community of Battle Mountain prefer to hunt. Access roads at the Valmy Exit are less-traveled. This area requires off-highway vehicle use and travel is rough. Therefore, hunter access would not generally conflict with access routes that would be used during mining operations.

During active mining and after closure large areas of public land both inside and outside the project area would remain open to recreation. Because there is no projected increase in either temporary or permanent employment at the Lone Tree Mine Complex due to the Trenton Canyon Project, no additional pressure on recreational resources is expected. The proposed expansion of the Trenton Canyon Project would have no direct impact on wilderness areas or wilderness study areas (WSAs). There may be indirect impacts (i.e., safety concerns) for recreationists seeking access and crossing roads with mine traffic, however, numbers of recreation users are low.

4.12.1.1 No Action Alternative

With the No Action Alternative, 29 acres of public land would be directly used for mining and 307 acres of public land are permitted to be used for exploration activities. There would be no measurable impact on dispersed recreation activities or access to popular use areas. The No Action Alternative would have no effect on access to wilderness areas or WSAs.

4.12.1.2 Proposed Action

The Proposed Action could disturb up to a total of 1,713 acres of private and 969 acres of public land. The three mine areas would not be available for recreation uses during mining and reclamation. Under the Proposed Action, the multiple open pits (348 acres) would remain, of which 214 acres are public land. For safety reasons following mining and reclamation, berms would be constructed and signs would be posted to restrict public access to the pits.

The primary access road would be widened and realigned (75 acres of public land) to accommodate a higher level of mining traffic and heavier equipment. New roads constructed for exploration purposes would facilitate access for hunting and other recreation activities.

4.12.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

Recreation impacts would be the same as for the Proposed Action. There would be approximately 35 acres less disturbance to public lands than the Proposed Action by eliminating TC-4 and TC-5.

4.12.1.4 Partial Backfill Alternatives

Recreation impacts would be the same as for the Proposed Action. There would be no additional disturbance to public lands.

4.12.2 Potential Mitigation and Monitoring Measures

No monitoring of recreation or wilderness resources would be required for the Proposed Action or the other alternatives. To promote public safety, a perimeter berm is proposed around the pits and warning and stop signs have been placed at the intersection of the road from Valmy with the primary mine access road.

4.12.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

The residual adverse effect to recreation resources would be an irretrievable loss of multiple use management of up to 214 acres of public land associated with the mine pits. There would be no residual adverse effects or irreversible or irretrievable losses to wilderness, WSAs, or recreation sites under the Proposed Action or any of the alternatives.

4.13 LAND USE AND ACCESS

4.13.1 Direct and Indirect Impacts

Land ownership in the project area would remain the same. Public access would be maintained throughout the mining operations and reclamation activities.

4.13.1.1 No Action Alternative

Under this alternative, no additional public lands would be removed from multiple use management. Twenty-nine (29) acres of public land has already been used for access and haul roads under the existing permit and 307 acres of public land has been or would be used for exploration drilling sites or roads.

4.13.1.2 Proposed Action

The land use impacts for the Proposed Action would be of the same types as those of the existing and permitted activities under the No Action Alternative; however, the impact duration and magnitude would be greater. Mining activities would take place for 7 more years and have direct effect on 633 more acres of public land (Table 2-2) than the No Action Alternative.

The existing 345kV transmission lines owned by Sierra Pacific Resources along Interstate 80 and the electrical distribution system in the area would not be affected by the Proposed Action. The 12kV distribution line running from LTM into Pumpernickel Valley and the 24.9kV aerial distribution line located adjacent to the road from LTM would continue to be utilized under the Proposed Action, although new facilities are also proposed (i.e., new substation, power lines, and water pipelines). All power and water facilities constructed as part of the Proposed Action would be removed during mine closure (Table 4-10).

New right-of-way (ROW) would be required to widen and realign the primary access road (75 acres of public land). Table 4-10 lists the proposed new ROW, legal descriptions, approximate length, and surface disturbance. No other ROWs would be directly affected by the Proposed Action, except for the Valmy - Buffalo Valley Road, which is currently crossed by the primary mine access road. Because mine traffic from the Proposed Action would utilize the Valmy-Buffalo Valley Road, there is public concern about safety at the intersection which lies within Section 7, T33N R43E (refer to Figure 2-3). As existing ROWs or portions of existing ROWs would be eliminated by the development of mine facilities, BLM would be notified and those ROWs or portions of ROWs would be relinquished by Newmont. The BLM would subsequently amend the existing ROW grants, as required.

4.13.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

For the expansion of overburden disposal and TC-6, an additional 25 acres and one to two miles of haul road would be required more than the Proposed Action. The additional land would be confined to private land within Section 19 of T32N, R43E. Overburden disposal areas TC-4 and TC-5 would not be constructed on public land in Section 18 of T32N, R43E.

4.13.1.4 Partial Backfill Alternatives

Rehandling of TC-4 and TC-5

Long-term land use impacts would be the same as for the Proposed Action.

Table 4-10
Public Right-of-Way Required for Proposed Linear Features

	Section	Length (ft)	Approximate Surface Area (acres)
Primary Access Road			
T33N R42E	36	5,413.4	12.4
T33N R42E	24	5,714.0	13.1
T33N R43E	18	1,178.7	2.7
T33N R43E	6	5,299.4	12.2
T34N R43E	30	5,237.0	12.0
T34N R42E	12	3,789.4	8.7
Haul Roads*			
T32N R42E	12	13,293.6	30.5
T32N R43E	18	11,371.4	26.1
T33N R43E	20	2,634.5	6.0
T33N R43E	28	1,945.1	4.5
T33N R43E	32	2,654.4	6.1
Powerline/Waterline and Communication Lines*			
T33N R43E	15	5,908.9	13.6
T33N R43E	16	207.6	0.5
T33N R43E	20	2,296.7	5.3
T33N R43E	30	868.7	2.0
T33N R42E	36	543.7	1.2

*A 100 foot ROW width used to calculate acreages.

Partial Sequential Backfill of Trenton Canyon Pits

It is possible that one or more of the open pits could be backfilled and reclaimed. This could return up to 100 acres public land (Section 18 T32N, R43E) back to multiple use management.

4.13.2 Potential Mitigation and Monitoring Measures

A perimeter berm is proposed to be constructed around the pits and warning and stop signs would be placed at the intersection of the road from the town of Valmy with the primary mine access road. Land uses would not be altered by the project; therefore, no additional mitigation or monitoring measures would be required beyond those proposed in the Plan of Operations and Reclamation Plan.

4.13.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

With the exception of loss of 348 acres comprising the pits (214 public and 134 private, Table 2-2) from multiple use management, there would be no residual adverse effects on land use and access following mine closure and reclamation. Reclamation of disturbed surfaces would restore all areas except for excavated pits to pre-mining land uses, including wildlife habitat, recreation, and grazing.

Under the Proposed Action and Expansion of TC-6 Alternative, 214 acres of public lands excavated as pits would be irreversibly and irretrievably lost to multiple use management. These lands would be posted with warning signs and access permanently restricted with earth berms.

Under the Partial Backfill Alternatives, somewhat less than 214 acres of public lands would be irreversibly and irretrievably lost to multiple use management. The total amount lost depends on the final configuration of pits, the shrink-swell factor of the overburden material, and the possibility of completely backfilling any one of the pits.

4.14 VISUAL

4.14.1 Direct and Indirect Impacts

4.14.1.1 No Action Alternative

Most of the mining activities that would occur under the No Action Alternative would not be visible from key observation points (KOPs) because the North Peak mine area is obscured by the surrounding topography. However, exploration roads and drill sites would be noticeable yet indistinct as seen from the KOPs. During and after mining operations, the exploration roads and drill sites would be reclaimed according to NDEP guidelines. This would result in reduction of the visual impacts of existing disturbance.

4.14.1.2 Proposed Action

A description of the existing visual resources for the vicinity of the proposed Trenton Canyon Project is provided in Chapter 3, Visual Resources. Figures 4-3 through 4-6 show the visual simulations of the Proposed Action from two KOPs along Interstate 80.

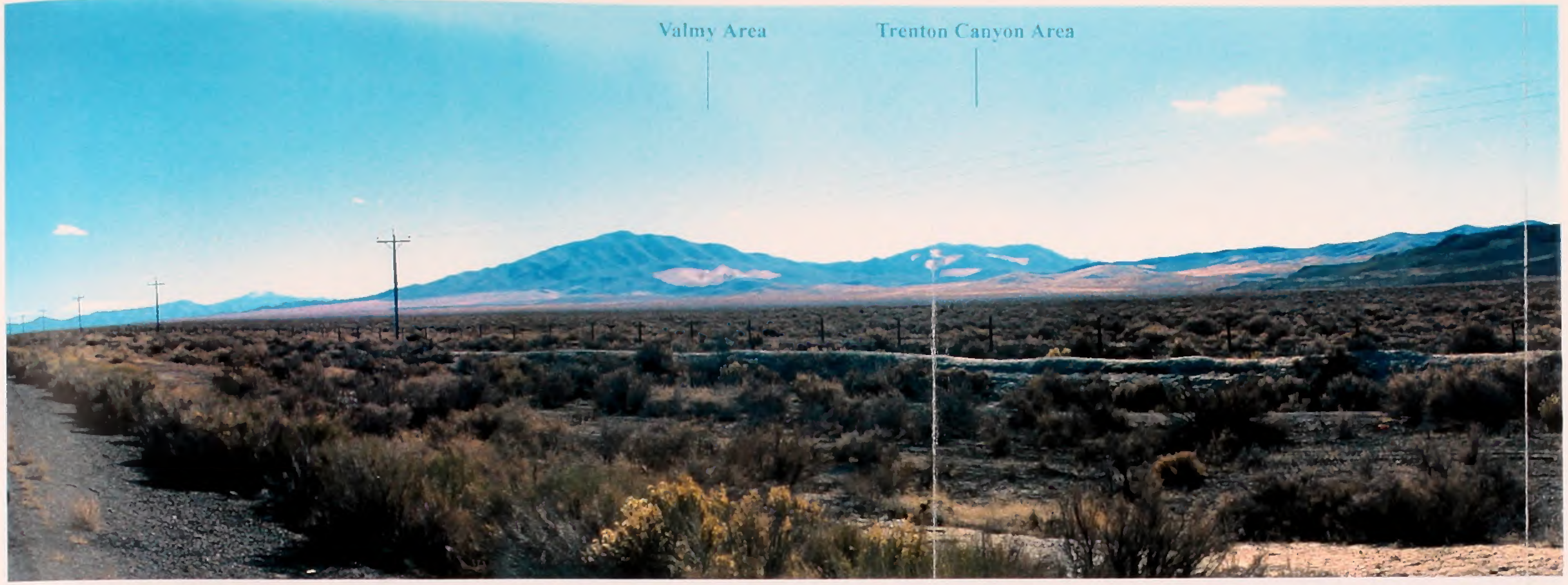
The primary impact of the Proposed Action would be shape contrasts created by physical modification of natural landforms and color contrasts created by disturbance of natural surfaces and vegetation. Angular, blocky forms and horizontal lines typical of mining would moderately contrast with the angular or rounded, rolling hills and ridges of the natural landscape. Land clearing and construction of mine facilities would expose soil and rock with a variety of contrasting colors ranging from chalky white to reddish brown. Natural undisturbed landscapes are characterized by light green or grey shades. Color contrast between disturbed and undisturbed surfaces would be moderate to strong. Both shape and color contrasts would be somewhat less striking where existing facilities were expanded than where facilities were constructed in previously undisturbed areas.

Any type of contrast in the project area would be more noticeable in bright sunlight and in the afternoon when front-lighted than under overcast conditions and in the morning when back-lighted. Contrasts would be substantially reduced following reclamation activities. The pit highwalls would remain visible from both KOPs and would result in long-term moderate contrasts and visual impacts. The simulations Figures 4-3 and 4-5 show the existing conditions, mining activity before reclamation, and Figures 4-3 and 4-6 show conditions following mine closure and reclamation.

Clearing of vegetation in mine expansion areas would result in color contrasts with the existing landscape. New lines would be introduced delineating the edges of cleared areas and some change in color would be noticeable to the casual observer. Visual impacts from new structures would be subordinate to the more visually dominant overburden disposal areas and pit highwalls.

When viewed from KOP 1 (e.g., interpretive tours and other viewers on I-80), the Proposed Action before reclamation would result in a moderate to strong visual contrast with the existing landscape, but would not dominate views. While some of the existing mining facilities would be visible, contrasts in form, line, and color for the proposed facilities would increase contrasts and visual dominance over existing conditions. The pits and overburden disposal areas for the Trenton Canyon mining area and the overburden disposal area in the Valmy mining area would be the most contrasting visual elements (also refer to section 3.12.1). Moderate to strong color contrasts would result from the reddish brown color of the disturbed soils (Figure 4-6).

The contrasts and visual impacts from KOP 2 would be nearly identical to KOP 1. Development of the overburden disposal facility at both mining areas would introduce moderate to strong contrasts in form, line, and color with the existing landscape. The pit in the Valmy mining area would also be a contrasting visual element of the project (Figure 4-5). The project's angular forms and straight geometric lines, and the color contrasts of exposed soils would be noticeable on the rounded forms of North Peak, but would not dominate views.

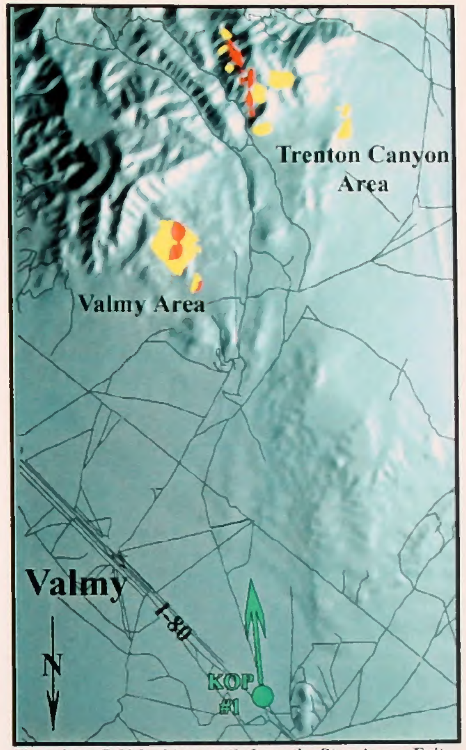


Simulation of Post-Mining Conditions

Existing Conditions

Summer 1997

Matching perspective of the terrain model.



View from I-80 looking south from the Stonehouse Exit.

Overburden Disposal Areas

Pits

Distance to **Valmy Area** from viewpoint: **9.5 miles**.
Distance to **Trenton Canyon Area** from viewpoint: **12 miles**.

Simulation of Post-Mining Conditions

TRENTON CANYON PROJECT

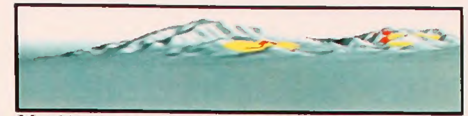
HUMBOLDT COUNTY, NEVADA

Figure 4-3

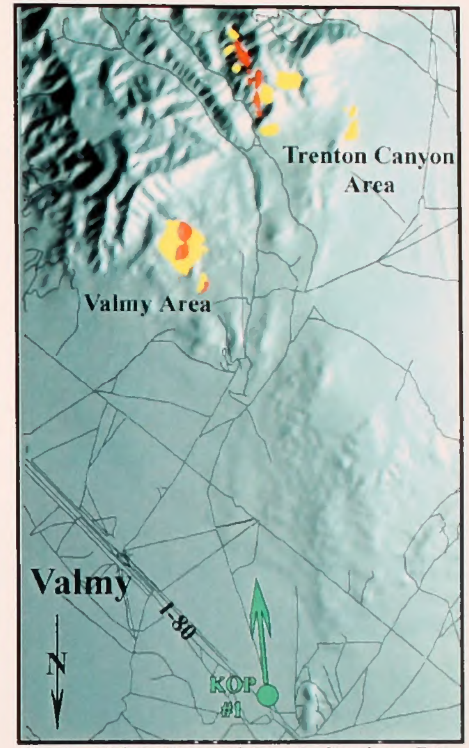
Simulation of Post-Reclamation Conditions

Existing Conditions

Summer 1997



Matching perspective of the terrain model.



View from I-80 looking south from the Stonehouse Exit.

Overburden Disposal Areas

Pits

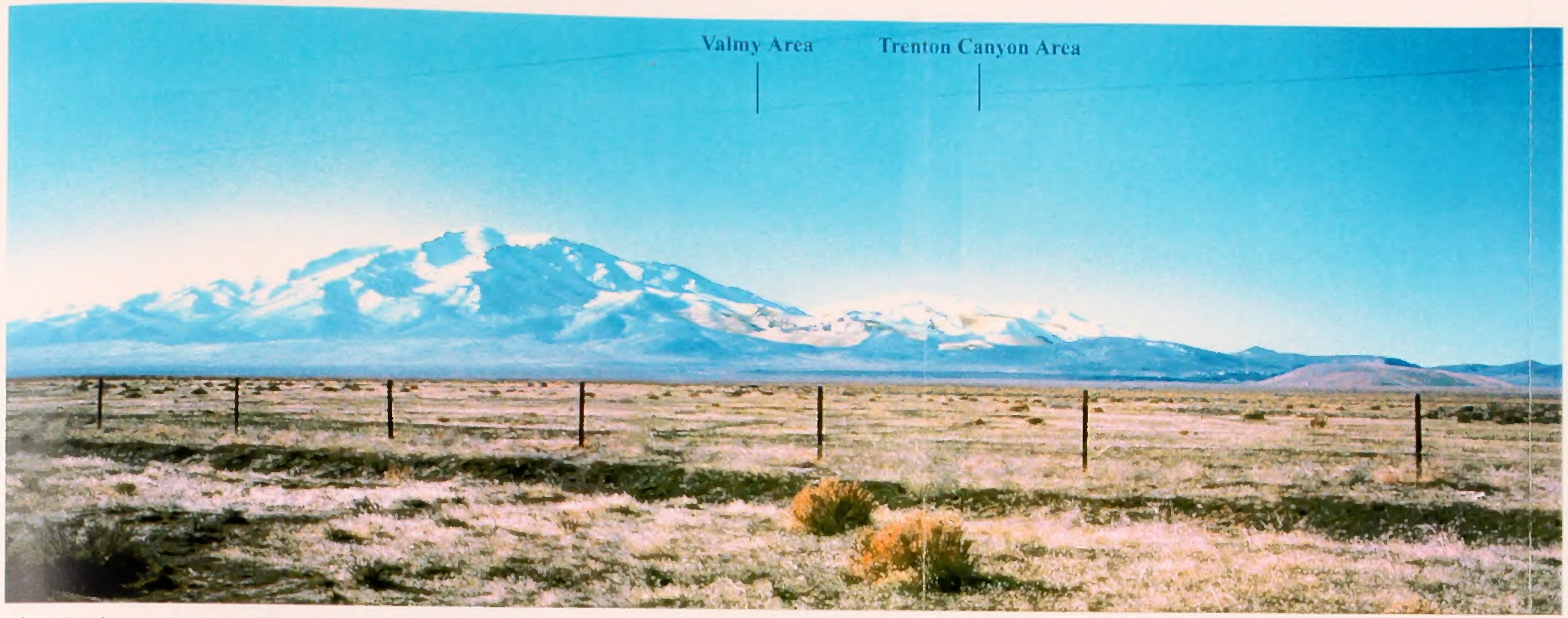
Distance to **Valmy Area** from viewpoint: **9.5 miles**.
Distance to **Trenton Canyon Area** from viewpoint: **12 miles**.

Simulation of Post-Reclamation Conditions

TRENTON CANYON PROJECT

HUMBOLDT COUNTY, NEVADA

Figure 4-4

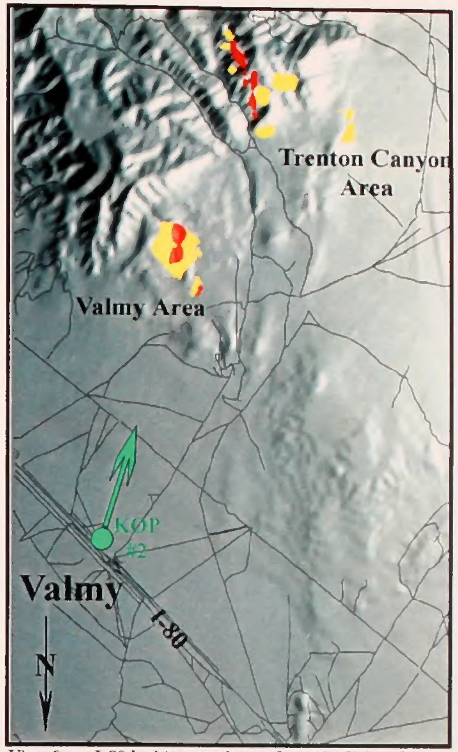


Simulation of Post-Mining Conditions

Existing Conditions

Winter 1997

Matching perspective of the terrain model.



View from I-80 looking southwest from the Valmy Exit.

Overburden Disposal Areas

Pits

Distance to **Valmy Area** from viewpoint: **6 miles.**
Distance to **Trenton Canyon Area** from viewpoint: **10 miles.**

Simulation of Post-Mining Conditions

TRENTON CANYON PROJECT

HUMBOLDT COUNTY, NEVADA

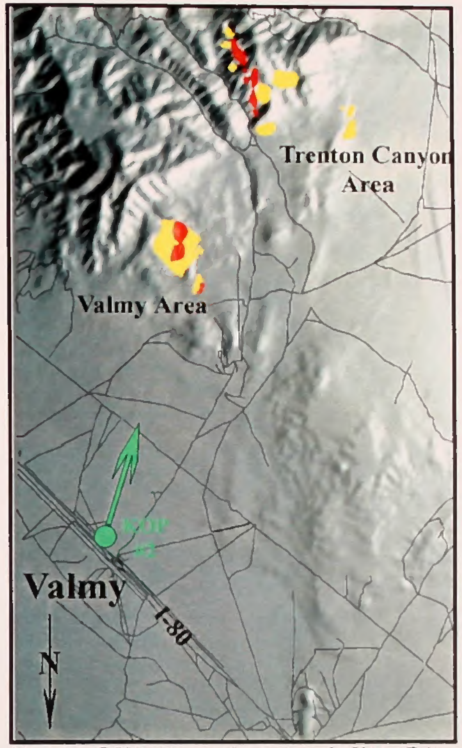
Figure 4-5

Simulation of Post-Reclamation Conditions

Existing Conditions

Winter 1997

Matching perspective of the terrain model.



View from I-80 looking southwest from the Valmy Exit.

Overburden Disposal Areas

Pits

Distance to **Valmy Area** from viewpoint: **6 miles.**
Distance to **Trenton Canyon Area** from viewpoint: **10 miles.**

Simulation of Post-Reclamation Conditions

TRENTON CANYON PROJECT

HUMBOLDT COUNTY, NEVADA

Figure 4-6

Views from KOP 1 and KOP 2 are considered potentially significant (i.e., moderate to strong contrasts) and therefore place lands surrounding the Trenton Canyon Project into either a Class III or Class IV visual rating.

4.14.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

The visual impacts of this alternative would be nearly identical to the Proposed Action. The expanded overburden disposal area TC-6 is obscured by the natural topography of the Trenton Canyon deposit, especially from the east and northeast. The differences in contrast between the two alternatives would not be noticeable to the casual observer. Reducing the number of overburden disposal areas would be a visual benefit to dispersed recreationists.

4.14.1.4 Partial Backfill Alternative

Both of the backfill alternatives would have less visual contrast due to the elimination of overburden disposal areas and partially filling in one or more pits.

Rehandling of TC-4 and TC-5

The visual effects of this alternative after reclamation would be similar to the Proposed Action, as the volume of material within overburden disposal areas TC-4 and TC-5 is not sufficient to completely fill the adjacent pit. The resultant effect would be high visual contrast of the Valmy pit high wall as within the Proposed Action.

Partial Sequential Backfill of Trenton Canyon Pits

If any of the pits that are visible from the KOPs could be completely filled and reclaimed, the visual contrast of the high walls would be reduced.

4.14.2 Potential Mitigation and Monitoring Measures

It would be important for BLM, because of the tourism and interpretive values of the area, to preserve through mitigation all aspects of the Trenton Canyon setting as viewed from I-80 (refer to section 3.12.1). The following elements of the reclamation activities provide for long-term aesthetic improvement:

- The slope gradients on embankments were designed to reflect the naturally rolling, rounded forms suitable to the region, and

- Plant species for revegetating overburden disposal area slopes were selected that suggest the natural vegetation color and texture.

Options for reducing visual contrast of high walls would be further examined (e.g., .artificial desert varnish on the pit highwalls).

4.14.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

Following successful implementation of reclamation measures, the only noticeable residual adverse effect of the Proposed Action and the other alternatives would be the pits. Significant portions of the upper high wall of the Valmy pit would be visible from Interstate 80 viewpoints (refer to Figures 4-3 and 4-6). These impacts are considered potentially significant (i.e., moderate to strong contrasts) and may not conform to the BLM Management guidelines for VRM III and IV classes in the area, depending upon the actual highwall color after mining and subsequent visual contrast as viewed from the KOPs. A weaker contrast (e.g., darker color rock on the highwall) would conform to Class III and Class IV VRM. A stronger contrast (e.g., lighter color rock on the highwall) may not conform to Class III. In this case, options for reducing this contrast would be examined.

Under the Proposed Action and the Expansion of TC-6 alternative, the pits would create an irreversible and irretrievable commitment of visual resources, which would remain visible for the long-term. Under the Partial Backfill alternatives, the irreversible and irretrievable commitment of visual resources would be for only those pits that are not reclaimed.

If mitigation is not possible, pit highwalls would be visible in an area identified to tourists on the I-80 transportation/historic trails corridors as the skirmish site involving Paiutes and military or road builders from which the name Battle Mountain derives.

4.15 NOISE

4.15.1 Direct and Indirect Impacts

Estimates of noise are based on noise research for mining activities, combined with the number and type of vehicles, machines, and blasting. Noise generated by trucks, bulldozers, and other equipment generally ranges from 85 to 90 dBA (A-weighted decibel sound scale) at 50 feet (refer to Table 3-24). Sound levels from blasting range from 115 to 125 dBA at 900 feet; occurring once per day in each pit being mined and is a relatively short term percussive sound.

4.15.1.1 No Action Alternative

Under the No Action Alternative, noise impacts including rock drilling, blasting, loading of overburden and ore, and truck hauling would remain at current levels (42 to 47 dBA) until mining and reclamation activities were completed at North Peak and Valmy.

4.15.1.2 Proposed Action

Sources of noise at the Trenton Canyon mine area would be the same as the No Action Alternative. The intensity of noise is not expected to increase because of the Proposed Action. The same types of equipment used in the operations at North Peak and Valmy mining areas would be used at the Trenton Canyon mine area. Blasting in the pits would continue at a frequency of one blast per day with a maximum of two per day (i.e., one at Valmy and one at Trenton Canyon) during periods of highest production across the project area. The Proposed Action would result in continuation of blasting-related noise until year 2005. Reclamation noise would continue until year 2009.

4.15.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

The noise impacts of this alternative would take place at the same level of intensity as the Proposed Action, but for four to six months longer duration. The longer period of time is due to farther distances to haul and move equipment and supplies during reclamation of TC-6.

4.15.1.4 Partial Backfill Alternatives

The noise associated with the partial backfill alternatives would be similar to the Proposed Action.

4.15.2 Potential Mitigation and Monitoring Measures

No mitigation or monitoring for noise would be required.

4.15.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

During mining there would be residual adverse noise effects on the environment under the Proposed Action or the other alternatives. Once mining and reclamation activities cease, noise would be reduced to pre-mining levels.

There would be no irreversible or irretrievable commitment of resources from noise generated by the Proposed Action or any of the alternatives.

4.16 SOCIAL AND ECONOMIC VALUES

4.16.1 Direct and Indirect Effects

Socioeconomic impacts arise from changes in population and demand for community resources. Such changes generally result from jobs being created (or eliminated) in a locale by the development (or elimination) of industrial or institutional activities, which, if the employment changes are large enough, would result in immigration or emigration of households. A change in population alters the local demand for land, housing, consumer goods, utilities and other public and private services like banking, health care, education, public safety and transportation, all of which are sources of employment, income and fulfillment for the community's residents. Socio-cultural impacts can also occur if the induced changes in the community's social groupings and resource demand/supply balance are significant, manifesting themselves in the form of friction between social and economic groups and changes in individuals' and families' quality of life.

4.16.1.1 No Action Alternative

Under a No Action Alternative, the public lands portion of the Trenton Canyon Project would not be mined. As was noted at the beginning of this section, Newmont already has approximately one-half of the workforce proposed for the project at work at the North Peak site with construction proceeding on ore processing facilities. Assuming a worst case situation with denial of permits forcing abandonment of the project, then none of the effects described above would occur, and the trends and patterns of social and economic activity discussed in Section 3.16 would continue unaccelerated. Population and employment growth in Humboldt and Lander Counties would be slower than with the project, but not by much.

4.16.1.2 Proposed Action

The Trenton Canyon Project's inputs includes the following (Ford, R. 1996):

- Total employees--maximum 130
- Years of production--10 (1998-2005 plus 3 years reclamation)
- Annual labor costs--$7.75 million
- Annual mining supplies cost--$7.82 million
- Annual processing materials cost--$2.63 million
- Capital expansion costs--$10.03 million (in years 1 and 6)

Part of the Trenton Canyon Project (the North Peak and Valmy mining areas) is located on private lands, and construction and operation activities commenced there in early 1996. As of November 1996, approximately one-half of the permanent workforce was already on site clearing overburden and stockpiling ore while approximately 50 short-term contract construction workers (one-half of whom were local residents) were building ore processing facilities. These workers are in fact part of the baseline inventory of regional socioeconomic resources discussed in Chapter 3, i.e., they are already residents of Humboldt and Lander Counties and their socioeconomic effects on the project area are already reflected in the 1996 estimates of population, employment, income and consumption of public and private goods and services. Thus, approval of the EIS and permits for the public land portion of the project would enable the balance of the workforce--approximately 65 full-time mine workers plus an estimated 20 short-term construction workers--to be hired (Ford, R. 1996). Technically, these yet-to-be-hired workers plus the non-labor resources to be consumed by the project on the public lands portions of the site area comprise the socioeconomic impact factors to be assessed in this DEIS. It is difficult to separate the project's employment and spending between the private and public land areas, however, because the distribution of activities could vary from year to year. More straightforward is to take the project's total hiring and procurements activities into the socioeconomic analysis, regardless of location, recognizing that the projected impacts would be on the high side, and thus conservative, in that the analysis would not understate the likely effects on the regional economic and social setting or environment.

Population, Employment and Community Resource Impacts

Regional economic analysis distinguishes three components of a project's multiplier effect: the direct effect, which is the employment and earnings of the project itself; the indirect effect, which is the result of the suppliers who sell directly to the project (fuel, chemicals and other consumables, equipment, etc.) expanding their operations to accommodate the project's requirements on top of their other business; and the induced effect, which is the result of persons receiving wages, salaries and other income from the project and its suppliers spending their earnings on, mainly, consumer goods and services, whose sellers in turn expand their payrolls and operations to accommodate the increased demand. Thus it is the indirect and induced components that account for the impact area jobs that are a multiple of the project's direct workers.

The employment multiplier effect relates to indirect and induced jobs, and the people that fill them often are already residents of the region. Depending on magnitude of the new project relative to the local unemployment rate and availability of part-time workers (e.g., students, housewives and partly retired persons), secondary jobs, which are mostly in retail trade and personal and business service occupations, typically are filled by existing residents of the project area, who thus do not increase the demand for housing, utilities and other public services. The induced component is spread over most of the impact area's retail and service sectors, and therefore individual proprietors typically can accommodate their increased business with relatively small increments of staff (often part-time workers).

Studies of the Nevada gold mining industry by the Nevada Bureau of Mines and Geology have yielded estimates of employment multipliers of 1.75 at the county level and 2.25 at the statewide level (USDI BLM 1995). Thus, for each direct job in gold mining and production another 0.75 indirect and induced jobs would develop in the project area plus another 0.5 indirect and induced jobs elsewhere in the state, for a total increase of 2.25 jobs (one direct plus 1.25 indirect plus induced jobs). Similarly, personal incomes experience a multiplier effect. For each dollar of direct earnings in the mining sector another $1.57 in indirect and induced income is generated throughout the state (USDI/BLM 1995). The indirect and induced jobs and associated earnings (collectively called secondary effects) would continue as long as the direct gold mining and production activity continued, but upon termination of production and cessation of operations and hiring, the direct employment stimulus would disappear and the economy would lose the secondary jobs and income.

Applying the employment multiplier coefficients to the projected direct hiring for the Trenton Canyon Project, the 130 total long-term direct hires and the projected procurements of equipment, materials and operating supplies would generate approximately 100 secondary jobs in the two-county project area. An additional 65 secondary jobs would be generated elsewhere in Nevada, mostly in the urban areas of Washoe and Clark Counties. Similarly, applying the $1.57 per dollar of direct income to the project's annual payroll of $7.75 million yields secondary income of $12.17 million per year accruing to non-mine sector workers and businesses throughout the state.

Based on the experience of the LTM project's personnel, approximately two-thirds of the Trenton Canyon Project's personnel would reside in the Winnemucca area and the remainder in or near Battle Mountain (USDI/BLM 1995). Thus, the employment base in Humboldt County would be expanded by upwards of 155 mine and non-mine jobs, while Lander County's would be expanded by approximately 75 jobs. The local employment and income multiplier effects would be similarly distributed.

It is not possible to predict accurately how many people would relocate to Humboldt and Lander Counties to fill the direct and secondary jobs. In an era of rapid expansion of an industry in a locale, skilled workers in that industry's trades would be scarce, so it is likely that employers would have to recruit workers from outside the locale to relocate there. Conversely, if economic growth in the area were slow, then the locale's manpower resources would be able to fill more or most of the new jobs. Humboldt County has experienced strong growth of mining in recent years, while Lander County has been static. Between 1990 and 1994, increases in Humboldt County mining employment were essentially offset by declines in Lander County mining jobs, but expansion of mining in Humboldt County in 1995 and 1996 caused a net increase in the two counties of approximately 445 mining jobs over the six-year period (Nevada Employment Security Department 1996). At the same time, there was an increase of approximately 2,000 in the two counties' combined total employment and a 3,300 increase in total population between 1990 and 1996, (BEA/REIS 1996; Nevada Employment Security Department 1996; Nevada State Demographer's Office 1996), indicating that non-mine-related economic growth has been the main driver of recent population growth in the two counties since the beginning of the decade.

Proposed new gold mine development (e.g., the Kinross Goldbanks mine) and expansions of existing mines (e.g., Newmont LTM, Hecla Rosebud, Getchell, and Battle Mountain Gold Company's Phoenix Project [JBR 1996]), however, would indicate that there could be continued pressure on the region's skilled mining manpower resources. Accordingly, it is likely that a major portion of the Trenton Canyon Project direct personnel would have to be recruited from outside the area. The extreme case would be that all 130 personnel would have to be recruited from outside the area. If so, they would be expected to bring, on the average, an equal number of dependents, for a maximum total population increment of 260 persons. This estimate is based on the ratio of increases in employed persons to increases in total population for the two county area, which was 2.0 to 1 (the average ratio for the period 1990-96).

Secondary jobs associated with mine development are less likely to require outside recruitment because the area's labor supply has grown rapidly in recent years due to population growth (see Footnote 3), so little secondary employment-based immigration due to the Trenton Canyon Project is likely. Therefore, the total employment impact of the Trenton Canyon Project on Humboldt and Lander Counties would not likely exceed 225-230 workers (including around 100 indirect/induced workers, most of whom are already residents of the project area) and that the total population impact of the project would not exceed 250-260 men, women and children, comprising 125-130 new households.

Referring back to the discussion of the project area's baseline socioeconomic characteristics (Section 3.16), the mid-1996 population of Humboldt and Lander Counties was estimated at 23,170 (16,460 in Humboldt County, with 7,890 in Winnemucca; 6,710 in Lander County with perhaps 4,000 in and near Battle Mountain). Following the experience of the LTM's workforce, with two-thirds located in Winnemucca and one-third in Battle Mountain, it can be anticipated that two-thirds of the Trenton Canyon Project personnel and their dependents--projected to number around 170-175 persons in approximately 85 households--would settle in the Winnemucca area, while most of the remainder--40-45 workers and a like number of dependents--would settle in the Battle Mountain area. The Winnemucca contingent would represent a 2.2% increment to that city's 1996 population, which is approximately one-third of the amount that the city grew between 1995 and 1996. The impact of the Battle Mountain contingent on that community would be of similar relative magnitude. Population increments that are only a fraction of the project area's recent growth rate would be regarded as less than significant.

Characterization of the project's demographic impacts as being less than significant applies equally to its potential impacts on housing, utilities and public services. The inventory of housing and public infrastructure in the Winnemucca and Battle Mountain areas has expanded in step with population growth, and both businesses and government are oriented to anticipating growth--not just accommodating it--as is exemplified by the goals and programs of the Tri-County Development Authority and the Chambers of Commerce of the two counties to expand and diversify the area's economic base.

Economic Impacts

The Trenton Canyon Project would have relatively small but positive effects on the local economy from the consumption spending of its workers and the procurements of local supplies by the project. Newmont estimates that its direct payroll would be approximately $7.75 million per year over the eight-year life of the project while its total procurements would amount to an average of $10.45 million per year (Ford 1996). Studies of household budgets indicate that working families spend around 80% of their pre-tax income on consumer goods and services, with the balance going into taxes and savings. Most of the spending occurs in the county of residence. Accordingly, it can be projected that local merchants and businesses in Humboldt and Lander Counties would accrue around $6 million per year in new business from the Trenton Canyon Project workers. Taxable retail sales in the two counties were around $475 million in 1994 (Applied Development Economics 1996; JBR 1996), so the increment of spending from the Trenton Canyon Project workers, while welcome, would be less than significant.

Procurements of operating supplies, equipment and other materials by the project are estimated at $10.45 million per year (Ford 1996). According to a study of the effects of northern Nevada gold mine purchases on the region (Humboldt, Lander, Pershing, Elko and Eureka counties), approximately 22% of the value of gold mine procurements accrues to local businesses in the region. In 1993, industry purchases amounted around $725 million, of which an estimated $156 million went to local vendors in northern Nevada (Applied Development Economics 1995). Applying that ratio to the projected Trenton Canyon Project's procurements yields a value of $2.3 million for local procurements. Again, this would be a welcome, but less than significant, increment of business for local vendors.

It is these local consumption expenditures and mining procurements that generate the employment and income multiplier effects described earlier.

Fiscal Impacts

The Trenton Canyon Project would generate ad valorem property taxes and sales taxes, principally for Humboldt County, since the mine property is, and the majority of its personnel would be, located there. Property taxes would accrue on the project's real and personal property. The assessed value of the project needs to be determined (including valuation of possessory interest on public lands) before an estimate of its property taxes can be made. Valuation data are not currently available. Similarly, it is not possible to project what the net proceeds of operation may be, since costs and yields vary from year to year. However, it can be said that the project would contribute to the county's revenue base, and that the contribution likely would exceed the incremental costs associated with the county providing services to the site (e.g., the mine has its own security and fire-fighting facilities and staff).

Some of the sales taxes generated by the project's procurements would flow back to the project area from the state government. Collectively these are an important source of income to local governments, but the Trenton Canyon Project's contribution would be relatively modest (as estimated above, $2.3 million in local sales would generate approximately $149,500 in sales tax revenues, at 6.5%, part of which is kept by the state government). Humboldt County received over $8 million in intergovernmental transfers in FY 1994-95, the majority of which were sales tax rebates, so the share of those funds that would come from Trenton Canyon Project procurements, while welcome, would be less than significant.

Humboldt County would accrue property and sales tax revenues from project-related personnel and spending. Lander County would receive no property taxes from the Trenton Canyon Project, but it would earn property taxes from project personnel residing in the county and sales taxes from project-related procurements and personnel consumption spending. Both counties would gain additional sales tax revenues as a result of the project's multiplier effects on local incomes. Whether these sources of fiscal revenues plus others based on state and federal programs keyed to population size would offset additional population-based costs of local government cannot be definitively stated. But the maximum additional number of new residents attributable to the Trenton Canyon Project would be small--on the order of a two percent increase in the counties' populations, as estimated above--which would be difficult to discern in the overall level of demand for public sector services.

Combined, the project- and personnel-based tax revenues that would be generated directly and indirectly by the project would likely exceed local government costs associated with the project.

Mine Closure and Decommissioning Impacts

Termination and decommissioning of mining at the Trenton Canyon site would reverse the expansion effects set off by construction and operation of the mine. While decommissioning activities would temporarily preserve some jobs and income at the mine, eventually the project's direct and indirect effects on employment and income would be canceled. Service capacities in the private and public sectors that had developed in response to the increment of demand associated with the project would become excess and the local unemployment rate would increase, at least temporarily.

Whether the mine layoffs and termination of procurements would have a significant impact on the area's population, jobs and incomes would depend on the economic situation at the time. In an era of strong regional economic growth, the displaced workers would probably be re-absorbed quickly by other new or expanding mine projects (as was the case between 1990 and 1994 where Humboldt County's rapid mine expansion offset the temporary contraction of Lander County's), and the local economy would scarcely register the changes. Conversely, if business in general or the mining sector in particular were stagnant or in recession, the loss of jobs and income could have negative multiplier effects on the regional economy. If businesses supporting export industries lose trade, then the contraction can cascade back throughout the local economy, impacting local governments as well. This is the classic "boom-bust" syndrome, which is countered by the local business community and government attracting new industries to broaden and diversify the economic base of a region.

The state demographer is projecting continued strong population growth for Humboldt County, in anticipation of the continued strength of the mining sector as well as diversification of the regional economy (which would spill over to Lander County, for which moderate growth is projected), so eventual closure of the Trenton Canyon Project would appear not to significantly affect the area's socioeconomic stability.

4.16.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

Under this alternative, there would be no change from Proposed Action effects.

4.16.1.4 Partial Backfill Alternatives

The backfill alternatives would have the same requirements and generate the same revenues as the Proposed Action.

4.16.2 Potential Mitigation and Monitoring Measures

No mitigation or monitoring measures are proposed for fiscal, social, community, or economic resources.

4.16.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

No residual adverse impacts on socioeconomic resources are foreseen as a result of the project.

Energy and economically non-recoverable physical resources associated with construction and operation of the project, and with supporting the activities of people associated with the project over its life (e.g., buried or chemically-altered materials), are the principal resources that would be irretrievably and irreversibly consumed.

4.17 CULTURAL RESOURCES

To be considered eligible for inclusion in the National Register of Historic Places (NRHP), a cultural resource must retain integrity and satisfy at least one of the four criteria. These criteria are listed below:

- Criterion A (36 CFR Part 60.4a) -Associated with events significant to broad patterns of history,
- Criterion B (36 CFR Part 60.4b)- Associated with the lives of persons significant in the past,
- Criterion C (36 CFR Part 60.4c) - Embody distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic values; or represent a distinguishable entity whose components lack individual distinction, and
- Criterion D (36 CFR Part 60.4d) - Yielded or may yield information important to history or prehistory.

4.17.1 Direct and Indirect Impacts

4.17.1.1 No Action Alternative

Figure 2-1 depicts the limits of the No Action Alternative. The No Action Alternative is defined based on limits of surface disturbances associated with mining operations on private lands that have been permitted by the State of Nevada and corner crossings granted by the BLM. Disturbance associated with the No Action Alternative would occur even if the BLM did not authorize the proposed Plan of Operations. As a result, the area affected under the No Action Alternative is not included within the Area of Potential Effect (APE).

Four cultural resources have been identified within the disturbance footprint of the No Action Alternative. Two are prehistoric sites, one is an historic site, and one contains material dating to both periods. Based on consultations between the BLM and the Nevada State Historic Preservation Office (SHPO), none of the sites are eligible to the National Register. Loss of these sites is not considered as a component of the Proposed Action; however, it is taken into consideration during the review of cumulative impacts.

4.17.1.2 Proposed Action

The surface disturbance associated with "proposed facilities" on Figure 3-23 represents the APE for the Proposed Action and the other action alternatives. In most areas, the APE includes public lands onto which existing mine facilities would be expanded; however, private lands are also included in the APE if federal authorization allows for the expansion of a facility that would not occur in the absence of a federal action. This results in a discontinuous APE for the Proposed Action illustrated as "proposed facilities" on Figure 3-23.

Twenty-one cultural resource sites are located within the footprint of disturbance associated with the Proposed Action. Fourteen sites date to the prehistoric period, two date to the historic period, four contain evidence of both periods, and one appears to be of ethnographic importance. Based on consultation between the BLM and the Nevada SHPO, four prehistoric period resources (22-6187, -6204, -6218, and -6243) are eligible to the National Register based on Criterion D.

Ethnographic resources include sites or areas of concern to Native American groups either for heritage or religious reasons. They may include burials or locations where medicinal and subsistence resources are gathered. One resource was identified initially as prehistoric in age (62-6812) and was found not to be eligible for the National Register (see Obermayer *et al.* 1995). Recently, this site has been identified as an ethnographic resource of interest to the Western Shoshone. As a result, re-evaluation of this site would be considered in consultation with the Western Shoshone.

The Western Shoshone are concerned that the Trenton Canyon Project may affect springs. These resources traditionally provided areas for past human use. In addition, there is a concern regarding the potential for continued wildlife use, water quality, and the continued viability of important plant species. Populations of plant species that are of subsistence and/or cultural value may be present in the general project area and project related disturbance may impact some such populations. The potential for choke cherry bushes to be lost as a result of overburden disposal area TC-4 is of concern to Native American groups. The Western Shoshone identified sage grouse strutting as an issue and remain concerned that past and current activities have caused some sage grouse to move out of the area. They are concerned that increased activities associated with the project would cause additional impacts to sage grouse and to the potential for strutting behavior that once occurred in the area.

In summary, there is no anticipated change in flows resulting from the Proposed Action as groundwater would not be impacted (see Section 3.3.2). Water quality of the Ames and Mud Springs is described in Section 3.2.2; they are both degraded due to other permitted land uses. The springs would not be directly affected by the project and would be protected from further degradation from spills or sedimentation.

Direct effects on vegetation, wetlands, and wildlife are examined in Sections 4.8 - 4.10 of this EIS. Plant populations that have subsistence and/or cultural value to the Western Shoshone are described in Section 3.9. Five plants of cultural value occur within the APE: two occur throughout other vegetative cover types in the project area and three have more specific habitat requirements and were not identified in the baseline vegetation sampling (Resource Concepts, Inc. 1995). Section 3.10.1.3 describes the results of sage grouse investigations. There is one sage grouse lek within the area.

The Western Shoshone have identified burial markers and any associated burials or burial grounds which may be impacted by surface disturbance and/or human intrusion into the general project area, including some located within or in close proximity to the Immediate APE. Some of these places would be impacted by the Proposed Action. The BLM has initiated consultation with Native Americans regarding places subject to impact.

Cultural resources located on lands surrounding the APE are considered to be at risk due to the proposed existence and intensity of nearby project activities. Thirty-one cultural resources are located within 500 feet of the footprints of the existing and Proposed Actions, including the primary access road. Nineteen are prehistoric period sites, six are historic period sites, and the remaining six sites contain evidence of both the prehistoric and historic periods. The BLM and the Nevada SHPO have determined that five prehistoric properties (22-6085, -6199, -6246, -6247, and -6248) are National Register eligible, as is the prehistoric component at one of the multi-component sites (22-6376). All six sites are considered eligible based on Criterion D. Until protection measures can be developed, continued integrity of these six eligible properties may be jeopardized due to the proximity of surface disturbing activities. In evaluating impacts to properties of concern under NRHP, it would be necessary to evaluate whether the activities could have the potential to affect the integrity of the artifact bearing deposits (surface and subsurface) at one or more of the identified sites.

One historic property (22-5562) located within the buffer area is National Register eligible based on Criterion A. This property, a trace of the Victory Highway, is located at the northern terminus of the proposed access road. Widening of that access road may have the potential to impact the integrity of site 22-5562. However, numerous previously permitted activities have had an effect on this property. These activities have included construction of I-80 and related improvements, construction of roads leading to the interchange near Lone Tree, the construction of various utilities, and existing mining operations. Therefore, it is considered unlikely that the Proposed Action would cause an impact to the setting or general integrity of 22-5562 that has not occurred already due to these other activities.

Indirect effects may occur to eligible properties located in lands surrounding the APE, even though no surface disturbance is proposed near the site. For example, impacts to properties deemed eligible based on National Register criteria A through C may occur due to the introduction of new visual or audible intrusions.

The Proposed Action would have the potential to impact the integrity of only one historic property located in the lands surrounding the APE - Site 22-5556, the site of Stonehouse. However, numerous previously permitted activities have had an effect on this property. These activities have included construction of I-80 and related improvements, construction of roads leading to the interchange near Lone Tree, the construction of various utilities, and existing mining operations. Therefore, the Proposed Action would not cause an impact to the setting or general integrity of 22-5556 that has not occurred already due to these other activities.

Places of concern to the Western Shoshone that are located in the lands surrounding the APE include burial markers that signify burials and burial grounds; Ames Spring (Section 21, T33N, R43E); plant populations; and a sage grouse lek (Section 19, T32N, R43E). Other indirect environmental impacts (e.g., change in aesthetic character, noise, or dust) may occur in some parts of the surrounding APE.

Until protection measures can be developed, continued integrity of these sites may be jeopardized due to the proximity of project activities. Consultation with the Western Shoshone is ongoing regarding the potential for other places of concern on lands around the APE.

4.17.1.3 Expansion of TC-6 to Eliminate TC-4 and TC-5

Cultural resource impacts of the expansion of TC-6 would be the same as those identified for the Proposed Action.

4.17.1.4 Partial Backfill Alternatives

The effects of either of the backfill alternatives would be the same as the Proposed Action.

4.17.2 Potential Mitigation and Monitoring Measures

This section provides suggested mitigation and data recovery activities that may aid in the elimination, amelioration, or off-setting of identified impacts. It should be noted that the identified impacts and mitigation measures are specific to the Proposed Action and other action alternatives as described in Chapter 2.

Three small areas within the right-of-way for the primary access road would be subject to surface disturbance and they have not been examined as part of a Class III inventory. No disturbance shall occur in areas that have not been subject to a Class III inventory or to sites that have been inventoried but for which consultation is not complete until the sites have been inventoried, reviewed, and approved by the BLM and Nevada SHPO. The National Register eligibility of any resources identified would be determined by the BLM in consultation with the Nevada SHPO and appropriate mitigation would be developed and approved by the BLM and the Nevada SHPO and implemented.

No surface disturbance shall occur within or immediately adjacent (within 100 feet) to the boundary of sites 22-6187, -6204, -6218, or -6243 prior to implementation of at least the field phase of a data recovery plan that has been reviewed and approved by the BLM and the Nevada SHPO. Impacts to these four prehistoric properties may be determined to have "no adverse effect" if a data recovery plan is prepared, approved by the BLM and the Nevada SHPO, and subsequently implemented.

Impacts would occur to ethnographic resources that may be determined National Register eligible. Consultation regarding this potential impact is currently taking place between the BLM and the Western Shoshone. No surface disturbance shall occur within or immediately adjacent to the boundary of a potentially National Register eligible ethnographic period property prior to the completion of all consultations required by law, and, as appropriate, implementation of at least the field phase of any data recovery or mitigation plan prepared to address impacts to that resource. Any such data recovery or mitigation plan must be reviewed and approved by the BLM and the Nevada SHPO. The Western Shoshone would be asked to participate as a concurring party in the development of any such data recovery or mitigation plans.

4.17.3 Residual Adverse Effects and Irreversible and Irretrievable Commitment of Resources

The Proposed Action and other action alternatives would result in the loss of cultural resources that are not National Register eligible. These sites have been recorded to BLM standards and the information has been integrated into local and statewide data repositories. Impacts to National Register eligible sites would be reduced through preparation and implementation of ~~a~~ data recovery and/or mitigation plans. Because some cultural value cannot be fully mitigated, the Proposed Action and alternatives would result in a residual impact to these cultural resources.

4.18 CUMULATIVE EFFECTS

A cumulative effect is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

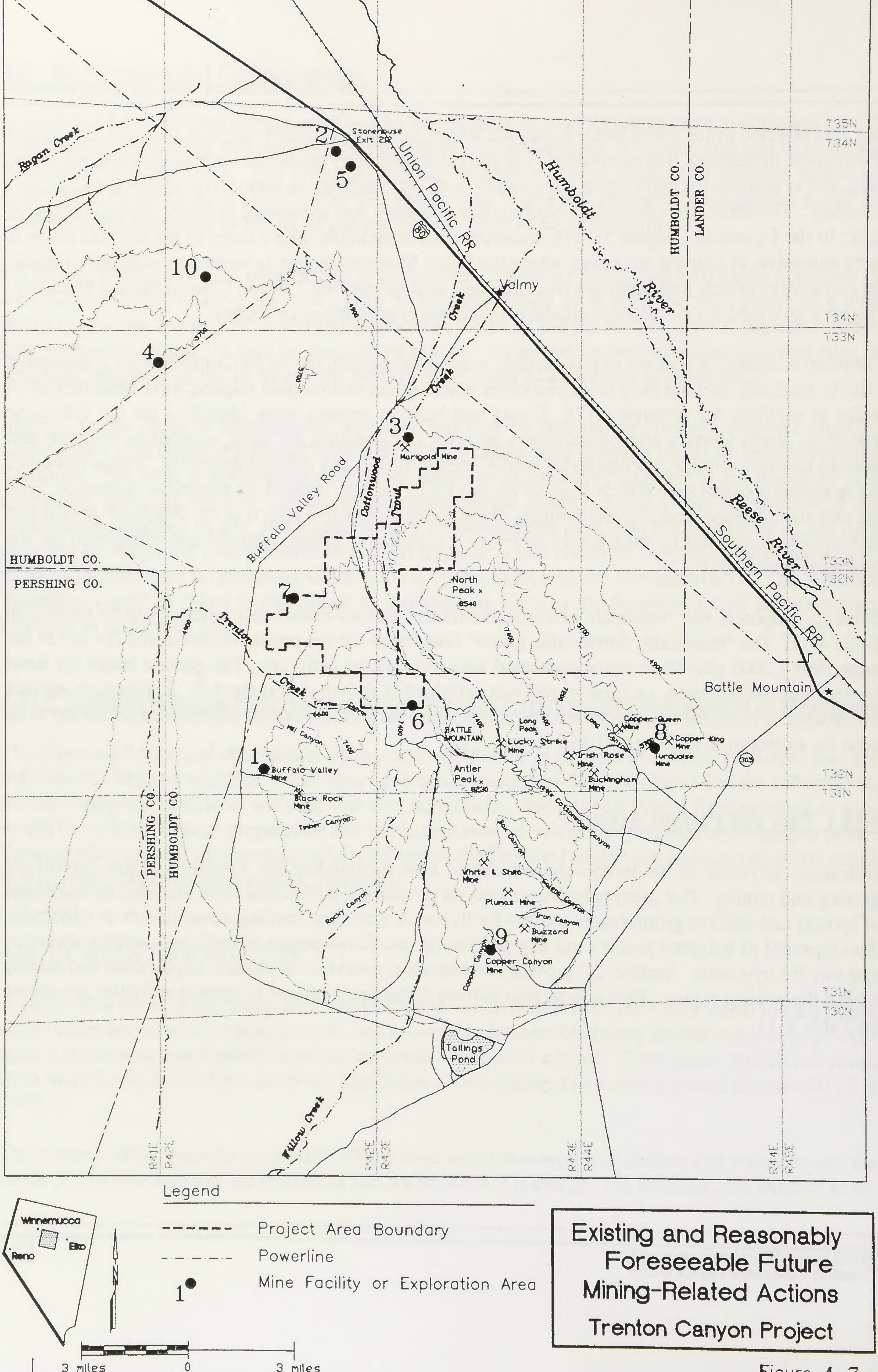
The resource study areas for cumulative effects were selected to represent an area that encompasses the needs or characteristics of the individual factors within that resource. For example, the wildlife study area was selected as the entire Battle Mountain Range, as some potentially impacted species have broad distribution throughout this ecosystem. For the more stationary resources such as geology, minerals, soils, and vegetation the cumulative effects study area was confined to boundaries nearer to the project boundary. Therefore, the cumulative effects study boundary was somewhat different for each resource (refer to the figures in Chapter 3). For resources such as wildlife, where some of the animals range is more extensive, or cultural resources, where the Battle Mountain Range is viewed as culturally similar, the cumulative effects area analyzed was extended well beyond the Trenton Canyon Project boundary. The area analyzed for cumulative effects is described in each resource section.

Cumulative effects discussed in this section, in accordance with the BLM Guidelines for Cumulative Effects Analysis, include only those resources where direct and indirect impacts have been identified (refer to sections 4.2 through 4.17). Direct and indirect impacts were identified for the following resources: water (surface and groundwater), geology and minerals, air, soils, vegetation, wetlands and riparian habitats, wildlife, special status species, range, visual, and cultural resources. Those resources not requiring a cumulative effects analysis for this DEIS include: hazardous materials, recreation, land use and access, noise, and socioeconomics. Because the cumulative effects of the Proposed Action and alternatives would not be measurably different, a cumulative effects analysis was completed for the Proposed Action only.

Existing, proposed, and "reasonably foreseeable future" surface disturbance is described by facility on Table 4-11. The "reasonably foreseeable future" time frame for this project is considered the life of the mine 1998 - 2005 plus three years associated with reclamation activities. The general locale for these exploration, reclamation, or mine expansion activities is shown on Figure 4-7. Exploration surface disturbance is included from BLM records and includes the total amount of disturbance permitted to be used for exploration drilling and drill roads.

4.18.1 Past and Present Actions

Dominant activities in the thirty square miles of land surrounding the Trenton Canyon deposit are grazing and mining. Past grazing improvements on private and public land have included development of springs and shallow groundwater sources for livestock watering, fencing, construction of windmills, development of irrigated pasture and hay production and development of wells and surface diversion systems for irrigation. Section 2.2 provides an historical overview of mineral exploration and mining within the project region. Past and present surface disturbance related to mining activities are shown on Table 4-11.



Existing and Reasonably Foreseeable Future Mining-Related Actions

Trenton Canyon Project

Figure 4-7

Table 4-11
Current and Reasonably Foreseeable Future Surface Disturbance in the Region

Map Reference Number (Fig 4-7)	Facility Name and Company	Past and Present (acres)	Proposed (acres)	Reasonably Foreseeable Future Actions (acres)	Total (acres)	Status/Comments
1	Buffalo Valley Mine	146			146	mining and exploration
2	Lone Tree Mine Newmont	3,617			3,617	approximately 700 ac. of the 3,617 ac. of surface disturbance is located north of I-80
3	Marigold Mine Rayrock Resources	1,350	714	134	2,232	permitted in 1997 for 1,344 ac. proposed for 1998 882 ac.
4	Buffalo Mountain	18			18	reclamation activity only
5	Stone House	126			126	reclamation activity only
6	Trenton Canyon Plan of Operation - Proposed Action Newmont	486	1,470		1,956	486 ac. currently permitted, existing mining at North Peak; proposed 969 ac. public land required
7	Trenton Canyon Exploration Consolidation Newmont	716	-260		456	exploration drill sites and roads
8 and 9	Battle Mountain Gold	3,537		1,545	5,082	Total Battle Mountain Gold disturbed acres for Battle Mountain Range
10	Brass Ring Resources	18			18	exploration and reclamation
TOTAL		10,008	1,210	2,901	14,119	

Exploration activities include drilling, trenching, and sampling and reclamation of the drill pads. Mining activities include open pit mining, ore milling and processing, overburden disposal, tailings disposal, and heap leaching. Recent mining activity has deepened open pits, necessitating installation of dewatering systems to prevent groundwater from entering them by lowering the groundwater table adjacent to the mine. Newmont's Lone Tree Mine and Rayrock Resources, Inc.'s Marigold Mine are the two active mines (Figure 4-7) that would be active at the same period of time as the Trenton Canyon Project and would potentially create additive effects on soils, air quality, vegetation and grazing, water quality, and wildlife.

Marigold Mine's existing surface disturbance is 1,350 acres. Marigold Mine facilities include four open pits (380 ac), four overburden disposal areas (440 ac), heap leach pads and solution ponds (130 ac), tailings dam and impoundment (180 ac), haul and access roads (97 ac), water diversions, topsoil stockpiles (20 ac), and ancillary facilities (includes roads, ponds, wells and buildings).

Lone Tree Mine is active and currently permitted operations cover approximately 2,900 acres of land near Lone Tree Hill south of the Stonehouse Exit on I-80. This open pit mine is scheduled to continue to operate until after Trenton Canyon is closed. LTM's facilities include one large open pit (405.5 ac), three overburden disposal areas (1,321.6 ac), heap leach pad and overflow ponds (267.6 ac), tailings dam and impoundment (302.3 ac), seepage collection pond (3.7 ac), sediment ponds (9.9 ac), powerlines and pipelines (175.7 ac), dewatering corridor (6.4 ac), haul and access roads (195.1 ac), water diversions (22 ac), ore and topsoil stockpiles (98.3 ac), and other stockpiles, waste rock pits, and borrow areas (60 ac).

4.18.2 Proposed and Reasonably Foreseeable Future Activities

Foreseeable activities within the cumulative effects area include mine exploration, development, operation, and reclamation. Mine development and operation would create an additional demand for energy, possibly creating the need for additional ROWs for powerlines or transmission facilities.

The disturbed area for present and reasonably foreseeable future mining activities in the region could be as high as 14,119 acres over the next ten years (Table 4-11). Existing mines and exploration activities have disturbed or are permitted to disturb 10,008 acres and the future mining activity prior to year 2009 is projected to disturb another 2,901 acres. Permitting for future expansion is currently ongoing for the Rayrock Resource's Marigold Mine and Battle Mountain Gold's Phoenix Project. Rayrock Resources long range plan entails surface disturbance to an additional 1,356 acres to develop six new pits and expansion of the overburden disposal areas and tailings disposal facility. The Phoenix Project is a new mine that would be located in T31N, R43E, Section 26 and 27 near the historic Copper Canyon Mine, and is projected to disturb 1,545 acres. Two exploration projects, Buffalo Mountain and Stone House, representing 144 acres, are scheduled to be reclaimed within the same time frame and hauling roads, drill pads, and portions of other active mines would most likely be reclaimed concurrent with mining operations. Continued modification of existing mines, proposed new mines, and possibly closure of existing mines can be expected in response to changes in environmental, operational, and regulatory conditions, ore grade, operating costs, and the price of mineral commodities.

The reasonably foreseeable activities at existing mines may include expansion of facilities with new facility designs that may require different uses of the resources. The expansion of the tailings impoundment at Marigold Mine could require additional storm water structures to be constructed around the impoundment. Each of these types of changes to an existing mine plan may result in some disturbance to public land or other use of a resource. In addition, there may be a need to modify the existing reclamation permits.

The other uses for the lands within the cumulative effects area would remain unchanged. Livestock grazing, dispersed recreation and hunting would continue. The grazing allotments are expected to be managed at present levels of grazing intensity, and range improvements would be implemented by the BLM to distribute water to various grazing allotments (M. Neff, Range Conservationist, BLM).

4.18.3 Water Resources

The cumulative assessment area for water resources is shown as the study area boundary on Figure 3-1. The primary geologic feature in the area is Battle Mountain. There are several perennial creeks which drain the area and flow into the Humboldt River. Most existing and future mine operations in the study area would contribute to increased sedimentation to the creeks from disturbed areas. These impacts are expected to be limited and should not contribute to a significant cumulative impact.

The Trenton Canyon Project would not contribute to the withdrawal of surface water or groundwater through pumping. Water required for mining operations would be supplied by the existing water supply pipeline directly from the Lone Tree Mine. The only removal of groundwater would be through evaporative loss from the regional groundwater system. Since this volume of groundwater is already included in the estimated losses due to pit dewatering at the LTM, the additive effect of the proposed project on the regional water resources would be negligible. Groundwater drawdowns are not anticipated for the Marigold Mine expansion, although a portion of Trout Creek was diverted and the need for additional water supply wells would be assessed as part of the amended plan of operations (Rayrock Mines, Inc. 1997).

The Trenton Canyon Project has little potential for adverse geochemical effects on surface or groundwater; therefore, it would not contribute to the cumulative effect on acid generation within the region.

4.18.4 Geology and Minerals

Since the entire region is intensely mineralized, metallic and non-metallic deposits are numerous. Minerals-related activities prevail within the region for the principal form of enterprise as could be expected from such extensive deposits. The cumulative effect on geology and mineral resources related to the historic and current mining operations at Lone Tree Mine, the North Peak and Valmy deposits (located on private land), the Marigold Mine, the Battle Mountain Gold Mine, the Buffalo Valley Mine, and historic surface exploration and drilling activities is shown on Table 4-12. Mining disturbance in the area has included exploration (road construction, drilling, trenching), open pit mining, overburden storage, heap leaching, ore processing, and tailings disposal.

The total area affected by mining related activities at the aforementioned projects under the past and present surface disturbance is estimated to be 6,168 acres (including 4,284 acres of private and 1,884 acres of public lands). The Proposed Action at Trenton Canyon and the proposed expansion at Marigold Mine would create an additional 1,879 acres of disturbance, increasing the surface disturbance by 30 percent. In addition, reasonably foreseeable expansion activity at the Marigold Mine could disturb up to an additional 882 acres of land, bringing the cumulative total disturbed acres to 9,376 acres increasing the total surface disturbance by 52 percent (%) over current conditions. Additionally, at least 759 acres would be reclaimed within the ten year analysis period; thus the resultant cumulative total would be 8,617 or 39% over current conditions.

Gold mining has been and will continue to be a major activity in the region. Continued mining activity would result in additional acreage allocated to open pits, overburden disposal areas, leach pads, tailing impoundments, ore processing facilities and additional supporting development. The degree that mining activity would increase in the future has been predicted by the Bureau of Mines, Bureau of Land Management in a document entitled "Mineral Resources of the Winnemucca-Surprise Resource Assessment Area" (USDI BLM 1996). Observations made over 1990-1994 show that production of copper, lead, tungsten, mercury, iron ore, manganese, and zinc have declined in the entire Resource area. Gold and silver and some nonmetallic commodities production are the highest producers and should continue into the reasonably foreseeable future.

4.18.5 Air

Most of the direct project-related air quality impacts would be confined to the project area within the Pumpernickel, Clovers, and Buffalo Valley Hydrographic Sub-basins. The potential for cumulative air quality impacts are from emissions related to fugitive dust from wind erosion around the existing and proposed mine developments. The Trenton Canyon Project would contribute no major point sources to the region. Table 4-13 demonstrates the total TSP and PM_{10} emissions within the cumulative effects area over time. Projected emissions from currently permitted activities including exploration related to the Trenton Canyon Project are 2,550 tons per year of total suspended particulate (TSP) and 1,100 tons per year of particulate matter of 10 microns or less in size (PM_{10}).

Table 4-12
Cumulative Effects Analysis for Geology and Minerals, Soils, and Vegetation

	Existing		Proposed		Foreseeable		Cumulative		
	Public	Private	Public	Private	Public	Private	Public	Private	Total
Acres Potentially Disturbed									
Lone Tree Mine	840	2,777	0	0	0	0	840	2,777	3,617
Marigold Mine	708	641	418	501	736	593	1,862	1,735	3,597
Trenton Canyon Project	29	457	519	701	0	0	548	1,158	1,706
Trenton Canyon Exploration	307	409	-114	-146	0	0	193	263	456
Subtotal Disturbed	1,884	4,284	823	1,056	736	593	3,443	5,933	9,376
Acres Potentially Reclaimed									
Buffalo Mountain	0	0	18	0	0	0	18	0	18
Stone House	0	0	126	0	0	0	126	0	126
Trenton Canyon Explor. [a]	0	0	0	0	102	136	102	136	238
Subtotal Reclaimed	0	0	144	0	102	136	246	136	382
Disturbed - Reclaimed Acres	1,884	4,284	679	1,056	634	457	3,197	5,797	8,994

[a] This analysis assumes that 1/3 of the area disturbed for exploration purposes would be reclaimed within the ten year period.

Table 4-13
Projected Air Emissions from Surface Disturbance within the Pumpernickel, Clovers, and Buffalo Valley Hydrographic Basins

Map Reference Number (Fig 4-7)	Facility Name	Past and Present Emissions, TPY		Proposed Emissions, TPY		Reasonably Forseeable Future Actions Emissions, TPY		Total TSP Emissions TPY	Total PM_{10} Emissions TPY
		TSP	PM_{10}	TSP	PM_{10}	TSP	PM_{10}		
1	Buffalo Valley Mine	146	25	0	0	0	0	146	25
2	Lone Tree Mine	1,374	615	0	0	0	0	1,374	615
3	Marigold Mine	511	228	0	0	505	226	1,016	454
4	Buffalo Mountain	7	3	0	0	-7	-3	0	0
5	Stone House	48	21	0	0	-48	-21	0	0
6	Trenton Canyon Plan of Operations - Proposed Action	185	83	661	296	0	0	846	378
7	Trenton Canyon Exploration Consolidation Plan	272	122	-99	-44	-90	-41	83	37
10	Brass Ring Resources	7	3	0	0	0	0	7	3
TOTAL		2,550	1,100	562	252	360	161	3,472	1,513

Note: The study area for this table includes the Pumpernickel, Clovers, and Buffalo Valley hydrographic basins to the north and west of Battle Mountain range to approximately the Humboldt River as shown on Figures 3-11 and 4-7.
TSP Emission Factor = 0.38 tons/acre-year; PM_{10} Emission Factor = 0.17 tons/acre-year (Reference: EPA, AP-42, Fifth Edition, Table 11.9-4).
This analysis assumes that approximately 1/3 of the area disturbed for exploration purposes would be reclaimed within the ten year period.

Fugitive air emissions projected for existing, proposed, and future mining actions within the Pumpernickel, Clovers, and Buffalo Valley hydrographic basins could result in a maximum of 3,617 tons per year TSP and 1,578 tons per year (PM_{10}). Only a fraction of these emissions would occur in the atmosphere on any one day of the ten year cumulative analysis period because of the dispersed nature of mining and exploration activities. It is estimated that the greatest quantity of emissions would occur at a point in time where the proposed activities at Lone Tree Mine, Trenton Canyon Mine, Marigold Mine are fully operating. Given the development schedules for each of these facilities, these three mine areas would be under full operation during late 1998 through 2003.

4.18.6 Soils

The soils cumulative effects area is represented by the same area as for cumulative effects on geology. Total estimated surface disturbances would increase 52 % over the current permitted area (Table 4-12); however, the area actually exposed at any particular point in time would be considerably less. Soil loss could occur over the entire 9,376 acres due to wind and water erosion. The rate and extent of soil loss would depend on the rates and sequence of facility development, topography and location of exploration and mining activities, and the meteorological conditions. Implementation of reclamation concurrent with mining would substantially reduce the soil loss from stockpiles, roads, and overburden disposal areas.

4.18.7 Vegetation and Special Status Plant Species

The cumulative effects study area for vegetation resources includes lands encompassed in the Copper Canyon and North Buffalo grazing allotments (Figure 3-17). The Proposed Action would not result in the cumulative loss of federally listed threatened or endangered plant species, or any habitat for such species. There would be an incremental loss of habitat suitable for supporting populations of the windloving buckwheat, a BLM sensitive species.

Vegetation throughout the region is similar to that described for the Proposed Action at Trenton Canyon, with sagebrush communities as the dominant vegetation cover. There are isolated stands of juniper trees within the sagebrush communities. The cumulative effect of the Trenton Canyon, Lone Tree, and Marigold Mines over the ten years of mining operations would result in a maximum disturbance of 9,376 acres of vegetated lands (Table 4-12). The loss of sagebrush vegetation due to the Trenton Canyon Proposed Action or alternatives represents 21 % of the cumulative disturbance in the study area (i.e., 1,470 acres for the mine and 456 acres for exploration activities).

Sagebrush cover types are not considered sensitive and are common throughout the Battle Mountain region. Reclamation plans associated with the different mining operations are designed to restore the vegetation within the area to a pre-mine condition which would be capable of supporting wildlife and livestock populations (see Range Resources) and the long-term cumulative impact would be negligible. The revegetation process is carefully monitored under both state and federal regulatory programs to ensure reclamation goals are met within three to six years after mining ceases.

4.18.8 Wetlands & Riparian Habitat

The cumulative assessment area for wetlands and riparian habitat is shown as the study area boundary on Figure 3-1. Most existing and future mine operations in the study area would contribute to increased sedimentation to the creeks from disturbed areas. These impacts are expected to be limited and should not contribute to a significant cumulative impact to wetland or riparian habitat.

No direct impacts to wetlands or riparian habitat would occur as a result of the Proposed Action, No Action, or any of the project alternatives. All impacts identified for the jurisdictional wetlands would be indirect. Wildlife diversity and/or abundance for wintering and aquatic diversity and/or abundance may decrease due to a presumed decrease in wetland vegetation with decreased seasonal surface flows. However, wildlife diversity and/or abundance for migration could improve if the wetland is dried up and becomes a seasonal mud flat. The extent and magnitude of such impacts depends on the effective control of erosion and maintaining ground and surface water hydrology which is part of the Plan of Operations.

4.18.9 Wildlife, Fisheries, and Special Status Animal Species

The cumulative impact assessment area for terrestrial wildlife, fisheries, and special status wildlife species is shown as the study area boundary on Figure 3-16. It includes public and private lands within the vicinity of Battle Mountain including the Cottonwood Creek, Trout Creek and Trenton Canyon Creek basins. Active mining, exploration, or reclamation activities that would be concurrent with the Trenton Canyon Project include Buffalo Valley Mine, Buffalo Mountain and Stone House mine reclamation, Lone Tree Mine, Marigold Mine and expansion, and Trenton Canyon, and Battle Mountain Gold's Range Operations and Phoenix Project (Table 4-11). There would be no additive effect on fisheries, aquatic species, riparian habitat, or special status species as the Trenton Canyon Project would not directly or indirectly affect these resources.

Past mining activity in the cumulative study area has resulted in impacts to wildlife and wildlife habitat. There has been a loss of habitat due to vegetation removal at mine sites and creation of overburden disposal areas, heap leach facilities, tailings ponds and impoundments, and overflow solution ponds. Construction of roads and ancillary facilities for each of these mining operations also removes vegetation. The vegetation types within the project area are common throughout the region and no crucial habitat for any big game species has been lost. Increased access into mule deer habitat from road construction could result in increased disturbance and possibly mortality resulting from vehicle collisions. Increased road access could also increase legal harvest and poaching. The long-term presence of mining features would increase the potential for habitat fragmentation and displacement of mammal, bird, reptile, and amphibian species.

Cumulative impacts to wildlife are considered according to the number of acres of wildlife habitat disturbed (Table 4-14). While the immediate area of concern is the 235,730 acre cumulative impact core area, the larger resource-specific area considered is Management Area 15 as designated by NDOW. Area 15 includes most of Lander County between I-80 on the north and Highway 50 on the south, plus a portion of Eureka County and a sliver of Pershing and Humboldt counties. The area is divided into four separate mule deer herd areas, but statistics are maintained on an area basis. The proposed project area is in herd Area 151 which includes the Battle Mountain Range, the Fish Creek Mountains, and a portion of the Shoshone Mountains.

A total of 10,008 acres of wildlife habitat in the cumulative impact study area has been disturbed in the past or is currently disturbed (Table 4-11). Wildlife habitat impacts associated with the proposed activities at new mines would be approximately 3,480 acres (see Table 4-14), and reasonably foreseeable activities would add another 2,121 acres, resulting in a cumulative impact of 15,609 acres over the projected next ten years. The existing and proposed disturbance for the Trenton Canyon project or other alternatives represents 18 % of this cumulative total. The cumulative impact of all current and projected mining activity within the study area represents less than 6 % of the available wildlife habitat in the Battle Mountain Range.

NDOW has identified approximately 61,519 acres of the Battle Mountain Range as mule deer range within the cumulative impact core area (Figure 3-16). A total of 3,262 acres of mule deer range has been disturbed in the past. Mule deer habitat impacts associated with the proposed Trenton Canyon Project and alternatives would amount to 1,220-1,245 acres and reasonably foreseeable future activities would affect another 1,329 acres, resulting in a cumulative loss of 5,811 acres over the ten year analysis period. The Proposed Action and other alternatives would disturb approximately 2% of the total mule deer range. Combined disturbance from all of the mining activities would affect 10 % of the available mule deer range in the region.

Data contained in previous cumulative analyses have not differentiated between permanently lost and temporarily displaced wildlife AUMs. This is important in that at least 382 acres of exploration-related disturbance is scheduled to be reclaimed within the next five years (Table 4-12). Thus, it is reasonable to expect that disturbance associated with mining and other exploration activities, and perhaps even some portion of the base disturbance would be returned to the status of functioning wildlife habitat if reclamation is successful.

Table 4-14
Wildlife Surface Disturbance Calculations (in acres)
By Alternative

Affected Area	Past and Present	Proposed	Reasonably Foreseeable Future Actions	Total
Proposed Action[a]				
Mule Deer Range[b]	3,262	1,220	1,329	5,811
Wildlife Study Area (Cumulative Effects Area)	10,008	3,480	2,121	15,609
No Action				
Mule Deer Range[b]	3,262	0	1,329	4,591
Wildlife Study Area (Cumulative Effects Area)	10,008	0	2,121	12,129
Expansion of TC-6 to Eliminate TC-4 and TC-5				
Mule Deer Range[b]	3,262	1,245	1,329	5,836
Wildlife Study Area (Cumulative Effects Area)	10,008	3,505	2,121	15,634

Total Cumulative Effects Area = 235,730 acres
Mule Deer Range Area = 61,519 acres
[a] Impacts from the Partial Pit Backfill Alternatives are the same as the Proposed Action
[b] Mule Deer Range as shown on Figure 3-16

There would be no additional loss of riparian habitats, however, there would be a loss of upland habitats including rocky cliffs which provide habitat for raptors. Raptors are known throughout the cumulative effects area. Nest sites exist on the east slope of Battle Mountain; along the Humboldt River and in Pumpernickel Valley, north of the proposed project; and, within the Phoenix Expansion Area, south of Trenton Canyon. Mining operations within the area could result in the loss of potential nest sites. However, the majority of these nest sites are located adjacent to drainages which would be avoided by mining. Active nest sites have been documented in baseline studies for the Phoenix Expansion Project (WESTEC 1995).

Sage grouse inhabit sagebrush and riparian corridors. Sage grouse leks potentially exist within the entire Great Basin in areas that combine open land, sagebrush cover, and riparian habitat. The Trenton Canyon Project would have a direct effect on sage grouse habitat, impacting 1789.6 acres of sagebrush vegetation. Indirect effects could result from activities at Marigold Mine and exploration activities associated with Trenton Canyon if they occur near typical sage grouse habitat. These effects are in addition to the impacts from pre-existing mining and land use practices in the Battle Mountains. The loss of historical lek sites and the long-term reduction in grouse populations in the area indicate that cumulative impacts to grouse are occurring from a variety of causes.

The initial winter survey did not reveal any abandoned mine workings suitable for bat hibernacula, although bats are prevalent in other areas around the Battle Mountain range. However, during the warm-season survey, an abandoned mine was discovered near the project site that could be a potential bat hibernaculum. Myotis species and the pallid bats have been recorded near the Trenton Canyon Project, and probably roost in rock crevices year-round on the project site. Bats may not occur in all the rock crevices surrounding the project; however, there would be an additive effect, the magnitude of which would depend upon the amount of disturbance to suitable habitat and the timing of the project disturbance.

4.18.10 Range

Cumulative impacts to range resources within the North Buffalo and Copper Canyon allotments include mining activities and operations at the Trenton Canyon mine, Lone Tree Mine, and Marigold Mine. There would be no additive effect on water sources for livestock resulting from the Trenton Canyon Project on springs, seeps, or surface waters.

Through surface disturbances, the past and present affect on range is the temporary suspension of 431.8 AUMs on the North Buffalo allotment (Table 4-15). The Trenton Canyon Proposed Action or other alternatives and expansion proposed at Marigold Mine could potentially affect an additional 131.4 AUMs based again upon total area available within the allotment and an average carrying capacity of 14.3 AUMs/acre. With the foreseeable future actions, an additional 93 AUMs could be potentially affected for a cumulative total of 655.8 AUMs lost. Reclamation efforts over the ten year period would revegetate lands to serve 26.7 AUMs, therefore, the cumulative total of range AUMs lost would be 629 or 31% more than existing and past impacts.

4.18.11 Visual

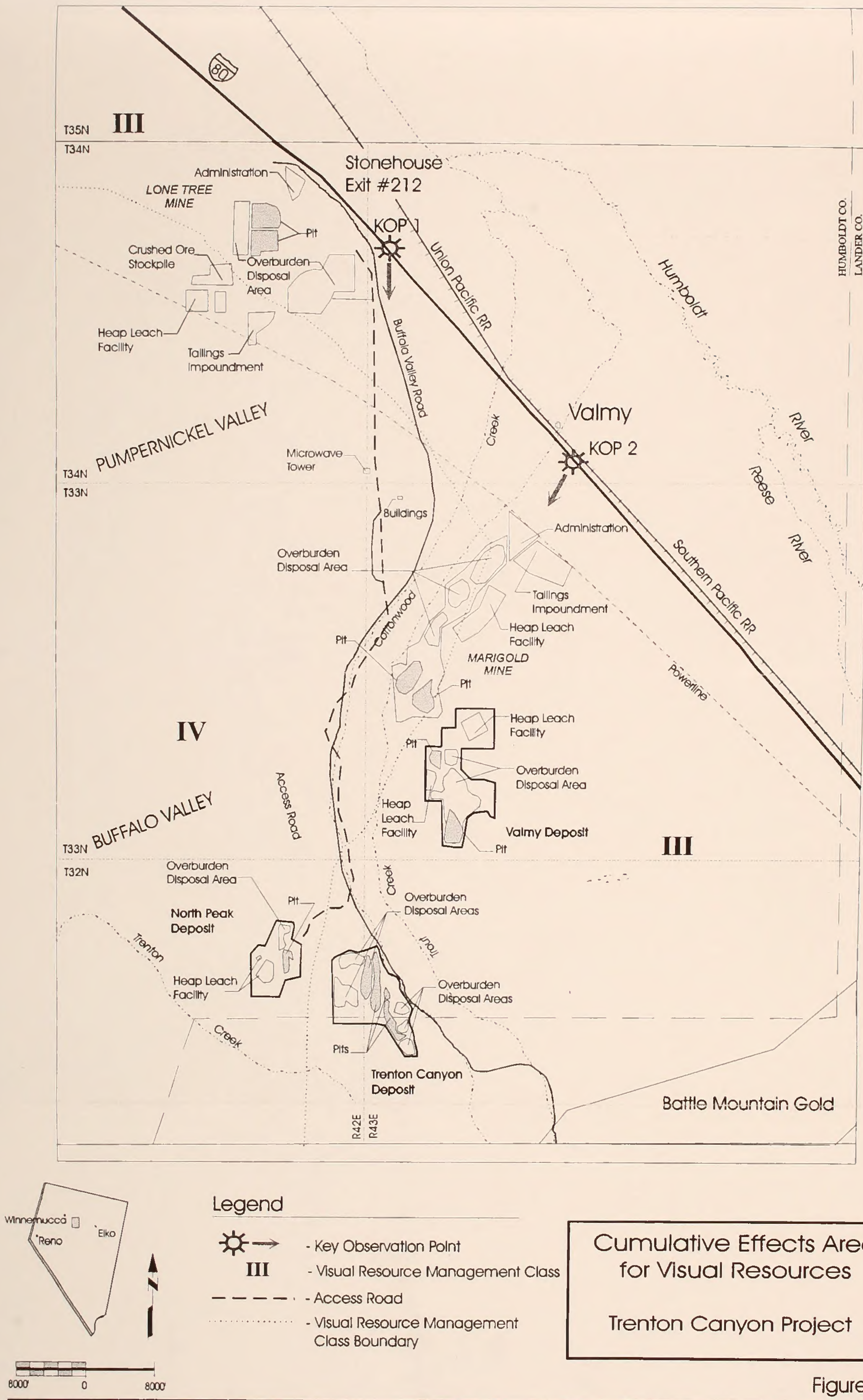
The cumulative effects study area for visual resources, shown on Figure 4-8, includes the Buffalo Valley, the Cottonwood Creek basin, and the northwestern flank of the Battle Mountain range. This area includes the entire viewshed of the Proposed Action as seen from key observation points (KOPs) identified in Section 3.14. Mining exploration and grazing within the cumulative effects area would not result in a significant or long-term visual impact. Foreseeable mining activities in the cumulative effects area are not expected to compromise the Visual Resource Management Objectives for Class III or Class IV lands, and cumulative visual impacts are expected to be minimal.

Table 4-15
Cumulative Effects for Range

	Existing		Proposed		Foreseeable		Cumulative		
	Public	Private	Public	Private	Public	Private	Public	Private	Total
Animal Unit Months (AUMs)[a]									
Lone Tree Mine	58.7	194.2	0.0	0.0	0.0	0.0	58.7	194.2	252.9
Marigold Mine	49.5	44.8	29.2	35.0	51.5	41.5	130.2	121.3	251.5
Trenton Canyon Project	2.0	32.0	36.3	49.0	0.0	0.0	38.3	81:0	119.3
Trenton Canyon Exploration	21.5	28.6	-8.0	-10.0	0.0	0.0	13.5	18.6	32.1
Subtotal Disturbed	131.7	299.6	57.6	73.8	51.5	41.5	240.7	415.1	655.8
AUMs Potentially Reclaimed									
Buffalo Mountain	0.0	0.0	1.3	0.0	0.0	0.0	1.3	0.0	1.3
Stone House	0.0	0.0	8.8	0.0	0.0	0.0	8.8	0.0	8.8
Trenton Canyon Exploration[b]	0.0	0.0	0.0	0.0	7.1	9.5	7.1	9.5	16.6
Subtotal Reclaimed	0.0	0.0	10.1	0.0	7.1	9.5	17.2	9.5	26.7
TOTAL (Disturbed - Reclaimed AUMs)	131.7	299.6	47.5	73.8	44.3	32.0	223.5	405.6	629.1

[a] AUM's are based on a calculation of 14.3 AUMs/acre.

[b] This analysis assumes that approximately 1/3 of the area disturbed for exploration would be reclaimed within the ten year period.



Cumulative Effects Area
for Visual Resources

Trenton Canyon Project

Figure 4-8

January 1998

Expansion of the Lone Tree Mine and Marigold Mine are the only mine projects of all those examined for cumulative effects that would have an additive visual effect from the observation points along the I-80 corridor. These expansions are proposed to occur within the reasonably foreseeable future time frame of the Trenton Canyon Project. The cumulative surface disturbance could vary from a minimum of 5,447 acres to as high as 7,916 acres depending on the approval schedules, the timing, and the location of mine facilities becoming fully operational. However, cumulative surface disturbance does not represent the actual visual effect. For example, facility layouts for the Lone Tree Mine Expansion are configured so that only a small portion can be viewed from I-80. The visual effects of the Marigold Mine Expansion would be more prominent as it is not obscured by topography. In fact, it is in the foreground and instead obscures the Valmy mine area. Figure 4-8, 4-9 and 4-11 illustrate the potential cumulative effect of the three mines operating concurrently prior to any reclamation.

After reclamation, impacts on visual resources would be the residual effects of those open pit highwalls that are facing the I-80 corridor; all other visual effects would be minimized through implementation of proposed reclamation measures. Figures 4-9 through 4-12 simulate the height and dimensions of the operations (as shown on Figure 4-8) during mining and after reclamation as viewed from KOPs 1 and 2.

4.18.12 Cultural Resources

The cultural resource cumulative effects assessment area (Figure 4-7) consists of the Battle Mountain Range, extending to I-80. There are currently 14 active or closed mines with permitted surface disturbance of more than 8,000 acres and proposed additional disturbance of 1,210 acres prior to 2005 with possible future disturbance of another 2,100 acres.

Cultural resource inventories have been conducted over most of these properties and cultural sites have been documented and evaluated according to National Register of Historic Places criteria. Within the Battle Mountain Range, including surveys conducted for the Trenton Canyon, Lone Tree Mine, Marigold Mine and the Phoenix Project, more than 30,000 acres have been surveyed intensively. Approximately 452 sites have been recorded within Class III survey reports and of those approximately 60 sites have been deemed eligible for National Historic Register status.

In general, completed surveys within the area give cultural resource professionals a sense for the site density and sensitivity expected in those areas not surveyed. Every year more surveys are conducted within the region on federal lands or in response to federally funded or licensed projects. These are resulting in the annual recording of previously unrecorded sites. Some of these sites are not being damaged or destroyed, but the annual resource base is undoubtedly being reduced.

Impacts to significant cultural resources would be mitigated with each project constructed or operated. Significant resources that would be affected by construction activities would be avoided, or if this is not possible, recovered for their scientific value. The cumulative effects of all of the mines within the area is not measurably different than the additive impacts of each single project, but again, the impacts of direct disturbance to sites would be mitigated.

Indirect impacts to cultural resources can result from:

- degrading the setting of a significant cultural feature, or
- incidental destruction of cultural sites by unwitting off-highway vehicle (OHV) recreationists.

In the case of the latter, if mine access makes formerly remote areas of the landscape more accessible now or in the future, OHV users may use these roads to gain easier access to these areas. Cumulative damage to cultural sites or properties having traditional values could result over time from repeated incremental damage caused by OHV users. Illegal "pot hunting" could also increase over time due to increased accessibility into remote areas depending upon public access control by the BLM following mine closure.

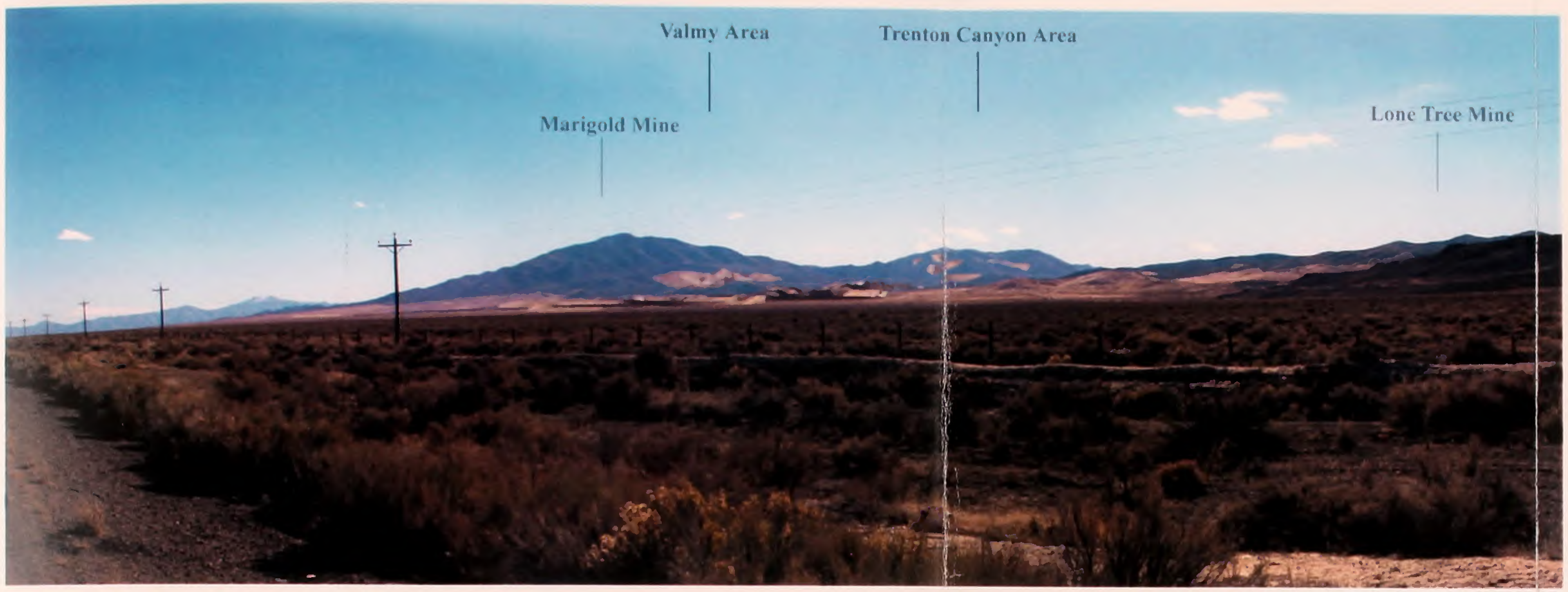
4.19 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The short-term use of resources during the construction, operation, closure, and reclamation of the project would result in beneficial impacts in the form of generation of revenue. It would also result in various short-term adverse impacts, such as temporary loss of soil and vegetative productivity, possible wildlife dislocation or mortality, reduced livestock grazing area, increased fugitive dust generation, and temporarily increased noise levels. These impacts are expected to vary in intensity during the life of the mine and to end upon closure of operations. Soil and vegetation productivity and wildlife habitat impacts would be mitigated through reclamation of the disturbed areas.

Impacts to the long-term productivity of the site (i.e., following project closure and reclamation) would depend primarily on the effectiveness of planned reclamation of the disturbed areas. The reclamation goal is to return the disturbed areas to livestock and wildlife grazing by establishing self-sustaining vegetation communities. The revegetation is also expected to stabilize the disturbed surfaces and control erosion of soil from these areas.

Under typical moisture conditions at the site, it is expected that initial reclamation efforts would result in sparse stands of perennial grasses, primarily wheat grasses, and scattered shrubs, such as four-wing saltbush. With proper management, this initial reclamation community should evolve toward greater abundance of grasses and shrubs. If initial reclamation of the areas occurs in years with above-average precipitation, grasses and shrubs may become established more quickly, thus hastening the evolution toward a self-sustaining mixture of predominantly perennial species. There would be long-term losses in vegetation and wildlife habitat associated with up to 348 acres of open pits, which would not be reclaimed.

While every year more cultural surveys are conducted within the region, which results in the recording of previously unrecorded sites, the impact to the resource base is long-term.

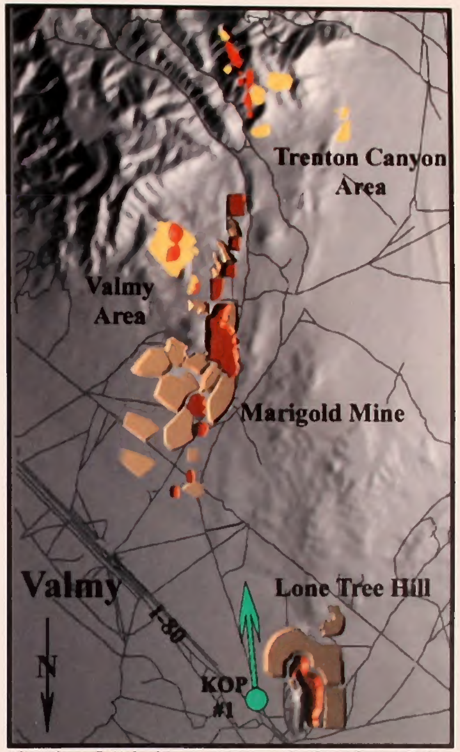


Simulation of Post-Mining Conditions

Existing Conditions

Summer 1997

Matching perspective of the terrain model.



View from I-80 looking south from the Stonehouse Exit.

- Overburden Disposal Areas
- Pits
- Lone Tree Hill/ Marigold Pits
- Lone Tree Hill/ Marigold Overburden Disposal Areas

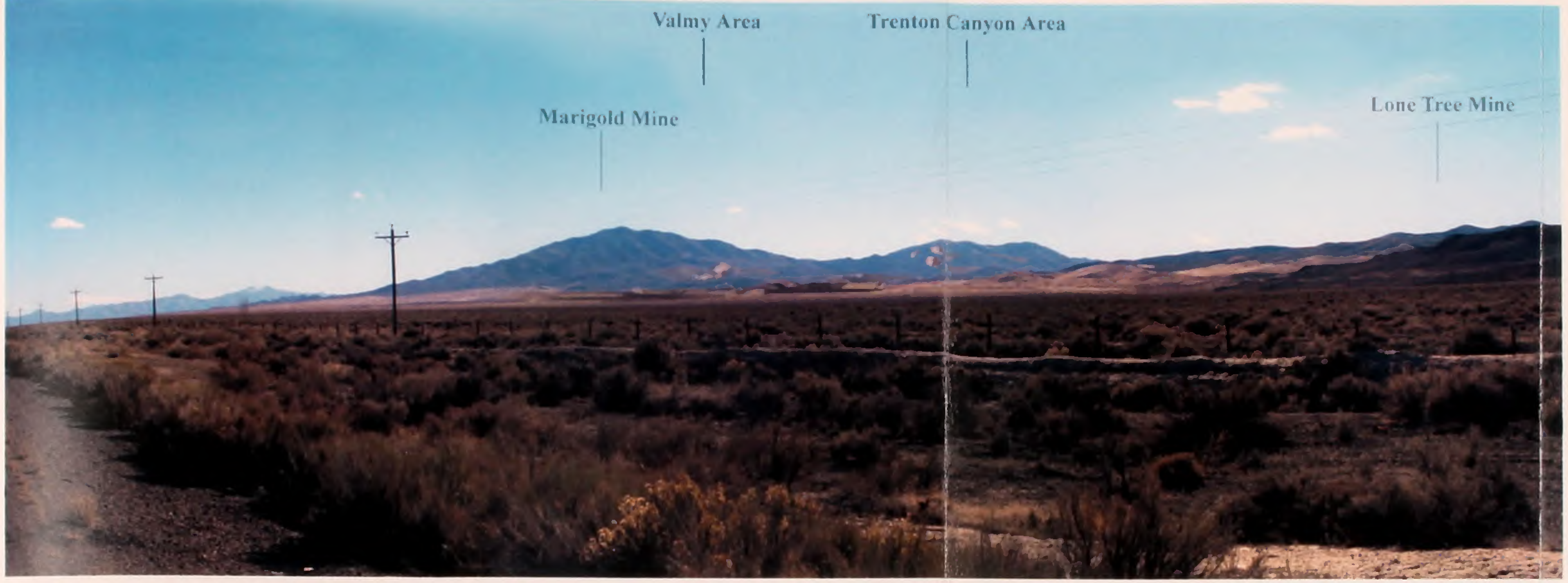
Distance to Valmy Area from viewpoint: 9.5 miles.
Distance to Trenton Canyon Area from viewpoint: 12 miles.
Distance to Marigold Mine Area from viewpoint: 6 miles.
Distance to Lone Tree Mine Area from viewpoint: 1 mile.

Simulation of Post-Mining Conditions

TRENTON CANYON PROJECT

HUMBOLDT COUNTY, NEVADA

Figure 4-9

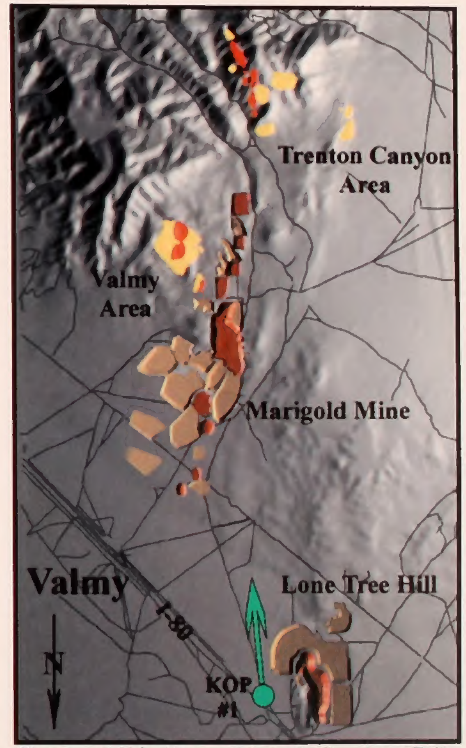


Simulation of Post-Reclamation Conditions

Existing Conditions

Summer 1997

Matching perspective of the terrain model.



View from I-80 looking south from the Stonehouse Exit.

- Overburden Disposal Areas
- Pits
- Lone Tree Hill/ Marigold Pits
- Lone Tree Hill/ Marigold Overburden Disposal Areas

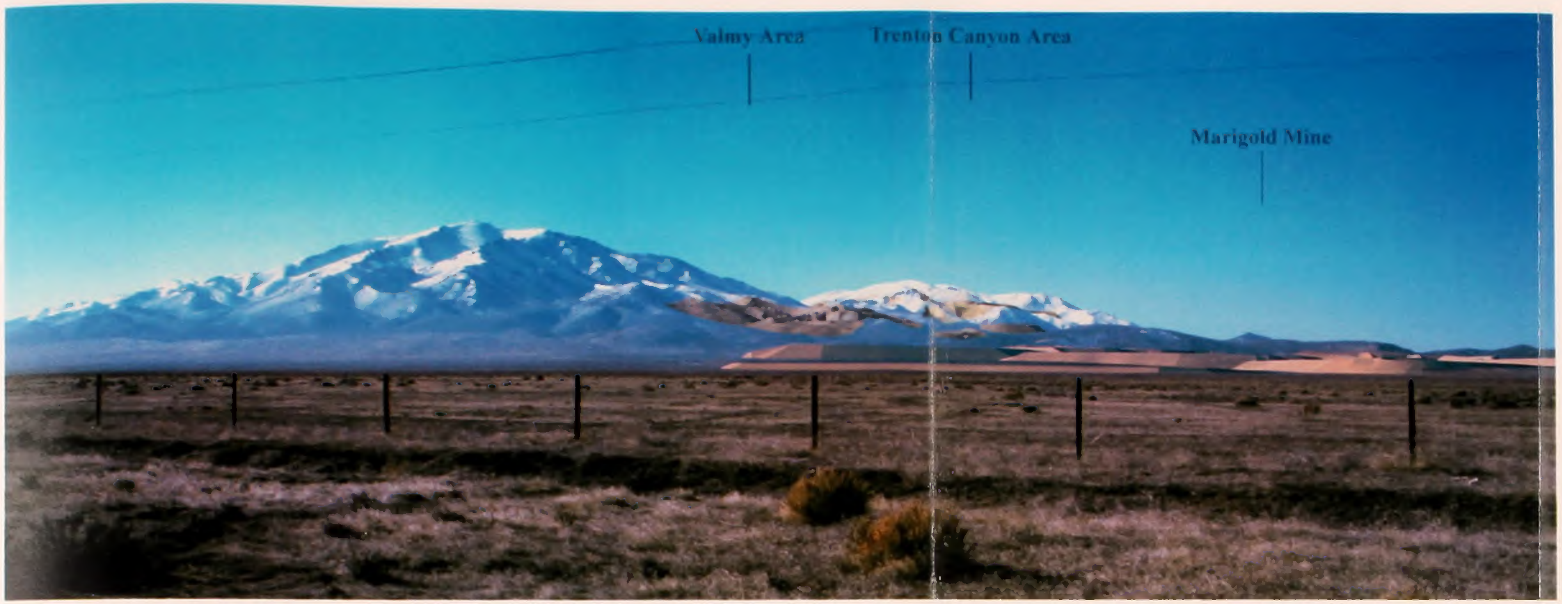
Distance to Valmy Area from viewpoint: 9.5 miles.
Distance to Trenton Canyon Area from viewpoint: 12 miles.
Distance to Marigold Mine Area from viewpoint: 6 miles.
Distance to Lone Tree Mine Area from viewpoint: 1 mile.

Simulation of Post-Reclamation Conditions

TRENTON CANYON PROJECT

HUMBOLDT COUNTY, NEVADA

Figure 4-10

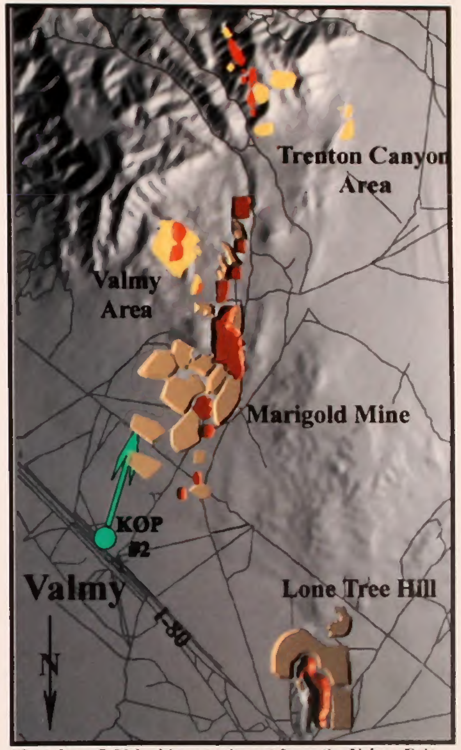


Simulation of Post-Mining Conditions

Existing Conditions

Winter 1997

Matching perspective of the terrain model.



View from I-80 looking southwest from the Valmy Exit.

- Overburden Disposal Areas
- Pits
- Lone Tree Hill/ Marigold Pits
- Lone Tree Hill/ Marigold Overburden Disposal Areas

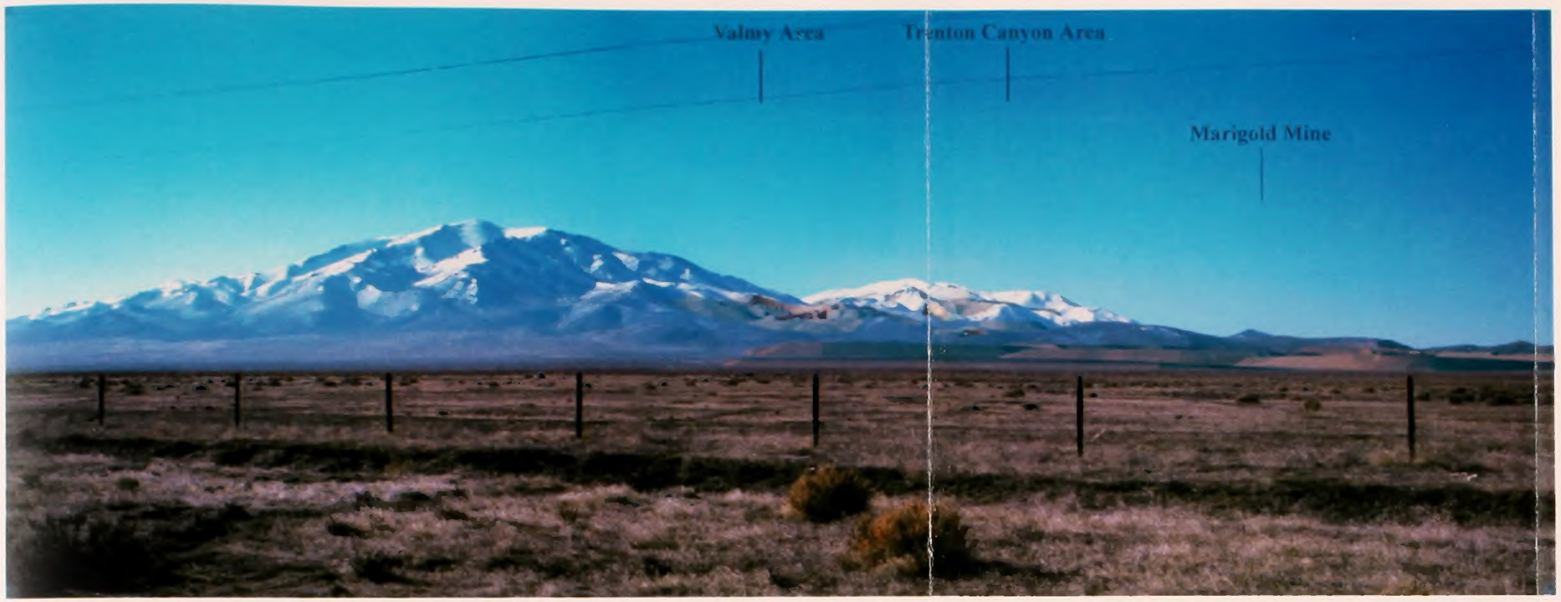
Distance to Valmy Area from viewpoint: 6.5 miles.
Distance to Trenton Canyon Area from viewpoint: 10 miles.
Distance to Marigold Mine Area from viewpoint: 2 miles.
Distance to Lone Tree Mine Area from viewpoint: 4 miles (Not Visible).

Simulation of Post-Mining Conditions

TRENTON CANYON PROJECT

HUMBOLDT COUNTY, NEVADA

Figure 4-11

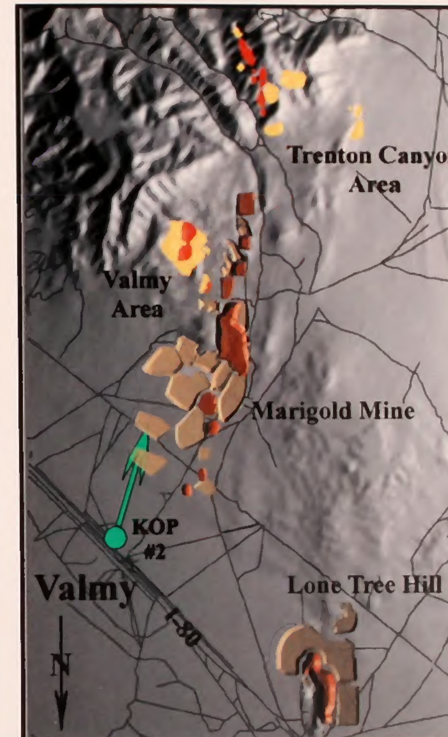


Simulation of Post-Reclamation Conditions

Existing Conditions

Winter 1997

Matching perspective of the terrain model.



View from I-80 looking southwest from the Valmy Exit.

- Overburden Disposal Areas
- Pits
- Lone Tree Hill/ Marigold Pits
- Lone Tree Hill/ Marigold Overburden Disposal Areas

Distance to Valmy Area from viewpoint: 6.5 miles.
Distance to Trenton Canyon Area from viewpoint: 10 miles.
Distance to Marigold Mine Area from viewpoint: 2 miles.
Distance to Lone Tree Mine Area from viewpoint: 4 miles (Not Visible).

Simulation of Post-Reclamation Conditions

TRENTON CANYON PROJECT

HUMBOLDT COUNTY, NEVADA

Figure 4-12

Chapter 5

Consultation and Coordination

CHAPTER 5 - CONSULTATION AND COORDINATION

5.1 SCOPING

Memorandum of Agreement and Initiation of Scoping

A Memorandum of Agreement (MOA) was entered into between Newmont (formerly SFPG) and both the Winnemucca and Battle Mountain Districts of the BLM for the preparation of this EIS according to the 40 CFR 1500-1508 and the BLM NEPA Handbook. Requests for Proposals (RFP) and Data Adequacy Standards were developed by the BLM and sent to numerous environmental consulting firms for competitive bid. Subsequent to the selection of a third-party consultant to prepare the EIS, public scoping was begun. Through the scoping process it was determined that identification of the possible effects on wildlife and protection of wildlife resources was an important issue to be analyzed in the Trenton Canyon Project EIS. The BLM invited the State of Nevada Division of Wildlife (NDOW) to participate as a cooperating agency in the EIS process whereupon a separate MOA was signed between the BLM and NDOW in January 1997.

Public Scoping Meeting

Topic: Trenton Canyon EIS
Date: September 24, 1996
Place: Winnemucca BLM Conference Room
Time: 7:00 pm

Attendees

Joyce Muir, Florida Canyon Mining, Inc.
Eadyann Filippini, Badger Ranch
Dan Filippini, Badger Ranch, P.O. Box 1083, Battle Mtn.
Ken Pavlich, Santa Fe Pacific Gold, Lone Tree/Trenton Canyon
Robert Thomason, Florida Canyon Mine
Randy Ford, Santa Fe Pacific Gold, Trenton Canyon
Keith Dagel, Santa Fe Pacific Gold
Nancy Olmsted, Dames & Moore
Mike Bone, Dames & Moore
Charlene Hager, Santa Fe Pacific Gold
John Mansanti, Santa Fe Pacific Gold
Chet Littledyke, Santa Fe Pacific Gold
Cindy DeWeese, Santa Fe Pacific Gold, Lone Tree Mine

Summary of the Meeting

The Notice of Intent (NOI) to prepare an Environmental Impact Statement for a mining Plan of Operations (POO) for the Trenton Canyon mine project, Humboldt and Lander Counties, Nevada was published in the federal register on September 12, 1996.

BLM published a news release in the Battle Mountain Bugle and the Humboldt Sun announcing the time and place for a public scoping meeting on September 24, 1996.

The public meeting was also noticed in the federal register on September 12, 1996 effectively starting the public scoping period. Written public comments were requested and accepted until October 15, 1996. Scoping letters were received from most of the state agencies and from several interested parties.

Summary of the Scoping Issues

Nine comment letters were received from agencies (8) and the public (1) during the scoping period, September 13th through October 15, 1996. The letters are provided for reference as the final section in this report.

Key comments and environmental issues that were identified included:

<u>U.S. Fish and Wildlife Service</u>

The agency expressed concern with potential impacts to wetlands and streams, potential discharge of fill into wetlands or waters of the U.S., and potential destruction of bird nests. The agency recommended that vegetation clearing not be done during the avian breeding season or that surveys be conducted prior to clearing to ensure that nests are not harmed or that exploration activities do not result in nest failures.

There are ten species of concern known from Humboldt and Lander Counties, including three species of bat, several small mammals and two bird species. The agency is concerned that these species and habitats be protected.

<u>Nevada Abandoned Mine Lands Program</u>

The EIS should contain information regarding how the open pit will be secured following completion of mining. The method(s) should conform to the requirements of NAC Chapter 513.

<u>Nevada Division of Wildlife</u>

Sage grouse are known to be present in the project area and there may be strutting grounds in the cumulative effects area near existing or proposed haul roads and the Marigold Mine. The EIS should address mule deer summer habitat, upland game habitat, and wildlife water sources and fisheries resources.

The Division is concerned with the cumulative effects on mule deer habitat from all of the mining projects in the Battle Mountain. The EIS should include analysis of the total disturbance to mule deer habitat in the Battle Mtn. range that has occurred as a result of mining activity.

Access to the project is through Trenton Canyon. There is a small seep at the mouth of Trenton Canyon that is essential to the local upland game and nongame wildlife. The Division would like to have the proponent commit that this water source would not be compromised by the proposed mining activity.

The Cottonwood Creek drainage supports valley quail populations. Important riparian habitat should be preserved for this species.

The Division also expressed concern about controls on sediment to Cottonwood Creek to protect the trout population in Cottonwood Creek.

The Division is concerned with disturbance to raptor habitats, which are common in the higher elevations throughout the Battle Mountain areas. Bat species are also common throughout the Battle Mountain and Winnemucca areas, and protection of these species is important.

Badger Ranch

Badger Ranch holds a grazing permit in the North Buffalo allotment near the Trenton Canyon project. Their concerns are that 1) access to and from waters and grazing not be blocked or hindered, and 2) that livestock numbers not be reduced because of the land being fenced out or disturbed. They do not want to see a reduction in their grazing permit or suffer any fiscal losses as a result of the project.

Other concerns included safety hazards for cattle and livestock from traffic on the roads and the desire for secure fences with cattle guards at the entrances.

5.2 LIST OF AGENCY CONTACTS

During the preparation of the EIS, the BLM communicated with and received input from various federal, state, and local agencies and private organizations. The following sections list these contacts.

5.2.1 Federal Agencies

Bureau of Land Management, Battle Mountain
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers

5.2.2 State Agencies

Nevada Department of Administration
Nevada Department of Business and Industry, Division of Minerals
Nevada Department of Conservation and Natural Resources
Nevada Department of Taxation
Nevada Department of Transportation
Nevada State Historical Preservation Office
Nevada Division of Environmental Protection
Nevada Division of Wildlife
Nevada Natural Heritage Program

5.2.3 Local Agencies

Humboldt County Assessor
Humboldt County Chamber of Commerce
Humboldt County Commissioners
Humboldt County Department of Transportation
Humboldt County Recorder-Auditor
Humboldt County Rural Fire Department
Humboldt County School District
Humboldt County Sheriff's Department
Lander County School District
Lander County Sheriff's Department
Lander County Water and Wastewater
Tri-County Development Authority
Winnemucca Police Department
Winnemucca Recreation Department
Winnemucca Volunteer Fire Department

5.2.4 Private Organizations and Companies

Battle Mountain General Hospital
Battle Mountain Realty
Century 21
Great Basin Mine Watch
Humboldt General Hospital
Humboldt Realty
Nevada First Corporation
Western Shoshone Tribe
Sierra Club
Sonoma Realty
Shepherd Miller, Inc.

5.3 LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS WHO WERE SENT COPIES OF THIS DEIS

The list of agencies, organizations, and individuals who were sent copies of this DEIS is found in Table 5-1 following this page.

Table 5-1
List of Agencies, Organizations, and Individuals Who Received Copies of this DEIS

Name/Contact	Organization
Adella Harding	Elko Daily Free Press
Alan D. Cox	Homestake Mining Company
Alan Septoff	Mineral Policy Center
Alice Baldrica	Historic Preservation Office
Allen Moss	
Bennie Hodges	Pershing County Water District
Branch of Mineral Assessment	Bureau of Mines
Brenda Williams	Bureau of Land Managment
Brian Amme	BLM Nevada State Office
Bureau of Land Management	Elko District
Bureau of Land Management	NSO Printing Specialist (NV-951)
Business and Government Information Center	University of Nevada Libraries
C. Barcomb	Commission for the Preservation of Wild Horses
Carl Slagowski	Slagowski Ranch
Carlos Mendoza, EIS Reviewer	U.S. Fish and Wildlife Service
Carol Boughton	USDI/US Geological Survey
Carrie Dann	Western Shoshone Defense Project
Charles Thomas	
Chief, Division of Environmental Coordination	Fish and Wildlife Service
Chief, Planning Division	South Pacific Division, Army Corps of Engineers
Chief, USDI/Office of Surface Mining	Division of Environmental and Economic Analysis
Chris Jensen and Martin Hanson	Jamar Farms
Christine Smith	
Cindy Emmons	
City of Winnemucca	City Council Members
Claudette Ramos for Jim Gelford	Battle Mountain Band of the Te-Moak Tribe of Western Shoshone
Commander	National Training Center
Connie Hicks	
Conrad and Doris Kersch	
Craig Plummer	NRCS Rangeland Mgmt./Resource Specialist
Cynthia May	Independence Mining Company, Englewood, CO
D.K. Young	
Dale Morlock	USDI/National Park Service (2310)
Dan and Eddyann Filippini	Badger Ranch, Battle Mountain, NV
Danny L. Taylor, Assistant Dean	Mackay School of Mines
David Grimes	USDI/USGS
David L. Deisley	Parsons, Behle, Latimer
Deannan Wieman, Director	Office of External Affairs, US EPA Region IX
Debra W. Struhsacker	

Table 5-1
List of Agencies, Organizations, and Individuals Who Received Copies of this DEIS

Name/Contact	Organization
Deloyd Satterthwaite	Ellison Ranching Company, Spanish Ranch
Department of Museums, Library and Arts	State Historic Preservation Office
Department of Transportation	Environmental Division
Division of Environmental Compliance	National Park Service
Division of State Lands	Capitol Complex
Don Bleiwas	USDI/USGS
Donna Bradley, Resource Officer	USDI/Bureau of Indian Affairs
Dr. Daniel Suman	University of Miami
Dr. Glenn Miller	Sierra Club
Edward S. Syrjala	
Elko County Commissioners	
Elko County Library	Reference Department
Environmental Affairs Program	U.S. Geological Survey
Environmental Review Coordinator	EPA Region IX
Eric Daniels	Echo Bay Minerals Company, McCoy Mine
Eric Dille	SAIC
Eureka Branch Library	
Eureka County Commissioners	
Eureka Opera House	
Gary G. McGill	
George Brown	
George Conger	Newmont Gold Company
Getchell Gold - Getchell Mine	
Governor Bob Miller	State Capitol Bldg., Governor's Office
Harriet Hill	United States Environmental Protection Agency, Region IX
Harry Corley	MMS-RMP
Honorable Dean Rhoads, State Senator	Legislative Building
Honorable Harry Reid	Federal Building
Honorable James Gibbons	Congressman
Honorable John Marvel, State Assemblyman	
Honorable Paul Vesco, Mayor	City of Winnemucca
Honorable Richard Bryan	Attn: Brent Heberlee
HQ-USAF/LEEV	Environmental Division
Humboldt County	Commissioners
Humboldt County Library	
Hycroft Mine	
Interior Department	
Jaak Daemen	Prof. and Chair, Dept. of Mining
Jack C. Orr, Chairman	Western Shoshone Resources Inc.

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List of Agencies, Organizations, and Individuals Who Received Copies of this DEIS

Name/Contact	Organization
JackMattox	Southwest Center for Biological Diversity
Jeanne Geselbracht	Office of Federal Activities
Jeff Parshley	Steffen Robertson and Kirsten
Jerald N. Hepworth, Director	Environmental, Health and Safety Services, Rayrock Mines, Inc.
Jim French	Nevada Division of Wildlife
Jim Nyenhuis	
Jim Trent	State of Nevada, Bureau of Mining Regulation and Reclamation
Joe Jarvis	
Joe McFarland	USDI/Bureau of Land Management, CA Desert District
Joe Tingley	Nevada Bureau of Mines and Geology
Johanna H. Wald	Natural Resources Defense Council
John Etchegaray	
John Gebhardt, Mining Biologist	Nevada Division of Wildlife
John H. Uhalde	
John Hillenbrand	United States Environmental Protection Agency
John Milton III	Board of Humbolt Cnty. Commissioners
John Williams	Nevada Building & Construction Trades Council
Julie Butler, Coordinator	Nevada State Clearinghouse/SPOC
Kara Wittstock	Documents Department
Kenneth Paulsen	
Kent McAdoo	Wildlife Society, Nevada Chapter
Kevin L. Jackson	Oxbow Power of Beowawe, Inc.
Lander County Commissioners	
Lander County Library	
Leonard Fiorenzi	Eureka County Public Works
LeRoy Etchegaray	
Library of Congress Madison Building	Exchange and Gift Division
Linda Koep	Hecla Mining
Lloyd Levy	Planning Information Corp.
Maggie Parhamovich	University of Nevada Las Vegas
Management Information Unit	Office of Federal Activities, Environmental Protection Agency
Marjorie Sill	Federal Lands Coordinator
Mark Abrams	
Mark Bennett	
Mark Demuth	
Mary Jo Elpers, Federal Activities Supervisor	U.S. Fish and Wildlife Service, Nevada State Office
Maxim Technologies, Inc.	
Meg Macdonald	WESTEC
Michael Reed	Bald Mountain Mine

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Name/Contact	Organization
Mike Baughman	Humboldt River Water Basin Authority
Mike Glock	Nevada Department of Transportation
Mike Smith	Sage Engineering
Mitchell Beauchamp	Pacific Southwest Bioservices
Nancy Kang, Biologist	U.S. Army Corps of Engineers, Sacramento Dist.
National Park Service	Environmental Quality Division 774
NDOT-Anne Irving, Staff Specialist	Right-of-Way Division
Neil Stevens	Eureka County School District Superintendent
Nevada Div. of Environmental Protection	Bureau of Mining Regulation and Reclamation
Nevada Woolgrower's Association	
Nye County Planning Department	
Office of Environmental Compliance	Department of Energy
Office of Environmental Policy	Federal Highway Administration
Office of the Deputy A/S of the USAF	Environment, Safety, Occupational Health
Offshore Environmental Assessment Division	Minerals Management Service
P.M. DeDycker & Assoc.	
Pat Rogers	Newmont Gold Company, Lone Tree Mine
Paul Davidson	Commissioner, Board of Pershing CC
Paul Dobak	
Paul Krzych	Dynamic Corp. Environmental Services
Paul Miller, Chairman	Humbolt River Basin Water Authority
Paul Robinson	SWRIC
Paul Scheidig	Nevada Mining Association
Paul Summers	BLM, National Applied Resource Science Ctr.
Pearl E. Young	EPA-Office of Fed Activities
Pershing County Commissioners	
Pershing County Library	
Peter Babin	Royal Gold, Inc.
Phillis Davis	USDI, Office of Environmental Policy and Compliance
Pierre Mousset-Jones	UNR Department of Mining Engineering
R. Blain Andrus	
Rachel Thomas	
Ray Salisbury	
Richard De Long	Environmental Managment Associates
Richard Heap	Nevada Division of Wildlife
Richard Waldemar	
Rick Fiddler	Western States Mineral Corporation
Robert G. Lopes	United Association of Plumbers and Pipefitters - Local #350
Robert McQuivey	Habitat Division, NDOW

Table 5-1
List of Agencies, Organizations, and Individuals Who Received Copies of this DEIS

Name/Contact	Organization
Rod Herrick	Bureau of Land Management, Winnemucca District
Roger Steininger	
Rory Lamp	Nevada Division of Wildlife
Roy Boyd	The Industrial Company
Russell A. Fields	Nevada Division of Minerals
Rusty Kiel	Manager, Lovelock Water District
Senator Dean A. Rhoads	
Sharon Sweeney	
Stanley Dempsey	Environmental Strategies, Inc.
State Engineer	Division of Water Resources
State of Nevada	Dept. of Conservation & Natural Resources
State Planning Coordinator	State of Nevada, Dept. of Administration
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Steve Siegel	
Steve West	Winnemucca City Mgr.
Stuart Fuller	Phelps Dodge Corporation
Sylvia Baca, Acting Director	USDI/Bureau of Land Management
Tammy Manzini	Lander County Commissioner
Tilman Jones	
Tim Dyhr	Group Environmental Manager, BHP Copper
Tom Myers	
U.S. Army Corps of Engineers	Regulatory Section
University of Nevada	Gund Ranch
USDA, Forest Service	Santa Rosa Ranger District, Humboldt-Toyabe National Forest
USDI/Bureau of Land Management	Carson City Field Office
USDI/Bureau of Land Management	Cedarville Field Office
USDI/Bureau of Land Management	Elko Field Office
USDI/Bureau of Land Management	Ely Field Office
USDI/Bureau of Land Management	Las Vegas Field Office
USDI/Bureau of Land Management	Tonopah Field Station
USDI/Bureau of Reclamation	Denver Federal Center (D-150)
USDI/Fish and Wildlife Service, Enhancement	Eastside Federal Complex
USDI/Minerals Management Service	Offshore Environmental Assessment Division
USDI/Natural Resources Library	
USDI/Office of Public Affairs	
Walter Johnson	
Western Field Operation Center	Bureau of Mines
Will Mattly	Lander Cty. DA
William D. Schrand	NGMI - Sleeper Mine

Table 5-1
List of Agencies, Organizations, and Individuals Who Received Copies of this DEIS

Name/Contact	Organization
Zane Stanley Miles	Deputy District Attorney Eureka County
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Table [illegible]

[illegible] Organizations [illegible] Individuals Who Received [illegible]

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[illegible] Sweeney		
[illegible]	Environmental Strategies, Inc.	
State Engineer	Division of Water Resources	
State of Nevada	Dept. of Conservation & Natural Resources	
State Planning Coordinator	State of Nevada, Dept. of Administration	
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Tim [illegible]	Group Environmental Manager, [illegible] Copper	
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University of Nevada	[illegible]	
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USDI Bureau of Land Management	Carson City Field Office	
USDI Bureau of Land Management	[illegible] Field Office	
USDI Bureau of Land Management	[illegible] Field Office	
USDI Bureau of Land Management	[illegible] Field Office	
USDI Bureau of Land Management	Las Vegas Field Office	
USDI Bureau of Land Management	[illegible] Field Station	
USDI Bureau of Reclamation	[illegible] (D-150)	
USDI Fish and Wildlife Service, [illegible]	[illegible]	
USDI Minerals Management Service	[illegible] Environmental Assessment Division	
USDI Natural Resources Library		
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Chapter 6

Preparers and Contributors

CHAPTER 6 - PREPARERS AND CONTRIBUTORS

6.1 BASELINE DATA AND SUPPORTING DOCUMENTS

The documentation for baseline data and support material for the Environmental Impact Statement were prepared over a period of four years by a team of professional resource specialists and environmental consulting firms. The scope of the studies was to survey and record the existing conditions and to observe the dynamics of the project areas and regional study area. The preparers of these baseline studies are listed below with a brief outline of their respective contributions. For a citation of the reference documents prepared from their studies, please refer to Chapter 7 - References. Copies of these studies are available for review at the U.S. Bureau of Land Management, Winnemucca District, Winnemucca, Nevada and the Lone Tree Mine, Newmont offices, Valmy, Nevada.

Table 6-1
Preparers of Baseline Supporting Documents

Firm or Organization	Contribution
Bureau of Land Management Winnemucca District Office Winnemucca, Nevada	Draft and Final Sonoma-Gerlach Grazing EIS; Draft and Final Resource Management Plan and EIS for the Shoshone-Eureka Resource Area; Marigold Mining Company Stonehouse Project Phase I EA; Newmont, Trenton Canyon Mine Project Rights-of-Way EA
Resource Concepts, Inc.	Surface Water Resource Inventory; Proposed Wetland Delineation and Other Waters of the US Inventory; Soil Survey Baseline Study; Vegetation Baseline Study; Draft Waters of the United States Wetlands Baseline Survey; Small mammal sampling; Wildlife Baseline Studies; Range Resources Baseline Study
Shepherd Miller, Inc.	Draft Baseline Hydrology and Geochemistry
J. Firby	Paleontological Inventory of the Winnemucca District
J.H. Stewart, and E.H. McKee	Geology and Mineral Deposits of Lander County, Nevada
Ronald Willden	Geology and Mineral Deposits of Humboldt County, Nevada
Newmont (with assistance of Shepherd Miller, Inc.)	Plan of Operations and Reclamation Permit Modification

Table 6-1
Preparers of Baseline Supporting Documents

Firm or Organization	Contribution
US Department of the Interior, Fish and Wildlife Service	Species List for Trenton Canyon Area, Humboldt and Lander Counties, Nevada
V. Clay (prepared by Archaeological Research Services)	Cultural Resources Inventory of the Trout Creek Project, Humboldt County, Nevada; Inventory and Evaluation of 2100 Acres in Santa Fe Pacific Mining Inc's Proposed Trenton Canyon Project Area, Lander and Humboldt Counties, Nevada
Daniel Dugas (prepared by Intermountain Research)	Class III Inventory of 685 Acres; Class III Inventory of Section 21, T33N R43E
Gnomon, Inc.	GIS Map Indicating the Location of Known Eligible and Ineligible Cultural Sites in Relation to the Proposed Trenton Canyon Project
R.M. Harmon, M. Fong Meyer, C. Busby (prepared by Basin Research Associates)	Cultural Resources Inventory of the Marigold Mine Project
F. Johnson	Cultural Resources Inventory of Approximately 1261 Acres at the Lone Tree Hill Project; Stonehouse Mine Project: A Cultural Resource Inventory of Approximately 835 Acres in Humboldt County, Nevada
D. Newsome	Cultural Pesource Inventory of 1,880 Acres South of the Marigold Mine, Humboldt and Lander County, Nevada
E. Obermeyer, D. Dugas (prepared by Intermountain Research)	Cultural Resource Inventory in the Trenton Canyon Area
P. Quick (prepared by ICF-Kaiser Engineers)	Summary Report on Native American Consultation for the Trenton Canyon Gold Mining EA

Table 6-1
Preparers of Baseline Supporting Documents

Firm or Organization	Contribution
M. Rusco, E. Seelinger	Report of Archaeological Reconnaissance Along Proposed 230 kV Transmission Line Right-of-Way of Sierra Pacific Power Company, Part 1: Tracy to Valmy, Nevada
D.P. Soper (prepared by Archaeological Research Services)	The Stone House Project: A Cultural Resources Inventory of 4100 Acres in Humboldt County, Nevada
Walsh	Class I Overview for Twin Creeks
S. Waechter (prepared by Far Western Anthropological Research Group)	Archaeological Survey of 640 Acres on Battle Mountain, Northern Lander County, Nevada

6.2 PREPARERS OF THE ENVIRONMENTAL IMPACT STATEMENT

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John Wallace Senior Geotechnical Engineer	Project Engineering Alternatives Development
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Chapter 7

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Glossary

GLOSSARY

Acidic	A substance whose water solution dissolves active metals with the liberation of hydrogen; has a pH of less than 7.0.
Acre-Foot	The volume of water that will cover an area of one acre to a depth of one foot.
Adit	A horizontal mine passage driven from the surface for the working or de-watering of a mine.
Alkaline soil	A soil that has a pH greater than 7.0.
Alluvial fan	A fan like deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.
Alluvium	A general term for all detrital deposits resulting from the operations of modern rivers, including the sediments laid down in river beds, floodplains, lakes, and fans at the foot of mountain slopes and estuaries.
Alternative (action)	An option for meeting stated need.
Ambient	That portion of the atmosphere, external to buildings, to which the general public (or neighboring businesses has access).
Analyte	Chemical constituents detected as a part of analysis or testing.
Aquatic	Growing or living in or near the water.
Aquifer	A stratum of permeable rock, sand, etc., which contains water. Water source for a well.
Archaeology	The science that investigates the history of peoples by the remains of earlier periods of their existence.
Area of Potential Effect (APE)	A geographical area where the Proposed Action may cause direct or indirect effects to historic properties.
Artifact	Any object showing human workmanship or modification, especially from a prehistoric or historic culture.
Avifauna	Birds of a specified region or time.
Bald Raise	A raise with no drifts or horizontal workings.

Bedrock	The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
Botanist	A specialist in botany-a branch of biology that studies plants.
Candidate Species	Species identified by the U.S. Fish and Wildlife Service as appropriate for listing as threatened or endangered.
Claimant	A person who makes a claim-e.g. right of ownership.
Clay	As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
Coarse fragments	If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.
Contrast	The diversity of adjacent parts, as in color, tone, or emotions. The closer the juxtaposition of two dissimilar perceptions, in time or space, the more powerful the appeal of the attention.
Cultural Resources	Archaeological, historic, and traditional cultural resources, including buildings, sites, districts, structures, or objects having historical, architectural, archaeological, cultural or scientific importance.
Cumulative Effect	The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).
Dewater	To remove water from a solution containing wastes in order to concentrate and then dispose of the wastes.
Direct Impacts	Effects which are caused by the action and occur at the same time and place (40 CFR 1508.8 (a)).
Drift	A horizontal underground mine passage following a vein.

Ecological Type	A basic unit of land that has a unique combination of biotic (plant and animal species) and abiotic (landscape, soils and climatic) features; they differ from each other in their ability to produce vegetation and respond to management activities.
Effects	(See Impacts) Physical, biological, social, and economic results (expected or experienced) resulting from achievement of outputs. Effects can be direct, indirect, and cumulative, and may be either beneficial or detrimental.
Endangered Species	Those species officially designated by the U.S. Government that are in danger of extinction throughout all or a significant portion of its range.
Environmental Impact Statement (EIS)	A federally mandated report that analyzes potential environmental effects of federally funded projects or projects involving lands with federal jurisdiction.
Ephemeral	Present only during a portion of the year such as water courses which flow briefly in response to precipitation.
Erosion	The group of processes whereby earth or rock material is loosened or dissolved and removed from any part of the earth's surface.
Extraction	The act of extracting or drawing a substance out of the earth, or some other object (e.g. extracting a tooth).
Fault	A fracture or fracture zone along which there has been displacement of the sides relative to one another parallel to the fracture.
Fauna	The wildlife or animals of a specified region or time.
Federal Land Policy and Management Act of 1976 (FLPMA)	This Act of Congress established public land policy for the management of all lands administered by the BLM. FLPMA specifies several key directions for the BLM, notably that management be on the basis of multiple use and sustained yield; land-use plans be prepared to guide management actions; public lands be managed for the protection, development, and enhancement of resources; public lands generally be retained in federal ownership; and public participation be included in reaching management decisions.
Floodplain	That portion of a river valley adjacent to a stream or river channel which is covered with water when the stream overflows its banks during flood stage.
Forb	Any herbaceous plant not a grass or sedge.

Game Species — Any species of wildlife or fish for which seasons and bag limits have been prescribed, and which are normally harvested by hunters, trappers, and fishermen under state or federal laws, codes, and regulations.

Genus — One of the major taxonomic groups used to scientifically classify plants or animals: several closely related species, or one species, make up one genus, while several genera, or one genus, make up a family.

Geology — The science that relates to the earth, the rocks of which it is composed, and the changes that the earth has undergone or is undergoing.

Granite — A plutonic or igneous intrusive rock.

Gravel — Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Habitat — The region where a plant or animal naturally grows or lives.

Herbaceous — Of, or having the nature of, an herb or herbs as distinguished from woody plants.

Host Rock — A body of rock serving as a host for other rocks or mineral deposits such as a rock susceptible to mineral solutions.

Hydrologic — The distribution of surface and underground waters.

Hydrology — The science that relates to the water of the earth.

Impacts — (See Effects) Physical, biological, social, and economic results (expected or experienced) resulting from achievement of outputs. Effects can be direct, indirect, and cumulative, and may be either beneficial or detrimental.

Indirect Effects — Secondary effects which occur in locations other than the initial action or significantly later in time.

Intrusive Rocks — An igneous rock mass formed beneath the earth's surface.

Kinetic cell testing — A method of testing rock materials to stimulate natural weathering. The test is used to assess acid-generating potential of rock.

Leaching — The removal of soluble material from soil or other material by percolating through soluble water or other solutions.

Leach Stockpile A storage pile of leached material from the extraction process for ore removal.

Loam Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Locatable Minerals Valuable mineral deposits that include precious metals, base metals, refractory metals and by special enactment building stone and saline deposits.

Migratory Birds, animals, or people that migrate, or move from one region or country to another.

Mine Pit An opening or excavation from the extraction of a mineral deposit.

Mitigation Includes:

- Avoiding the impact altogether by not taking a certain action or parts of an action.
- Minimizing impacts by limiting the degree of magnitude of the action and its implementation.
- Rectifying the impact of repairing or restoring the affected environment.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- Compensating for the impact by replacing or providing substitute resources or environments.

Native Vegetation Vegetation originating in a certain region or locality.

National Environmental Policy Act of 1969(NEPA) Public Law 91-190. Establishes environmental policy for the United States Among other items, NEPA requires federal agencies to consider environmental values in decision-making processes.

Nonpoint Source Pollution Sources from which the pollution discharged are (1) induced by natural process including precipitation, seepage, percolation, and runoff; (2) not traceable to any discrete or identifiable facility; and (3) better controlled through the utilization of Best Management Practices, including process and planning techniques. This includes natural pollution sources not directly or indirectly caused by man.

Noxious Weed A plant that interferes with management objectives of a given area of land at a given point in time.

Obliteration The reclamation and or restoration of land to resource production from that of another use such as roadways or facilities.

One-hundred (100) year flood	A flood with a magnitude which may occur once every 100 years. A 1-in-a-100 chance of a certain area being inundated during any year.
Orebody	A mineral deposit that is being mined for its metals.
Outcrop	That part of a geologic formation or structure that appears at the surface of the earth.
Overburden	Material of any nature, consolidated or unconsolidated, overlying an ore deposit, excluding topsoil.
Patented Mining Claim	A government instrument (or deed) that conveys legal title for public land to an individual or another government entity.
Perched Water	Unconfined ground water separated from an underlying main body of ground water by an unsaturated zone.
Perennial Stream	A stream or part of a stream that flows continuously during all of the calender.
Permeability	The measure of the east with which a fluid can diffuse through a particular porous material.
pH	A measure of how acid or how caustic (basic) a substance is on a scale of 0-14. A pH of 7 indicates that a substance is neutral, pH less than 7 is acidic, and pH or greater than 7 is basic.
Porphyry	A rock texture characterized by large megascopic crystals surrounded by a matrix of microscopic minerals.
Portal	A horizontal mine entrance
Potential Natural Community	Biotic community that would be established if all successional sequences were completed without additional human-caused disturbance under present environmental conditions. These are sites with good soil health or soil quality as well as indicators of rangeland health.
Precambrian	The period of geologic time from approximately 570 million years ago back to the formation of the earth.
Prehistoric Resources	Sites and associated artifacts that date from before the time of written records, which do not appear before the arrival of Spanish explorers in the sixteenth century in the American Southwest.

Prey An animal hunted or killed for food by another animal.

Primitive Area An area that is not developed; a pristine natural area.

Quaternary A unit in geologic time extending from the present to approximately 2 million years ago.

Raise A vertical or inclined opening driven upward from one mine level to connect with the level above, or used to explore the ground above a level.

Range A large, open area of land over which livestock can wander and graze.

Range Allotment A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under a range allotment management plan. It is the basic land unit used to facilitate management of the range resource on the National Forest System, BLM lands, state, and associated lands administered by federal and state land management agencies.

Raptor Birds of prey such as hawks, owls, and eagles.

Rare Species A designation for animals that are not presently threatened with extinction, but occur in such small numbers throughout their range that they may become endangered if their environments worsen.

Reclamation The restoration of land to resemble its original condition or an acceptable substitute as to shape, vegetation, and wildlife.

Recreation Opportunity Spectrum (ROS) A method of measuring the ability of the forest land to meet the various types of demands imposed by a variety of recreation uses.

Recruitment Refers to new species of plants that begin growing in a region.

Residual Ore Left over ore, after part or most of the ore is taken away.

Residuum (geology) Residue; an accumulation of rock debris formed by weathering and remaining essentially in place.

Revegetation The reestablishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance such as seed bed preparation, reseeding, and mulching.

Riparian	An aquatic or terrestrial ecosystem that is associated with bodies of water, such as streams, lakes, or wetlands, or is dependent upon the existence of perennial, intermittent, or ephemeral surface or subsurface water drainage. Riparian areas are usually characterized by dense vegetation and an abundance and diversity of wildlife.
Roosting Sites	A place with perches for birds or bats.
Rooting Depth	The depth to which a plant's, or tree's roots grow.
Saline soil	A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.
Sand	As a soil separate, individual rock mineral fragments from 0.05 millimeters to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class a soil that is 85 percent or more sand and not more than 10 percent clay.
Seep	An area, generally small, where water or another liquid percolates slowly to the earth's surface.
Shaft	A vertical mine opening from the surface into a mine.
Silt	As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05) millimeter. As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.
Slope	The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by the horizontal distance, then multiplied by 100. Thus a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope Classes

Slope (percent)	
Nearly level	0-2
Gently sloping	2-4
Moderately sloping	4-8
Strongly sloping	8-15
Moderately steep	15-30
Steep	30-50
Very steep	50-75
Extremely steep	> 75

Soil	A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over time.
Special Status Species	Plants and wildlife species listed by U.S. Fish and Wildlife as endangered, threatened, proposed or candidates for such listing, BLM or Forest Service sensitive, or species of concern at the state level.
Spring	A place where ground water flows naturally from a rock or the soil on the land surface or into a body of surface water.
Stope	An underground cavity made by the removal of ore. An overhand stope is made by working upward from a mine level, and an underhand stope is made by working downward beneath a mine level.
Subsoil	The soil below the surface soil or topsoil.
Subspecies	Any natural subdivision of a species that exhibits small, but persistent morphological variations from other subdivisions of the same species living in different geographical regions or times.
Substratum	Any layer lying below another layer such as rock units or soils.
Sump	A hole dug at the bottom of a mine shaft to collect water.
Tertiary	The first period of Cenozoic Era, spanning the time between 65 and 2 million years ago.
Texture, soil	The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay.
Threatened and Endangered (T&E) Species	Plants and animals listed by the U.S. Fish and Wildlife Service or the State of New Mexico as threatened or endangered (see Endangered Species, Threatened Species).
Threatened Species	Those species officially designated by the U.S. Government that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Topsoil	The upper part of the soil or "A" horizon which is the most favorable material for plant growth.
Torpor	A state that bats achieve during hibernation where physiological processes are slowed to reduce energy demands on the species.
Total Dissolved Solids (TDS)	Salt, or an aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts.
Toxicity	The potential of a substance to exert a harmful effect on humans or animals and a description of the effect and the conditions or concentrations under which the effect takes place.
Unpatented Mining Claim	A claim made under the authority of the Mining Law of 1872 on vacant, unappropriated public land, where valuable locatable minerals have been discovered.
Vegetation Communities	Species of plants that commonly live together in the same region or ecotone.
Vein	A fault in the ground that contains valuable minerals.
Visual Resource Management Classes	Classification containing specific objectives for maintaining or enhancing visual resources, including the amount of acceptable change to the existing landscape to meet established visual goals (BLM).
Waste Rock	In mining, rock that must be broken and disposed of in order to gain access to or upgrade the ore.
Watershed	A drainage basin; the region drained by, or contributing water to a stream, lake, or other body of water.
Water Table	The level in the saturated zone at which the pressure is equal to the atmospheric pressure.
Waters of the U.S.	A jurisdictional term from Section 404 of the Clean Water Act referring to water bodies such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds. The use, degradation, or destruction of these waters could affect interstate or foreign commerce. For this project the Waters of the U.S. are primarily intermittent streams.

Wetlands Those areas that are inundated by surface or groundwater with a frequency sufficient to support vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Winze A vertical or inclined opening sunk downward from inside a mine for the purpose of connection with a lower level, or for exploring the ground beneath a lower level.

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Appendix A

Methods Used to Analyze Water and Geochemistry

APPENDIX A
METHODS USED TO ANALYZE WATER AND GEOCHEMISTRY

CONTENTS

1.0 ACID GENERATION POTENTIAL

Significant leaching might be expected to occur if the overburden or pit wall rock is susceptible to rapid oxidation and acid generation. The main factors to be considered when assessing the potential for leaching of metals from the overburden rock and pit walls are:

- The relative and absolute quantities of sulfide minerals (e.g., pyrite),
- The relative and absolute quantities of carbonate minerals (e.g., calcite), and
- The proportion of any particularly reactive rock types.

For each of the proposed pit areas, the acid-base accounting data were used to calculate weighted life-of-mine pit averages for sulfur in the form of pyrite and acid neutralization potential (ANP). The results of the calculations are shown in Table A-1. These estimates can be assumed to be biased to "higher than expected" concentrations because core sampling was biased to rock containing visible pyrite (Shepherd Miller, Inc. 1996).

The weighted sulfur contents for the six areas sampled are very low (Table A-1). The Trenton Canyon deposit-South has the highest pyritic-sulfur concentration at 0.12%. The Valmy and North Peak deposits have lower sulfur concentrations at 0.01%. The significance of these values can be judged from regulatory criteria or thresholds that have been established to screen for acid generation potential. Generally, screening thresholds are written in terms of the ratio of ANP to AGP for discrete samples. Different jurisdictions have established values varying from 1.2 to 3.0, above which acid generation potential is considered insignificant. Below the threshold, the rock is considered potentially acid generating until proven otherwise by testing. The U.S. Bureau of Land Management guideline is 3.0 for the ANP/AGP threshold. Comparison of even the highest criteria (State of California) with the weighted estimates for the Trenton Canyon Project indicates that there is a very low risk of acid generation. The lowest ANP/AGP is 4.9 (Valmy deposit - V-2, V-3, V-4, V-5). The Canadian Province of British Columbia has also established a screening criterion of 0.3% pyritic sulfur for rock that is suitable for construction purposes to prevent use of materials for construction that has any potential for acid generation. At a highest value of 0.12% for the Trenton Canyon deposit - South, the overburden material would be considered sufficiently unreactive as to be suitable for construction purposes. This rock also has a weighted ANP/AGP of 12 indicating a considerable excess of acid neutralization potential.

Finally, the percentage of core length with any potential for acid generation was determined for each proposed mining area. The classification was based on AGP>10 and ANP/AGP<2. Four of the pits (Trenton Canyon - North, Valmy deposit and North Peak deposit) had no samples falling into this category. For the Trenton Canyon deposit - South and Central, the proportion of weakly potentially acid generating rock was 7% and 2%, respectively. Since sampling was biased, these low proportions are likely to be higher than would be expected throughout the overburden rock.

From these calculations, it can be concluded that the potential for metal leaching due to acidic conditions is extremely low for overburden material and pit walls. Leachate pH can be predicted from the release

Table A-1
Summary of Acid-Base Accounts by Mining Area

Location	Total Interval Sampled	Number of Samples	Weighted Values					Core Interval with AGP >10 and ANP/AGP <2
			S(py)	ANP	AGP	ANP/AGP	NNP	
	feet		%	kg/t	kg/t	Ratio	kg/t	% of total
TRENTON CANYON DEPOSIT								
South TC-4, TC-5, TC-6	85.8	39	0.12	44	4	12	40	7
Central TC-1, TC-2	117.7	36	0.05	10	2	6	9	2
North TC-3	11.3	6	0.03	7	1	8	6	0
VALMY DEPOSIT								
V-1	73.4	19	0.01	12	0	29	11	0
V-2, V-3, V-4, V-5	9.2	5	0.01	2	0	5	1	0
NORTH PEAK DEPOSIT								
NP-1, NP-2	43.1	11	0.01	11	0	30	11	0

NOTE:

Units of kg/t in calcium carbonate equivalents of sulphate produced by oxidation of sulfide minerals. The humidity cell results were used to predict the sulfate release rate from sulfur in the form of pyrite (Figure A-1):

$$\log SO_4 \text{ (mg/kg of rock/week)} = 0.451 \log S_{py} + 1.631$$

The sulfate release rate was then used to predict leachate pH:

$$pH = -1.25 \log SO_4 + 7.891.$$

2.0 METAL CONCENTRATIONS IN OVERBURDEN MATERIAL LEACHATE AND PIT WALL RUNOFF

Estimates of metal concentrations are required for overburden disposal area leachate and pit wall runoff to evaluate potential impacts of the project on groundwater and surface water. No suitable models are available for these predictions (Perkins *et al.*, 1995) therefore an empirical approach based on first principals of geochemistry was adopted. The most important controlling factor in the predictions was the over-riding very low potential for acid weathering conditions in the rocks due to low sulfide mineral concentrations and the relative abundance of "acid-consuming" minerals (presumed to be calcium and magnesium-based carbonates). This indicates that pore water chemistry in waste rock and pit walls would be buffered to near neutral pH (or slightly alkaline conditions) by the dissolution of carbonate minerals. Therefore, the concentrations of elements such as iron (Fe), manganese (Mn), aluminum (Al), copper (Cu), and zinc (Zn) in solution would be limited by the relatively low solubility of their respective carbonates, oxides and hydroxides at near neutral pH. These minerals are commonly least soluble at pH 7. Solubility increases for lower and higher pHs (see example for iron in Figure A-2). Observed concentrations of these elements would likely be less than the solubility limits due to the slow liberation of the elements from the source minerals (sulfides). The actual concentrations are site-dependent and require project-specific estimates of solution chemistry. The predictions of pH dependent requires the construction of curves such as that shown for iron for each element of interest. For most elements, only the straight line portion extending to low pH is required.

Predictions of leachate chemistry may be developed based on observation of site conditions (seepage and groundwater) in the vicinity of the deposit and interpretation of laboratory leach tests. The former may act as a natural analogue for weathering since conditions may be comparable.

2.1 Groundwater Chemistry

In the case of Trenton Canyon, groundwater chemistry has limited relevance to the project since the groundwater table is predicted to be 20 ft. to 400 ft. below the proposed pit bottoms. This is a zone of active chemical weathering different from that expected in the majority of the pit waste rock. Weathering of sulfide minerals would be expected which would contribute elements such as Fe, Mn,

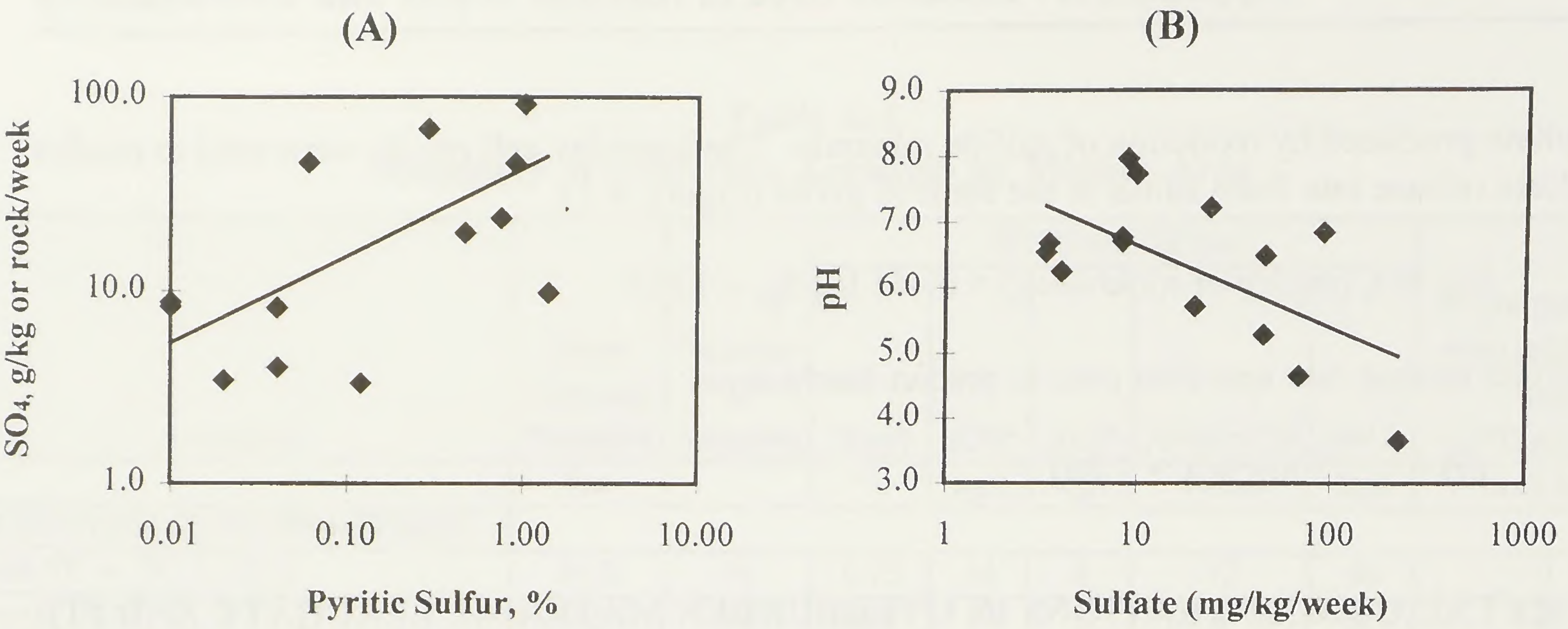

Figure A-1
Summary of Relationships Used to Model Overburden Disposal Area Leachate Quality

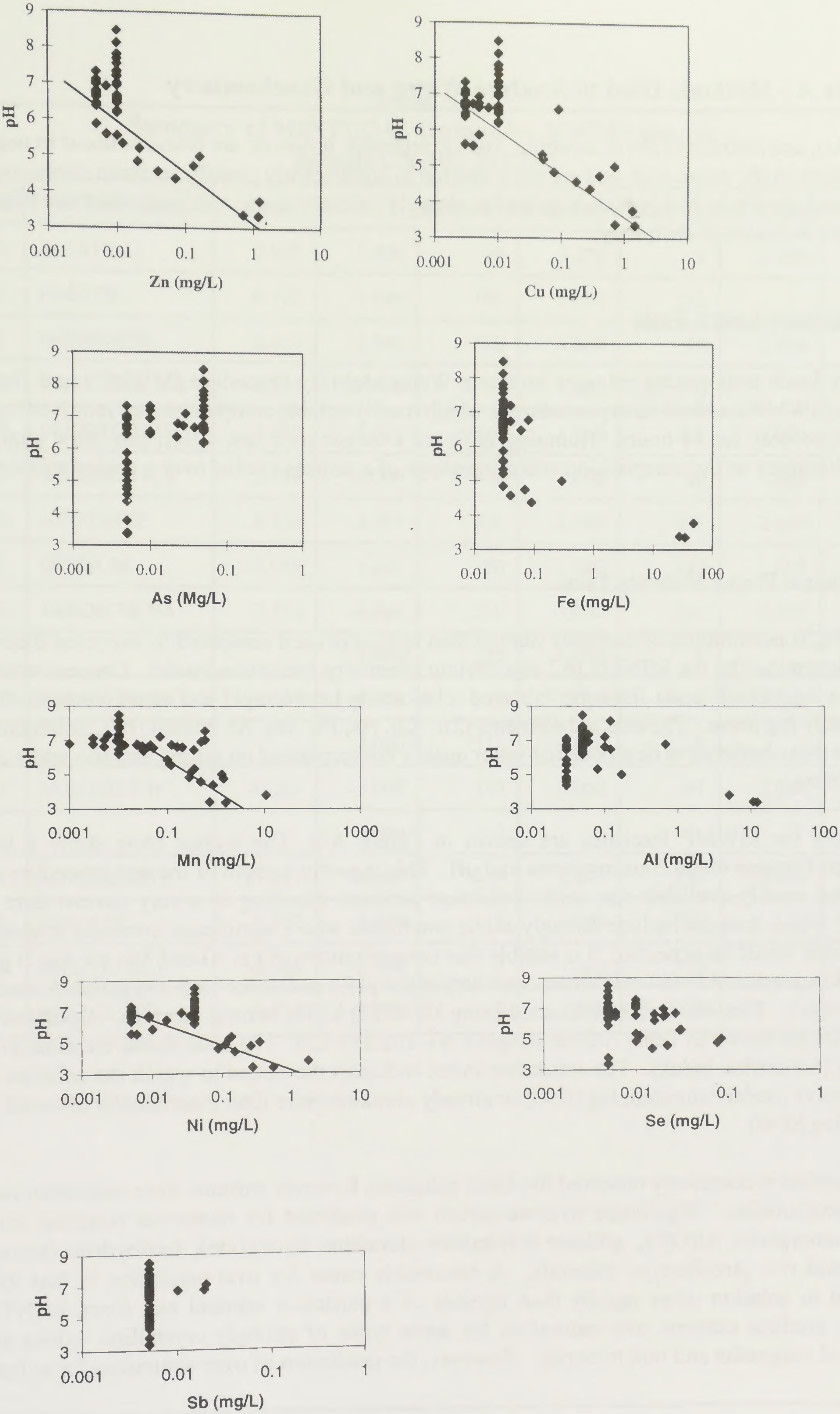

Figure A-2

Summary of Relationships Used to Model Overburden Disposal Area Leachate Quality arsenic (As), and antimony (Sb) to solution. Sulfide minerals, however, are found to occur in negligible concentrations in the waste rock and are not expected to significantly modify leachate chemistry. The use of groundwater in MW-3 (which is located in strongly oxidized waste rock) was therefore eliminated as a reliable indicator of chemistry.

2.2 Laboratory Leach Tests

Laboratory leach tests conducted were Meteoric Water Mobility Procedure (MWMP) and Humidity Cells. The MWMP is a short-term procedure in which readily soluble components are removed by water agitated vigorously for 24 hours. Humidity cells are a longer term test which can show changes in leachate chemistry as the composition and mineralogy of a sample evolve over a period of months or years.

2.2.1 Meteoric Water Mobility Tests

For each test, concentrations of elements were plotted against pH and compared to expected theoretical behavior determined by the MINTEQA2 equilibrium chemistry speciation model. Concentrations are plotted on a logarithmic scale since the expected relationship between pH and metal concentrations is approximately log linear. The selected elements (Zn , Cu, As, Fe, Mn, Al, Nickel (Ni), Selenium (Se), and Sb) are those believed to be a potential water quality concern based on testing and site water quality determinations.

Scatter plots for MWMP leachates are shown in Figure A-3. The scatter plots show a lack of relationships between metal concentrations and pH. This is partly a result of the test procedure which only leaches readily available non-acidic oxidation products resulting in a very narrow data range ($6<pH<10$) which does not include strongly acidic conditions where significant increases in elemental concentrations would be expected. It is notable that concentrations of Fe, Al and Mn are much greater than would be predicted from equilibrium chemistry at the pH's and under well-oxygenated conditions in the laboratory. This was further evaluated using MINTEQA2 for several samples. A portion of the output results are shown in Table A-2 for sample CNT-102 233-239. The table shows the mineral name and log SI (Saturation Index). The saturation index indicates the extent to which the solution could further dissolve (under-saturated, log $SI<0$) or already contains more than theoretically allowed (over-saturated, log $SI>0$).

Under-saturation is commonly observed for dilute solutions, however extreme over-saturation requires a careful explanation. Significant over-saturation was predicted for numerous common minerals including amorphous $Al(OH)_3$, gibbsite (crystalline aluminum hydroxide), ferrihydrite (amorphous $Fe(OH)_3$) and two jarosite-type minerals. A reasonable cause for over-saturation is that ions are contributed to solution more rapidly than crystals of a particular mineral can form. MINTEQA2 commonly predicts extreme over-saturation for some types of strongly crystalline oxides such as hematite and magnetite and rare minerals. However, the prediction of over-saturation for at least two

Table A-2
Summary of MINTEQA2 Output for MWMP Results
Sample CN-102 233-239

Mineral	ID and Name	Log SI	Mineral Stochiometry {MINTEQA2 Codes}					
2003000	ALOH3(A)	0.849	1.000	30	3.000	2	-3.000	330
6010000	BARITE	0.412	1.000	100	1.000	732		
2003001	BOEHMITE	2.652	-3.000	330	1.000	30	2.000	2
2077000	CHALCEDONY	0.239	-2.000	2	1.000	770		
2028100	FERRIHYDRITE	4.032	-3.000	330	1.000	281	3.000	2
2003003	GIBBSITE (C)	2.459	-3.000	330	1.000	30	3.000	2
2028102	GEOTHITE	8.423	-3.000	330	1.000	281	2.000	2
6015001	GYPSUM	-3.045	1.000	150	1.000	732	2.000	2
6050000	JAROSITE NA	2.510	-6.000	330	1.000	500	3.000	281
			2.000	732	6.000	2		
6041002	JAROSITE K	6.387	-6.000	330	1.000	410	3.000	281
			2.000	732	6.000	2		
6028101	JAROSITE H	-0.703	-5.000	330	3.000	281	2.000	732
			7.000	2				
3028101	MAGHEMITE	11.461	-6.000	330	2.000	281	3.000	2
2077002	QUARTZ	0.722	-2.000	2	1.000	770		
2077003	SIO2 (A, GL)	-0.266	-2.000	2	1.000	770		
2077004	SIO2 (A, PT)	-0.574	-2.000	2	1.000	770		

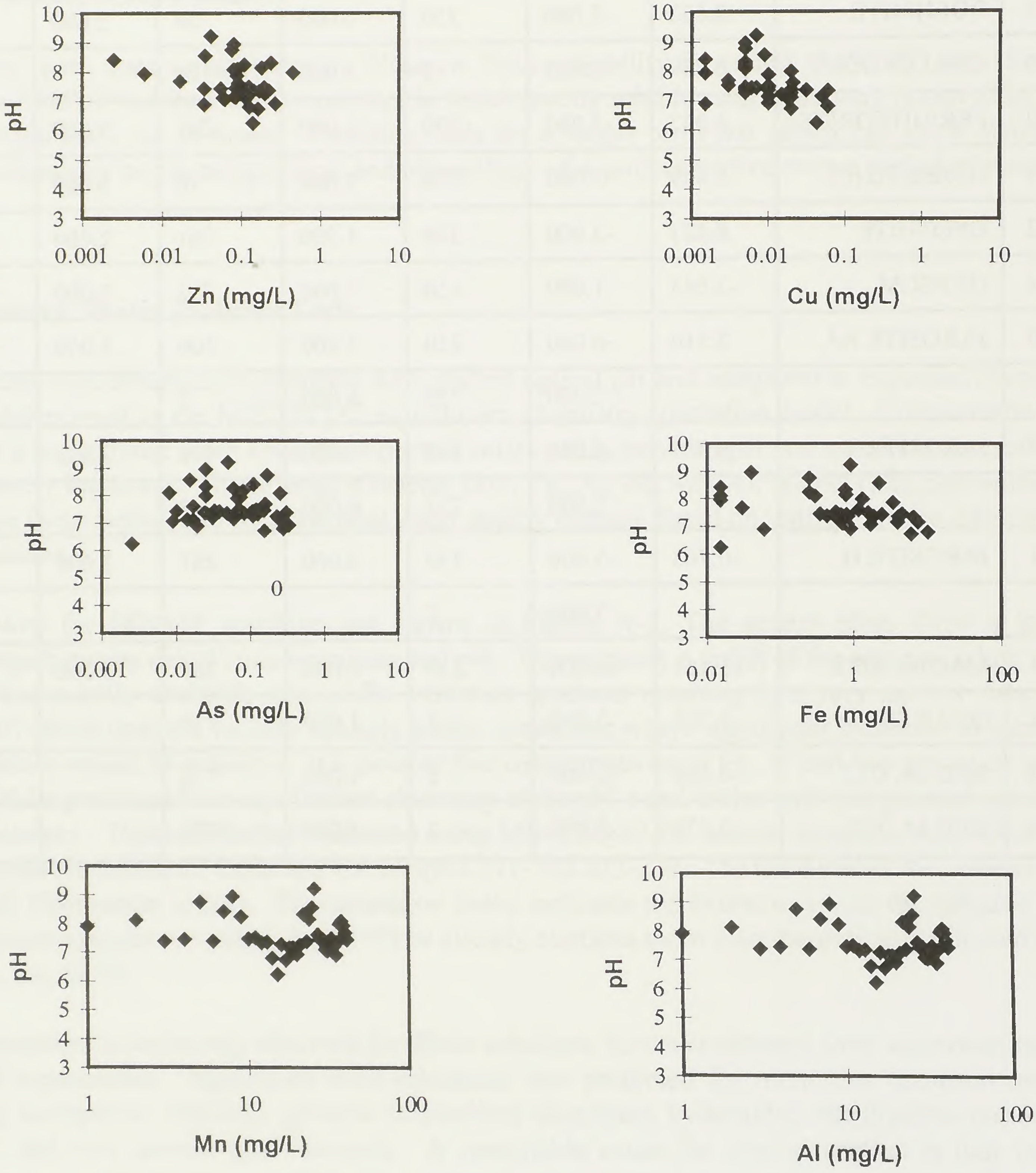

Figure A-3
Minetaq Output for MWMP Results

common rapidly-forming amorphous substances, particularly ferrihydrite, indicates an inconsistency in the MWMP leachate chemistry. Possible explanations for this observation might include:

- The presence of reducing conditions in the tests, therefore allowing much greater iron concentrations in solution,
- Colloidal matter in the leachates which was not removed by filtration, and
- A laboratory analytical or processing error.

The first explanation can be eliminated since the test method ensures conditions are well-oxygenated. The second explanation may be appropriate for this project since it may be a result of leaching clay altered materials. The presence of colloids is largely an artifact of the aggressive test method and would not be expected in a static test cell. The latter explanation cannot be ignored though the project laboratory has checked the methods and claims that the correct protocols were followed. Since the second explanation seems most likely, the presence of colloids would also be expected to result in elevated concentrations of all other parameters. This may explain the lack of any relationship between metal concentrations and pH.

2.2.2 Humidity Cell Tests

Due to the lack of useful predictive relationships for the MWMP leachates, similar relationships were examined for the humidity cell leachates (Figure A-4). For many elements, a log-linear relationship between element concentrations and pH is observed and is consistent with theoretical behavior. That is regression equations are typically of the form of:

$$\text{Log } [M^{n+}] = x_0 + x_1\text{pH},$$

in which x_1 is negative. Deviations from the regression line occur as a result of detection limit values. Also, detection limits were variable. This is particularly apparent for Zn, Cu, As, Al, and Ni in which points plot as vertical lines at a single pH value. In some cases, the regression equation could not be obtained due to behavior of particular elements. Iron, for example, shows roughly the expected trend but the detection limit was not low enough to give actual concentrations at high pH. Table A-3 summarizes values of x_0 and x_1 for each element.

Based on the better fit of humidity cells with theoretical equilibrium chemical behavior, the relationships indicated in Table A-3 were used to predict water chemistry for each of the proposed mining areas. The pH was estimated based on previous equations deriving sulfate release rates from sulfur in the form of pyrite, and leachate pH estimated from sulfate release. Predicted leachate metal concentrations are shown in Table A-4.

Table A-3
Coefficients for Regression Equations of the Form Log $[M^{n+}] = x_0 + x_1 pH$ Derived from Humidity Cell Leachates

Element	Code	Condition	x_0	x_1
Zinc	Zn	Entire pH range	2.22	-0.710
Copper	Cu	Entire pH range	2.98	-0.833
Arsenic	As	Entire pH range	-2	0
Iron	Fe	pH > 5	-1.52	0
Manganese	Mn	Entire pH range	2.21	-0.550
Aluminum	Al	pH > 5	-1.15	0
Nickel	Ni	Entire pH range	1.94	-0.613
Selenium	Se	Entire pH range	-2.05	0
Antimony	Sb	Entire pH range	-2.30	0

Table A-4
Leachate Quality Predictions for Overburden Disposal Areas

LOCATION	pH	Al	As	Sb	Cu	Fe	Mn	Ni	Se	Zn	SO_4	Ca	Mg
	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Drinking Water Standard	6.5-8.5	0.05-0.2	0.050	0.146	1.0	0.3	0.05		0.01	5	250(500)a		125(150)a
Aquatic Life Standard (96 hr)	6.5-9.0		0.180		0.014 f(H)b	1			0.005	0.123 f(H)b			
Agricultural Standard (irrigation)	6.5-9.0		0.1		0.2	5	0.20		0.020	2			
Agricultural Standard (stock)	6.5-9.0		0.2		0.5					25			
TRENTON CANYON DEPOSIT													
South (TC-4, TC-5, TC-6)	6.4	0.07	0.01	0.005	0.005	0.03	0.05	0.011	0.009	0.005	1059	441	75
Central (TC-1, TC-2)	6.6	0.07	0.01	0.005	0.003	0.03	0.04	0.008	0.009	0.003	1059	441	75
North (TC-3)	6.7	0.07	0.01	0.005	0.002	0.03	0.03	0.007	0.009	0.003	1059	441	75
VALMY DEPOSIT													
Main Pit (V-2, V-3, V-4, V-5)	7.0	0.07	0.01	0.005	0.001	0.03	0.02	0.005	0.009	0.002	1059	441	75
North Pit (V-1)	7.0	0.07	0.01	0.005	0.001	0.03	0.02	0.005	0.009	0.002	1059	441	75
NORTH PEAK DEPOSIT													
NP-1, NP-2	7.0	0.07	0.01	0.005	0.001	0.03	0.02	0.005	0.009	0.002	1059	441	75
BASELINE	7-8.5c	0.01-0.14	.01-.03	<0.01	<0.003	<0.02	<0.02	<0.021	<0.05	<0.004d	1059	441	75

NOTES:

Refer to Figures2-8, 2-9, and 2-10 for overburden disposal area locations.

a) Numbers in ( ) are mandatory secondary standards for public water systems.
b) Numbers are dependent on hardness; displayed values are for Hardness = 145mg/L (see NAC445A 144 for equations)
c) pH range of 6.6-7.2 for Ames and Mud Springs
d) Measured up to 0.13 mg/L in Ames and Mud Springs

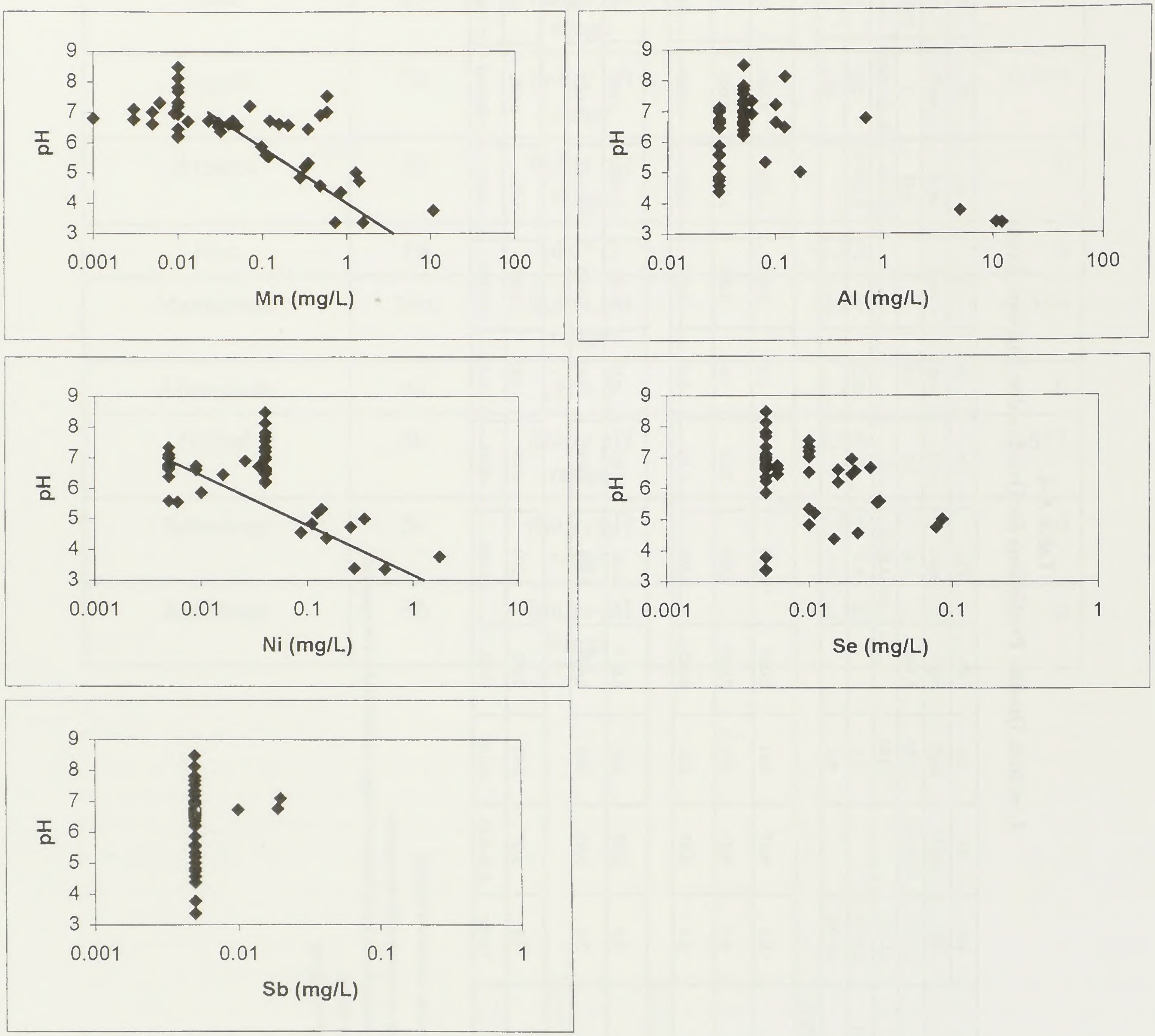

Figure A-4
Summary of Relationships Used to Model Overburden Disposal Areas Leachate Quality

Predicted sulfate concentrations using the relationship between sulfate release and pyritic sulfur are much greater than would be obtained with calcium sulfate (gypsum) constraining sulfate concentrations in solution. It was therefore assumed that sulfate concentrations would be limited by the solubility of gypsum which therefore limits the concentration of calcium and magnesium in solution. Constant sulfate, calcium and magnesium concentrations have therefore been estimated for each mine area regardless of the concentrations of other parameters.

3.0 LONG-TERM EFFECTS OF WEATHERING OF OVERBURDEN DISPOSAL AREAS AND PITS

One of the potential long-term effects investigated included the change in groundwater chemistry due to the infiltration of precipitation through the overburden disposal areas and pit walls. A study was conducted which predicted the long-term infiltration rates and proportioning of the outflow from reclaimed overburden disposal areas (Shepherd Miller, Inc.1997).

The infiltration rates and predicted outflow were developed from a 100-year simulation using a combination of three mathematical models. The HELP model (Schroeder *et al.* 1994) was used to generate meteorology in the form of a 100-year record of stochastic weather. This record was adapted for use in the OPUS model (Smith 1992) which predicted infiltration rates through the overburden disposal areas. Infiltration rates estimated using the OPUS model were used as input to the UNSAT2 model (Davis and Neuman 1983).

The predicted annual precipitation near the Trenton Canyon deposit (elev. 7,000 ft amsl) was generated using the HELP (Schroeder *et al* 1994) model to 13.6 inches per year. Characteristics of the overburden disposal area including top and bottom elevation, length and depth as well as the material properties for each layer were identified for use as inputs to the model. Certian input parameters were varied to provide a feasible range of infiltration results (Shepherd Miller, Inc. 1997). Soil characteristics, surface area, and drainage basin size and configuration were factors considered in the outflow analysis.

The study estimated that under the design case which included annual precipitation of 13.6 inches, topsoil depth of 6 inches, root depth of 30 inches, compacted depth of 36 inches and moisture content of 0.072 vol/vol and runoff curve number of 80, the infiltration rate was 0.57 inches per year (Table A-5). Given that amount of inflow, the UNSAT2 model resulted in outflow through TC-4, TC-5, and TC-6 would result in 1.2 gpm to groundwater and 1.1 gpm to Cottonwood Creek as measured at sampling site CCS-06 (Table A-6). This amount of flow was used in the predictions of impacts to surface water due to infiltration and seepage through overburden disposal areas.

Table A-5
Estimate of Long-Term Infiltration

Overburden Disposal Area	Surface Area (acres)	Infiltration Rates Steady State Outflow (gpm)	
		Contribution to Groundwater	Contribution to Cottonwood Creek
TC-4	21	0.3	0.3
TC-5	19	0.3	0.3
TC-6	38	0.6	0.5

Table A-6
Summary of Estimated Surface Flows
From Infiltration through Overburden Disposal Areas,
Cottonwood Creek Watershed

Average Baseflow and Interflow by Sampling Location	
	CCS-06
Percent of Basin Covered by Proposed Overburden Areas	4.10%
Base Flow (gpm)	25.7
Aggregate Proposed Overburden Areas (gpm)	1.1
Proposed Overburden Area TC-4	0.3
Proposed Overburden Area TC-5	0.3
Proposed Overburden Area TC-6	0.5

Source: Shepherd Miller, Inc. September 24, 1997.

4.0 PREDICTION OF SURFACE WATER QUALITY CHANGE FROM LONG-TERM SEEPAGE

Each of the water quality constituents was subjected to the following procedure to predict future conditions for flow and concentration of the element. For example, to predict copper concentrations at CCS-01 for flow and water quality conditions similar to that measured on October 24, 1994, the following steps were taken:

1) The measured flow for that date at CCS-01 is multiplied by the measured copper concentration at CCS-01 for that date,
2) The estimated seepage flows to surface water from each of TC-4, TC-5, and TC-6 (those for CCS-1A from Table A-7) are multiplied by their corresponding copper concentrations (from Table A-4), and
3) The four products are summed and divided by the aggregate flow from the four sources, to calculate the estimate for copper concentration at CCS-01 for that date in Table A-8.

Flows into CCS-06 from individual disposal areas (presented in Table A-7) were applied for that sampling location and all locations upstream. For example, a flow of 0.52 gpm from TC-6 was applied to location CCS-19, and flows of 0.52 gpm (TC-6) and 0.26 gpm (TC-5) were applied to location CCS-18. In similar fashion the estimated disposal area flows for location CCS-1A were applied to all sampling locations downstream of CCS-06. Seepage flow for this model is assumed constant throughout the year. For example, water has been sampled at location CCS-04 (with measured flowrates) on 5 dates. Five water quality estimates were performed for this site, one for each date. For each date, the corresponding flow and water quality at CCS-04 was mixed with the estimated constant flows and quality from stockpiles TC-4, TC-5, and TC-6. For parameters where baseline studies provide both a dissolved and total concentration, the dissolved concentration was used. The dissolved concentration was used as more consistent with the estimated concentrations for the same parameters derived for seepage, and because dissolved and total concentrations measured during baseline sampling and analysis are similar.

Nickel (Ni) was not included in the mixing calculations, because the analyses performed on baseline samples collected from the creek had non-detect results from tests with a detection limit that varied from 0.010 mg/l to 0.021 mg/l. These detection limits are near to or above the drinking water standard of 0.013 mg/l. The predicted Ni concentrations for seepage from the disposal areas vary from 0.005 mg/l to 0.011 mg/l, which is well within the surface water quality standard.

4.1 Comparison to State and Federal Standards

A summary of the changes in water quality due to seepage from Trenton Canyon overburden disposal areas is presented in Table A-8 for Cottonwood Creek. State and federal drinking water, agricultural water, and aquatic life standards are shown for comparison (TableA-8). Standards for Cu, Ni, and Zn, which are hardness dependent, are shown in the right columns of the tables. Predicted exceedances are outlined in bold.

4.2 Results of Seepage Impacts

The long-term concentrations for water quality would be within state and federal standards for the average conditions for each of the studied parameters. There are isolated occurrences of marginal exceedances for selected parameters, as discussed below:

- *Sulfate.* The high sulfate in the seepage waters leads to mix values above the secondary drinking water standard of 250 mg/l under low flow conditions where the estimated seepage constitutes a high percentage (over 50%) of the total flow.

- *Copper.* The only exceedance is at CCS-04 for conditions similar to the 12/16/95 sampling date. The measured dissolved copper concentration at this site was 0.025 mg/l (total copper below the 0.003 mg/l detection limit) on this date. The discrepancy between the results of the tests indicates the likelihood that the high dissolved reading is anomalous.

- *Selenium.* The estimated selenium concentration in seepage from disposal areas is 0.008 mg/l, which is above the 96-hour aquatic life standard of 0.005 mg/l. For smaller total flows, the concentrations of selenium in the creek are calculated to slightly exceed this standard. These calculated exceedances are largely an artifact of the calculation method and use of analytical testing with a 0.005 mg/l detection limit for selenium. Seven of the instances of calculated concentrations in TableA-8 in excess of 0.005 mg/l are from cases where selenium analyses for the creek showed no concentrations above a 0.005 mg/l detection limit, but a value of 0.005 mg/l was used for the creek concentration in the mix calculations. When a detection limit of 0.001 mg/l was used in testing, the measured concentrations of selenium in Cottonwood Creek measured in the range of 0.001 mg/l to a maximum of 0.004 mg/l (when not non-detect). Therefore the 0.005 mg/l value for selenium used in the seven cases is demonstrably over-conservative. In similar fashion, the detection limits for selenium for the humidity cell leachate analyses that underlie the 0.008 mg/l estimate for predicted concentrations are 0.005 to 0.010 mg/l, and 31 out of 50 samples tested had no detectable selenium. To derive the 0.008 mg/l estimate, the estimated values for the humidity cell leachate tests with no detectable selenium were set equal to the detection limit. If the estimated values for the tests with no detectable selenium were set equal to half the detection limit, the estimated selenium concentration in the disposal area seepage would be 0.0056 mg/l. If this value for predicted selenium concentration were used, five additional instances of calculated concentrations in TableA-8 in excess of 0.005 mg/l would be less than the 0.005 mg/l aquatic life standard. In sum, taking into account analytical detection limits, one exceedance in TableA-8 appears due to the addition of the overburden disposal area seepage.

Table A-7
Water Sampling Locations Potentially Affected by Seepage Waters

Station	Overburden Disposal Areas Upgradient from Water Station
CCS-00	TC-3, TC-4, TC-5, TC-6
CCS-01	TC-4, TC-5, TC-6
CCS-1A	TC-4, TC-5, TC-6
CCS-2A	TC-4, TC-5, TC-6
CCS-03	TC-4, TC-5, TC-6
CCS-04	TC-4, TC-5, TC-6
CCS-04A	TC-4, TC-5, TC-6
CCS-05	TC-4, TC-5, TC-6
CCS-06	TC-4, TC-5, TC-6
CCS-18	TC-5, TC-6
CCS-19	TC-6
CCS-13	TC-6

Note: Sampling stations are shown in Figure 3-1.

Table A-8
Predicted Water Quality Impacts
in Cottonwood Creek

Sample Date	Station	Flow Rate (gpm)	pH	Aluminum mg/l	Sb mg/l	As mg/l	Cu mg/l	Fe mg/l	Mn mg/l	Se mg/l	Zn mg/l	Cu mg/l (Standards for Hardness Dependent Elements)	Ni mg/l (Standards for Hardness Dependent Elements)	Zn mg/l (Standards for Hardness Dependent Elements)	Ca mg/l	Mg mg/l	SO4 mg/l	Hardness mg/l
Drinking Water Standard			6.5	0.05-0.2	0.146	0.050	1.0	0.3	0.05	0.01	5					125	250	
Aquatic Life Standard (96 hr)			6.5			0.180	f(hardness)	1		0.005	f(hardness)							
Agricultural Standard (irrigation)			6.5			0.1	0.2	5	0.20	0.020	2							
Agricultural Standard (stock)			6.5			0.2	0.5				25							
3/4/1995	CCS-00	133	8.1	0.016	0.024	0.014	0.002	0.007	0.003	0.002	0.004	0.016	0.212	0.142	49	12	NV	171.7
5/19/1995	CCS-00	3203	8.2	0.091	0.019	0.012	0.003	0.045	0.001	0.001	0.002	0.008	0.108	0.072	22	6	NV	77.1
5/19/1995	CCS-0A	2800	8.2	0.078	0.018	0.014	0.003	0.036	0.001	0.001	0.002	0.008	0.107	0.072	22	6	NV	77.0
10/24/1994	CCS-01	6	7.2	0.061	0.004	0.016	0.007	0.026	0.031	0.005	0.006	0.063	0.829	0.559	267	48	NV	861.6
10/30/1994	CCS-1A	11	7.2	0.041	0.009	0.019	0.008	0.016	0.017	0.004	0.008	0.040	0.527	0.355	154	29	NV	504.9
3/4/1995	CCS-1A	263	8.0	0.016	0.024	0.020	0.002	0.006	0.003	0.001	0.137	0.014	0.186	0.125	42	10	NV	147.7
5/19/1995	CCS-1A	3103	8.1	0.099	0.018	0.012	0.003	0.052	0.002	0.001	0.002	0.008	0.105	0.071	21	5	NV	75.3
9/11/1995	CCS-1A	15	7.4	0.021	0.015	0.016	0.003	0.020	0.012	0.003	0.002	0.034	0.446	0.300	126	24	NV	414.3
12/15/1995	CCS-1A	61	7.6	0.024	0.001	0.020	0.003	0.024	0.003	0.002	0.002	0.019	0.246	0.166	60	14	96	205.0
3/12/1996	CCS-1A	1203	8.1	0.096	0.001	0.015	0.003	0.056	0.002	0.001	0.002	0.011	0.141	0.095	30	8	29	106.3
7/2/1996	CCS-1A	79	8.3	0.023	0.001	0.021	0.003	0.024	0.004	0.002	0.002	0.016	0.212	0.143	50	11	64	171.9
9/25/1996	CCS-1A	17	8.0	0.037	0.003	0.019	0.003	0.025	0.010	0.0057*	0.002	0.032	0.427	0.288	120	23	224	393.5
12/12/1996	CCS-1A	142	8.0	0.056	0.003	0.019	0.003	0.029	0.003	0.005	0.002	0.016	0.209	0.141	49	12	62	169.2
5/21/1995	CCS-2A	93	7.9	0.028	0.018	0.007	0.003	0.017	0.003	0.001	0.002	0.009	0.120	0.080	26	6	NV	87.4
10/30/1994	CCS-03	22	7.6	0.036	0.006	0.031	0.009	0.013	0.006	0.002	0.009	0.030	0.391	0.263	106	22	NV	354.6
3/4/1995	CCS-03	223	8.1	0.016	0.024	0.018	0.002	0.008	0.003	0.001	0.010	0.015	0.203	0.136	46	12	NV	162.9
5/19/1995	CCS-03	2703	8.0	0.093	0.023	0.010	0.003	0.046	0.003	0.001	0.002	0.008	0.107	0.072	22	5	NV	76.2
12/15/1995	CCS-03	61	7.7	0.024	0.001	0.021	0.003	0.024	0.011	0.002	0.002	0.020	0.259	0.174	64	14	90	217.9
10/30/1994	CCS-04	21	7.5	0.036	0.008	0.022	0.009	0.013	0.014	0.003	0.009	0.029	0.384	0.259	105	21	NV	347.5
3/4/1995	CCS-04	183	8.0	0.016	0.024	0.011	0.002	0.006	0.003	0.001	0.004	0	0.200	0.135	46	11	NV	160.5
5/19/1995	CCS-04	2803	8.1	0.130	0.018	0.006	0.003	0.063	0.005	0.001	0.002	0.008	0.105	0.071	21	5	NV	75.0
9/11/1995	CCS-04	25	7.8	0.016	0.022	0.020	0.003	0.019	0.013	0.002	0.002	0.025	0.334	0.225	90	17	NV	294.6
12/16/1995	CCS-04	52	7.6	0.024	0.001	0.016	0.025	0.024	0.004	0.001	0.002	0.020	0.271	0.182	68	14	96	229.5
3/4/1995	CCS-4A	28	7.8	0.021	0.022	0.025	0.002	0.012	0.007	0.003	0.004	NV	NV	NV	85	16	NV	NV
5/19/1995	CCS-4A	10	7.8	0.061	0.014	0.028	0.003	0.029	0.017	0.004	0.002	0.041	0.539	0.363	161	28	NV	518.4
9/11/1995	CCS-4A	6	7.4	0.040	0.011	0.018	0.004	0.024	0.026	0.005	0.003	0.059	0.770	0.519	246	43	NV	790.4
12/16/1995	CCS-4A	4	6.7	0.065	0.005	0.012	0.004	0.029	0.043	0.008	0.003	0.089	1.156	0.780	400	68	952	1277.5
3/13/1996	CCS-4A	10	7.6	0.051	0.004	0.023	0.003	0.036	0.017	0.004	0.002	0.040	0.529	0.356	157	28	351	506.3
7/2/1996	CCS-4A	5	7.8	0.050	0.003	0.017	0.004	0.028	0.035	0.006	0.004	0.064	0.842	0.568	274	47	632	877.9
9/26/1996	CCS-4A	4	7.2	0.065	0.005	0.012	0.004	0.029	0.043	0.009	0.003	0.089	1.159	0.781	401	68	954	1280.2
12/13/1996	CCS-4A	19	7.7	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	NV	206	NV
10/30/1994	CCS-05	5	6.8	0.058	0.005	0.010	0.006	0.024	0.034	0.007	0.005	0.073	0.961	0.648	319	56	NV	1026.0
3/4/1995	CCS-05	163	7.8	0.016	0.024	0.003	0.002	0.006	0.003	0.001	0.007	0.016	0.210	0.141	47	13	NV	169.9
5/19/1995	CCS-05	1303	8.1	0.097	0.018	0.002	0.003	0.051	0.004	0.002	0.002	0.009	0.124	0.083	25	7	NV	91.0
9/11/1995	CCS-05	8	6.8	0.033	0.013	0.014	0.004	0.022	0.023	0.005	0.002	0.049	0.647	0.436	201	34	NV	643.2
12/16/1995	CCS-05	19	7.4	0.029	0.002	0.007	0.003	0.025	0.009	0.002	0.002	0.032	0.419	0.282	115	24	210	384.9
3/13/1996	CCS-05	599	7.9	0.066	0.001	0.002	0.004	0.072	0.017	0.001	0.002	0.011	0.150	0.101	31	9	31	114.3
7/2/1996	CCS-05	37	7.9	0.025	0.001	0.007	0.003	0.025	0.006	0.003	0.004	0.021	0.278	0.187	69	16	114	236.7
9/26/1996	CCS-05	8	7.7	0.040	0.003	0.009	0.004	0.026	0.019	0.007	0.011	0.048	0.634	0.427	194	35	426	627.2
12/13/1996	CCS-05	31	7.8	0.026	0.003	0.006	0.006	0.025	0.008	0.005	0.009	0.025	0.331	0.223	86	19	147	290.7
10/30/1994	CCS-06	5	6.8	0.045	0.008	0.017	0.008	0.017	0.007	0.006	0.007	0.047	0.617	0.416	190	33	NV	608.4
3/4/1995	CCS-06	16	7.5	0.019	0.023	0.016	0.002	0.008	0.005	0.004	0.004	0.019	0.254	0.171	66	12	NV	212.6
5/19/1995	CCS-06	1103	7.9	0.146	0.018	0.009	0.003	0.076	0.003	0.001	0.002	0.006	0.078	0.053	16	3	NV	52.9

Table A-8
Predicted Water Quality Impacts
in Cottonwood Creek

Sample Date	Station	Flow Rate (gpm)	pH	Aluminum mg/l	Sb mg/l	As mg/l	Cu mg/l	Fe mg/l	Mn mg/l	Se mg/l	Zn mg/l	STANDARDS for HARDNESS DEPENDENT ELEMENTS Cu mg/l	Ni mg/l	Zn mg/l	Ca mg/l	Mg mg/l	SO4 mg/l	Hardness mg/l
Drinking Water Standard			6.5	0.05-0.2	0.146	0.050	1.0	0.3	0.05	0.01	5					125	250	
Aquatic Life Standard (96 hr)			6.5			0.180	f(hardness)	1		0.005	f(hardness)							
Agricultural Standard (irrigation)			6.5			0.1	0.2	5	0.20	0.020	2							
Agricultural Standard (stock)			6.5			0.2	0.5				25							
9/11/1995	CCS-06	8	7.1	0.020	0.016	0.010	0.003	0.019	0.011	0.003	0.002	0.031	0.407	0.274	113	22	NV	371.8
12/16/1995	CCS-06	12	7.2	0.026	0.001	0.016	0.003	0.025	0.006	0.004	0.003	0.023	0.302	0.203	81	14	131	261.2
3/13/1996	CCS-06	79	7.6	0.022	0.001	0.016	0.003	0.027	0.021	0.006	0.006	0.011	0.150	0.101	35	6	33	114.2
7/2/1996	CCS-06	18	7.7	0.024	0.001	0.017	0.003	0.024	0.005	0.002	0.002	0.017	0.226	0.152	57	10	86	185.3
9/26/1996	CCS-06	10	7.9	0.028	0.002	0.014	0.003	0.025	0.008	0.006	0.002	0.025	0.326	0.219	90	15	155	286.0
12/13/1996	CCS-06	12	7.7	0.026	0.003	0.013	0.003	0.025	0.008	0.005	0.003	0.022	0.288	0.194	77	13	131	246.6
5/20/1995	CCS-13	9	7.9	0.128	0.019	0.003	0.003	0.064	0.010	0.002	0.002	0.013	0.172	0.116	40.7	8.1	NV	134.7
5/21/1995	CCS-18	8	7.6	0.053	0.019	0.005	0.003	0.034	0.008	0.002	0.002	0.018	0.237	0.159	60.6	10.8	NV	195.7
5/21/1995	CCS-19	39	8.0	0.042	0.026	0.003	0.003	0.023	0.003	0.001	0.002	0.007	0.093	0.062	19.5	3.9	NV	64.8
maximum		3203	8.3	0.146	0.026	0.031	0.025	0.076	0.043	0.009	0.137				400.6	68.3	954.4	1280
minimum		4	6.7	0.016	0.001	0.002	0.002	0.006	0.001	0.001	0.002				15.8	3.3	29.0	53
average		400	7.7	0.047	0.011	0.014	0.004	0.028	0.011	0.003	0.006				103.2	19.5	237.4	339
date of max		5/19/1995	7/2/1996	5/19/1995	5/21/1995	10/30/1994	12/16/1995	5/19/1995	9/26/1996	9/26/1996	3/4/1995				9/26/1996	9/26/1996	9/26/1996	9/26/1996

NOTES:

Predicted results above a water quality standard are outlined in a bold line.

NV= No value measured

a) Most selenium concentrations shown in excess of the 96-hour aquatic life standard are due to the use of non-detect analytical results with relatively high (0.005 mg/l) detection limits in the mix calculations.
The selenium exceedance shown in bold uses a measured (I.e. above the test detection limit) creek concentration.

- *Zinc*. The only predicted exceedance is at CCS-01A for conditions similar to March 4, 1995 (3/4/95). The seepage would not significantly contribute to the exceedance as the estimated maximum seepage dissolved zinc concentration (0.005 mg/l) is less than that measured (0.139 mg/l dissolved) in the natural waters on that date. The total zinc concentration measured on that date was below the detection limit of 0.004 mg/l. As was the case above for a high dissolved copper reading, the discrepancy between the results of the tests for dissolved and for total zinc indicates the likelihood that the high dissolved reading is anomalous.

5.0 REFERENCES

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