CHAPTER 3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the affected environment in the proposed Emigrant Project area and the potential direct and indirect impacts associated with the Proposed Action and No Action alternative. The Emigrant Project area is located on public and private land in Elko County, along the east slopes of the Piñon Range approximately 10 miles south of Carlin, Nevada. The Project area is characterized by steep hills and ephemeral and intermittent drainages within the Dixie Creek watershed. Elevations in the Project area range from 5,700 feet to over 7,400 feet above mean sea level.

Mining and reclamation of the proposed Emigrant Project identified in Chapter 2 would result in irreversible and irretrievable commitments of resources and residual effects to the environment. Irreversible commitments of resources are those that cannot be reversed, except over a very long period of time. Irretrievable commitments of resources are those that are lost. Residual effects are those effects that remain after completion of the Proposed Action and implementation of mitigation measures.

Mitigation measures that would reduce or limit environmental or social impacts that could result from the Proposed Action may be required by BLM as a condition or stipulation of approval for authorization of the Proposed Action are described at the end of this chapter. Additional monitoring that may be required by BLM and NDEP is also described at the end of the chapter. Stipulations or conditions attached to the Record of Decision for the proposed Emigrant Plan of Operations would conform to regulatory provisions in 43 CFR 3809.

Study Area boundaries were developed for each resource area and are described in the respective resource sections of this chapter. Study Areas for each environmental resource are based on predicted locations of direct and indirect impacts associated with the Proposed Action.

SUPPLEMENTAL AUTHORITIES TO BE CONSIDERED

Appendix 1 of BLM's NEPA Handbook (H-1740-1) identifies Supplemental Authorities to be Considered in all BLM environmental documents. The appendix is a list of statutes and executive orders pertinent to the human and natural environment that must be considered in all BLM Environmental Assessments (EA) and Environmental Impact Statements (EIS). Supplemental Authorities for the proposed Emigrant Project are listed in **Table 3-1**. These authorities are included in the evaluation for this EIS.

This chapter provides a summary of environmental baseline information and a description of environmental consequences that could result from implementation of the Proposed Action. In the following sections, "Project area" refers to land included within the permit boundary associated with the Proposed Action and adjacent areas.

TABLE 3-1
Supplemental Authorities
Emigrant Project

Element	Authority
Air Quality	The Clean Air Act as amended (42 USC 7401 *et seq.*)
	The State of Nevada has been granted primacy in administration of the Clean Air Act under Nevada Revised Statutes (NRS) and Nevada Administrative Code (NAC) Chapter 445B by the Nevada Bureau of Air Pollution Control.
Cultural Resources	National Historic Preservation Act, as amended (16 USC 470)
Fish Habitat	Magnuson-Stevens Act Provision: Essential Fish Habitat (EFH): Final Rule (50 CFR Part 600; 67 FR 2376, January 17, 2002)
Forest and Rangeland	Healthy Forests Restoration Act of 2003 (P.L. 108-148)
Migratory Birds	Migratory Bird Treaty Act of 1918, as amended (16 USC 703 *et seq.*)
	Executive Order (E.O.) 131186, "Responsibilities of Federal Agencies to Protect Migratory Birds" January 10, 2001.
Native American Religious Concerns	American Indian Religious Freedom Act of 1978 (42 USC 1996)
Threatened or Endangered Species	Endangered Species Act of 1983, as amended (16 USC 1531)
Wastes, Hazardous or Solid	Resource Conservation and Recovery Act of 1976 (43 USC 6901 *et seq.*)
	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (43 USC 9615)
Water Quality	Safe Drinking Water Act, as amended (43 USC 300f *et seq.*)
	Clean water Act of 1977 (33 USC 1251 *et seq.*)
	The State of Nevada has been granted primacy in administration of the Clean Water Act under Nevada Revised Statutes (NRS) and Nevada Administrative Code (NAC) Chapter 445B by the Nevada Bureau of Water Pollution Control.
Wild and Scenic Rivers	Wild and Scenic Rivers Act, as amended 16 USC 1271)
Wilderness	Wilderness Act of 1964 (16 USC 1131 *et seq.*)
	Federal Land Policy and Management Act of 1976 (43 USC 1701 *et seq.*)
Environmental Justice	E.O. 12898, "Environmental Justice" February 11, 1994
Floodplains	E.O. 11988, as amended, Floodplain Management Act
Wetland and Riparian Zones	E.O. 11990 Protection of Wetlands May 24, 1977

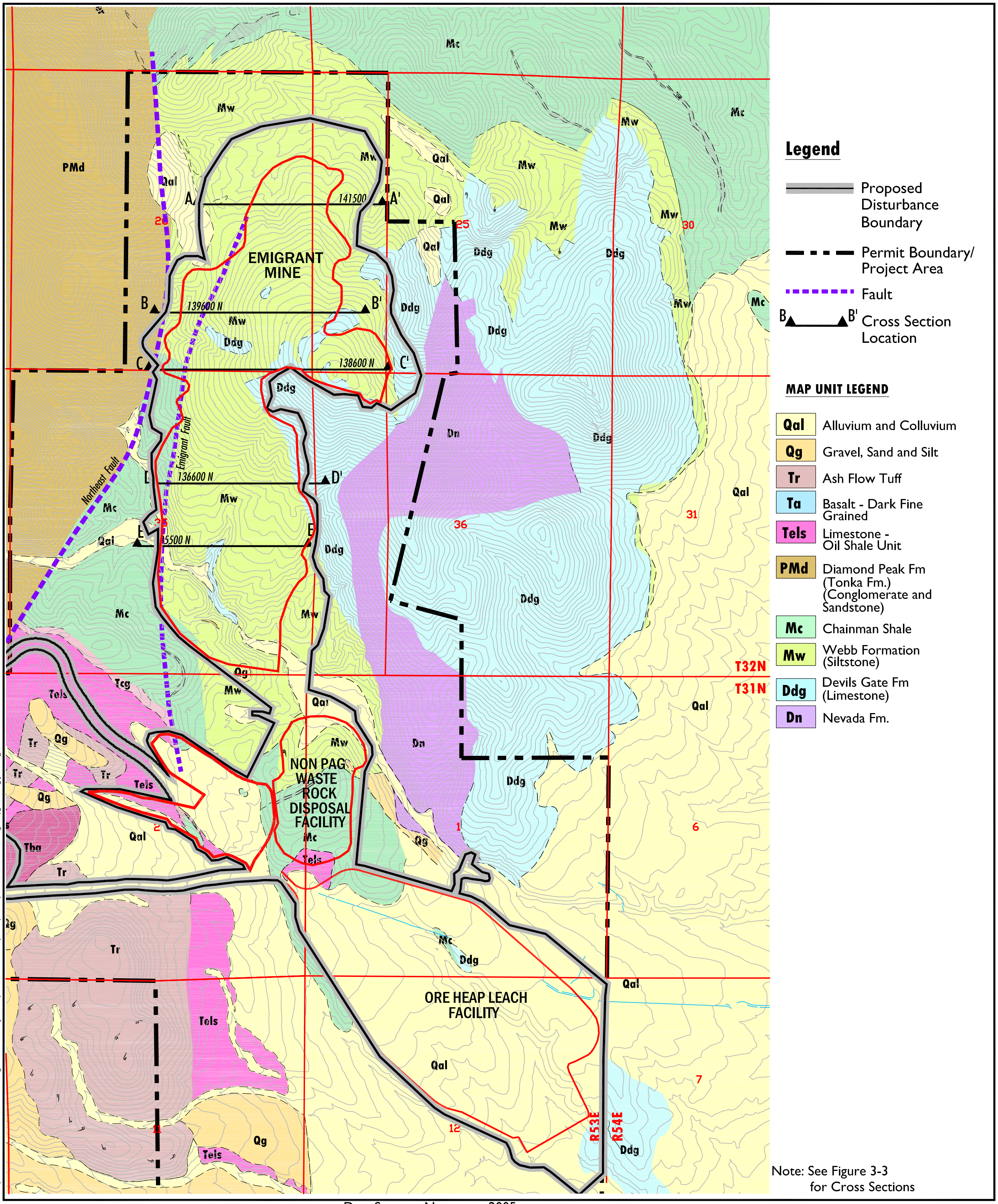
Source: BLM NEPA Handbook H-1740-1

GEOLOGY AND MINERALS

Affected Environment

The Project area is located within the Basin and Range Physiographic Province, a region that extends over most of Nevada and parts of adjoining states. Range-front faulting in the province has created north-south trending fault-block mountain ranges separated by broad valleys filled with unconsolidated sediments (alluvium and colluvium). The Emigrant deposit is located near Emigrant Spring at the northern end of the Piñon Range. This mountain range is comprised of Ordovician- through Permian-age shale, siltstone, limestone, and conglomerate. Deposition of this sequence of rocks was interrupted by the Antler Orogeny – a major mountain building event.

Figure 3-1 is a geologic map of the Emigrant Project area and **Figure 3-2** presents a generalized stratigraphic section. Emigrant gold deposits are contained primarily within the Lower Mississippian-age Webb siltstone and Devonian-age Devils Gate limestone (Thoreson



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Data Source: Newmont, 2005

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Elko, Nevada

Geologic Map
Emigrant Project
Elko County, Nevada
FIGURE 3-1

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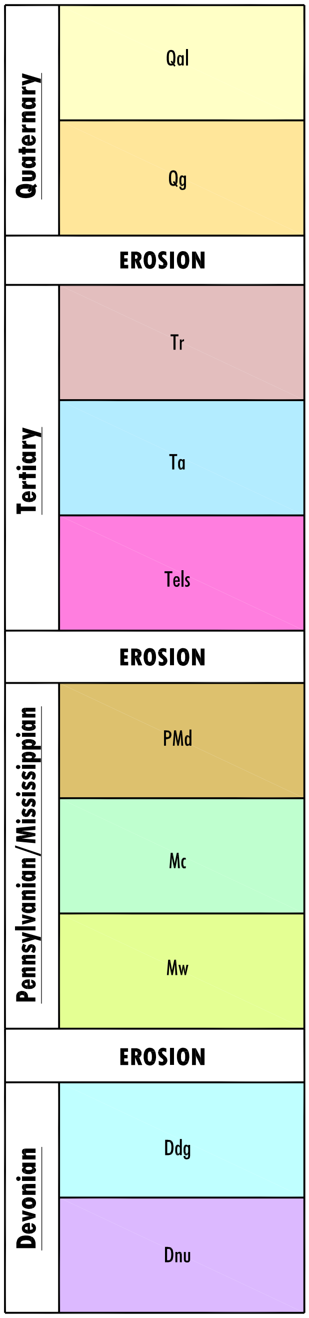

Alluvium and Colluvium
Alluvium and colluvium deposited along active stream channels, valleys and alluvial fans

Gravel, Sand and Silt
Older alluvial gravel and sand deposits as major valley fill and playa lake deposits

Rhyolite Tuff
Massive rhyolitic lapilli tuff and minor volcanic breccia, locally glassy texture with phenocrysts of biotite and hornblende

Basalt
Dark fine grained volcanic rocks

Limestone (Oil Shale Unit)
Limestone, thin bedded light gray and tan, interbedded with laminated shale, siltstone, oil shale and tuff

Diamond Peak Formation (Tonka Formation)
Conglomeration and sandstone with minor marly shale interbeds; thickness 4700+ feet

Chainman Shale
Predominantly light gray and black, soft, carbonaceous shale with lesser amounts of gray siltstone, lenticular tan quartzose sandstone, and minor conglomerate and limestone; thickness 1600+ feet

Webb Formation
Predominantly laminated to thin-bedded, gray carbonaceous and siliceous mudstone and claystone that weathers grayish brown to black, thin sandstone and minor limestone; thickness 730-800+ feet

Devils Gate Formation
Predominantly thin to thick interbedded blue-gray limestone and black to white dolomite; thickness 800+ feet

Nevada Formation
Upper dolomite member - brown and gray dolomite in alternating layers; thickness 940+ feet

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Elko, Nevada

Geologic Stratigraphic Section
Emigrant Project
Elko County, Nevada
FIGURE 3-2

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1991). Gold occurs in shallow west-dipping tabular bodies at or near the contact of the Webb siltstone and underlying Devils Gate limestone (unconformity), with secondary occurrence of gold along the Emigrant Fault (**Figure 3-3**). Gold mineralization is present near the surface. A small percentage of ore occurs in the Mississippian-age Chainman siltstone and Fresh Webb siltstone.

The Emigrant Fault occurs along the western margin of the Emigrant gold deposit. The fault strikes north-10 degrees-east and dips 80 to 85 degrees west. The fault separates the Chainman siltstone in the hanging-wall (above fault plane) with the Webb siltstone and Devils Gate limestone in the foot-wall (below fault plane) (**Figure 3-3**) (Thoreson 1991; Lapointe *et al*. 1991). Although mineralization commonly occurs adjacent to the Emigrant Fault, elsewhere mineralization lies as much as 3,000 feet east of the fault. The Emigrant Fault is a localizing structure for hydrothermal fluids that migrated up the fault, and outward into adjacent sediment to form disseminated low-grade gold deposits. Mineralization extends 12,000 feet along a north-south trend parallel to the fault, and thins away from the fault.

In the vicinity of the Emigrant ore deposits, siltstone and sandstone are argillaceous, fractured, silicified, bleached, and iron oxide stained (Bentz *et al*. 1983). Most of the ore proposed for mining is completely oxidized, with pyrite converted to limonite and hematite. A small percentage of ore is unoxidized carbon sulfur refractory rock (Chainman siltstone and Fresh Webb siltstone).

Seismic Conditions

The Basin and Range Province is an area of moderately high rates of seismic activity and contains three zones of significantly higher rates of activity within Nevada. The Emigrant Project area occurs about 90 miles east of the Nevada Seismic Zone, the nearest of these three zones. Recent movement along fault structures in the Project area has not been evaluated; however, many of the high-angle faults shown on the Emigrant area geologic map (**Figure 3-1**) are considered geologically active. Most of these faults have long recurrence intervals where the return period of seismic activity is thousands of years (most recent movement typically within Quaternary period). Recent work by the U.S. Geological Survey (USGS 2004a) in 2000-2001 documented Quaternary-age fault movement on a number of regional fault systems.

Approximately 54 earthquakes with magnitudes greater than 3.0 on the Richter scale have occurred within a radius of 100 kilometers (62 miles) of the Project area during the period 1901-2007 (USGS 2007). Earthquake epicenters ranged in distance from 2.5 to 61 miles of the Project area, with Richter scale magnitudes from 3.0 to 5.1. The closest recorded earthquake event was magnitude 3.9, about 2.5 miles from the Project area (Valera Geoconsultants 2004; USGS 2007). A magnitude 6.0 earthquake occurred near Wells, Nevada, approximately 80 miles northeast of Elko on February 21, 2008. The preliminary event location determined by the Nevada Seismological Laboratory was approximately 6 miles northeast of Wells at a depth of 4.2 miles. The earthquake has not been associated with a previously mapped fault (Nevada Seismological Laboratory 2008).

In addition to buildings (*e.g.,* operations office, maintenance shop, and plant facility), the waste rock disposal facility and heap leach facility are the only structural mine facilities proposed for the Emigrant Project that could be affected by seismic events. A recent study by Valera Geoconsultants (2004) consisted of a seismic hazard assessment of the proposed heap leach facility. Foundation soil and bedrock materials at the site were evaluated and determined to consist mostly of gravel, sand, silt and clay to depths up to 30 feet, with underlying bedrock composed of siltstone and shale that is highly fractured near the surface. The dense soil and soft bedrock conditions place the Emigrant Project area in Seismic Zones 2B and 3 of the 1997 Uniform Building Code (UBC 2000). Depth to groundwater beneath the proposed heap leach facility is approximately 120 feet in shallow perched alluvial deposits, and 420 to 650 feet in underlying bedrock.

The probability of earthquakes occurring that have magnitudes causing potential damage to a facility are on the order of 3 percent for the 14-year operational mine life (475-year return period) and 2 percent for the appropriate post-closure period (2,475-year return period). In addition to the heap leach facility, this analysis can be applied to the proposed waste rock disposal facility at the Emigrant site. In a study of seismic activity of the nearby Rain Mine area (2.5 miles west of Emigrant Project area), Call and Nicholas (1986) predicted a maxim acceleration of 0.4 g, with a recurrence interval of about 1,000 years.

Paleontological Resources

Exposures in Paleozoic stratigraphic units of the Project area are similar to those commonly found across Nevada and are not considered either unusual or unique. Noteworthy fossil resources are generally considered vertebrate fossils. Vertebrate fossils occur primarily in Tertiary- and Quaternary-age sediments, and invertebrate fossils are more common in Paleozoic-age sedimentary rocks. No important paleontological resources have been identified within the Project area.

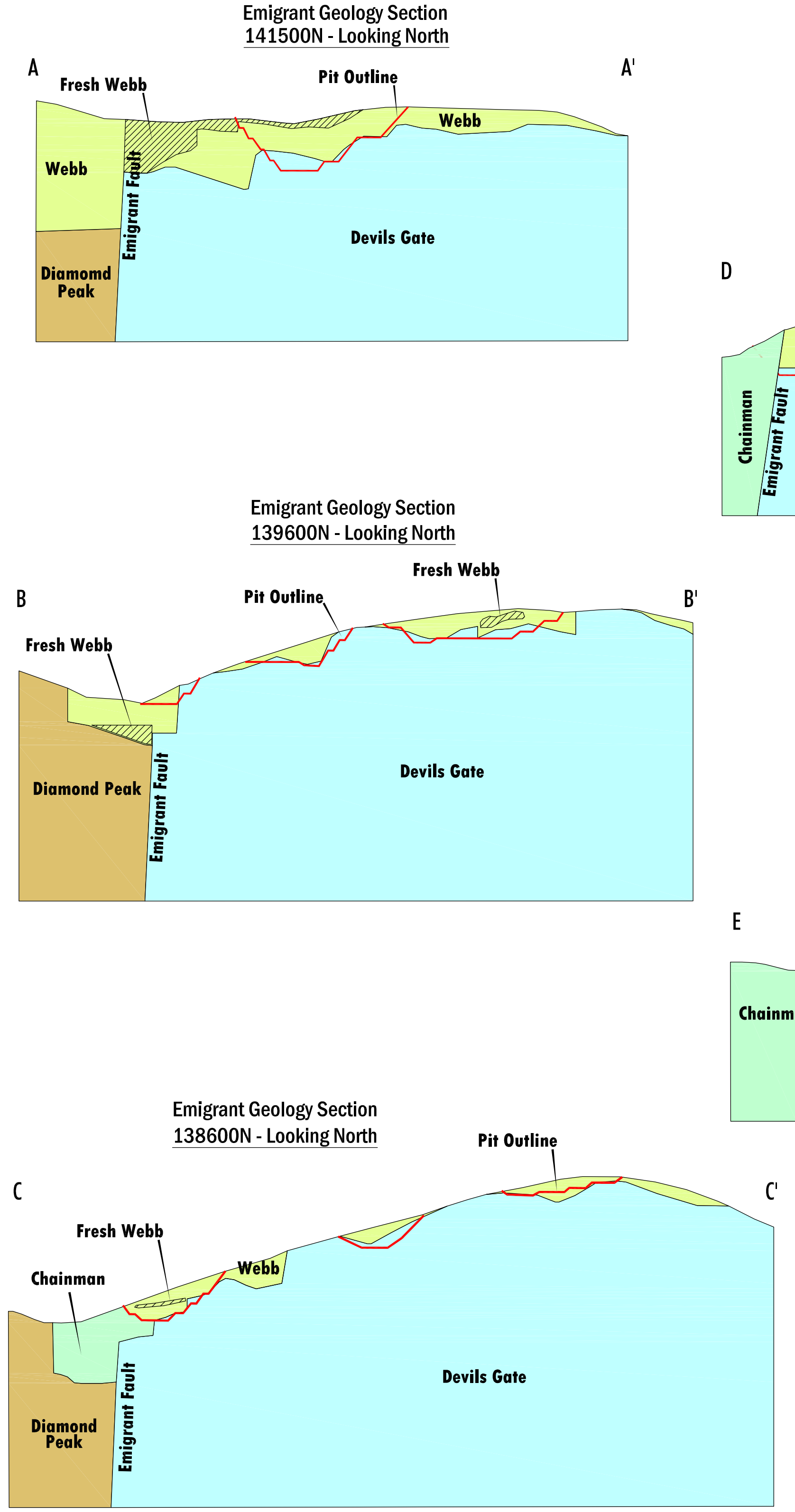
Waste Rock and Ore Characterization

Approximately 83Mt of waste rock and 92Mt of ore would be mined in the Emigrant Project area (see *Proposed Action* in Chapter 2). Based on site geology, waste rock that would be excavated has been divided into three general classifications: oxidized Webb siltstone; oxidized Devils Gate limestone (oxide carbonate); and unoxidized Chainman/Fresh Webb siltstone (carbon sulfur refractory). Most rock to be removed from the mine pit would be Webb siltstone (67% of waste rock and 76% of ore) and Devils Gate limestone (32% of waste rock and 21% of ore). The Chainman/Fresh Webb siltstone accounts for the remainder of the rock to be mined (1% of waste rock and 3% of ore).

For comparison, the nearby Rain Mine has the following percentages of waste rock types: oxidized Webb siltstone = 75 percent; oxidized Devils Gate limestone = 10 percent; and unoxidized Chainman/Fresh Webb siltstone = 15 percent (Harris 2005). The amount of unoxidized Chainman/Fresh Webb siltstone waste rock at the Rain Mine (15%) is greater than that expected for the Emigrant Mine (1%); the amount of Devils Gate limestone waste rock at Rain Mine (10%) is less than expected at Emigrant (32%). Overall mineralogical composition of the rock types at Rain Mine is similar to Emigrant, with the exception of higher barite content at Rain (Harris 2005).

Numerous ore and waste rock samples from the proposed mine pit area were evaluated by Newmont to identify minerals in rock at the Emigrant mine site (Newmont 2006b and 2006c) using x-ray diffraction (XRD) analysis. Quartz was identified as a constituent in all samples. Sericite, alunite, illite, barite, jarosite, and iron oxide are common constituents in most samples, indicating the rock has been hydrothermally altered and subsequently oxidized. Pyrite was detected in a minority of the samples. Carbonate minerals include calcite, dolomite, and siderite.

Various static and kinetic tests were performed on the primary rock types to characterize the potential to generate acid and/or mobilize metals from rock at the Emigrant Mine. These test types are summarized in **Table 3-2** and described in the following sections.



Note: See Figure 3-1 for Cross Section Locations

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Geologic Cross Sections
Emigrant Project
Elko County, Nevada
FIGURE 3-3

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Initial static testing was performed by Newmont in 2002, whereby 1,100 waste rock samples and 172 ore samples were collected from the proposed Emigrant mine pit area for characterization of potential acid generation (**Table 3-2**). These samples generally represented 20-ft bench composites from selected drill holes in the proposed mine pit area. Initial static testing consisted of acid-base accounting, which includes determination of neutralization potential, acidification potential, net neutralization potential, and net carbonate value (NCV).

In 2005-2006, Newmont performed supplemental static testing on 36 composite samples prepared by blending samples of similar acid generation potential classes within a respective waste rock type. Of the 36 total composite samples, 34 were accepted as valid tests (22 Webb siltstone samples, 10 Devils Gate limestone samples, and 2 Chainman/Fresh Webb siltstone samples). Two of the samples were not properly prepared. Of the 34 composite samples, 18 represent waste rock and 16 are ore samples. Supplemental testing included static tests [Acid-base Accounting; Peroxide Acid Generation (Net Acid Generating); and Meteoric Water Mobility Procedure], and kinetic tests (Humidity Cell and Biological Acid Production Potential tests). Paste pH measurements were also taken on oxidized samples undergoing Humidity Cell testing.

TABLE 3-2
Initial and Supplemental Static and Kinetic Tests
Emigrant Project

Testing Method	Rock Type	Number of Samples Tested
INITIAL STATIC TESTING (2002)		
Acid-base Accounting (NP:AP, NNP, NCV)	Chainman/Fresh Webb siltstone; Devils Gate limestone; Webb siltstone	1,100 waste rock
		172 ore
		Total = 1,272 samples
SUPPLEMENTAL STATIC TESTING (2005-2006)		
Acid-base Accounting (NP:AP, NNP, NCV, paste pH)	Chainman/Fresh Webb siltstone	1 waste rock + 1 ore
	Devils Gate limestone	6 waste rock + 4 ore
	Webb siltstone	11 waste rock + 4 ore
		Total = 27 samples
Meteoric Water Mobility Procedure	Chainman/Fresh Webb siltstone	1 waste rock + 1 ore
	Devils Gate limestone	4 waste rock + 3 ore
	Webb siltstone	8 waste rock + 10 ore
		Total = 27 samples
Peroxide Acid Generation (Net Acid Generating)	Chainman/Fresh Webb siltstone	1 waste rock + 1 ore
	Devils Gate limestone	4 waste rock + 2 ore
	Webb siltstone	11 waste rock + 11 ore
		Total = 30 samples
SUPPLEMENTAL KINETIC TESTING (2005-2006)		
Humidity Cells	Chainman/Fresh Webb siltstone	1 waste rock + 1 ore
	Webb siltstone	6 waste rock + 7 ore
		Total = 15 samples
Biological Acid Production Potential	Chainman/Fresh Webb siltstone	1 waste rock + 1 ore
	Devils Gate limestone	4 waste rock + 2 ore
	Webb siltstone	11 waste rock + 11 ore
		Total = 30 samples

TABLE 3-2
Initial and Supplemental Static and Kinetic Tests
Emigrant Project

Testing Method	Rock Type	Number of Samples Tested
METAL MOBILITY TESTING (Initial[2002]and Supplemental [2005-2006])		
Meteoric Water Mobility Procedure	Chainman/Fresh Webb siltstone	3 waste rock + 1 ore
	Devils Gate limestone	6 waste rock + 3 ore
	Webb siltstone	10 waste rock + 10 ore
	Run-of-Mine	1 waste rock
		Total = 34 samples
Humidity Cells	Chainman/Fresh Webb siltstone	1 waste rock + 1 ore
	Webb siltstone	6 waste rock + 7 ore
		Total = 15 samples
ADDITIONAL STATIC TESTING (2008)		
NCV and Paste pH	Representative Composite Samples of Waste Rock and Ore	Total = 1,271 samples

Note: NP = Neutralization Potential; AP = Acidification Potential; NNP = Net Neutralization Potential; NCV = Net Carbonate Value. The paste pH tests performed in 2005-2006 were conducted only on those samples subject to Humidity Cell testing.
Source: Tetra Tech 2007; Environmental Resources Management 2006; Newmont 2008a.

During the 2005-2006 testing, a geochemical review team noted that some samples with NCV values between 0.0 and 0.30 percent CO_2 produced acid during static and/or kinetic testing contrary to the NCV classification (see **Table 3-3** for NCV classification). As a result, the geochemical review team recommended that the break between acid generating and acid neutralizing NCV values should be established at 0.30 percent CO_2, rather than the standard -0.1 percent CO_2 classification (Tetra Tech 2007). Conflicting NCV and Biological Acid Production Potential test data indicated presence of active acidity from non-sulfide minerals (*e.g.*, jarosite).

The geochemical review team recommended that combining the NCV test with Acid Concentration Present Low Range titrations (Newmont 2003) may resolve uncertainty in the lower NCV range and allow the acid generating NCV cutoff to be lowered based on the data set (Tetra Tech 2007). Based on these recommendations, Newmont (2008a) conducted another study in 2008 that evaluated Paste pH and NCV of 1,271 composite samples from oxide and ore material collected from within the proposed Emigrant mine pit. Paste pH is similar to Acid Concentration Present Low Range testing except it involves one less step to complete the test. Results of these tests are described below.

Acid Generation Potential

Static Test Methods

Static Acid-base Accounting (ABA) testing is typically performed as an initial analysis to determine the potential for rock samples to generate acid. Representative waste rock and ore samples are subjected to laboratory analysis of carbon fractions (total, organic, and carbonate carbon) and sulfur fractions (total, sulfate, and sulfide sulfur). From these results, the following values are calculated: Neutralization Potential (NP); Acidification Potential (AP); Net Neutralization Potential (NNP); and Net Carbonate Value (NCV).

TABLE 3-3
Criteria Used to Determine Acid Generating Potential
Emigrant Project

Classification for Acid Generation Potential	Criteria for Classification
Acid-Base Accounting	
Potentially Acid Generating	NP:AP < 1 and NNP < -20
Uncertain Acid Generation Potential	NP:AP between 1 and 3 and/or NNP between -20 and +20
Unlikely to Generate Acid	NP:AP > 3 and NNP > +20
Net Carbonate Value (NCV)[1]	
Highly Acidic	NCV ≤ -5
Acidic	-5 < NCV ≤ -1
Slightly Acidic	-1 < NCV ≤ -0.1
Neutral	-0.1 < NCV < 0.1 and (NP ≥ 0.1 or AP ≤ -0.1)
Inert	-0.1< NCV < 0.1 and (NP < 0.1 or AP > -0.1)
Slightly Basic	0.1 ≤ NCV < 1
Basic	1 ≤ NCV < 5
Highly Basic	NCV ≥ 5
Recommended Field Classification for Emigrant Project	
Potentially Acid Generating	NCV > 0.0 and paste pH < 6.0; or NCV < 0.0

[1] Newmont 2003 (also ASTM E-1915-05).
NCV = Net Carbonate Value (%CO_2); NP = Neutralization Potential; AP = Acidification Potential; NNP = Net Neutralization Potential
Source: BLM 1996; USEPA 1994; Newmont 2008a.

Initial characterization uses Net Neutralization Potential values (NNP = NP – AP) and the ratio NP:AP to evaluate potential for acid generation from the various rock types. Criteria used to characterize acid generation potential using these values are presented in **Table 3-3**; these criteria were developed by BLM (1996) and USEPA (1994). When NP or AP values are low, NP:AP ratios become erratic and may incorrectly predict acid generation potential (Tetra Tech 2007). This condition typically occurs when sulfide concentrations in the sample are very low.

In addition to the NP:AP ratio and NNP-based criteria, Newmont (2003) developed NCV criteria for evaluating potential for rock to generate acid (NCV as %CO_2 = NP + AP). These criteria are presented in **Table 3-3**. The NCV method is approved as an accepted standard method of analysis (ASTM E1915-05, Standard Test Methods for Analysis of Metal Bearing Ores and Related Materials by Combustion Infrared Adsorption Spectrometry) (Bucknam 2005). NCV results are evaluated in combination with other static and kinetic data. Samples classified as "neutral" can contain both carbonates and sulfides, but adequate carbonate is present to neutralize any acidity. Samples classified as "inert" lack substantial carbonates and sulfides.

The NCV method typically is applied in the field during operations to determine final disposition of waste rock at the mine site. Every third blast hole is analyzed for NCV; if results show potential for acid generation, this rock volume would be encapsulated in rock that provides neutralization potential (Newmont 2007a).

Other static tests performed to assist in evaluation of acid generation potential include Paste pH, Meteoric Water Mobility Procedure, and Peroxide Acid Generation (Net Acid Generating) testing. Paste pH testing follows the American Testing of Agronomy (ASA Monograph 9 method). Titration of NaOH required in the Acid Concentration Present Low Range test method was not included because lime addition to neutralize potentially acid generating rock is not proposed for the Emigrant Project. The Meteoric Water Mobility Procedure test was developed by NDEP and standardized as ASTM E2242-02.

Kinetic Test Methods

Samples falling into the "uncertain" category from Acid-base Accounting tests are typically subjected to kinetic testing methods to evaluate whether the samples or rock types would generate acid over an extended period of weathering. Kinetic testing is also used to confirm NCV results where samples are shown to have potential for acid generation. Kinetic test methods included Humidity Cell tests (ASTM D5744-96) and Biological Acid Production Potential.

Descriptions of the supplemental test methods are included in the following two reports: *Supplemental Geochemical Data for Environmental Impact Statement. Emigrant Project Elko, Nevada* (ERM 2006) and *Final Evaluation of Geochemical Data for the Emigrant Mine Project EIS* (Tetra Tech 2007). Additional references for the supplemental test include McClelland Laboratories, Inc. (2006a, 2006b); Little Bear Laboratories, Inc. (2006), and Newmont (2006b, 2006c, 2006d, 2006e).

Initial Test Results

As described previously, initial static tests were performed on 1,100 waste rock and 172 ore samples from the Emigrant site (**Table 3-2**). Average or mean results of initial ABA tests are shown in **Table 3-4**. The average NP:AP ratios and NNP values show that the Devils Gate limestone is unlikely to generate acid. In contrast, Chainman/Fresh Webb siltstone (unoxidized carbon sulfur refractory) has potential to generate acid. Oxidized Webb siltstone exhibits uncertainty with respect to acid generation potential, primarily based on the NNP values. Graphs of NP:AP values for the waste rock and ore samples are presented as **Figure B-1** in **Appendix B**.

Average NCV results for waste rock and ore samples collected in 2002 are included in **Table 3-4**. Results of NCV analyses and classification schemes show that Webb siltstone is slightly basic, Devils Gate limestone is highly basic, and Chainman/Fresh Webb siltstone is slightly acidic to acidic. These results generally coincide with the average NP:AP ratios and NNP values, except that the Webb siltstone exhibits some uncertainty for acid generation potential.

NCV criteria were developed to address samples showing "uncertain" acid generation potential, or some level of "potentially acid generating" using NP:AP criteria. Such samples can exhibit NP:AP and NNP values that indicate potential for acid generation, despite an absence of acid-generating sulfide minerals. The relationship between NP:AP and NCV-based classification schemes for Emigrant waste rock samples with a NP:AP ratio of less than 10 is presented as **Figure B-2** in **Appendix B**. This cut-off excludes Devils Gate limestone samples which have large NP:AP ratios. **Figure B-2** shows that for the portion of Webb siltstone samples having NP:AP ratios in the "uncertain" and "potentially acid generating" categories, NCV results are "inert" or "neutral".

TABLE 3-4
Initial Acid-base Accounting Data for Waste Rock and Ore Static Testing in 2002
Emigrant Project

Formation	Average or Mean Values[2]										
	Total Carbon %	**Organic Carbon %**	**Carbonate Carbon %**	**Total Sulfur %**	**Sulfate Sulfur %**	**Sulfide Sulfur %**	**NP[1]**	**AP[1]**	**NP : AP**	**NNP[1] (tons/kton $CaCO_3$)**	**NCV[1]**
Waste Rock (1,100 samples)											
Chainman/ Fresh Webb Siltstone	0.7	0.6	0.03	1.336	0.385	0.951	0.1	-1.3	**0.1**	**-27.4**	**-1.2**
Devils Gate Limestone	5.9714	0.1604	5.8111	0.2989	0.2284	0.0705	21.3	-0.1	221	481.9	21.2
Webb Siltstone	0.2317	0.1917	0.0400	0.3338	0.3152	0.0186	0.1	0.0	5.8	2.8 (U)	0.1
Ore (172 samples)											
Chainman/ Fresh Webb Siltstone	0.3269	0.3204	0.0065	1.4451	0.8642	0.5809	0.0	-0.8	**0.0**	**-17.5**	**-0.8**
Devils Gate Limestone	4.3357	0.1090	4.2267	0.4063	0.3797	0.0266	15.5	0.0	424	351.3	15.5
Webb Siltstone	0.1831	0.1399	0.0432	0.7577	0.7376	0.0201	0.2	0.0	5.7	3.0 (U)	0.2

[1] NP = neutralization potential; AP = acidification potential; NNP = net neutralization potential; kton = kiloton; NCV = net carbonate value (%CO_2). Note: shaded & bolded cell indicates acid generating potential; bolded (U) value indicates uncertain acid generating potential.

[2] Run-of-mine averages based on tonnages reported in Chapter 2. Carbon and sulfur fractions were analyzed by laboratory for each rock sample; NP, AP, NNP, and NCV values are calculated.

Source: Newmont 2005b.

Average sulfide sulfur percentages determined from initial Acid-base Accounting tests are less than 0.1 percent for Devils Gate limestone and Webb siltstone samples (**Table 3-4**). These values indicate that these rock types have little or no potential to generate acid. Average sulfide sulfur for the Chainman/Fresh Webb siltstone is 0.5 to 1.0 percent, which indicates a greater potential for acid generation.

Supplemental Test Results

To confirm initial static test results from 2002, supplementary geochemical testing was conducted in 2005-2006 (**Table 3-2**), including static and kinetic tests, with a focus on composite samples of oxidized Webb siltstone; the rock type at Emigrant that exhibited test results indicating uncertain potential to generate acid based on NNP calculations (Newmont 2006f). Initial static test results showed Devils Gate limestone as acid neutralizing and Chainman/Fresh Webb siltstone as acid generating. Results of supplemental static and kinetic tests with respect to potential to generate acid are summarized in **Table 3-5** (ERM 2006; Tetra Tech 2007).

TABLE 3-5 Supplemental Test Results for Waste Rock and Ore Static and Kinetic Testing in 2005-2006 Emigrant Project								
Composite Sample[1] No.	**Rock Type[1]**	**Tests That Indicate Potential to Generate Acid[2]**						
		Static Tests[3]					**Kinetic Tests[3]**	
		NP:AP	**NNP ($TCaCO_3$/k)**	**NCV (%CO_2)**	**MWMP (delta pH)**	**Peroxide Acid Generation (final pH)**	**Humidity Cell (final pH)**	**BAPP (final pH)**
Waste Rock Samples								
1-pulp	C/FW	**0.40:1**	**-22.2**	**-0.54**	+3.4	**2.86**	7.25	**3.18**
3-pulp	DG	3.55:1	48.0	3.52	---	10.41	---	7.36
4-pulp	DG	41.46:1	52.7	2.49	---	10.16	---	7.35
5-pulp	W	4.54:1	17.7	2.81	---	6.7	---	4.08
6-pulp	W	**0.95:1**	-0.3	0.77	---	8.28	---	3.71
16-pulp	W	29.83:1	17.3	0.8	---	10.8	---	5.71
34-reject	W	**0.80:1**	-1.1	0.31	7.27	7.8	6.45	3.7
35-reject	W	**0.13:1**	-6.5	0.15	8.05	6.38	6.27	**3.47**
36-reject	W	**<0.06:1**	-5.3	0.1	6.29	6.3	5.37	**3.35**
37-reject	W	2.32:1	2.9	0.3	7.81	7.45	5.97	3.59
38-reject	W	**<0.04:1**	-7.2	0.11	**4.55**	**4.37**	**4.98**	**3.18**
39-reject	W	**<0.16:1**	-1.9	0.28	**4.63**	6.14	---	3.65
44-reject	DG	3.86:1	20.6	0.97	7.71	9.37	---	4.9
45-reject	DG	2413:1	724	31.83	7.92	---	---	---
46-reject	DG	>2153:1	646	29.25	7.87	---	---	---
47-reject	DG	2.91:1	14.9	1.8	7.52	8.36	---	5.39
48-reject	W	1.73:1	9.6	0.6	7.99	7.81	5.83	5.85
49-reject	W	6.23:1	6.8	0.39	8.03	9.54	---	4.05
Ore Samples								
17-pulp	C/FW	**<0.01:1**	**-38.8**	**-0.22**	**4.08**	**3.09**	**2.91**	**2.15**
18-pulp	DG	6.25:1	83.4	5.05	---	11.09	---	7.99
20-pulp	W	2.02:1	5.4	0.57	---	8.22	---	4.31
21-pulp	W	**<0.01:1**	**-36.9**	0.61	6.59	**3.31**	**4.14**	**2.93**
25-reject	W	>1.67:1	0.5	0	6.65	5.47	6.73	**3.32**
26-reject	W	**0.24:1**	-3.1	0	7.31	6.16	6.71	**3.27**
27-reject	W	**<0.03:1**	-10.0	0.07	7.33	5.45	---	**3.4**
28-reject	W	**0.90:1**	-0.5	0	7.26	7.44	---	3.59
29-reject	W	9.33:1	5.0	0.03	7.57	9.51	6.76	3.74
30-reject	W	**0.24:1**	-4.8	0.11	7.32	7.49	6.5	3.63
31-reject	W	1.40:1	1.0	0	7.5	7.16	---	3.91
32-reject	W	**0.21:1**	-7.4	0	7.08	7.21	6.42	3.71
33-reject	W	**0.26:1**	-1.4	0.14	5.98	6.85	6.1	3.63
41-reject	DG	3.61:1	7.3	0.81	7.0	10.12	---	5.13
42-reject	DG	>1093:1	328.0	14.99	7.88	---	---	---
43-reject	DG	>1313:1	394.0	17.95	7.19	---	---	---

[1] Composite sample 22 not included because it was collected from outside the proposed mine pit area; sample 40 not included because it was prepared with a combination of both Webb and Fresh Webb siltstone. C/FW = Chainman/Fresh Webb siltstone; DG = Devils Gate limestone; W = Webb siltstone. [2] Shaded & bolded cell = acid generating potential.

[3] NP = Neutralization Potential; AP = Acidification Potential; NNP = Net Neutralization Potential; NCV = Net Carbonate Value; MWMP = Meteoric Water Mobility Procedure; BAPP = Biological Acid Production Potential; $TCaCO_3$/k = tons calcium carbonate per kiloton; %CO_2 = percent carbon dioxide. "---" = not tested.

Source: Tetra Tech 2007; ERM 2006; Little Bear Laboratories 2006; McClelland Laboratories 2006a, 2006b; Newmont 2006b,c,d,e.

Acid-Base Accounting Static Testing

Acid-base Accounting test values for NP:AP, NNP, and NCV indicate the following with respect to acid generation potential for the 34 composite samples of waste rock and ore:

- NP:AP = 15 samples "potentially acid generating" (two Chainman/Fresh Webb siltstone; 13 Webb siltstone); sulfide sulfur content for these samples ranged from 0.06 to 1.24 percent by weight.
- NNP = three samples "potentially acid generating" (two Chainman/Fresh Webb siltstone; one Webb siltstone).
- NCV = three samples "slightly acidic" (two Chainman/Fresh Webb siltstone; one Webb siltstone).
- NP:AP = six samples "uncertain" acid generation potential (five Webb siltstone; one Devils Gate limestone).
- NNP = 23 samples "uncertain" acid generation potential (21 Webb siltstone; two Devils Gate limestone).
- NCV = seven samples "inert" (all Webb siltstone).

The NP:AP results indicate more samples as potentially acid generating compared to the NNP and NCV values. With the exception of one sample, NNP and NCV values are in agreement with respect to classifying the samples as potentially acid generating. NNP values indicate more samples in the "uncertain" classification. The NCV classifications are inert or basic for rock samples with low sulfide concentrations and are classified by NP:AP ratios and/or NNP values as "uncertain" or "potentially acid generating."

Meteoric Water Mobility Procedure Static Testing

Of the 27 Meteoric Water Mobility Procedure tests, three indicated a reduction in pH when comparing the initial pH to the final extract pH (implies potentially acid generating). One of these samples is Chainman/Fresh Webb siltstone, and the other two are Webb siltstone. The other Chainman/Fresh Webb siltstone sample that did not show a reduction in pH showed potentially acid generating conditions for most of the other supplemental static and kinetic tests (Newmont 2005a).

Peroxide Acid Generation Static Testing

Four of the 30 samples subject to peroxide acid generation testing indicated acid producing potential. Two of these are the Chainman/Fresh Webb siltstone samples, and the other two are Webb siltstone. Three out of the four samples coincide with acid generation potential determinations from NCV numbers (Newmont 2005a).

Humidity Cell Kinetic Testing

Humidity Cell tests were performed on two Chainman/Fresh Webb siltstone samples and 13 Webb siltstone samples. Results of these tests show that one of the Chainman/Fresh Webb samples (ore) is acid producing, along with two Webb siltstone samples (waste rock and ore) (Newmont 2005a).

Biological Acid Production Potential Kinetic Testing

Of the 30 samples subject to Biological Acid Production Potential testing, two were from Chainman/Fresh Webb siltstone, six were from Devils Gate limestone, and 22 were from Webb siltstone. Results show that the two

Chainman/Fresh Webb and seven of the Webb siltstone samples are acid producing (Newmont 2005a).

Comparison of Initial and Supplemental Test Results

Supplemental test results were in general agreement with the original static test results, although some inconsistencies were observed (Tetra Tech 2007). Both Chainman/Fresh Webb siltstone samples are classified as "slightly acidic" based on NCV values. With the exception of one Humidity Cell test, and one Meteoric Water Mobility Procedure test, all supplemental static and kinetic tests confirmed acid generation potential from this rock type. The discrepancy Humidity Cell test, however, indicates a trend of increasing acidity near the end of the test (Tetra Tech 2007). With the exception of one NNP value, all initial and supplemental Devils Gate limestone samples indicate no potential to generate acid.

Initial static tests indicate some uncertainty with respect to potential to generate acid for the Webb siltstone samples. Most supplemental static tests (total of six types of tests or calculations) indicate that the Webb siltstone has little or no potential to generate acid. However, NP:AP ratios for the supplemental tests indicate approximately half the samples have some acid generation potential. NNP values for the supplemental tests show that the majority of Webb siltstone samples (21 of 22 samples) have an uncertain potential to generate acid. Only one of the NCV tests for the supplemental Webb siltstone samples indicated acid generation potential.

Two of the supplemental Webb siltstone samples (#38-waste rock reject and #21-ore pulp) had four or more of the six static tests or calculations showing acid generation potential.

The other 20 Webb siltstone samples show inconsistent static test results with respect to acid generation potential.

Seven Webb siltstone samples indicated some potential for acid generation (three waste rock and four ore samples) as a result of supplemental kinetic testing. Of the seven samples, two were confirmed from Humidity Cell tests and all seven were confirmed from Biological Acid Production Potential tests. All seven of these supplemental kinetic test samples also were classified as potentially acid generating by one or more of the static tests.

Tetra Tech (2007) concluded that many of the composite samples classified as "potentially acid generating" or "uncertain" based solely on acid-base account data, which is used as guidance by regulatory agencies, did not generate acid in other static or kinetic tests, including 20-week Humidity Cell testing. Approximately 75 percent of the rock originally identified as having an uncertain potential to generate acid is shown to be unlikely to generate acid in the supplemental test results. These data support the site-specific use of NCV classification as an alternative means of identifying PAG and Non-PAG materials during mine operations (see ASTM 1915-05). However, certain static and kinetic test results from 2002 and 2005-2006 conflict for samples with NCV classifications between -0.1 and 0.15 percent CO_2.

Tetra Tech (2007) also noted that conflicting NCV and Biological Acid Production Potential data suggest the presence of active acidity from the presence of non-sulfide minerals. As a result, Tetra Tech (2007) recommended combining the NCV test with Acid Concentration Present Low Range titration testing to see if this would resolve the uncertainty in the lower NCV range which may allow lowering of the cutoff for PAG waste rock to be determined in the field.

Additional NCV and Paste pH Test Results

In 2008, Newmont (2008a) prepared an additional 1,271 composite samples of waste rock and ore to be analyzed for NCV and Paste pH. NCV modeling was completed by Newmont for these samples, along with previous NCV results. When the NCV data are plotted against the Paste pH data for the 1,271 samples analyzed in 2008, the largest grouping for proposed Non-PAG designation of Emigrant rock is when NCV > 0.0 and Paste pH > 6.0 (Newmont 2008a). Newmont (2008a) further compared the NCV and Paste pH values for the 16 samples subjected to Humidity Cell testing from the 2005-2006 supplemental testing. Based on these results, there was a high predictive accuracy using a combination of NCV and Paste pH results, compared to the Humidity Cell test predictions. This relationship for designating PAG rock occurs with the following: [NCV <0.0% CO_2] or [NCV ≥ 0.0% CO_2 and Paste pH < 6.0]. These criteria are included in **Table 3-3**. A summary comparison of the 16 Paste pH, NCV, and Humidity Cell results, along with other previous static and kinetic test results, is presented in **Table 3-6**. Based on the new NCV and Paste pH classification criteria identified above, total tons of PAG waste rock associated with the proposed Emigrant Project is approximately 4 million tons, or 4.9 percent of total waste rock.

A total of 13 waste rock samples (1 Chainman/Fresh Webb siltstone, 8 Webb siltstone, and 4 Devils Gate limestone samples) and 14 ore samples (1 Chainman/Fresh Webb siltstone, 10 Webb siltstone, and 3 Devils Gate limestone samples) were subject to Meteoric Water Mobility Procedure testing as part of the 2005-2006 supplemental testing program. An additional seven composite waste rock samples (2 Chainman/Fresh Webb, 2 Devils Gate, 2 Webb, and 1 run-of-mine composite) prepared in 1995, 1997, and 2002 during exploration drilling were subject to Meteoric Water Mobility Procedure testing (Tetra Tech 2007; Newmont 2005a). The 1995-1997 waste rock samples were composites based on a preliminary mine plan that focused exploration drilling in what is now the southern portion of the proposed Emigrant pit.

Results of metal concentrations and other constituents from waste rock and ore samples are compared to NDEP Profile I reference values for Meteoric Water Mobility Procedure testing (**Table 3-7**). Profile I reference values typically are the same as federal drinking water standards. NDEP Profile I reference values are used for comparison purposes because no releases are expected from waste rock and ore to surface water. Therefore, Profile I values are most applicable for groundwater which could be affected by seepage from some mine facilities.

Meteoric Water Mobility Procedure test results show that the Chainman/Fresh Webb siltstone samples for waste rock exceeded NDEP Profile 1 reference values for antimony, arsenic, lead, manganese, nickel, selenium, thallium, zinc, pH, fluoride, and sulfate (**Table 3-7**). The Devils Gate limestone waste rock samples exceeded NDEP Profile 1 reference values for antimony, arsenic, cadmium, manganese, mercury, selenium, thallium, and sulfate. The Webb siltstone waste rock samples exceeded NDEP reference values for antimony, arsenic, manganese, nickel, selenium, thallium, and sulfate. The 1997 waste rock sample exceeded the reference value for antimony and arsenic.

TABLE 3-6
Comparison of Humidity Cell and Paste pH Test Results with Other Tests for Waste Rock and Ore
Emigrant Project

Composite Sample No.	Rock Type[1]	Tests That Indicate Potential to Generate Acid[2]							
		Static Tests[3]						Kinetic Tests[3]	
		NP:AP	NNP	NCV	MWMP	Peroxide Acid Generation	Paste pH	Humidity Cell	BAPP
Waste Rock Samples									
1-pulp	C/FW	**Y**	**Y**	**Y**	N	**Y**	N	N	**Y**
34-reject	W	**Y**	U	N	N	N	N	N	N
35-reject	W	**Y**	U	N	N	N	N	N	**Y**
36-reject	W	**Y**	U	N	N	N	**Y**	N	**Y**
37-reject	W	U	U	N	N	N	N	N	N
38-reject	W	**Y**	U	N	**Y**	**Y**	**Y**	**Y**	**Y**
40-reject	W/FW	**Y**	U	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
48-reject	W	U	U	N	N	N	N	N	N
Ore Samples									
17-pulp	C/FW	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
21-pulp	W	**Y**	**Y**	N	N	**Y**	**Y**	**Y**	**Y**
25-reject	W	U	U	N	N	N	N	N	**Y**
26-reject	W	**Y**	U	N	N	N	N	N	**Y**
29-reject	W	N	U	N	N	N	N	N	N
30-reject	W	**Y**	U	N	N	N	N	N	N
32-reject	W	**Y**	U	N	N	N	N	N	N
33-reject	W	**Y**	U	N	N	N	N	N	N

1 C/FW = Chainman/Fresh Webb siltstone; W = Webb siltstone.

2 Bolded "Y" = Yes for acid generating potential; "N" = No for acid generation potential; "U" = uncertain acid generation potential. Only those "Y" cells are shaded in the rows that have "Y" for Humidity Cell tests.

The following criteria are used to determine "Y", "N", and "U":

NP:AP --- "Y" <1; "N" > 3; "U" ≥ 1 and ≤ 3.
NNP --- "Y" < -20; "N" > +20; "U" ≥ -20 and ≤ +20.
NCV --- "Y" < 0.0; "N" ≥ 0.0.
MWMP --- If MWMP extract pH is less than initial pH, then "Y".
Peroxide Acid Generation --- "Y" <4.5; "N" ≥ 4.5.
Paste pH --- "Y" < 6.0; "N" ≥ 6.0.
Humidity Cell --- "Y" < 5.0; "N" ≥ 5.0.
BAPP --- "Y" < 3.5; "N" ≥ 3.5.

3 NP = Neutralization Potential; AP = Acidification Potential; NNP = Net Neutralization Potential as tons calcium carbonate per kiloton; NCV = Net Carbonate Value as %CO_2; MWMP = Meteoric Water Mobility Procedure; BAPP = Biological Acid Production Potential.

Source: Tetra Tech 2007; Newmont 2008a.

TABLE 3-7
Metal Mobility Results for Waste Rock and Ore Samples from Meteoric Water Mobility Procedure Tests
Emigrant Project

Chemical Parameter	NDEP Profile I Ref. Value	Concentrations of Parameters from Meteoric Water Mobility Procedure Tests that Exceed NDEP Profile I Reference Values									
		Chainman/ Fresh Webb Siltstone			Devils Gate Limestone			Webb Siltstone			1997 Waste Rock
		1995 & 2002 Waste Rock	2005 & 2006 Waste Rock	2005 & 2006 Ore	1995 & 2002 Waste Rock	2005 & 2006 Waste Rock	2005 & 2006 Ore	1995 & 2002 Waste Rock	2005 & 2006 Waste Rock	2005 & 2006 Ore	
Aluminum	0.2			59			0.059				
Antimony	0.006	0.014-0.063	0.015	0.018	0.163	0.007-0.048	0.019-0.057	0.018	0.0066-0.0069	0.0068-0.0456	0.008
Arsenic	0.01	0.026-0.06	0.026	0.081	0.039	0.0203-0.0562	0.0284-0.0871	0.114	0.0158-0.103	0.0126-0.111	0.07
Cadmium	0.005			0.022		0.00847					
Chromium	0.1			0.132							
Iron	0.6			77							
Lead	0.015	0.05									
Manganese	0.1	5.85	3.66	29.7		1.05			3.7-5.7	0.131-16.5	
Mercury	0.002					0.00245	0.0029			0.0028-0.0067	
Nickel	0.1	3.64	0.393	4.15					0.265-0.478	0.842-1.81	
Selenium	0.05	0.1	0.17			0.0617			0.0597-0.0902		
Thallium	0.002	0.232	0.0022	0.0127		0.0022	0.0037		0.0024	0.00204-0.0263	
Zinc	5.0	5.16		5.12							
pH	6.5 – 8.5	6.4		4.1							
Fluoride	4.0	NA	4.3	6.6	NA			NA			NA
Sulfate	500		1650	2320		526			856	805-1520	

Note:
Concentrations in milligrams per liter (mg/L), except pH in standard units. NA = not analyzed. This table shows only those chemical parameters and concentrations that exceed the Nevada Division of Environmental Protection (NDEP) Profile I reference values; if more than one sample result exceeded a reference value, the range in exceedence is shown. NDEP Profile I Reference Values are used for comparison purposes because no releases to surface water are expected from the waste rock and/or ore. Therefore, the Profile I values are most applicable for evaluating potential impacts to groundwater. The NDEP Profile I Reference Values (version 09/20/09) are from Bruce Holmgren at NDEP (bholmgre@ndep.nv.gov) emailed on 01/05/10.
For the 2005-2006 waste rock data set, composite samples 38 and 39 (Webb siltstone) and sample 40 (Fresh Webb siltstone) were not used for this table due to compositing problems (see Tetra Tech 2007).
Source: Tetra Tech 2007.

Meteoric Water Mobility Procedure test results for ore samples show that the Chainman/Fresh Webb siltstone samples exceeded NDEP Profile I reference values for aluminum, antimony, arsenic, cadmium, chromium, iron, manganese, nickel, thallium, zinc, pH, fluoride, and sulfate (**Table 3-7**). The Devils Gate limestone ore samples exceeded NDEP Profile I reference values for aluminum, antimony, arsenic, mercury, and thallium. The Webb siltstone ore samples exceeded NDEP reference values for arsenic, antimony, manganese, mercury, nickel, thallium, and sulfate.

In general, Humidity Cell leachate samples collected during 20 weeks of testing show that fewer constituents exceeded NDEP Profile I reference values than were measured in Meteoric Water Mobility Procedure samples (**Tables 3-7** and **3-8**). Constituents for which reference values were most commonly exceeded in waste rock and ore Humidity Cell tests included aluminum, arsenic, manganese, nickel, and pH. Other constituents, including antimony, cadmium, chromium, iron, and thallium occasionally exceeded NDEP Profile I reference values in the leachate samples. Constituent mobility generally was higher for potentially acid producing samples.

TABLE 3-8
Metal Mobility Results for Waste Rock and Ore Samples from Humidity Cell Tests
Emigrant Project

Chemical Parameter	NDEP Profile I Reference Value	Concentrations of Parameters from Humidity Cell Tests that Exceed NDEP Profile I Reference Values			
		Chainman/Fresh Webb Siltstone		Webb Siltstone	
		Waste Rock	Ore	Waste Rock	Ore
Aluminum	0.2		9.2 – 21.2		0.222 – 0.641
Antimony	0.006				0.0068
Arsenic	0.01	0.043 – 0.053	0.019 – 0.102	0.013 – 0.099	0.011 – 0.119
Beryllium	0.004				
Cadmium	0.005		0.007 – 0.009		
Chromium	0.1		0.24 – 0.91		
Iron	0.6		4.1 – 32.1		
Lead	0.015				
Manganese	0.1	0.12 – 0.17	0.17 – 7.1	0.11 – 2.76	0.13 – 2.78
Mercury	0.002				
Nickel	0.1		0.125 – 0.855		0.131 – 0.197
Selenium	0.05				
Thallium	0.002				0.0039 – 0.0068
Zinc	5.0				
pH	6.5 – 8.5	5.8 – 5.9	2.8 – 3.8	6.0 – 6.5	4.5 – 6.5
Fluoride	4.0				
Sulfate	500				

Note:
Concentrations in milligrams per liter (mg/L), except pH in standard units. This table shows only those chemical parameters and concentrations that exceed the Nevada Division of Environmental Protection (NDEP) Profile I reference values; if more than one sample result exceeded a reference value, the range in exceedences is shown. NDEP Profile I Reference Values are used for comparison purposes because no releases to surface water are expected from the waste rock and/or ore. Therefore, the Profile I values are most applicable for evaluating potential impacts to groundwater. The NDEP Profile I Reference Values (version 09/20/09) are from Bruce Holmgren at NDEP (bholmgre@ndep.nv.gov) emailed on 01/05/10.
Samples from Humidity Cell tests were collected for the following periods: weeks 1-5; weeks 6-10; weeks 11-15; and weeks 16-20. Composite sample 38 (Webb siltstone) and sample 40 (Fresh Webb siltstone) were not used for this table due to compositing problems (see Tetra Tech 2007).
Source: Tetra Tech 2007.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Geology

Implementation of the Proposed Action would include excavating and relocating waste rock, processing ore, and removing gold from the ore rock. The principal direct effect of mining is removing rock from the natural setting and placing this rock at other locations (*i.e*., waste rock disposal facility and leach pad), and creation of open mine pits. Ultimately, mining would result in the extraction and relocation of approximately 83Mt of waste rock and 92Mt of ore rock. Mining operations are expected to remove all recoverable mineral resources based on available technology and at current or reasonably foreseeable gold prices. Open pit mining would cause modification of existing topography. Backfilling the open pits (see *Proposed Action* in Chapter 2) and using natural regrade techniques would eventually restore most of the mine pit to blend with surrounding topography.

Areas of no potential economic value in the Project area are usually identified by condemnation drilling, and these areas are often used for waste rock disposal, ore processing, and infrastructure facilities. These surface disturbances are not expected to result in loss of access to future mineral resources.

Area Seismicity

Earthquakes with characteristics determined for the Project area represent limited risk to the stability of proposed waste rock and heap leach facilities at the Project area. In a study of seismic activity of the nearby Rain Mine area (2.5 miles west of Emigrant Mine area), Call and Nicholas (1986) predicted a maxim acceleration of 0.4 g, with a recurrence interval of about 1,000 years. Earthquakes with these characteristics represent limited risk to stability of proposed waste rock and heap leach facilities at the Emigrant site where reclaimed slopes would be at an angle of 2.5H:1.0V for the heap leach pad and 3.0H:1.0V for the Non-PAG and in-pit waste rock disposal facilities.

Acceptable levels of risk for heap leach and waste rock disposal facilities are determined by regulatory agencies and are usually based on consequences envisioned from potential failure of the facility. Valera Consultants (2004) calculated the probability of earthquakes occurring that have magnitudes causing potential damage to the proposed heap leach facility at the Emigrant Project site. Results are on the order of 3 percent for the 14-year operational mine life (475-year return period) and 2 percent for the 200-year closure and post-closure period (2,475-year return period). The conservative nature of seismic calculations by Valera Consultants (2004) and the limited consequences of a potential failure are considered acceptable seismic risks for proposed Project facilities.

United Building Code standards based on the nature of foundation materials, and USGS earthquake record data, were used by Valera Consultants (2004) to assess seismic risk to the heap leach facility. The maximum credible earthquake used for the evaluation was magnitude 6.1 occurring at distances ranging from 10 to 17 miles from the site. These earthquakes have potential to produce strong ground shaking. Therefore, design of the heap leach facility addressed these conditions to prevent damage to the facility from material slumping on the 2.5H:1.0V slopes.

Paleontological Resources

Physical disturbance associated with the Emigrant Project could result in limited direct impacts to paleontological resources. The location of potential buried paleontological deposits can not be predicted by surface inspections and would not be identified until encountered in actual mining excavations. Other mining-related excavations associated with facilities development (*e.g.*, facility pads, heap leach pads, and waste rock disposal areas) are shallow and would typically only affect near-surface unconsolidated soil materials.

If vertebrate fossils are discovered during mine development or operational activities, Newmont would cease mining in the vicinity of the discovery, and contact BLM to determine steps necessary to evaluate the discovery. No fossil localities, quarries, or significant vertebrate fossil remains are known to be located in the Emigrant Project area.

Waste Rock and Ore Geochemical Characterization

Devils Gate limestone, which has no potential to generate acid, would comprise approximately 32 percent of waste rock for the Emigrant Project. Isolation and encapsulation of PAG waste rock would be accomplished through placement of a 10-ft thick drainage layer constructed of Encapsulation Material (Non-PAG waste rock with an NP:AP ratio of at least 3:1) around compacted PAG waste rock to function as a drainage layer around PAG waste rock (see Chapter 2 – *Proposed Action*). The drainage layer would limit exposure of this rock to oxygen and direct meteoric water, thereby reducing potential for acid leachate formation. Acidic leachate that may be generated by contact with PAG waste rock would be neutralized by the underlying Devils Gate limestone. Results of potential leachate migration modeling are included in the *Water Quantity and Quality* section of this Chapter.

PAG waste rock at Emigrant would total approximately 4Mt or 4.9 percent of total waste rock to be removed during mining. PAG waste rock may be exposed during Phase 3 of mining in the west pit high walls. These exposures would be reclaimed by backfilling with Encapsulation Material at a 3H:1V slope.

Potential impacts to groundwater and/or surface water from release of trace metals in waste rock is described in the *Water Quantity and Quality* section of this Chapter. Impacts are expected to be minimal due to the distance to groundwater (approximately 450 feet or more in the proposed mine pit area) and the potential for sorption by ferric oxides and precipitation of non-soluble minerals (Langmuir 1997). No releases to surface water are expected from waste rock at the project site.

Ore placed on the leach pad would be neutralized by the leaching solution which is maintained at basic pH values. Potentially acid producing ore (mined during early phases) represents approximately 3 percent of ore placed on the heap leach pad. In addition, during closure, a water balance cover would be placed on the heap leach pad. Residual drain-down of leachate from the heap would be managed in an evapotranspiration cell. This cell would remain functional until such time as leachate ceases to report to the cell or the quality of the leachate requires no further treatment. For these reasons, it is unlikely that trace metals in the spent ore pile would be released to environmental receptors.

No Action Alternative

The No Action alternative would avoid potential direct and indirect impacts of the Proposed Action and would eliminate recovery of approximately 92Mt of ore from the geologic resource. The gold reserve intended to be mined would remain in-place. Paleontological resources, if present, would not be affected.

POTENTIAL MONITORING AND MITIGATION MEASURES

Newmont, in conjunction with BLM and NDEP, has developed a supplemental waste rock characterization study as a monitoring and mitigation measure to provide additional data to address long-term acid generating potential of waste rock. The Adaptive Management Plan for Waste Rock is described in the *Potential Monitoring and Mitigation Measures* section at the end of this chapter and is included in **Appendix A**.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Under the Proposed Action, approximately 83Mt of waste rock and 92Mt of ore would be mined from the Emigrant Project area. About 1.5 million ounces of gold would be produced from the geologic resource. Removal of gold from the rock package would constitute an irreversible commitment of the geologic resource because the gold could not be replaced in its original setting. The recovered gold, however, would be available for uses identified in Chapter 1 and is generally competitive in the recycling industry.

Irreversible and irretrievable commitment of paleontological resources could occur as a result of mining activities if fossils are encountered in disturbance areas. Should fossil artifacts be identified and recovered, the paleontological resource would be archived and could be made available for viewing and study.

RESIDUAL EFFECTS

No residual effects to other resources are expected as a result of the extraction, processing, and disposal of rocks associated with the Proposed Action.

AIR QUALITY

AFFECTED ENVIRONMENT

Meteorology

The proposed Emigrant Project area is subject to daily temperature fluctuations, low relative humidity, and limited cloud cover. Wind data collected at Newmont's Rain Mine (located adjacent to the Emigrant Project area) from April 1993 through December 2003 indicate the most common wind direction is from the south-southeast and southeast, with an average speed of 8.2 miles per hour. The Emigrant Project area is at an elevation of approximately 6000 feet above mean sea level.

Temperature and Precipitation

Mean monthly temperature recorded at the Emigrant Project meteorological station ranges from 27.5° Fahrenheit (F) in January to 74.7°F in July. Precipitation measured at the Emigrant Project meteorological station shows the heaviest precipitation occurring from November through April. Summer precipitation occurs mostly as scattered showers and thunderstorms that contribute relatively small amounts to overall precipitation. Average annual precipitation in the Emigrant Mine area is 9.7 inches. Average annual pan evaporation for the Emigrant Project area is about 46 inches per year (in/yr), with a lake/pond surface evaporation rate of about 35 in/yr (Telesto Solutions, Inc. 2004). Average precipitation and temperatures recorded at the Emigrant Project meteorological station are shown in **Table 3-9.**

Ambient Air Quality Standards

The Clean Air Act (42 U.S.C. § 7401) directs the USEPA to establish national ambient air quality standards (NAAQSs) for those pollutants that have been determined to pose a risk to public health or welfare, and delegate primary responsibility for air pollution control to state governments, which comply with certain minimum requirements. The State of Nevada and federal government have established ambient air quality criteria standards for certain criteria air pollutants. Criteria pollutants are carbon monoxide (CO), lead (Pb), sulfur dioxide (SO_2), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), ozone, and nitrogen dioxide (NO_2).

Ambient air quality standards must not be exceeded in areas accessible to the general public. National primary standards are the levels of air quality necessary, with an adequate margin of safety, to protect public health. National secondary standards are levels of air quality necessary to protect public welfare from known or anticipated adverse effects of a regulated air pollutant.

Attainment status for pollutants within the Project area is determined by monitoring levels of criteria pollutants for which National Ambient Air Quality Standards (NAAQS) and Nevada Ambient Air Quality Standards (NvAAQS) exist. Standards for PM_{10} are 150 micrograms per cubic meter (µg/m^3) for a 24-hour average and 50 µg/m^3 for the annual mean (NvAAQS only).

Particulate matter in the 10 micron size faction (PM_{10}) is principally regulated under the Nevada Air Quality standards at most mine projects. PM_{10} particles are in the respirable size range for humans and are typically associated with fugitive dust and engine exhaust. Controlling PM_{10} is required for stationary sources such as mills, crushers, and diesel-powered generator sets. Mobile equipment (*e.g.,* loaders, haul trucks, light vehicles) are not regulated like stationary sources under current regulations. Fugitive dust from wheel traffic is controlled as a condition of air quality permits (road watering or chemical binding agents). Combustion emissions from mobile equipment engines are regulated by engine manufacturing standards.

On July 18, 1997, EPA promulgated a revised National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$. The effective date of this rule is November 21, 2008 which requires states to complete a State Implementation Plan to implement $PM_{2.5}$ rules. The State of Nevada has submitted a plan to comply with the 1997 ($PM_{2.5}$) NAAQS, but as of the date of this document the EPA has not acted on the plan. The Emigrant Project is located within an area classified by NDEP as an Attainment Area indicating air pollution levels in the area do not exceed ambient standards.

No estimate of $PM_{2.5}$ emissions has been required by NDEP Bureau of Air Pollution Control (BACP) during permit review for any of the mines in the Carlin Trend, in part because the current EPA emission estimating guidance for metallic minerals processing (AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Volume I, Chapter 11: Mineral Products Industry, Section 11.24 Metallic Minerals Processing [08/82]) contains no estimating factors for fine particle emissions. Fine particle emissions ($PM_{2.5}$) typically are produced from sources such as diesel engines, wood burning activities, and other industrial and commercial combustion processes. Currently, NDEP-BAPC requires only conformance with PM_{10} standards at mining operations.

TABLE 3-9
Precipitation and Temperature for the Period of 2000 - 2007
Emigrant Project Area

Year	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Annual
Precipitation (inches)													**Total Annual Precipitation**
2000	--	--	--	--	0.4	0.16	0.16	0.25	0.15	--	--	--	--
2001	--	--	--	0.41	0.08	0.08	0.61	0.24	0.51	0.38	2.31	--	--
2002	0.22	0.46	0.58	1.66	0.24	--	--	0.08	0.89	0.03	1.47	0.48	--
2003	0.96	0.79	1.73	2.27	1.44	0.07	0.35	2.09	--	0.28	--	--	--
2004	--	3.33	0.92	1.76	1.11	0.32	0.37	1.17	0.96	--	--	--	--
2005	1.74	0.7	1.71	0.13	2.7	--	--	0.17	0.71	1.51	1.54	2.76	--
2006	1.85	1.72	1.34	1.99	0.32	0.35	0.54	0.00	0.29	1.19	0.6	0.42	10.61
2007	0.62	0.77	0.47	1.03	0.68	1.16	0.08	0.38	0.71	0.98	0.59	1.31	8.78
Mean	1.08	1.30	1.13	1.32	0.87	0.36	0.35	0.55	0.60	0.73	1.30	1.24	9.70
Temperature (°F)													**Mean Annual Temperature**
2000	--	--	--	48.9	54.7	66.8	74	73.2	61	47.3	30.1	31.5	--
2001	25.4	28.8	39.9	42	59.4	66	71.3	75.1	65	53.7	38.9	26.3	49.3
2002	26.4	28.4	34.2	45.1	52.9	--	--	69.6	61.6	47	38	32.2	--
2003	38.3	30	39.9	39.6	53.6	66.2	77	71.8	--	55.6	32.5	30.6	--
2004	23.8	26.5	44.3	45	52.7	64.2	72.4	67.6	59.3	46.7	34.1	31	47.3
2005	28.4	29.1	30.1	42.3	52	52.2	75.7	70.9	59.2	51.6	45.7	--	48.8
2006	--	--	--	42.3	57.2	66.9	75.6	71.4	59.6	46.8	30	27.3	--
2007	22.6	32.9	42.3	45	56.1	65.8	76.8	72.3	59.5	46.8	39.6	25.9	48.8
Mean	27.5	29.3	38.5	43.8	54.8	64.0	74.7	71.5	60.7	49.4	36.1	29.3	48.6

Note: -- Data not available.
Source: Newmont 2008c.

Newmont has obtained a Class II Air Quality Operating Permit (AP1041-2085) from the NDEP-BAPC for the Emigrant Project. A Class II permit is issued for facilities that: 1) emit less than 100 tons/yr of any one regulated pollutant; 2) less than 25 tons/yr total hazardous air pollutants; and 3) less than 10 tons per year of any single hazardous air pollutant. As NDEP-BAPC does not require air quality monitoring to maintain the Class II Air Quality Operating Permit (AP1041-2085), no air quality monitoring has been conducted.

Air Quality Monitoring Data

PM_{10} ambient air quality data have been collected within the town of Elko since 1993. Ambient ozone data were also collected at the town of Elko from 1997 through 2001. Newmont collected PM_{10} data at the Gold Quarry Project located approximately 13 miles northwest of the Emigrant Project area. **Table 3-10** lists available PM_{10} and ozone monitoring data for sites nearest the Emigrant Project.

PM_{10} data from the Elko monitoring station represent air quality within populated areas. Primary contributors to ambient particulate concentrations in populated areas are road dust and residential wood smoke. Air quality data from Newmont's Gold Quarry Mine monitoring station are representative of air quality surrounding active mine sites in the area, however Gold Quarry mining and ore processing operations are considerably larger than the proposed Emigrant Project.

Ambient monitoring of gaseous emissions (SO_2, CO, NO_x) is not required under air quality permits. Accordingly, no monitoring data are available to characterize existing air quality in the local area. Air quality in Elko County is classified as attainment or unclassified for all pollutants. Attainment or unclassified designation means no violations of Nevada or national air quality standards have been documented in the region.

Prevention of Significant Deterioration Classification

The area surrounding the proposed Emigrant Project is a designated Class II area as defined by the federal Prevention of Significant Deterioration of Air Quality program. The Class II designation allows moderate growth or degradation of air quality within certain limits above baseline air quality. Industrial sources proposing construction or modifications must demonstrate that emissions would not cause deterioration of air quality in all areas. Standards for deterioration are stricter for Class I areas than Class II areas. The nearest Class I area is the Jarbidge Wilderness, located approximately 80 miles northeast of the proposed Emigrant Project area. As a federal mandatory Class I area, the Jarbidge Wilderness receives visibility protection through the air quality permitting process. No designated Integral Vistas are associated with the Jarbidge Wilderness.

Two other wilderness areas are located in the Humboldt National Forest southeast of the Project area: East Humboldt Wilderness and Ruby Mountain Wilderness. Neither of these wilderness areas are mandatory federal Class I airsheds. BLM manages 10 Wilderness Study Areas in the Elko District, of which seven (all or portions of) have been recommended for wilderness designation. None of these Wilderness Study Areas are mandatory Class I airsheds (Hawthorne 2004).

Current Activity

Existing exploration operations in the Project area produce criteria pollutant emissions, most notably from particulate matter. Fugitive particulate matter emissions are created from drilling and road dust. Combustion products including CO, NO_2, SO_2, and hydrocarbons are emitted from vehicle engines. Newmont's Rain Mine is the only existing mining operation in the vicinity of the proposed Emigrant Project. The Rain Mine is currently in closure with process solution collection and disposal the only remaining activities at the site.

TABLE 3-10
PM_{10} and Ozone Monitoring Data

PM_{10} Monitoring Data[1]

Site	Year	Annual mean ($\mu g/m^3$)	24-Hour High ($\mu g/m^3$)	24-Hour 2nd High ($\mu g/m^3$)
City of Elko	1997	25	49	48
	1998	22	103	65
	1999	25	97	78
	2000	25	87	76
	2001	25	102	71
	2002	23	214	151
	2003	20	163	111
	2004	21	77	72
	2005	21	88	71
	2006	26	134	125
	2007	26	94	88
	2008	15	36	35
Newmont Gold Quarry Project	1995[2]	19	44	NA
	1996	23	83	
	1997[3]	15	35	

Ozone Monitoring Data[1]

Site	Year	Annual Mean (ppm)	1-Hour High (ppm)	1-Hour 2nd High (ppm)	8-Hour Running Average (ppm)
City of Elko	1997	0.0469	0.089	0.077	0.076
	1998	0.0502	0.084	0.08	0.073
	1999	0.0518	0.08	0.075	0.069
	2000	0.0514	0.086	0.076	0.069
	2001	0.0559	0.091	0.086	0.075

Source: U.S. Environmental Protection Agency 2009.

[1] PM_{10} = particulate matter smaller than 10 microns; $\mu g/m^3$ = micrograms per cubic meter; ppm = parts per million; NA = not available.

[2] Data collection is for last three quarters of 1995 only.

[3] Data collection is for first quarter of 1997 only.

Greenhouse Gas Emissions

On-going scientific research has identified the potential impacts of "greenhouse gas" (GHG) emissions on global climate, including carbon dioxide (CO_2), methane, nitrous oxide, water vapor, and several trace gasses. Through complex interactions on a regional and global scale, these GHG emissions can cause a net warming effect of the atmosphere (making surface temperatures suitable for life on Earth), primarily by affecting the amount of heat energy radiated by the Earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO_2 concentrations to increase which likely contribute to overall climatic changes, typically referred to as global warming.

Depending on where measurements are reported, some scientists believe global mean surface temperatures have increased nearly 1˚C (1.8°F) from 1890 to 2006 (Goddard Institute for Space Studies 2007). The Intergovernmental Panel on Climate Change (IPCC 2007) and National Academy of Sciences (2006) indicated that by year 2100, global average surface temperatures could increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels, but also indicated that there are uncertainties in the modeled results, especially regarding how climate change may affect different regions. Observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24° N) have exhibited temperature increases of 1.2°C (2.1°F) since 1900, with nearly a ˚C (1.8°F) increase since 1970. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures. Without additional meteorological monitoring systems, it is not possible to determine the spatial and temporal variability and change of climatic conditions.

The assessment of GHG emissions and climate change is in its formative phase; therefore, it is not yet possible to know with confidence the net impact to climate. The lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Carbon monoxide (CO), sulfur dioxide (SO_2), oxides of nitrogen (NO_x), volatile organic compounds (VOCs) and particulate emissions would be generated during construction and continue throughout the mining period. Mercury emissions would result from carbon processing at South Operations Area. Particulate emissions from construction and mining would be caused by drilling, blasting, excavating, loading, hauling, and dumping of waste rock and ore. Particulate emissions would be limited through implementation of Best Management Practices (BMPs), including minimizing drop heights during loading, and watering and chemical stabilization of haul roads. Diesel engine exhaust from construction equipment, mining equipment, and various transportation vehicles would generate gaseous air pollutants including carbon dioxide (CO_2). Daily transport of carbon impregnated slurry from the Emigrant Project to the South Operations Area Mill 5/6 would not have any adverse effects on air quality as a result of gaseous emissions from a diesel powered over-the-road tanker truck or fugitive dust on gravel roads. Newmont would employ all necessary emission control systems, equipment, maintenance protocols, and travel frequencies/speeds to ensure compliance with State of Nevada air quality standards.

Air Pollutant Emission Estimates and Ambient Air Quality Modeling

The potential air pollutant emissions from the Emigrant Mine Project were calculated and the potential effects to local ambient air quality which may result from these emissions were assessed (EMA 2010).

A comprehensive inventory of potential sources of air pollutant emissions from the Emigrant Mine identified approximately 80 individual emission units, including stationary "point" sources; "fugitive" sources; and mobile and non-road combustion sources. Using mine operating parameters, generally available USEPA and other air pollutant emission factors, and emission control techniques to be implemented as part of the Emigrant Mine Project, estimates were made of the air pollutant emission rates from each emission unit for operational year 8, the project year determined to have the potential for the greatest air pollution emissions, Emission estimates were made for five criteria air pollutants (PM_{10}, $PM_{2.5}$, CO, NO_X (a conservative substitute for NO_2) and SO_2; two criteria air pollutant precursors [NO_X and volatile organic compounds (VOCs)]; and CO_2. Emission estimates for these air pollutants for all five applicable criteria air pollutant regulatory time periods (1-hour, 3-hour, 8-hour, 24-hour, and annual) are presented in **Table 3-11**.

TABLE 3-11
Emigrant Mine Project Emissions by Air Pollutant and Applicable Time Period

Time Period	Calculated Air Pollutant Emissions for Indicated Time Period							
	PM	PM_{10}	$PM_{2.5}$	SO_2	CO	NO_X	VOCs	CO_2
1-Hour (lb/time)	805	301	39.2	2.49	576	113	12.6	9,968
3-Hour (lb/time)	1,642	527	63.3	2.94	624	177	34.4	18,899
8-Hour (lb/time)	3,735	1,092	123.7	4.07	745	336	89.1	41,228
24-Hour (lb/time)	10,437	2,899	315.3	6.39	1,114	818	217.1	109,743
Annual (tons/time)	1,809	494	51.9	0.96	156	139	38.5	19,158

Source: EMA 2010.

Because the Emigrant Mine Project has few stationary processes, few of these air pollutant emissions are directly subject to a stationary air permit issued by the NDEP-BAPC. Fugitive dust emissions are generally regulated by NDEP-BAPC through Surface Area Disturbance permits, dust control plans, and best management practices (BMPs).

The current USEPA-approved air pollutant regulatory model (AERMOD) was used to conduct the ambient air quality modeling for NO_X, CO, SO_2, PM_{10} and $PM_{2.5}$. The model used three years (2000, 2004, and 2005) of hourly meteorological data collected by the National Weather Service (NWS) from the Elko, Nevada NWS station located approximately 18 miles north-northeast of the proposed Emigrant Mine.

Air pollutant emissions were modeled using four different model source types (point source; volume source; area source; and open pit source). Model inputs included emission parameters developed in cooperation with Newmont.

For gaseous air pollutants (NO_X, CO, SO_2), the 1-hour emission rate was used for modeling all applicable regulatory time periods, as the 1-hour regulatory time period is the shortest period required for these gaseous air pollutants. For the particulate air pollutants, an hourly emission rate calculated from the 24-hour emissions was used for modeling all applicable regulatory time periods, as the 24-hour averaging period is the shortest particulate regulatory averaging time period.

Representative measured regional air pollutant concentrations were determined and added to the applicable modeled air pollutant concentrations. **Table 3-12** lists the representative background air pollutant concentrations and the sources selected for this air modeling.

TABLE 3-12
Representative Background Air Pollutant Concentrations Added to Modeled Results

Criteria Pollutant	Averaging Period	Selected Background Concentration ppm	(μg/m³)	Notes
Particulate Matter ≤10 Microns in Aerodynamic Diameter (PM_{10})	24-Hour	-	16.047	Average of highest 24-hour average PM_{10} concentrations measured 2005-2007 from the IMPROVE Great Basin National Park, NV station
	Annual	-	4.775	Average of annual average PM_{10} concentrations measured 2005-2007 from the IMPROVE Great Basin National Park, NV station
Particulate Matter ≤2.5 Microns in Aerodynamic Diameter ($PM_{2.5}$)	24-Hour	-	6.726	Average of the 98th percentile of the 24-hour average PM10 concentrations measured 2005-2007 from the IMPROVE Great Basin National Park, NV station
	Annual	-	2.360	Average of the annual average concentrations PM10 concentrations measured 2005-2007 from the IMPROVE Great Basin National Park, NV station
Sulfur Dioxide (SO_2)	1-Hour	0.02167	56.49	Average of first-high 1-hour average SO_2 concentrations measured 2005-2007 from the SLAMS Trona, CA station
	3-Hour	0.00833	21.73	Average of second highest 3-hour average SO_2 concentrations measured 2005-2007 from the SLAMS Trona, CA station
	24-Hour	0.00433	11.30	Average of second highest 24-hour average SO_2 concentrations measured 2005-2007 from the SLAMS Trona, CA station
	Annual	0.00100	2.61	Average of the annual average SO_2 concentrations measured 2005-2007 from the SLAMS Trona, CA station
Carbon Monoxide (CO)	1-Hour	1.70000	1,942.86	Average of second highest 1-hour average CO concentrations measured 2006-2007 from the Turtleback Dome, Yosemite National Park, CA station
	8-Hour	0.60000	685.71	Average of second highest 8-hour average CO concentrations measured 2006-2007 from the Turtleback Dome, Yosemite National Park, CA station
Nitrogen Dioxide (NO_2)	1-Hour	0.00800	15.09	Average of first-high 1-hour average NO_2 concentrations measured 2006-2007 from the Turtleback Dome, Yosemite National Park, CA station
	Annual	0.00100	1.89	Average annual average NO_2 concentrations measured 2006-2007 from the Turtleback Dome, Yosemite National Park, CA station
Ozone (O_3)	1-Hour	0.08267	162.03	Average of second highest 1-hour average O_3 concentrations measured 2005-2007 from the Great Basin National Park, NV station
	8-Hour	0.07333	143.73	Average of fourth highest 8-hour average O_3 concentrations measured 2004, 2007 and 2008 from the Great Basin National Park, NV station

Ppm = parts per million: μg/m³ = micrograms per cubic meter; IMPROVE = Interagency Monitoring of Protected Visual Environments; SLAMS = State and Local Air Monitoring Station.
Source: EMA 2010.

Table 3-13 lists, for each criteria air pollutant and applicable averaging period, the applicable National ambient air quality standard, the 3-year average modeled concentration, the added background concentration, the resulting total concentration, and the percentage of the applicable standard for all modeled sources. **Table 3-14** lists the same information compared to the applicable Nevada ambient air quality standard.

TABLE 3-13
Modeled Air Pollutant Concentrations - NAAQS
Emigrant Mine 3-year Average

Criteria Pollutant	Averaging Period	Concentration ($\mu g/m^3$)				Total % of NAAQS
		NAAQS	Modeled High	Background	Total	
Particulate Matter ≤10 Microns in Aerodynamic Diameter (PM_{10})	24-Hour	150	104.28	16.047	120.33	80.22%
Particulate Matter ≤2.5 Microns in Aerodynamic Diameter ($PM_{2.5}$)	24-Hour	35	21.02	6.726	27.75	79.27%
	Annual	15	4.94	2.360	7.30	48.70%
Sulfur Dioxide (SO_2)	1-Hour	195	1.88	56.488	58.36	29.93%
	3-Hour	1,300	0.94	21.726	22.67	1.74%
	24-Hour	365	0.28	11.298	11.58	3.17%
	Annual	80	0.07	2.607	2.67	3.34%
Carbon Monoxide (CO)	1-Hour	40,000	429.73	1,942.857	2,372.59	5.93%
	8-Hour	10,000	96.26	685.714	781.98	7.82%
Nitrogen Oxides (NOx)	1-Hour		212.58			
	Annual		10.96			
Nitrogen Dioxide (NO_2)	1-Hour	189	159.43	15.094	174.53	92.50%
	Annual	100	8.22	1.887	10.11	10.11%

NAAQS = National Ambient Air Quality Standards; $\mu g/m^3$ = micrograms per cubic meter.
Source: EMA 2010.

TABLE 3-14
Modeled Air Pollutant Concentrations - NvAAQS
Emigrant Mine 3-year Average

Criteria Pollutant	Averaging Period	Concentration ($\mu g/m^3$)				Total % of NvAAQS
		NvAAQS	Modeled High	Background	Total	
Particulate Matter ≤10 Microns in Aerodynamic Diameter (PM_{10})	24-Hour	150	115.77	16.047	131.81	87.88%
	Annual	50	31.13	4.775	35.91	71.81%
Sulfur Dioxide (SO_2)	3-Hour	1,300	0.94	21.726	22.67	1.74%
	24-Hour	365	0.28	11.298	11.58	3.17%
	Annual	80	0.07	2.607	2.67	3.34%
Carbon Monoxide (CO)	1-Hour	40,500	549.78	1,942.857	2,492.64	6.15%
	8-Hour	7,000	96.26	685.714	781.98	11.17%
Nitrogen Oxides (NO_x)	Annual		10.96			
Nitrogen Dioxide (NO_2)	Annual	100	8.22	1.887	10.11	10.11%

NvAAQS = Nevada Ambient Air Quality Standards; $\mu g/m^3$ = micrograms per cubic meter.
Source: EMA 2010.

Consistent with USEPA guidance, the initial ("Tier 1") air impact assessment modeled project emissions of NO_X instead of NO_2, which over-predicts the anticipated ambient concentrations of NO_2 from the mine. As directed by USEPA guidance, the "Tier 2" step multiplies the "Tier I" model result by 0.75, a conservative national NO_2/NO_X ratio. **Table 3-13** and **Table 3-14** each present the results of this "Tier 2" adjustment to produce NO_2 ambient air concentrations.

As shown in **Table 3-13** and **Table 3-14**, the modeling results demonstrate that modeled emissions of the five criteria air pollutants from the proposed Emigrant Mine, when added to the representative background air pollutant concentrations, would not exceed National or Nevada ambient air quality standards.

Other Gaseous Emissions

Newmont's ore roasting, carbon stripping and regeneration, and retort furnace processing facilities at the South Operations Area Mill 5/6 complex have a maximum throughput of ore limited by both the design of the facility, on-line availability, and the air quality permit for the facility. As such, the amount of gaseous emissions from processing the precious metal laden-carbon from Emigrant would not affect the overall emissions released from the Mill 5/6 complex because of the throughput and emission limitations associated with the facility. Mill 5/6 operates under a Class I Air Quality Permit No 1041-0793 issued by NDEP. Air quality standards adopted by the State of Nevada are protective of human health and the environment. Newmont's Mill 5/6 has been evaluated in previous EIS documents, including the *Final Supplemental EIS South Operations Area Project Amendment, Cumulative Effects* (BLM 2010a), which states that emissions from Mill 5/6 are projected to be below State of Nevada air quality standards.

In addition to regulated gaseous emissions, CO_2, an as yet unregulated gas, is produced by the Project primarily during consumption of diesel fuel by mining equipment. Recently proposed draft guidance from the Council on Environmental Quality on the consideration of the effects of greenhouse gas emissions on climate change suggests that federal agencies should consider a quantitative and qualitative assessment for proposed actions would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2-equivalent GHG emissions on an annual basis. Under the Proposed Action, the Project is expected to directly emit approximately 19,200 tons (about 17,400 metric tons) of CO_2 during operational year 8, the project year determined to have the potential for the greatest air pollution emissions.

Mercury Emissions

Ore from the Emigrant Project would be processed by run-of-mine oxide heap leach techniques. Loaded carbon (carbon containing metal) resulting from the leaching process would be transported by enclosed truck to Newmont's South Operations Area processing facility. Average mercury concentrations in Emigrant Project ore are approximately 4 parts per million (ppm). This concentration is less than average mercury concentrations in other sources of ore being processed at the South Operations Area facility (*e.g.*, Leeville Project ore = 17.54 ppm mercury; and South Operations Area Gold Quarry = 6.90 ppm mercury) (Newmont 2008d). Carbon handling and refinery services at the South Operations Area facility that emit mercury to the atmosphere include carbon regeneration, carbon stripping, electro-winning, retorting, and smelting. Mercury emissions at each of these processes are subject to controls listed in NAC 445B.3651 as constituting the presumptive Nevada Maximum Achievable Control Technology for controlling mercury emissions from these processes under Nevada's Mercury Emissions Control Program. Diesel and gas combustion sources also emit mercury in the mine areas.

Maximum potential hourly emissions would not increase due to processing of loaded carbon columns from the Emigrant Project at the South Operations Area. Based on average mercury content of Emigrant ore, approximately 1,100 pounds (lbs) of mercury would load to the carbon columns annually. Emission factors based on 2008 source testing (Newmont 2009a) for Newmont's South Operations Area processing facilities indicate that 99.89 percent of the mercury is retained or removed through emission controls at the roaster and carbon regeneration plant. As a result, average annual mercury emissions from processing Emigrant Project carbon columns would be approximately 2 lbs (Newmont 2009b). Mercury emissions from Newmont's Mill 5/6 in 2008 totaled 422 lbs (NDEP 2009a). Assuming that annual ore and carbon processing at Mill 5/6 would remain at 2008 levels, processing carbon columns from the Emigrant Project would constitute 0.4 percent of total mercury emissions from Mill 5/6.

Given that the mercury content of Emigrant Project ore is low (4.0 ppm) compared with other ore sources, when combined with control technology, processing carbon columns from Emigrant as a batch or blended with other ore (columns) would not increase annual mercury emissions from the Mill 5/6 facility, but would extend the period of emissions and increase the total amount of mercury emitted from Mill 5/6. No mercury concentrations exceeding water quality standards have been detected in area streams monitored by mining operations in the Carlin Trend (Newmont 2009c).

Regulatory Requirements

The Emigrant Project would comply with the Nevada Revised Statutes (NRS) and the Nevada Administrative Code (NAC) Chapter 445B which contain the Nevada air pollution rules and regulations. The Emigrant Project would also comply with all applicable federal air regulations. Nevada regulations require operators to obtain air quality permits from the Nevada Bureau of Air Pollution Control for each emission source (process/activity) that emits air contaminants at the mine property. NRS 445B.155 defines an emission source as "any property, real or personal, which directly emits or may emit any air contaminant." NRS 445B.110 defines an "air contaminant" as "any substance discharged into the atmosphere except water vapor and droplets."

Newmont has obtained the Class II Air Quality Operating Permit from the Nevada Bureau of Air Pollution Control for the Emigrant Project. The Nevada Bureau of Air Pollution Control permits are:

- Class III - Typically for facilities that emit 5 tons per year (tons/yr) or less in total of regulated air pollutants and emit less than ½-ton/yr of lead, and must not have any emission units subject to Federal Emission Standards (*i.e.* NSPS, NESHAPS, MACT).

- Class II - Typically for facilities that emit less than 100 tons/yr for any one regulated pollutant and emit less than 25 tons/yr total HAP and emit less than 10 tons/yr of any single hazardous air pollutant (HAP).

- Class I - Typically for facilities that emit more than 100 tons/yr for any one regulated pollutant or emit more than 25 tons/yr total HAP or emit more than 10 tons/yr of any single HAP or is a PSD source or major MACT source.

- Surface Area Disturbance greater than 5 acres.

The EPA promulgated a New Source Performance Standard (NSPS) for stationary compression ignition internal combustion engines in 40 CFR Part 60 Subpart IIII. The final rule became effective in September 2006 and would reduce particulate, NOx, SO_2, CO, and hydrocarbon emissions from stationary diesel internal combustion engines whose construction, modification, or reconstruction commenced after July 11, 2005 by requiring compliance with new emission standards. In addition to new emission standards, the diesel fuel used for stationary compression ignition internal combustion engines must meet the requirements of 40 CFR 80.51(a), which requires diesel fuels have a maximum sulfur content of 500 ppm and either a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent. Operations at the Emigrant Project would be required to meet New Source Performance Standards for diesel engines at the mine.

No Action Alternative

The No Action alternative would avoid potential direct and indirect impacts of the Proposed Action to air resources.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures for air resources beyond those described in the Proposed Action have been identified by BLM or NDEP.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible or irretrievable commitment of air resources would result from implementation of the Proposed Action.

RESIDUAL EFFECTS

No residual effects on air resources would occur as a result of the Proposed Action and mitigation measures. After cessation of mining and completion of reclamation activities, air quality would be expected to reach pre-mining conditions.

WATER QUANTITY AND QUALITY

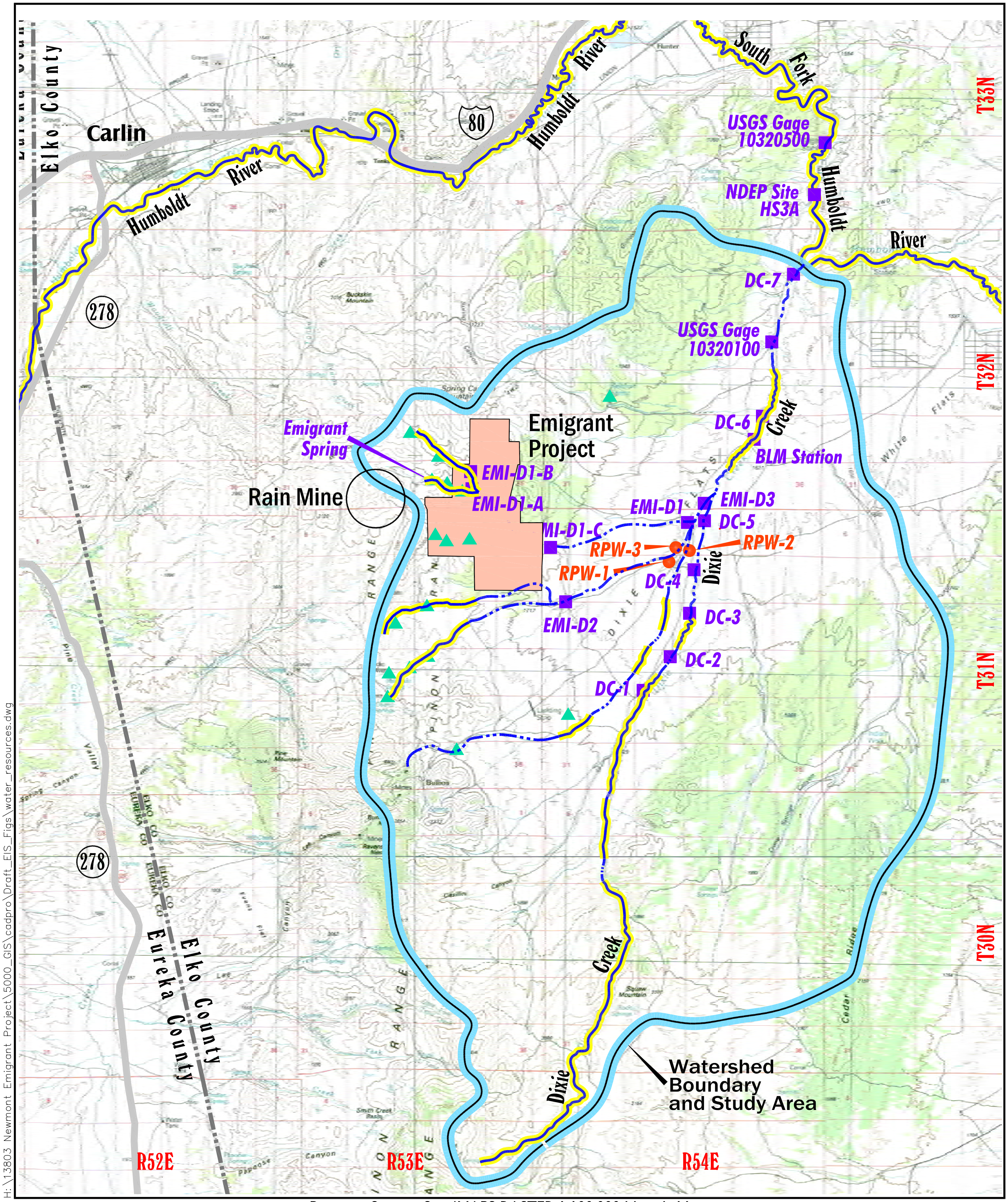
AFFECTED ENVIRONMENT

The Study Area for water resources includes the Dixie Creek watershed within hydrographic area No. 48 (Dixie Creek – Tenmile Creek Area) as shown on **Figure 3-4**. Hydrographic area No. 48 encompasses 392 square miles. Dixie Creek drains north to the South Fork Humboldt River approximately 8 miles northeast of the Emigrant Project area. Dixie Creek is located 4 miles east of the Project area and encompasses a watershed area of about 170 square miles (**Figure 3-4**). Drainages in this watershed are either perennial (year-round flow), intermittent (flow is seasonal in response to precipitation and groundwater discharge), or ephemeral (short-term flow only in response to snowmelt and major rain events).

Surface Water Quantity

Dixie Creek flows north to the South Fork Humboldt River, which then flows to the Humboldt River approximately 10 miles northeast of the Emigrant Project area (**Figure 3-4**). This watershed is bounded on the west and south by the Piñon Range and on the east by White Flats and Cedar Ridge.

The main channel of Dixie Creek is intermittent in some segments and perennial in other segments (**Figure 3-4**). Tributary channels to Dixie Creek are small intermittent or ephemeral drainages with flow occurring primarily in response to precipitation events or



Basemap Source: Sure!MAPS RASTER 1:100,000 Nevada Map

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- Spring or Spring Complex
- Surface Water Monitoring Station
- Water Supply Well
- Perennial Stream Reach
- Ephemeral or Intermittent Stream Reach

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Elko County, Nevada
FIGURE 3-4

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snowmelt runoff, typically during the period of March through June. According to Siebert and Kiracofe (1988), the entire Dixie Creek watershed has 39 miles of perennial stream and 153 miles of ephemeral or intermittent channels. The tributary channels in and near the Emigrant Project area extend southeast and east to the main channel of Dixie Creek. Where flow occurs in these channels, base-flow rates usually are in the range of 0.1 to 1 cubic foot per second (ft^3/sec) or less; this is equivalent to approximately 45 to 450 gallons per minute (gal/min).

Tributary drainages within the Emigrant Project area (**Figure 3-4**) encompass an area of about 28 square miles, or 16 percent of the 170-square mile Dixie Creek watershed. The proposed Project area is located in the upper half of this tributary drainage area located along the west side of the Dixie Creek watershed. Tributaries that drain the Project area are relatively small ephemeral channels, except for some upper reaches that are perennial due to discharge from springs and seeps (**Figure 3-4**). Flow typically disappears in these channels near the west side of the Emigrant Project area, except during periods of spring runoff when water flows to or near Dixie Creek.

Dixie Creek is perennial in portions of its upper reaches and typically flows several months each year at its confluence with South Fork Humboldt River (**Figure 3-4**). A gauging station (No. 10320100) was operated by the USGS on lower Dixie Creek for 7 years from 1990 through 1996. Newmont has monitored flow at seven stations (DC-1 through DC-7) along Dixie Creek (**Figure 3-4**). Only station DC-5 is monitored on a regular basis; the other stations were monitored primarily in 1988-1989 and 1994-1997.

BLM monitored flow on Dixie Creek at two temporary Remote Automated Weather Station (RAWS) locations from 2000-2002. The lower site was located at the USGS gauging station and the upper site was in the SE¼ of Section 31, T30N, R54E. BLM has monitored discharge periodically at the upper RAWS location since the station was removed. Discharge was also monitored at another location approximately one mile upstream of the upper RAWS in Section 6 during 1982 and from 2001 to the present time. During March and April 2004, BLM measured discharge at six sites on two tributary channels that drain the Emigrant Project area to Dixie Creek. BLM also measured discharge on lower Dixie Creek approximately ½-mile upstream of DC-6 (**Figure 3-4**) in the early 1980s and in 2003-2004.

Flow along Dixie Creek was measured by Newmont (2004) at five of the DC-stations and the USGS gauging station in June 1993, November 1994, October 1995, and September 1996. Based on these synoptic flow measurements (**Table 3-15**), Dixie Creek has perennial flow at uppermost station DC-1 and in the vicinity of DC-6 (**Figure 3-4**). Flow around station DC-5 may also be perennial. In general, flow along Dixie Creek is highest at the uppermost monitoring site (DC-1), declines down to between stations DC-5 and DC-6, increases at DC-6, declining again down to the mouth (DC-7) where flow was always dry for the four measurement dates (**Table 3-15**).

TABLE 3-15
Synoptic Flow Measurements for Dixie Creek
Emigrant Project

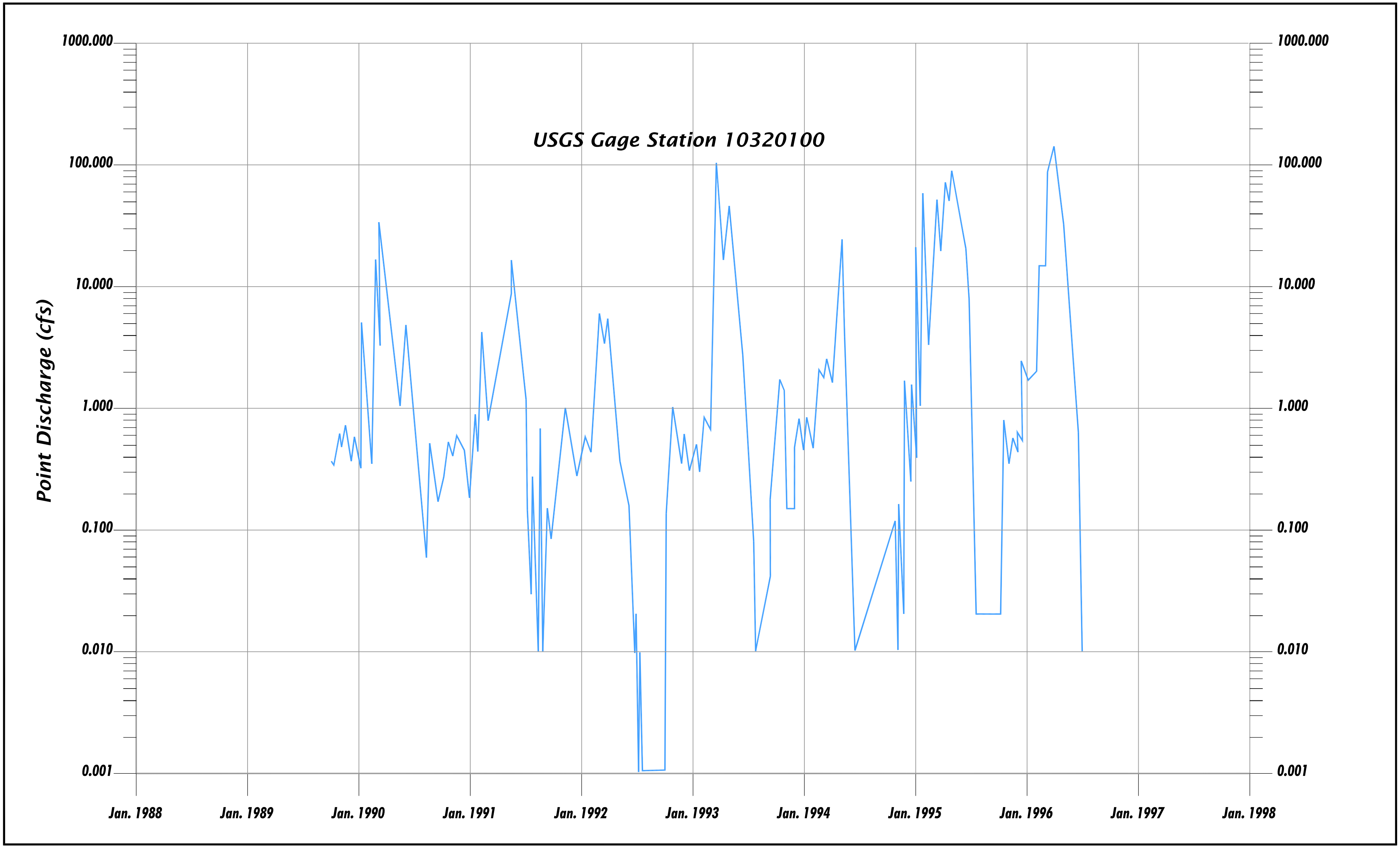
Dixie Creek Station [1]	Flow Measurement (cubic feet per second – ft^3/sec) [2]			
	June 17, 1993	Nov. 4, 1994	Oct. 10, 1995	Sept. 24, 1996
Upstream				
DC-1	3.10	1.38	0.26	NM
DC-4	1.78	0	0	0
DC-5	1.37	0.02	0.01	NM
DC-6	2.18	0.32	NM	NM
USGS Gauge	1.71	0	NM	NM
DC-7	0	0	0	0
Downstream				
Precipitation at Jiggs 8 SSE Zaga, NV (inches per month) [3]	May – 2.07 / 2.03 June – 1.86 / 0.92	Oct. – 1.47 / 0.93 Nov. – 2.58 / 1.22	Sept. – 0.71 / 0.98 Oct. – 0.00 / 0.93	Aug. – 0.05 / 0.66 Sept. – 0.40 / 0.98

Source: Newmont 2004; Western Regional Climate Center 2004.
[1] See **Figure 3-4** for station locations.
[2] NM = not measured. Note: 1 ft^3/sec = 448.8 gal/min.
[3] First value is monthly total precipitation (inches) for specified month/year; second value is mean monthly precipitation (inches) for period of 1978 – 2004.

Table 3-15 also presents mean monthly precipitation values for the month of measurement and the previous month from one of the nearby precipitation stations. The first two synoptic runs in June 1993 and November 1994 had average or above average precipitation, whereas the last two events in October 1995 and September 1996 had below average precipitation. As previously stated, Dixie Creek usually contributes surface flow to South Fork Humboldt River seasonally for several months each year. Riparian habitat improvements along portions of lower Dixie Creek likely have resulted in longer periods of flow in this area.

The drainage area upslope of the Emigrant Project area includes a reclaimed waste rock disposal facility associated with the Rain Mine and undeveloped hills with sagebrush and grass vegetation. The primary drainage channel that extends through the proposed mine area generally is trapezoidal with a top width of about 20 feet, bottom width of about 5 feet, depths of 5 to 10 feet, and a longitudinal slope of 3 to 4 percent (Simons & Associates 2004). The channel bottom consists of silt. sand, gravel, and cobbles. Channel cross-sections for Dixie Creek at stations DC-1, DC-4, DC-5, and the USGS gauge are presented in Newmont's (2004) report, *Dixie Flats, Ground-Water and Surface-Water Monitoring Results*.

Table 3-16 summarizes 1990-1996 flow data for Dixie Creek at USGS gauging station 10320100, located approximately 1.5 miles upstream of the confluence with South Fork Humboldt River. A hydrograph of mean daily discharge versus time for this Dixie Creek gauging station is presented on **Figure 3-5**. Mean monthly flows at the gauging station range from no flow in some years for July/August/September, to approximately 50 ft^3/sec in some years during March/April/May.



Source: Newmont 2004

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Elko, Nevada

Hydrograph for Dixie Creek Flow at USGS Gage
Emigrant Project
Elko County, Nevada
FIGURE 3-5

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TABLE 3-16
Dixie Creek Stream Flow Summary at USGS Gauging Station 10320100
Emigrant Project

Year	Mean Monthly Stream Flow (cubic feet per second – ft³/sec)											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
1989	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.43	0.53	0.48
1990	0.69	2.09	9.83	5.26	2.02	2.23	0.17	0.20	0.24	0.40	0.52	0.36
1991	0.51	0.99	1.32	3.40	10.9	4.19	0.14	0.14	0.11	0.31	0.64	0.38
1992	0.49	1.57	4.14	2.43	0.39	0.12	0.002	0.0	0.0	0.29	0.62	0.41
1993	0.38	0.67	65.6	27.7	21.9	4.02	0.13	0.0	0.13	1.02	0.26	0.49
1994	0.61	1.10	1.83	3.07	5.60	0.20	0.0	0.0	0.0	0.0	0.04	0.53
1995	3.49	12.2	22.9	39.8	57.9	24.0	2.07	0.0	0.0	0.17	0.45	0.67
1996	1.86	6.32	43.4	74.2	23.8	2.11	0.001	0.0	0.0	NM	NM	NM
Mean Monthly Flow	1.15	3.56	21.3	22.3	17.5	5.27	0.36	0.05	0.07	0.37	0.44	0.47

Year	Mean Annual Flow (ft³/sec)		Year	Peak Annual Flow (ft³/sec)	Gauge Height (feet)	Peak Flow Date
1990	2.00		1990	65	2.50	3-3-90
1991	1.92		1991	26	2.11	5-14-91
1992	0.87		1992	6	Not measured	5-4-92
1993	10.3		1993	350	4.54	3-17-93
1994	1.09		1994	113	3.14	5-12-94
1995	13.6		1995	140	3.67	5-10-95

Source: USGS 2004b.
Note: See **Figure 3-4** for station location. USGS = U.S. Geological Survey; NM = not measured.

Highest mean monthly flows occur in March/April/May and range 17 to 22 ft³/sec. Lowest mean monthly flows occur in August/September (0.05 to 0.07 ft³/sec).

Mean annual flow for Dixie Creek during 1990-1995 ranged 0.87 ft³/sec (1992) to 13.6 ft³/sec (1995) (**Table 3-16**). Annual peak flow measurements for the same period ranged from 6 ft³/sec (March 1992) to 350 ft³/sec (March 1993). According to Siebert and Kiracofe (1988), estimated annual discharge from the Dixie Creek watershed is 2,290 acre-feet. Based on the USGS flow data and assuming that flow in Dixie Creek reaches South Fork Humboldt River primarily during the period March through June, it appears that a flow rate of at least 5 ft³/sec is required at USGS gauging station for water in Dixie Creek to reach the South Fork Humboldt River.

Flow measurements and observations by BLM at two stations on Dixie Creek in 2000-2001 had the following approximate stream flow rates at the lower site at USGS gauge 10320100 (**Figure 3-4**): May 2000 = 6 to 10 ft³/sec; late March 2001 = 20 to 40 ft³/sec or more; April 2001 = 10 to 20 ft³/sec; June 2001 = 3 to 5 ft³/sec; and July 2001 = 2+ ft³/sec (BLM 2005). BLM measurements at the upper Dixie Creek site approximately ½-mile upstream of DC-6 (**Figure 3-4**) were approximately: April and

May 2000 = 2 to 4 ft^3/sec; June 2000 = 1 ft^3/sec; May 2001 = 4.5 to 6.5 ft^3/sec; June 2001 = 3.5 ft^3/sec; and July 2001 = 3 ft^3/sec (BLM 2005).

In March-April 2004, BLM measured stream flow at six sites (EMI-D1, EMI-D1-A, EMI-D1-B, EMI-D1-C, EMI-D2, and EMI-D3) along two tributary channels to Dixie Creek that drain the Project area (**Figure 3-4**). Station EMI-D1 is located on the lower part of the channel that primarily drains the proposed mine pit area. Stations EMI-D1-A, -B, and -C are located farther upstream from EMI-D1 near the Emigrant Project area. Station EMI-D2 is located along the middle portion of the channel that primarily drains the proposed leach pad area. Station EMI-D3 is located below the confluence of the two channels described above and near their confluence with Dixie Creek.

Results of BLM measurements show that on March 16, 2004, flows at stations EMI-D1 and EMI-D2 were 10.9 and 4.1 ft^3/sec, respectively (**Table C-1, Appendix C**). Flow measured at the combined channels farther downstream (EMI-D3) on the same day, however, was only 6.9 ft^3/sec, indicating that about 8 ft^3/sec was lost to the subsurface in Dixie Creek valley prior to reaching Dixie Creek. Flow in Dixie Creek below the tributary confluence (near DC-6) on March 16, 2004 was about 34 ft^3/sec. On March 24, 2004, measurements at the same locations indicate that combined flow of the two tributary channels (EMI-D1 & EMI-D2) was 7.4 ft^3/sec, which is similar to the measurement of 7.6 ft^3/sec for the combined channels at EMI-D3 on March 24 (**Table C-1, Appendix C**). On the same day, Dixie Creek below the tributary confluence near DC-6 had a flow rate of about 38 ft^3/sec.

Highest flow measured by BLM (2004) for tributary channel stations EMI-D1, EMI-D2, and EMI-D3 was 12.7 ft^3/sec at EMI-D1 on March 23, 2004 (**Table C-1, Appendix C**). This tributary drains the northern part of the Emigrant Project area. Lowest flow was 0.26 ft^3/sec at EMI-D2 on March 24, 2004. Flow measurements in 2003-2004 for lower Dixie Creek ½-mile upstream of DC-6 were in the range of 0.34 ft^3/sec (July 21, 2003) to 42 ft^3/sec (March 23, 2004). Flow rates at this Dixie Creek station between 1982 and 1985 were in a similar range of 1.3 to 45 ft^3/sec.

Flow was measured by Newmont (2007a) at tributary stations EMI-D1-A, EMI-D1-B, and EMI-D2, and at Dixie Creek station DC-5 (**Figure 3-4**) between May 2005 and April 2007 (**Table C-1, Appendix C**). Highest measured flow in the tributaries was 1.5 ft^3/sec at station EMI-D1-A on May 2, 2005 in the Emigrant Spring tributary above the Project area. At station EMI-D2 (south tributary below Project area), the channel had no flow on the six measurement dates between July and December 2005, and the five measurements between July and November 2006.

Several springs are located in the vicinity of the Emigrant Project area, most of which are located in headwater areas of the Piñon Range (6,000 to 6,500 feet elevation) west-southwest of the Study Area (**Figure 3-4**). The two forks of the tributary drainage to Dixie Creek that extend through the north-central portion of the Project area immediately west of the proposed mine area each contain two or three springs or spring complexes that provide year-round base flow to these channel segments. Emigrant Spring is located in the upper reach of the southern-most of the two forks in the SW¼NE¼ of Section 34 (**Figure 3-4**). Three more springs are located in the upper portion of the tributary drainage located in the southern portion of the Project area. This channel extends immediately west and south of the proposed heap leach facility area. Most springs are associated with major geologic structures.

Flow from Emigrant Spring has been periodically measured since May 1997 (Newmont 2004). Results of these measurements show that flow generally ranges 0.01 to 0.03 ft^3/sec (5 to 15 gal/min) during the summer-fall period, with some instances of no flow. Flow measurements taken in April, May, and June 2003-2004 were less than 0.6 ft^3/sec downstream of the Emigrant Spring site where surface water runoff contributes to flow from Emigrant Spring.

Flow rates of other springs discussed above that are west of the Emigrant Project area are generally less than 0.01 ft^3/sec. BLM measured flow in springs upgradient (west) of the Emigrant Project area in September 1981 and August 2003, with resulting flow rates of 0.002 ft^3/sec or less (BLM 1981, 2003). There are no natural ponds or lakes in the vicinity of the Emigrant Project. In general, flow from springs upgradient (west) of the Project area extend down to the west side of the Project area, and then often go subsurface prior to reaching the middle of the Project area (**Figure 3-4**).

On March 31, 2004, BLM measured flow in two forks of the tributary that extend through the northern portion of the Project area; these measurements were 1.1 and 2.7 ft^3/sec in the west side of the Project area (stations EMI-D1-A and EMI-D1-B, **Figure 3-4**; also see **Table C-1, Appendix C**). On the east side of the Project area, the flow rate in the tributary channel was 3.2 ft^3/sec on March 31, 2004 (station EMI-D1-C, **Figure 3-4**). Therefore, on that day, water was flowing in that tributary channel through the entire Emigrant Project area. Farther downstream at station EMI-D1, flow measured on March 31, 2004 was 2.6 ft^3/sec, indicating that about 0.6 ft^3/sec was lost in this channel between EMI-D1-C and EMI-D1 (**Table C-1, Appendix C** and **Figure 3-4**).

Surface water runoff in the watershed that contains the Emigrant Project area was calculated by Simons & Associates (2004) using the HEC-1 computer model. For this model, the amount of area to be mined was estimated at 0.48 square mile, with an upstream drainage area of 4.18 square miles (i.e., drainage area upstream of sub-basins where mining would occur). The total sub-basin area down to the outlet point below the area to be mined is 5.17 square miles. The estimated area to be mined would be about 9 percent of this 5.17 square mile sub-basin used in the model. The HEC-1 model was used to compute runoff for a range of storm events having return periods of 2 years to 500 years, as well as the Probable Maximum Flood (PMF), for several locations upstream and inside the Emigrant Project area. **Table 3-17** presents peak flow and volume calculated for the 5.17 square mile sub-basin that includes the proposed mine area. At this location, modeled peak flow ranges from 44 to 707 ft^3/sec for return periods ranging from 2 to 500 years.

Flooding that occurred periodically from 1910 to the mid-1980s caused damage to the Dixie Creek channel and bridge (Siebert and Kiracofe 1988), and likely had similar effects on some tributary channels to Dixie Creek. Estimated peak flow in 1979 at the Dixie Creek site located in Section 26 (T32N, R54E) was 752 ft^3/sec (Siebert and Kiracofe 1988).

The Crane Springs sub-watershed is located along the east side of the Dixie Creek watershed and covers an area of 17,920 acres. A numerical model was used to calculate a maximum discharge of about 112 ft^3/sec for the 20-year return period from the Crane Springs area (Siebert and Kiracofe 1988). A portion of Dixie Creek watershed that does not contain the Crane Springs drainage was estimated to have seven times more surface water flow than the Crane Springs sub-watershed. Based on this assumption, the largest peak flow in lower Dixie Creek during 1965-1985 was 784 ft^3/sec (in 1975) above the confluence with Crane Springs drainage, and 896 ft^3/sec at the mouth of Dixie Creek (Siebert and Kiracofe 1988).

TABLE 3-17
Modeled Peak Flow and Volume for Watershed Containing Proposed Emigrant Mine

Peak Flow Return Period (years)	Peak Flow (cubic feet per second)	Volume (acre-feet)
2	44	19
5	67	32
10	98	48
25	169	89
50	214	112
100	312	166
500	707	343
Probable Maximum Flood (PMF)	6,552	1,939

Note: Watershed includes 5.17 square miles, extending from the west side to east side of the proposed mine pit area.
Source: Simons & Associates 2004.

A USGS gauging station is located on South Fork Humboldt River below the Dixie Creek confluence (**Figure 3-4**). This station (No. 10320500) is outside of the Study Area, but flow data are summarized here because it is located just downstream of the Study Area. The station was monitored from 1937 to 1973, with some gaps in the record. Results of this monitoring show that mean monthly flows for lower South Fork Humboldt River are lowest in August/September/October (6.4 to 16.8 ft^3/sec), and highest in May and June (376 to 482 ft^3/sec) (**Table 3-18**). Mean annual flows for the lower South Fork Humboldt River station are in the range of 23 to 226 ft^3/sec for the most recent 25-year period of record (USGS 2004b).

TABLE 3-18
Monthly Stream Flow for Lower South Fork Humboldt River Below Dixie Creek (USGS Gage No. 10320500)

Period of Record	Mean Monthly Stream Flow (cubic feet per second)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1937-1973	38.1	64.8	105	210	376	482	133	16.8	6.4	14.5	25.3	29.5

Note: See **Figure 3-4** for station location. USGS = U.S. Geological Survey.
Source: USGS 2004b.

Surface Water Quality

Water Quality Standards

Nevada water is regulated for quality standards that are established by the State of Nevada under Nevada Water Pollution Control regulations and statutes (NAC 445A.070 et seq.; NRS 445A.300 et seq.). Both numeric and narrative criteria are included in Nevada's water quality standards. Numeric water quality criteria (NAC 445A.144) apply to Class water and

Designated water. Numeric standards in Nevada are established for designated beneficial uses (i.e., irrigation, livestock watering, aquatic life, recreation, municipal or domestic supply, industrial supply, and propagation of wildlife) and are summarized in **Table C-2** (**Appendix C**). Some of these standards are taken from the Humboldt River control point (Designated water) at the Palisade gauge (NAC 445A.204), which is located approximately 10 air miles downstream of the Carlin gauge.

Some streams in Nevada are classified as Class A, B, C, or D, with Class A streams of best quality and Class D streams of poorest quality (NAC 445A.123-127). Dixie Creek and its tributaries are not specifically classified; however, South Fork Humboldt River in this area is Class B. As such, Dixie Creek would also be a Class B water under the "tributary rule" (NAC 445A.145). Beneficial uses of Class B water are municipal or domestic supply, or both, with treatment of disinfection and filtration only, irrigation, watering of livestock, aquatic life and propagation of wildlife, recreation involving contact with the water, recreation not involving contact with the water, and industrial supply (NAC 445A.125.2). Standards for Class B streams are summarized in **Table C-3** (**Appendix C**). Narrative standards applicable to all surface water in the state are specified in NAC 445A.121.

For purposes of comparison, Nevada "Profile I" reference values included in **Table C-2** (**Appendix C**) are used to evaluate groundwater quality in the Study Area. These values are considered more applicable to groundwater that is not used as a drinking water source.

NDEP compiles the Section 303(d) list (Clean Water Act) for development of "Total Maximum Daily Loads" (TMDLs) for impaired water bodies. In general, a water body is included on the Section 303(d) list if the beneficial uses are not met more than 25 percent of the time. Dixie Creek is on Nevada's 2006 303(d) impaired waters list for total phosphorus and temperature (NDEP 2009b). South Fork Humboldt River from Lee to South Fork Reservoir is listed as impaired for iron, total phosphorus, and temperature; from South Fork Reservoir to the Humboldt River, the South Fork is listed as impaired for iron, lead, and dissolved oxygen (NDEP 2009b). Waste discharges to any state water must be such that no impairment of beneficial use occurs as a result of the discharge (NAC 445A.120[2]). No discharges, however, are planned for the Emigrant Project.

Study Area Watersheds

Surface water has been sampled and analyzed from several locations along Dixie Creek and from some tributaries of Dixie Creek that drain the Emigrant Project area. During a 4-year period from 1982 through 1985, eight water samples were collected by BLM from Dixie Creek ½-mile upstream of station DC-6 where the road crosses the channel (**Figure 3-4**) (Siebert and Kiracofe 1988). These water quality results are summarized in **Table 3-19**. The flow rate of Dixie Creek at the time these samples were collected ranged from 1.3 to 45 ft^3/sec. Another eight water samples from the same location on Dixie Creek were collected by BLM (2004) in 2003-2004 and analyzed for six to eight parameters (**Table 3-19**).

Surface water in Dixie Creek upstream from DC-6 generally is a sodium-bicarbonate type with pH in the range of 7.1 to 8.8 standard units (su) (**Table 3-19**). Water temperature ranges from 7 to 25 degrees Celsius (°C), and total dissolved solids (TDS) is in the range of 150 to 290 milligrams per liter (mg/L). Electrical conductivity (EC) ranges from 150 to 550 micromhos per centimeter (µmhos/cm). Sulfate in Dixie Creek ranges from 14 to 31 mg/L. Nitrate concentrations are less than 2 mg/L.

TABLE 3-19
Water Quality Data for Dixie Creek at Road Crossing One-Half Mile Upstream of DC-6
(1982-1985 and 2003-2004)
Emigrant Project

Parameter	Sample Date								Nevada Aquatic Life Standard
	5-10-82	7-13-82	9-14-82	6-21-83	9-26-83	4-24-84	6-26-84	8-19-85	
Flow (ft³/sec)	30	1.7	1.3	37	1.5	45	22	2	---
Temperature (˚C)	---	19	15	20	17	8	19	25	---
EC (µmhos/cm)	---	---	---	150	400	185	200	---	---
pH (su)	7.7	8.3	7.7	8.1	8.8	8.0	8.2	---	6.5 – 9.0
TDS	152	281	264	---	---	---	---	---	---
DO	---	---	---	---	---	12.3	---	---	<5.0
Turbidity (JTU)	115	9.6	1.5	37	3	585	33	1.7	---
Sulfate	15	26	25	---	---	---	---	---	---
Chloride	5.2	29	25	1	3	11	17	30	---
Nitrate as N	0.43	ND	0.16	0.4	0.7	1.6	1.5	0.4	10
Total Phosphate	---	---	---	0.9	0.2	1.2	0.4	0.1	---
Bicarbonate Alk.	94	168	165	96	95	74	94	106	---
Carbonate Alk.	0	0	0	0	12	0	ND	10	---
Calcium	7.6	22	24	---	---	---	---	---	---
Magnesium	4.9	5.6	6.0	---	---	---	---	---	---
Potassium	2.1	7.4	8.6	---	---	---	---	---	---
Sodium	12	32	53	---	---	---	---	---	---
Manganese	0.1	ND	ND	---	---	---	---	---	---
	5-20-03	7-21-03	9-11-03	3-8-04	3-16-04	3-23-04	3-24-04	4-13-04	
Temp. (°C)	7.8	23.9	12.2	8.3	8.9	10.0	6.7	9.4	---
EC (µmhos/cm)	230	---	550	399	182	156	161	192	---
pH (su)	7.13	---	7.14	8.21	8.34	8.63	8.30	8.31	6.5 – 9.0
DO	---	>11	---	>11	---	9.5	9.6	10.9	5.0
Turbidity (NTU)	23	4.5	233	68	167	106	96	45	50
TSS	19	5	206	68	153	103	94	50	80
Sulfate	14	21	15	29	16	31	31	21	---
Total Phosphorus	0.157	0.238	0.26	1.76	0.157	0.0978	0.134	0.107	0.1

Source: Siebert and Kiracofe 1988; BLM 2004.

Note: All units are in milligrams per liter (mg/L) unless otherwise specified; ft³/sec = cubic feet per second; ˚C = degrees Celsius; EC = electrical conductivity; µmhos/cm = micromhos per centimeter; su = standard units of pH; TDS = total dissolved solids; DO = dissolved oxygen; JTU = Jackson Turbidity Units; N = nitrogen; Alk. = alkalinity; NTU = nephelometric turbidity units; TSS = total suspended solids; ND = not detected; --- = not analyzed.

Samples collected in 2003-2004 were analyzed by BLM using in-house instruments.

Nevada aquatic life standards are 96-hour average for put and take (see Table C-2, Appendix C).

The only parameter in **Table 3-19** that exceeds an aquatic life standard shown on **Table C-2** (**Appendix C**) is total suspended solids (TSS), turbidity, and total phosphorus. Comparison of the early Dixie Creek sample results (1982-1985) to more recent samples (2003-2004) in **Table 3-19** shows no significant changes or trends.

The range of TSS measured in 1986 at the BLM Dixie Creek station upstream of DC-6 was 160 to 2,910 mg/L, with flow rates in the range of 8 to 70 ft^3/sec (Siebert and Kiracofe 1988). Turbidity measurements at the same Dixie Creek location in 1982-1985 range from 1 to 585 Jackson Turbidity Units (JTU), with highest sediment load occurring during higher flows (**Table 3-19**). In 2003-2004, TSS and turbidity measured by BLM (2004) in Dixie Creek upstream of DC-6 were in the ranges of 5 to 206 mg/L, and 5 to 233 Nephelometric Turbidity Units (NTU), respectively (**Table 3-19**). These values show that sediment concentrations decline in Dixie Creek below where tributary channels from the Emigrant Project area enter the creek. Additional reduction in sediment load along lower Dixie Creek is expected due to riparian improvements.

In 2004-2007, BLM (2004) and Newmont (2007a) collected and analyzed surface water samples from some channels in and near the Emigrant Project area that are tributary to Dixie Creek (**Table C-4, Appendix C**). The sample sites (EMI-D1, EMI-D1-A, EMI-D1-B, EMI-D1-C, EMI-D2, EMI-D3, and Dixie Creek ½-mile upstream of confluence of Dixie Creek and the tributary channels) are shown on **Figure 3-4**. Water temperature for these samples typically was in the range of 10 to 20°C. Electrical conductivity and pH were typically in the range of 100 to 400 µmhos/cm, and 7.0 to 9.0 su, respectively.

Turbidity and TSS in most samples from Dixie Creek tributary channels collected in 2003-2007 were in the range of 10 to 250 NTU and 10 to 250 mg/L, respectively. Several samples, however, had higher sediment levels associated with higher flow measurements (**Table C-4, Appendix C**). Other parameters analyzed in some of the sample results presented in **Table C-4** (**Appendix C**) include dissolved oxygen, sulfate, nitrate, nitrite, ammonia, total nitrogen, phosphorus, orthophosphate, chloride, and fecal coliform.

Also included in **Table C-4** (**Appendix C**) is a surface water quality sample collected in December 2005 from an ephemeral drainage (site no. RN-CC) located downgradient from the nearby Rain Mine North Waste Rock Storage Facility. This sample had a pH of 8.11 su, TDS of 645 mg/L, and sulfate of 328 mg/L. The lowest aquatic life standard for selenium (0.005 mg/L; **Table C2, Appendix C**) was exceeded in the surface water sample (0.0068 mg/L) (Newmont 2009d).

Newmont (2004, 2009d) has collected and analyzed water samples from Emigrant Spring on a quarterly basis since mid-1994. A statistical summary of water quality data from the Emigrant Spring monitoring site for the period 1994-2004 is presented in **Table C-5** (**Appendix C**) for samples collected during the fall low-flow season. A summary of water quality data for the period 2004-2008 is presented in **Table C-6** (**Appendix C**). The 1994-2004 data show the following ranges: TDS = 407 to 852 mg/L, with a mean value of 529 mg/L; pH = 7.2 to 7.6 su; sulfate = 119 to 422 mg/L, with a mean value of 183 mg/L; and nitrate+nitrite = <0.02 to 3.4 mg/L, with a mean value of 0.32 mg/L (**Table C-5, Appendix C**). The 2004-2008 data show the following selected ranges: TDS = 467 to 534 mg/L, with a mean value of 509 mg/L; pH = 7.4 to 8.0 su; sulfate = 153 to 171 mg/L, with a mean value of 161 mg/L; and nitrate+nitrite = <0.02 to 0.022

mg/L (**Table C-6, Appendix C**). Surface water aquatic life standards (**Table C-2, Appendix C**) for iron, selenium, and silver have been exceeded in one or more samples from Emigrant Spring.

Groundwater Quantity

Groundwater in the Emigrant Project area moves through bedrock consisting of volcanics (extrusive ash/tuff) and sedimentary rocks (limestone, shale, sandstone, and conglomerate) along the Piñon Range. Localized deposits of unconsolidated alluvium along some of the stream channels also have limited groundwater. Groundwater in the Project area flows eastward into basin fill deposits in the Dixie Creek Valley.

Figure 3-6 illustrates a conceptual model of groundwater flow in the vicinity of the Project area. The figure covers the Project area portion of a larger-scale groundwater flow system that includes the entire groundwater basin. At this intermediate scale, the upland areas and valleys form a series of groundwater basins bounded by groundwater divides, which are typically at or near the surface water divides. Groundwater flows from the upland areas toward the valleys. The uplands are the primary recharge areas, and valleys are the primary discharge areas. This results in a system where net water movement in the recharge areas is downward, and net groundwater flow in the discharge areas is upward. Between these areas, lateral groundwater flow predominates.

On a smaller localized scale, groundwater movement can be controlled by sub-basin topography and/or geologic controls (e.g., faults and fracture zones). Examples of such local flow systems are springs that occur in the valleys west of the proposed Emigrant mine pit area. Here the springs are localized by the faults and generally occur near where the fault planes intersects the sub-basin valley bottom. This spring discharge initially flows on the surface, but as it flows downstream, the flow typically enters the perched alluvial groundwater system in the stream valley. This perched groundwater in valley alluvium eventually seeps back into the bedrock, thus entering an adjacent groundwater local flow system.

Mine Area

Geologic cross-sections (stacked blocks) in **Figure 3-7** illustrate depths to groundwater and the fault blocks in the Emigrant Project area that isolate zones of groundwater. Two piezometers were installed by Newmont west and east of the Emigrant Fault. Piezometer REP-6, west of the fault, encountered groundwater above and within the Chainman Formation at a depth of about 100 feet (Simons & Associates 1997). Piezometer REP-5, east of the fault in the proposed Emigrant Mine area, did not encounter groundwater at a depth of 360 feet in the Devils Gate limestone.

No groundwater was encountered in approximately 950 exploration holes (drilled on 100-ft centers) in the proposed mine pit area. However, projection of groundwater levels in the proposed pit area, based on water levels in piezometers EMW-5 and EMW-2 installed in the areas of the proposed waste rock disposal and oxide heap leach facility, indicates that depth to groundwater would be approximately 450 feet below the base of the proposed Emigrant mine pit. Shallow perched groundwater was also encountered in some exploration drill holes in alluvium overlying sedimentary bedrock at depths of less than 15 feet (Simons & Associates 1997). Shallow alluvial deposits of interbedded sand and gravel in the drainage bottoms are up to 50 feet thick.

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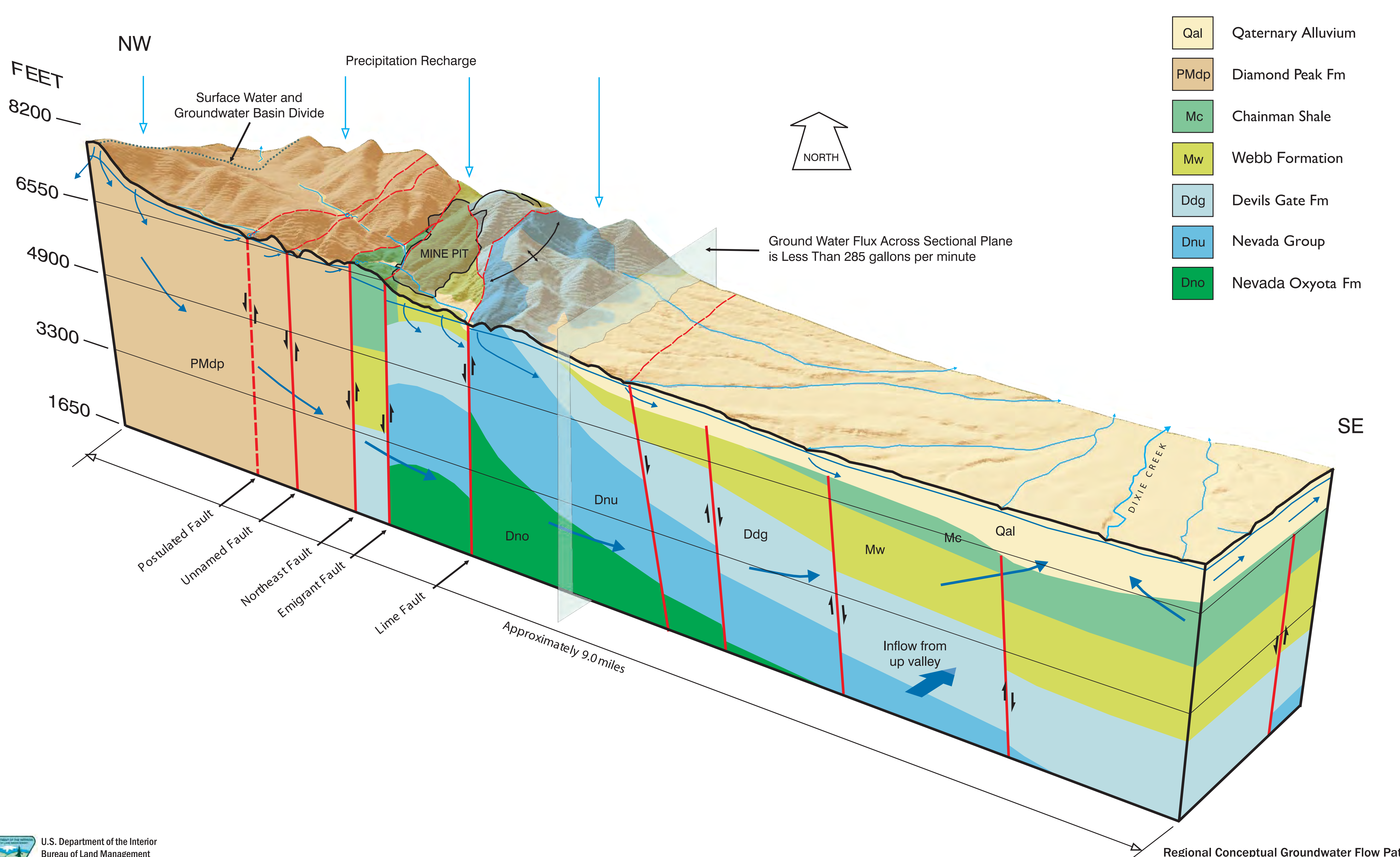

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Elko District Office
ELko, Nevada

Regional Conceptual Groundwater Flow Path
Emigrant Project
Elko County, Nevada
FIGURE 3-6

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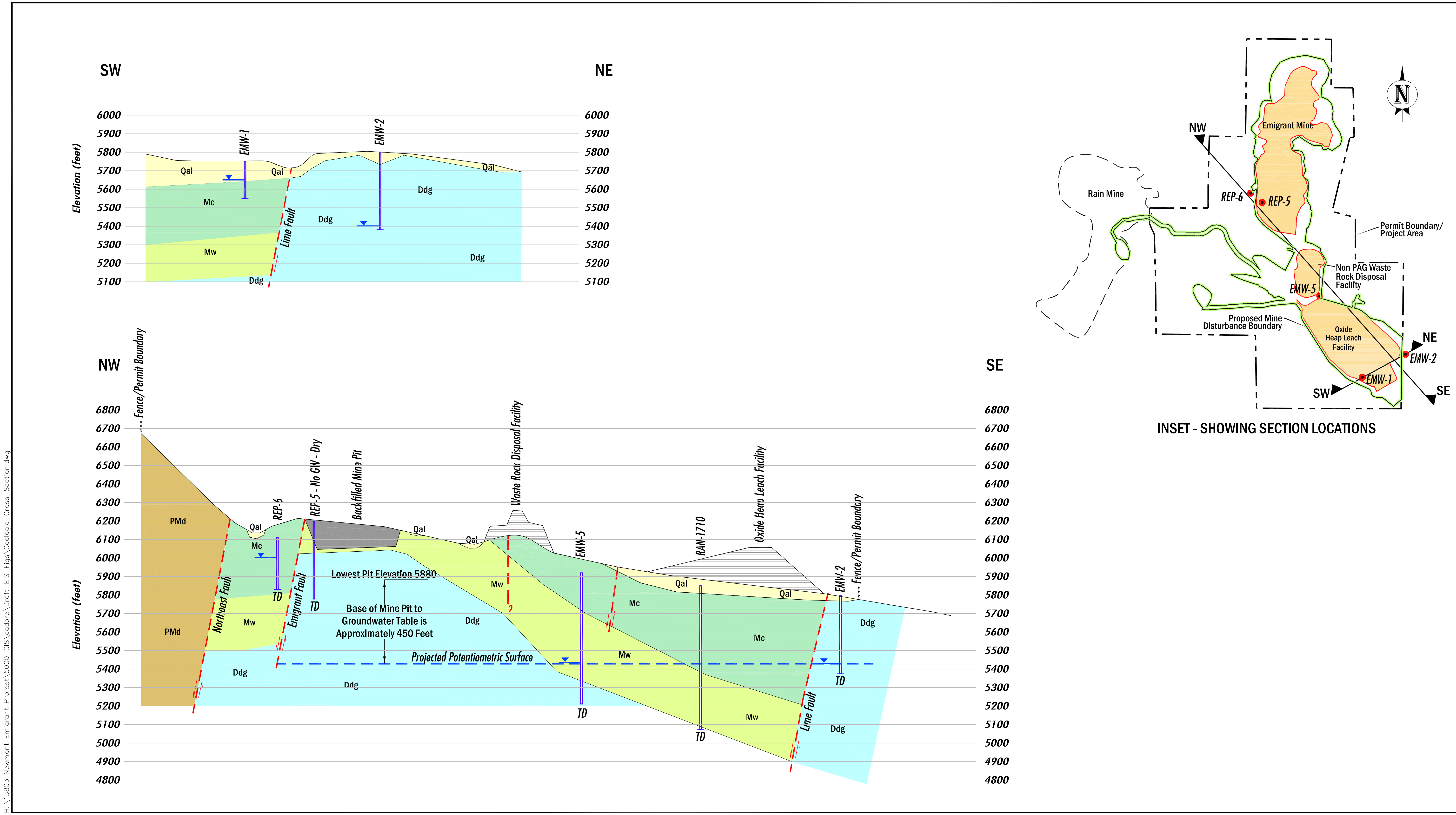

Horizontal: 0 Feet 2000

Vertical: 0 Feet 500

Symbol	Description
Well Collar	
Measured Groundwater (GW) Level in Well	
TD	Total Depth of Well
Qal	Alluvium and Colluvium
PMd	Diamond Peak Formation (Tonka Formation.) (Conglomerate and Sandstone)
Mc	Chainman (Sandstone)
Mw	Webb Formation (Siltstone)
Ddg	Devils Gate Formation (Limestone)

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Bureau of Land Management
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Elko, Nevada

Geologic Cross Sections Showing Wells and Depth to Groundwater
Emigrant Project
Elko County, Nevada
FIGURE 3-7

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Wells and piezometers in the Emigrant Project area are shown on **Figure 3-8**, along with groundwater potentiometric contours for alluvium along Dixie Creek and for bedrock in the proposed mine area. Groundwater in Dixie Creek Valley alluvium generally flows to the north at a low gradient of about 0.01 ft/ft. Groundwater in siltstone bedrock in the proposed mine area generally flows west to east at a gradient of about 0.08 ft/ft.

Depth to groundwater in the proposed heap leach facility area was measured in some exploration and condemnation drill holes. In five holes, depth to water was in the range of 145 to 590 feet below ground surface (Simons & Associates 1997). Three other drill holes did not encounter groundwater at total drilled depths of 175, 255, and 505 feet. Piezometers EMW-2 and EMW-5 in the proposed heap leach facility area encountered groundwater at depths of approximately 360 and 480 feet below ground surface, respectively, as shown on **Figure 3-7**. Shallow groundwater also was encountered in alluvium in the drainage bottom to the west and south of the proposed heap leach facility (Simons & Associates 1997).

Precipitation in the Piñon Range is the primary source of groundwater recharge in the Project area. Average annual precipitation at the Rain Mine (1997-2004) is 13 inches per year (in/yr) and about 10 in/yr in the proposed Emigrant Project area, with up to 20 in/yr in the highest elevations.

An estimate of recharge to the groundwater system from precipitation infiltration was developed using methods presented by Maurer *et al.* (1996). Working in the northern part of the Carlin Trend, Maurer *et al*. (1996) developed a correlation between elevation and precipitation, and estimates of the percentage of precipitation that infiltrates to recharge the groundwater system for various elevations.

Precipitation is estimated by the equation (Maurer *et al.* 1996): $P = (A \times 0.00356) - 8.56$, where P is the mean annual precipitation in inches and A is the altitude in feet above mean sea level. Maurer *et al*. (1996) estimated that, for a mean annual precipitation range of 8 to 12 inches, 3 percent of total precipitation recharges the groundwater system; for a precipitation range of 12 to 15 in/yr, 7 percent recharges the groundwater system; and for 15 to 20 in/yr precipitation, 15 percent recharges the groundwater system.

To apply the method of Maurer *et al*. (1996) to the Emigrant Project site, the drainage basin west of the proposed mine site was subdivided into three elevation zones: one zone between 7,000 feet and the highest point in the drainage basin (7,417 feet); a second zone between 6,500 and 7,000 feet; and a third zone between 6,100 and 6,500 feet. The elevation at the low point on the west side of the proposed mine pit is approximately 6,100 feet. Based on the surface area and median elevation of each elevation zone, precipitation and groundwater recharge were calculated. Recharge for the selected drainage basin was calculated at 478 acre-ft/yr.

Additional components of the overall water balance for the groundwater system as a whole (including both the alluvium and the underlying bedrock) must be incorporated to estimate the quantity of water entering and flowing through the Project area. Over the long-term, change in groundwater storage is minimal. Groundwater flow into the Study Area is assumed to be zero, because the upgradient boundary of the area for which the water balance is being developed is the surface water divide. Also, there is likely no flow into the area through shallow alluvium, as alluvium is typically absent or its thickness is very small at the divide.

Maurer *et al.* (1996) provide estimates of evapotranspiration (ET) depending on the type of vegetation and depth to groundwater. For the Emigrant mine area, total ET rate from this area is approximately 2 acre-ft/yr. Using all information presented above, the estimated groundwater flux flowing in bedrock through the proposed Emigrant mine area from the divide west of the site toward the Dixie Creek valley bottom is 285 gal/min.

Dixie Creek Area

Two water supply production wells (RPW-1 and RPW-2) were installed by Newmont during 1988 along Dixie Creek to provide water for the Rain Mine. A third production well (RPW-3) was installed in the same area in 1984; however, this well currently is not used by Newmont. These three wells are shown on **Figure 3-4**. Highest annual pumping volumes from wells RPW-1 and RPW-2 occurred during 1988-1994, averaging about 100 million gallons per year (gal/yr), decreasing to about 15 million gal/yr during 1995-2004 (Newmont 2004). Maximum total pumping rate was about 1,500 gal/min.

Fourteen piezometers have been installed in the vicinity of production wells RPW-1 and RPW-2 along the Dixie Creek channel. South of the production wellfield, groundwater levels in piezometers are below creek bed elevation. This is one intermittent reach of Dixie Creek where flow does not occur year-round. Depth to water near RPW-1 and RPW-2 is about 50 feet and 10 feet, respectively (Newmont 2004). Well RPW-2 is located closer to Dixie Creek. Water levels in these wells decline a few feet seasonally due to production pumping, with recovery typically occurring during wetter periods and during times of reduced pumping from the production wells (Newmont 2004).

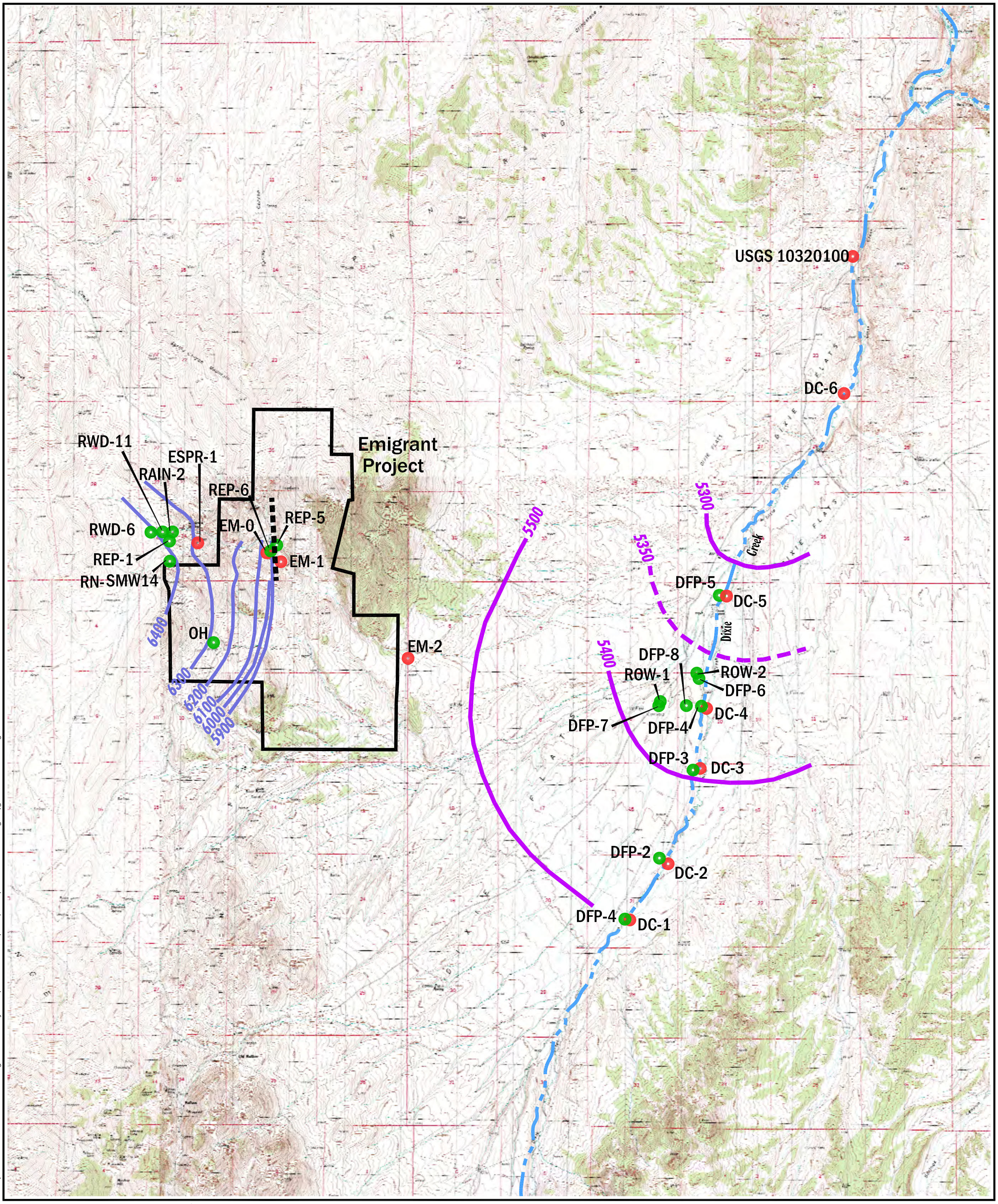
Well construction logs for the production wells and nearby piezometers are presented in Newmont's (2004) report, *Dixie Flats, Ground-Water and Surface-Water Monitoring Results*. These logs show that the production wells (RPW-1, RPW-2, and RPW-3) were drilled to depths ranging from 700 to 860 feet below ground surface. Only well log RPW-3 has lithologic descriptions, indicating that all material intercepted was unconsolidated valley-fill deposits of clay, sand, and gravel. Most of the monitoring wells/piezometers are less than 100 feet deep; however, two of these monitoring wells are 700 and 860 feet deep (ROW-1 and ROW-2, respectively).

Aquifer hydraulic properties have not been determined for the Emigrant Project area; however, the Dixie Creek valley-fill material has yielded an average of about 1,500 gal/min collectively to Newmont's water supply wells (RPW-1 and RPW-2) since 1988 (Newmont 2004). This unconsolidated material has relatively high transmissivity. Using an estimated hydraulic conductivity of 100 feet/day for alluvium in the smaller tributary channels, cross-sectional area of 200 ft^2, and hydraulic gradient of 0.04 feet/feet, groundwater flux in alluvium located along the two tributary channels west of the proposed Emigrant Mine pit area is about 800 ft^3/day, or 4 gal/min.

Bedrock in the vicinity of the proposed mine site is expected to have low primary permeability, with zones of higher permeability where fractures are prevalent and interconnected. As stated above, the Emigrant Fault appears to be a barrier to groundwater flow rather than a zone of higher permeability.

Groundwater Quality

Groundwater quality data in the Emigrant Project area includes water samples collected from Emigrant Spring and other small springs west of the Project area. Newmont would install and sample monitoring wells in selected locations to establish baseline water quality conditions in the Project area in accordance with State Water Pollution Control Permit requirements.



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Basemap Source: USGS 7.5 min DRG files
Data Source: Newmont 2005

0 Feet 8000

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Piezometer
Surface Water Monitoring Site
Siltstone Water Contour (feet)
Alluvial Water Contour (feet)
Approximate Geologic Fault

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Bureau of Land Management
Elko District Office
Elko, Nevada

Groundwater Contours
Emigrant Project
Elko County, Nevada
FIGURE 3-8

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Newmont collected samples from Emigrant Spring on a quarterly basis since mid-1994. A summary of these analyses is included in the *Surface Water Quality* section and in **Tables C-5** and **C-6** (**Appendix C**). Comparison of water quality data for Emigrant Spring (**Tables C-5** and **C-6, Appendix C**) to Nevada Profile I reference values (**Table C-2, Appendix C**) shows that the following parameters have concentrations that exceed one or more Profile I reference values: aluminum, arsenic, iron, and manganese. These exceedances of reference values likely reflect the regional and mineralized groundwater flow system that is a source of water to Emigrant Spring.

Some field parameters were measured by BLM in 1981 and 2003 from springs located in the tributary drainages west of the Emigrant Project area. Parameters measured include: electrical conductivity = 100 to 800 µmhos/cm; temperature = 10 to 24˚C (one spring was 32˚C); and pH = 7.0 to 8.0 su (BLM 1981, 2003).

Some groundwater sample results are available from a monitoring well at the nearby Rain Mine in proximity to the North Waste Rock Disposal Facility. That well (RN-RWD14) had sufficient water to sample once in 2005 and again in 2006 (Newmont 2009d). Results of these samples show following selected values: TDS = 718 and 746 mg/L; pH = 7.2 and 7.7 su; sulfate = 79 and 83 mg/L; and nitrate+nitrite = 0.42 and 0.44 mg/L (Newmont 2009d). The only parameter that exceeds NDEP Profile I reference values shown in **Table C-2** (**Appendix C**) is selenium, with concentrations of 0.069 and 0.075 mg/L (selenium reference value = 0.05 mg/L).

Water Use

Water in the Study Area is used for wildlife, stock watering, mining/milling, irrigation, and domestic purposes. Locations of water right points-of-diversion are shown on **Figure 3-9** and listed in **Table 3-20**. Stock watering uses are scattered throughout Dixie Creek Valley, whereas mining and milling uses are associated primarily with water supply wells located near Dixie Creek that supply water to the Rain Mine and would supply water to the Emigrant Project. The two domestic uses are located in the vicinity of Bullion in the southwest part of the Study Area. The Bartlett Decree of October 20, 1931 and the Edwards Decree of October 8, 1935 adjudicated water rights along Dixie Creek to the Cord Estate and J. Tomera Ranches Inc. (Seibert and Kiracofe 1988).

As of September 2004, 11 surface water and spring diversion water rights and 10 groundwater rights are on record with the Nevada Division of Water Resources (NDWR) (**Table 3-20**). These include certificates, permits, and vested rights. Other historic water rights have been abandoned, cancelled, denied, revoked, or withdrawn. None of the water rights listed in **Table 3-20** are designated as Public Water Reserve (PWR); however, some of the springs located on public land likely qualify as PWRs.

Not included in **Table 3-20** are decreed water rights for approximately 1,500 acre-feet per year (af/yr) of irrigation water from Dixie Creek by Circle L Ranch. Eight surface water diversions permitted to J. Tomera Ranches Inc. for stock watering are located within a 4-mile radius of the Emigrant Project area. Two surface water diversions located approximately 5 miles south of the Project area near Bullion are designated for domestic use.

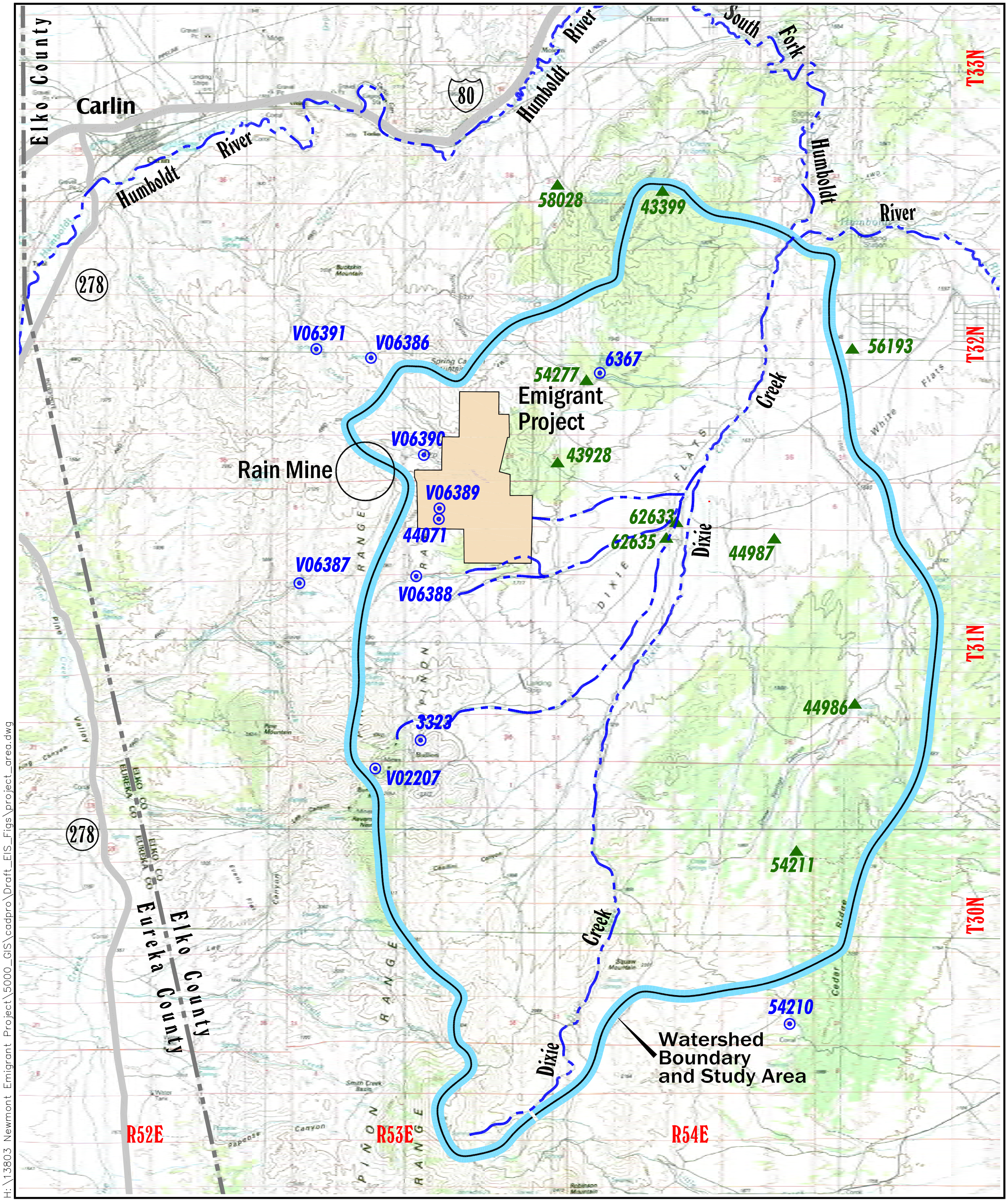
TABLE 3-20
Water Rights in Emigrant Project Area

Water Right No. & Status[1]	Owner Name	Point of Diversion[2]	Diversion Rate (ft^3/sec)[3]	Water Use	Distance from Emigrant Project Area (miles)
Surface Water					
54210-cer	Elko Blacksmith Shop	T30N, R54E, Sec. 36 NWSE	0.008	Stock	12.5
3323-cer	James Burke	T31N, R53E, Sec. 34 NWSE	---	Domestic	4.25
6367-cer	J.T. Ranches	T32N, R54E, Sec. 20 SENW	0.003	Stock	2.0
44071-rfa	J.T. Ranches	T31N, R53E, Sec. 03 SESE	---	Stock	0.75
V02207-vst	Hesson, Hunter, & Hylton	T30N, R53E, Sec. 04 NENW	---	Domestic	5.75
V06388-vst	J.T. Ranches	T31N, R53E, Sec. 15 NENW	---	Stock	2.0
V06389-vst	J.T. Ranches	T31N, R53E, Sec. 03 NESE	---	Stock	0.75
V06390-vst	J.T. Ranches	T32N, R53E, Sec. 34 SWNE	---	Stock	0.75
V06386-vst	J.T. Ranches	T32N, R53E, Sec. 21 NWNE	---	Stock	2.5
V06391-vst	J.T. Ranches	T32N, R53E, Sec. 20 NENW	---	Stock	3.75
V06387-vst	J.T. Ranches	T31N, R53E, Sec. 18 LT01	---	Stock	4.0
Groundwater					
43928-per	Newmont Exploration	T32N, R54E, Sec. 31 LT04	---	Mining & Milling	1.0
44987-cer	BLM	T31N, R54E, Sec. 12 NENW	0.005	Stock	6.0
54211-per	Elko Blacksmith Shop	T30N, R54E, Sec. 12 SWSE	0.011	Stock	9.5
54277-per	BLM; Tomera	T32N, R54E, Sec. 20 SWSW	0.009	Stock	1.8
62633-per	Newmont Exploration	T31N, R54E, Sec. 03 SWSW	0.42	Mining & Milling	4.5
62635-per	Newmont Exploration	T31N, R54E, Sec. 09 SENE	0.84	Mining & Milling	3.5
44986-rfp	BLM	T31N, R55E, Sec. 30 NESE	0.006	Stock	8.5
56193-per	BLM	T32N, R55E, Sec. 19 NENE	0.006	Stock	7.5
43399-cer	J.T. Ranches	T33N, R54E, Sec. 33 NESE	0.016	Stock	5.75
58028-cer	Maggie Creek Ranch	T33N, R54E, Sec. 31 NWSE	0.025	Stock	4.75

Source: Nevada Division of Water Resources (NDWR) 2004.
[1] See **Figure 3-9** for locations of water rights. Status abbreviations: cer = certificate; vst = vested right; per = permit; rfa = ready for action; rfp = ready for action (protested).
[2] T = Township, R = Range, Sec. = Section, quarter sections.
[3] ft^3/sec = cubic feet per second. -–– indicates no information available.

Four groundwater rights are located within a 4-mile radius of the Emigrant Project area (**Table 3-20**). Three of the four wells are permitted to Newmont Exploration for mining and milling purposes; two of these wells are located along Dixie Creek; and the third water right is located closer to the Emigrant Project area. The fourth groundwater right is about 2 miles to the northeast of the Emigrant Mine site, and is held by J. Tomera Ranches Inc. for stock watering purposes.

The two water supply wells (RPW-1 and RPW-2) installed by Newmont for the Rain Mine in 1988 were periodically pumped at a maximum instantaneous rate of 1,500 gal/min from 1988 to 2004 (Newmont 2004). Highest annual pumping volumes occurred during 1988-1994, averaging about 100 million gal/yr, decreasing to about 15 million gal/yr during of 1995 to 2005, and 2 million gal/yr in 2006-2007 (Newmont 2007a). Water from these production wells near Dixie Creek is transported 6 miles to the



Basemap Source: Sure!MAPS RASTER 1:100,000 Nevada Map

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N

POINT OF DIVERSION

- Stream or Spring
- Well

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Bureau of Land Management
Elko District Office
Elko, Nevada

Water Rights
Emigrant Project
Elko County, Nevada
FIGURE 3-9

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Rain Mine by a 12-inch diameter buried pipeline. Approximately 2 to 3 million gal/yr will continue to be pumped from these wells for the Rain Mine for about another 5 years or less.

DIRECT AND INDIRECT IMPACTS

Proposed Action

This section describes potential direct and indirect impacts to Water Quantity and Quality due to proposed mining-related activities at the Emigrant Project site.

Surface Water Quantity and Quality

The Proposed Action would result in disturbance of land (removal of vegetation and modification of the natural landscape) that can result in exposure of soil and bare rock to wind and water erosion. In addition, mine development can include excavation of some rock types that upon exposure to oxygen and water (precipitation) can result in release of trace metals to the environment. Without proper planning and design of the mine project, potential impacts of these activities can result in degrading the quality of surface water and groundwater downgradient of the mine site.

Implementation of the Proposed Action includes control and capture of sediment throughout the Project area during operations and in the post-closure period through installation and maintenance of sediment ponds, run-on and run-off control ditches, and revegetation of disturbed areas. Sediment ponds with run-off ditch systems would be installed at locations throughout the mine area wherever sediment could mobilize and move down slope.

Sediment collected in the run-off and sediment pond system would be periodically removed and returned to soil stockpiles or reclaimed areas within the mine area. Removal of sediment from these structures would maintain the capacity of the ditch and pond system to capture and store subsequent storm events.

A Storm Water Permit (No. MSW-365) has been issued by NDEP to Newmont for the Emigrant Project that specifies monitoring and mitigation measures to reduce and control runoff and sediment from disturbed areas. Surface water management and sediment control measures are described in Chapter 2 – *Proposed Action*.

Design of the engineered stream channel that replaces the existing stream channel would allow sediment from undisturbed areas upstream of the mine area to accumulate in the channel which would facilitate establishment of riparian zones within the new channel. In addition, construction of a riparian area and groundwater cut-off wall upstream of the engineered stream channel would cause groundwater to rise to ground surface and flow into the new channel at this upstream location (see Chapter 2 – *Proposed Action*).

Impacts to surface water quantity, including springs, are not expected to occur as a result of the Proposed Action; primarily due to the intermittent/ephemeral nature of surface water flow in the area, and because no direct discharges from the mine facilities would occur to surface water. Measures included in the Proposed Action as described above and in Chapter 2 are designed to minimize impacts to water quantity.

Potential release of trace metals and other constituents to surface water from development of the Emigrant Mine would not be expected due to the surface water control systems, site reclamation, isolation of PAG rock, and lack of interconnection between groundwater and surface water. PAG waste rock would be segregated and placed in mined-out portions of the mine pit on benches of

Devils Gate limestone, and encapsulated with a minimum 10-ft thick layer of Encapsulation Material. Refer to the *Geology and Minerals* section in this chapter for more information about waste rock characterization and Chapter 2 – *Proposed Action* for a description of PAG encapsulation.

Dixie Creek is on Nevada's 2006 303(d) impaired waters list for total phosphorus and temperature (NDEP 2009b). The Emigrant Project is not expected to adversely affect Dixie Creek for these parameters. Background concentrations of TSS in Dixie Creek sometimes exceed the aquatic life standard of 80 mg/L. Surface water samples collected from Emigrant Spring and an ephemeral drainage downgradient of the Rain Mine North Waste Rock Storage Facility show some exceedences of aquatic life standards for iron, selenium, and/or silver. These sites are located upgradient from the Emigrant Project site.

During closure and decommissioning of the leach pad, addition of makeup water would be suspended and process solutions contained in the heap leach facility would be circulated through the leach pile to promote evaporation of the solution. This method would be used until the bulk of the solution has been removed from the leach pad circuit. As described in Chapter 2 – *Proposed Action*, residual draindown of process solution will be discharged to an evapotranspiration cell. No process solutions would be discharged from the site.

Sediment

Potential direct and indirect impacts to water resources from the proposed Emigrant Project would include erosion and sedimentation to drainages in the vicinity of disturbed areas until vegetation is sufficiently established during reclamation. Primary disturbance areas include the backfilled mine pit, Non-PAG waste rock disposal facility, heap leach pad, and roads. These facilities are located in two tributary drainages that extend eastward from the Piñon Range, through the northern and southern portions of the Project area, and eventually to Dixie Creek located approximately 5 miles east of the Project area. Dixie Creek flows into the South Fork Humboldt River approximately 8 miles northeast of the Project area. Since the tributary channels are ephemeral downstream of the Project area, potential increases in sediment load to surface water would occur during snowmelt and major rain events. The natural sediment load in surface water in this area, however, already is high during these high flow events (also see *Soil Resources* section in this chapter for more information regarding erosion).

As mentioned above, Newmont has obtained a Storm Water Permit for the Emigrant Project that specifies monitoring and mitigation measures to reduce and control runoff and sediment from disturbed areas. Surface water and sediment control measures also are described in Chapter 2 – *Proposed Action*. If increased sediment load did move downstream from the Project area to Dixie Creek, the riparian habitat improvement areas and beaver dams along lower Dixie Creek would help trap sediment and prevent or reduce sediment load to South Fork Humboldt River from this area. Refer also to the *Engineered Stream Channel* section below for a description of other erosion control measures.

Engineered Stream Channel

A permanent surface water engineered stream channel, 5,000 feet in length, would be constructed through the operational and reclaimed mine pit area. Increased sedimentation to the affected drainage channel below the Project area is not expected from the channel, because most of this channel would be constructed on limestone bedrock. The engineered stream channel would be designed to transmit the 500-year, 24-hour storm event. Retention of sediment in portions of the engineered stream channel would be a benefit to possible establishment of riparian areas, and increasing habitat for aquatic species. A detailed description of the construction of the engineered stream channel, including sediment control measures, is included in Chapter 2 – *Proposed Action*.

A sediment catchment basin would be constructed downstream of the heap leach facility to collect sediment transported in surface water above and through the engineered stream channel. The engineered stream channel through the mine pit area would be constructed almost entirely in Devils Gate limestone and, therefore, would not adversely affect water quality.

Placement of the engineered stream channel during and after mining operations would allow continued surface water flow through the Emigrant Project site. Backfilling and reclamation of the mine pit also would allow natural runoff conditions to occur after completion of post-mining closure activities. During mining operations, open pit areas would capture precipitation on a temporary basis.

Groundwater Quantity

Fault blocks isolate zones of groundwater in the Project area, and depth to groundwater in bedrock varies as a result. Groundwater was encountered in the Chainman siltstone at a depth of about 100 feet in a piezometer completed west of the Emigrant Fault (west of proposed mine pit area). On the east side of the fault (in the proposed mine pit area), a piezometer did not intercept groundwater to its total depth of 360 feet in the Webb siltstone. The Emigrant Project ore body is shallow and would be mined above the groundwater table in bedrock. The mine pit may intercept some shallow groundwater in a few isolated locations along the western highwall where it intercepts the Chainman siltstone west of the Emigrant Fault (see **Figures 3-1** and **3-3**). These isolated areas of groundwater drawdown in the siltstone are expected to have no affect on any springs or surface water features (see discussion below). The lowest point in the proposed mine pit would be approximately 450 feet above the projected bedrock water table east of the Emigrant Fault.

Shallow perched groundwater was encountered in some exploration drill-holes in alluvium overlying sedimentary bedrock at depths of less than 15 feet (Simons & Associates 1997). Shallow alluvial deposits of interbedded sand and gravel in the drainage bottoms are up to 50 feet thick. This alluvial material would be removed by the proposed Emigrant Project pit. Therefore, some minor groundwater (approximately 5 gal/min in each of two tributary channels) would flow from alluvium into the west side of the open and backfilled mine pit, causing drawdown of water levels in alluvium upstream of the mine pit. A cutoff wall, however, would be constructed through alluvium in the drainage above the mine pit, thereby directing flow of alluvial groundwater upward into the engineered stream channel. Water exiting the engineered stream channel back into the natural channel would be available to recharge alluvium downgradient of the mine pit.

Discharge from several small springs and seeps west of the Project area, including Emigrant Spring, would not be influenced by the Emigrant Project, because the springs are located upgradient and at elevations higher than the mine facilities, and their locations are controlled by faults not intercepted by the mine pit. A groundwater monitoring program would be implemented for wells in the Emigrant Project area to track water level and water quality conditions throughout Project life.

Production Wells

Short-term impacts to groundwater levels would occur in the central Dixie Creek valley due to removal of water by two production wells (RPW-1 and RPW-2). These wells would transport water from the valley bottom to the Emigrant Mine site for consumptive uses. The production wells are completed into 700 to 860 feet of unconsolidated valley-fill deposits of clay, sand, and gravel. The two production wells were pumped at average combined rates of about 120 to 130 million gal/yr from 1988-1995 for Newmont's nearby Rain Mine.

Water use at the Rain Mine will continue for about another 5 years or less at an expected rate of approximately 3 million gal/yr (Newmont 2008b). The proposed volume to be pumped from Dixie Creek Valley production wells for the Emigrant Project would total about 130 million gal/yr for the 14-year operational mine life. The combined pumping volumes for the Emigrant Mine and Rain Mine for the initial 5-year period (133 million gal/yr) would be less than the peak pumping rate of 138 million gal/yr that occurred for the Rain Mine in 1991 (Newmont 2004), and slightly more than the average pumping rates at Rain Mine from 1988 to 1995 (120 to 130 million gal/yr). Lower pumping rates would occur at the Emigrant Project for post-mine reclamation activities.

No adverse impacts are expected to surface water flow in Dixie Creek and groundwater levels in the valley bottom from proposed pumping for the Emigrant Project. Groundwater withdrawals for the Rain Mine from the Dixie Creek Valley production wells have not measurably impacted flows in Dixie Creek (Newmont 2004). Depth to groundwater measured in the production wells and nearby piezometers shows that water levels decline a few feet seasonally due to production well pumping, with recovery typically occurring during wetter periods and during times of reduced pumping from the production wells (Newmont 2004). A piezometer (DFP-8) located midway between the production wells and Dixie Creek has shown no response to increased pumping rates from the production wells. Portions of Dixie Creek are perennial and appear to be in connection with groundwater; however, the creek is intermittent in the area of the production wells and flows mainly in response to springs, seasonal snowmelt, and major rain events. Monitoring water levels in the wells would continue during the life of the Emigrant Project to detect any possible adverse effects to groundwater.

Groundwater Quality

Static and kinetic geochemical tests of Project area ore and waste rock were used to evaluate potential for acid generation from water contacting the rock. Using these results and recommended criteria for establishing PAG classification, PAG waste rock at the Emigrant Mine would be approximately 4Mt, or 4.9 percent of total waste rock to be removed during mining. Potential for mobilizing trace metals from waste rock and ore also was evaluated using some of the static and kinetic tests. See the *Geology and Minerals* section in this chapter for more information about geochemical rock characterization.

Potential for mobilizing metals from waste rock and ore at the Emigrant site was evaluated using analysis of leachate collected from the Meteoric Water Mobility Procedure and Humidity Cell tests. In general, metal mobility was higher for PAG rock. Constituents for which NDEP Profile I reference values were most commonly exceeded in samples from waste rock and ore include sulfate, aluminum, antimony, arsenic, manganese, nickel, selenium, and thallium. As a comparison, concentrations of aluminum, antimony, arsenic, iron, and manganese measured in some samples from Emigrant Spring have exceeded associated Profile I reference values. Also as a comparison, groundwater samples from a monitoring well located near the North Waste Rock Disposal Facility at the nearby Rain Mine showed an exceedence of Profile I reference values for selenium.

Devils Gate limestone, which has no acid generating potential, would comprise 32 percent of waste rock for the Emigrant Project. Isolation and encapsulation of PAG waste rock with a minimum 10-ft thickness of Encapsulation Material would direct meteoric water around the compacted PAG waste rock. This method would also limit exposure of PAG rock to oxygen and direct meteoric water, thereby reducing potential for acid generation. In addition, the PAG waste rock would be placed onto Devils Gate limestone benches in the Emigrant Mine pit. Any acidic solution that could be generated by waste rock would be neutralized by the underlying limestone. During mining of the Phase III pit, PAG rock may be exposed in the west pit high wall. These exposures would be reclaimed by backfilling with Encapsulation Material from Phase IV mining.

Approximately 450 feet of unsaturated zone thickness occurs beneath the mine pit which would result in slow dispersed movement of any seepage from the backfilled mine pit. Fractures created in the Devils Gate limestone as a result of blasting would not propagate to depths exceeding the standard 20-foot bench configuration used during mining. Unsaturated flow from backfilled pits into the limestone would first fill these fractures and then would move within the undisturbed limestone bedrock. The slow advancement of unsaturated flow in limestone would provide increased opportunity for attenuation and precipitation of metals in limestone bedrock prior to reaching the groundwater table.

Seepage of water into the unsaturated zone in bedrock underlying a PAG cell was modeled by AMEC Geomatrix (2009) using a typical PAG cell design and a calculated average rate of flux out of the cell into underlying limestone. HYDRUS-1D and HYDRUS-2D/3D software were used to predict the flux rate of seepage from the base of the backfilled mine pit. Kinetic Humidity Cell test results were used to estimate the chemistry of seepage from the PAG rock for input into the geochemical equilibrium/speciation software PHREEQC. This model was used to predict equilibrium concentrations of constituents at the top of Devils Gate limestone bedrock immediately underlying the backfilled mine PAG cell. A low permeability growth media cap would be constructed over the final reclaimed encapsulation cell, and vegetation would be established to minimize water seepage to the PAG.

AMEC Geomatrix (2009) modeled both 0.5-ft and 2.0-ft thick growth media cap (HYDRUS-1D and HYDRUS-2D/3D), and both 1 and 5 percent slopes for the top of the reclaimed surface (HYDRUS-2D/3D only). Average rates of seepage to underlying limestone through a typical PAG cell are summarized in **Table 3-21**. For the 0.5-ft thick growth media cap, seepage ranges from 1.33 to 2.67 in/yr, and for the 2.0-ft thick cap, seepage ranges from 0.25 to 1.47 in/yr. The Hydrus-1D model predicts greater seepage for the 2.0-ft thick cap (1.47 in/yr) than the equivalent Hydrus-2D model (0.25 to 0.46 in/yr). In the Hydrus-2D model, the thicker growth media cap maintains moisture closer to the surface over a greater surface area, and thus results in greater actual evaporation and less seepage through the PAG cell to underlying limestone.

TABLE 3-21
Seepage Model Results for PAG Cell in Backfilled Mine Pit
Emigrant Mine

Growth Media Cover Thickness	Seepage/Flux Rates from Hydrus-ID Model Results			Seepage/Flux Rates from Hydrus-2D Model Results					
				1% Surface Slope			5% Surface Slope		
	in/yr	Portion of Annual Precip. (%)	acre-ft/acre/yr	in/yr	Portion of Annual Precip. (%)	acre-ft/acre/yr	in/yr	Portion of Annual Precip. (%)	acre-ft/acre/yr
0.5 ft	2.67	22	0.223	1.74	14	0.145	1.33	11	0.111
2.0 ft	1.47	12	0.121	0.25	2	0.021	0.46	4	0.038

Note: PAG = Potentially Acid-generating; in/yr = inches per year; acre-ft/acre/year = acre-feet per acre per year. Seepage flux rates are from the base of the PAG cell on top of Devils Gate limestone in the backfilled mine pit. Portion of annual precipitation is that percentage of annual precipitation (12.5 inches) discharging from base of PAG cell in backfilled mine pit.
Source: AMEC Geomatrix 2009.

No vegetative cover was included with the model scenarios. Based on model results, total water flux down through the PAG cell would be 0.121 to 0.223 acre-ft/acre/yr for the Hydrus-1D model, and 0.021 to 0.145 acre-ft/acre/yr for the Hydrus-2D model. For a 100-acre PAG cell footprint, total water flux from the base of the cell would be approximately 2 to 22 acre-ft/yr (1 to 14 gal/min) based on the Hydrus-1D and Hydrus-2D models.

Results of the PHREEQC model show that unsaturated zone seepage that enters Devils Gate limestone immediately beneath the backfilled mine PAG cell would have concentrations of antimony, manganese, nickel, sulfate, thallium, and TDS above NDEP Profile I reference standards (AMEC Geomatrix 2009). Establishment of a vegetative cover would reduce seepage volume. In addition, attenuation of chemical constituents would likely occur as seepage water moves down to groundwater through about 450 feet of unsaturated limestone bedrock.

Near the Intera Pond in the Robinson Mining District, Nevada, the presence of limestone underlying the acidic Intera Pond effectively attenuated acid and solutes (Davis *et al.* 2001). Attenuation of inorganic solutes in subsurface environments includes precipitation and coprecipitation (Langmuir 1997). Solid phases precipitate in response to a change in pH that occurs when an acidic solution is neutralized by an alkaline solution or by a neutralizing solid phase such as calcite and/or dolomite, which is abundant (25%) in the 450 feet of Devils Gate limestone under the pit bottom and is also present in lesser amounts in the oxidized Webb siltstone.

Based on simple geochemical model calculations (PHREEQC version 2.13.05; Parkhust and Appello 1999) using the Meteoric Water Mobility Procedure data, neutralization of acidic solutions from the Chainman/Fresh Webb siltstone by the acid neutralizing Devils Gate limestone and/or Webb siltstone would result in precipitation of secondary solid phases (e.g., iron hydroxides (ferrihydrite or goethite), aluminum hydroxide (gibbsite), iron/aluminum/barium sulfate (alunite, jarosite, $Al_4(OH)_{10}SO_4$, $AlOHSO_4$, and barite). Precipitation of these secondary phases would reduce metal solubility, and thus decrease solute concentrations. The presence of iron oxide in waste rock and ore samples from all lithologies (Chainman/Fresh Webb siltstone, Webb siltstone, and Devils Gate limestone) was also detected by XRD.

The heap leach facility and collection ponds would be lined and, therefore, no drain-down water would be expected to move through the liner systems. Atomizers would be used in ponds to increase evaporation of water for about 7 years after cessation of processing. Atomizers would not be used during periods of high wind in order to keep solutions within areas designed for containment. After atomizer use ceases, one or more of the lined ponds would be filled with growth media and vegetated such that natural evapotranspiration would remove residual drain-down water flowing to the "treatment cell". Drain-down rate of water infiltrating through the reclaimed heap leach facility would decline to about 20 gal/min after 5 to 7 years from cessation of processing (Telesto Solutions Inc. 2004, 2005). The final reclaimed surface of the heap leach facility would temporarily store most excess infiltrated meteoric water in the growth media during periods of precipitation, and then release the water by evapotranspiration.

Where needed, diversion ditches would be constructed around the mine pit, waste rock disposal and heap leach facilities, and other ancillary facilities to prevent undisturbed area surface water runoff from entering disturbed areas. These diversion ditches would be designed to convey runoff from the 100-year/24-hour storm event, except for the engineered stream channel through the reclaimed mine pit, which would be designed to transmit the 500-year/24-hour storm event. After cessation of mining, the mine-related facilities would be contoured to promote runoff and prevent water ponding.

The Non-PAG waste rock disposal and heap leach facilities, as well as the backfilled mine pit, would be subject to placement of growth media and vegetated to enhance evapotranspiration so that minimal precipitation would infiltrate into the rock.

A surface water and groundwater monitoring program would be implemented during the Emigrant Project life to detect any possible effects on water quality, depth to groundwater, and surface water flows in the Study Area.

No Action Alternative

The No Action alternative would avoid potential direct and indirect impacts of the Proposed Action to water resources. Some groundwater pumping (approximately 3 million gal/yr) from production wells in Dixie Creek Valley likely would continue for 5 years or less for use in closure activities at the nearby Rain Mine.

POTENTIAL MONITORING AND MITIGATION MEASURES

BLM and NDEP have identified a monitoring measure that would require Newmont to monitor total suspended solids (TSS) and other chemical constituents in surface water at locations upstream and downstream of the proposed Emigrant Project and in natural stream channels located in Dixie Creek drainage outside the influence of the proposed Project. The need for and location of additional groundwater monitoring wells would be determined by NDEP and BLM. These monitoring measures are further discussed in the *Potential Monitoring and Mitigation Measures* section at the end of this chapter.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible or irretrievable commitment of water resources would result from the Proposed Action.

RESIDUAL EFFECTS

Based on the information presented, there would be no residual effects to water resources associated with the Emigrant Project. No impacts from implementation of mitigation measures are expected for this Project.

SOIL RESOURCES

Affected Environment

Information for soil resources in the Emigrant Project area was obtained from the Order III Soil Survey of Elko County, Nevada, Central Part (USDA 1997), an Order II Soil Survey conducted in the proposed disturbance areas by Maxim Technologies (2004a), and an assessment of soil salvage potential (AMEC Geomatrix 2010a). These surveys characterized the soil resources in the Project area. Soil information included potential erosion hazards and general construction- and reclamation-related parameters. Distribution of soil map units and soil salvage potential within the Project area is described in **Appendix D, Tables D-1** and **D-2,** and shown on **Figure D-1**, respectively. Additional information concerning physical and chemical properties of soil in the Project area was obtained from the Natural Resource and Conservation Service (NRCS).

Soil types in the Project area are divided into two physiographic zones: 1) pediment surfaces in the southern portion of the Project area near the proposed leach pad; and 2) steeply sloping terrain at the proposed mine site. Soil types in the leach pad area are comprised of loamy to silty loam surfaces with occasional clay loam subsurface underlain by compacted zones at depths of approximately 24 inches. With the exception of terrace edges, this area is gently sloping with less than 15 percent surface coarse fragments. Clay-rich horizons are occasionally present. Soil at the proposed mine pit site is generally comprised of clayey surface textures with clay-rich subsoil. Soil in this area is shallow, includes bedrock outcrops, has a high percentage of coarse fragments, and is located on steep slopes.

Depth of soil varies throughout the Emigrant Project area. Shallow soil (less than 20 inches to bedrock) and bedrock outcrops are found along weathered slopes and ridges in the mine portion of the Project area. Shallow soil interspersed with moderately deep soil (20 to 40 inches) is also located along the western margin of the Project area.

Soil types encountered at lower elevations in the Project area are dominated by weathered hardpans present approximately two feet below ground surface. The soil types on these pediments, alluvial fans, and terraces are most often without clay-rich horizons. Soil depths of 60 inches or more are found within the drainage bottoms and lower alluvial features.

Restrictive properties of soil that affect suitability as growth media include physical or chemical characteristics that result in inhibition of plant growth or restrict soil structure development. Soil encountered in the Project area generally contains low percentages (three percent) of organic matter resulting in low fertility. Other soil properties considered when determining use as growth medium include: coarse fragment content and size (greater than 3 inches in diameter) in the profile; clay content; soil erodibility or K-factor; and depth to bedrock. Physiographic and non-soil features such as steep slopes, rough terrain, and rock outcrops would also limit the ability for equipment to salvage soil in these areas.

The ability of soil to support vegetation varies throughout the area. On some soil, vegetation is relatively easy to establish and maintain, the surface is stable and resists erosion. Other soil types can support vegetation by modifying one or more properties. Laboratory analytical data did not indicate soil chemistry would interfere with revegetation success. However, soil types in this region generally exhibit low concentrations of organic matter and resultant nutrient availability.

Shallow depth to a restrictive layer, high clay content, and coarse fragments are the common limiting characteristics of soil in the Project area. Eight soil map units (approximately 173 acres) in the area are not suitable for opportunistic salvage due to shallow soil and high concentrations of coarse fragments. Ten soil map units (approximately 557 acres) rate as "poor" overall. The remainder of footprint acreage (626 acres) rate fair for salvage potential. Portions of Map Units M and I have surface horizons with sufficient organic matter composition and other characteristics to rate as "good" for growth medium potential.

Information on each soil family, including percent of soil series included in each mapping unit, slope range, landform, depth to induration or bedrock, rooting restriction depth, permeability, available water holding capacity, surface runoff class, hydrologic group, and erosion hazard potential, is contained in Soil Survey of Elko County, Nevada, (USDA 1997). Additional details on soil family designations are presented in the Order II Soil Survey (Maxim 2004a).

Soil Erosion Hazard

The rate of soil erosion (undisturbed soil conditions) is dependent primarily on slope, soil surface texture, and soil surface cover. The NRCS rates suitability of in-situ soil for potential erosion hazards of water and wind. NRCS erosion hazard ratings for soil in the Emigrant Project area are summarized in the referenced USDA Soil Survey (USDA 1997) and the Order II Soil Survey (Maxim 2004a).

The hazard of water erosion ranges from slight to high within the Project area. Soil types in the northern portion of the Project area rate moderate due to steep, long slopes. However, the high percentage of coarse fragments on the surface, and generally clayey textures, mitigate these values under existing conditions. Water erosion values in lower elevations of the southern Project area generally rate as moderate to high, due primarily to silt and very-fine sand content.

The wind erosion hazard is generally low to moderate due to predominance of surface rock fragments which reduces susceptibility to wind entrainment. Clayey surface textures occur at many locations throughout the Project area which reduces susceptibility to wind erosion. Exceptions include localized very fine sand and silt loam surfaces encountered on pediment surfaces.

DIRECT AND INDIRECT IMPACTS

The National Soil Survey Handbook (USDA 1993), Table 620-11, Soil Reconstruction Material for Drastically Disturbed Areas, rates suitability of soil based on properties that influence erosion and stability of the surface, and productive potential of reconstructed soil. A number of restrictive properties are evaluated in descending order of importance. Reconstruction of soil in drastically disturbed areas involves replacing layers of soil material or unconsolidated geologic material, or both, in a vertical sequence of such quality and thickness that a favorable plant growth medium results.

Potential impacts to soil resources would occur during soil salvage operations and soil redistribution activities. Impacts to soil during salvage and stockpiling operations include physical loss of soil from excavating and handling the soil and interruption of soil biological, physical, and chemical activity as a result of placement of soil in stockpiles. Additional soil loss occurs during reclamation when soil is re-handled from stockpiles and distributed on regraded areas.

Proposed Action

Direct impacts to soil resources resulting from implementation of the Proposed Action include modification of the soil chemical, biological, and physical characteristics as well as direct loss of soil from handling and stockpiling. These impacts would be reduced through direct hauling stripped growth media from active mine pits for placement over backfilled portions of previously mined pit areas where possible. Such efforts would reduce the duration of time that soil is exposed in stockpiles to erosional elements. Direct haulage and placement of stripped growth media would also reduce the losses of biological activity and chemical changes in the growth media.

In areas where direct haul and placement of growth media is not feasible (*e.g.*, borrow areas, ancillary facilities, heap leach pad), growth media would remain in stockpiles over the duration of mining activity. Stockpiled soil would be subject to wind and water erosion resulting in greater loss over the life of the mine. Stockpiled soil would also exhibit decreased biological activity and altered physical and chemical characteristics.

The primary mechanism for direct soil loss is wind erosion. Wind erosion hazard increases when soil is stockpiled, because the surface soil which contains more organic matter (which reduces wind erosion susceptibility) is mixed with subsoil and substratum which contain less organic matter, soil aggregates are destroyed, biological soil crusts are buried, and vegetative cover and litter is removed.

Water erosion potential on disturbed soil could occur during periods of heavy precipitation due to exposed soil, steep slopes, lack of biological soil crusts, and low organic matter content. Under the Proposed Action, Best Management Practices (BMPs) would be implemented to control soil loss including: run-on/run-off control berms, installation of sediment ponds, mulching, interim seeding, leaving selected slopes in a roughened condition, and maintenance of surface water control structures. Soil would be removed from the run-off control ditch system and sediment ponds as needed to maintain capacity. Soil removed from ditches and ponds would be returned to the stockpiles and subsequently used in reclamation.

Chemical changes would result from mixing surface soil horizons with subsoil during salvage and stockpiling of soil from the site. Mixing soil horizons during salvage and stockpiling would reduce the amount of organic matter contained in the surface horizon by diluting the surface horizon with subsoil. Redistributed soil would have lower organic matter content as a result of salvage and stockpiling. Soil biological activity would be reduced or eliminated during stockpiling as a result of anaerobic conditions created in deeper portions of stockpiles. After soil redistribution, biological activity would increase and eventually reach pre-salvage levels.

Soil movement that could occur during the post-closure/reclamation period of the mine site would be controlled through maintenance of BMPs implemented during mining operations. BMPs including sediment control ponds, diversion ditches, silt fences, and revegetation would continue to be used to trap soil that moved from reclaimed areas. The soil would be replaced on reclaimed areas. The use of BMPs would remain until the site stabilizes and meets bond release criteria.

Impacts to physical characteristics of soil include mixing of horizons (loss of soil structure), compaction, and pulverization as a result of equipment handling and traffic; especially during reclamation activities. Soil compaction and pulverization would result in decreased permeability, water-holding capacity, and loss of soil structure. Seedbed preparation activities, including ripping compacted surfaces, would reduce effects of compaction.

No Action Alternative

Implementation of the No Action Alternative would eliminate potential impacts of the Proposed Action on soil resources.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures beyond those associated with the Proposed Action for soil resources have been identified by BLM or NDEP.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Soil loss as a result of the Proposed Action would constitute an irreversible commitment of the resource as it pertains to soil movement from the natural setting to another physical location. Reclamation of disturbed areas using available growth media would re-initiate soil development processes on reclaimed sites. Soil development would reduce or eliminate the potential irretrievable commitment of soil resources.

RESIDUAL EFFECTS

Loss of soil and interruption of natural soil processes and functions (*e.g.*, soil development, infiltration, percolation, water holding capacity, structure, and organic matter) can be reversed by natural soil development over an unknown period. Reclamation efforts would expedite those processes. Loss of vegetation productivity as a result of impacts to soil and land uses could be reversed within 5 to 10 years after reclamation.

UPLAND VEGETATION

Affected Environment

The Study Area for vegetation resources is the proposed mine permit area. Dominant vegetation is characterized by big sagebrush and grassland communities and juniper woodlands (Westech 2004a). Eleven vegetation communities were identified in the Study Area. In addition, springs and seeps provide limited riparian habitat that support a diversity of species not found on drier upland sites. Following fire, non-native cheatgrass has become invasive on some sites, and is a dominant herbaceous species on many sites. **Figure 3-10** is a vegetation map of the proposed mine area. A list of common and scientific plant names identified in the Study Area are presented in **Appendix E**.

Low Sagebrush Community

The low sagebrush community occupies 340 acres and is a common type scattered throughout the Study Area. It occurs on shallow, rocky soil of variable aspect, frequently on ridges, and on convex to straight topography with gentle to moderate slope (up to 30 percent).

Because of low vegetation cover, large areas of bare ground (average 49 percent), and rock cover (30 percent), wildfires have not burned some low sagebrush stands and these stands occur as isolated islands of unburned vegetation within burned areas.

Total vegetation cover averages 35 percent. Low sagebrush dominates the type with cover between 15 and 25 percent; averaging about 22 percent. Other shrubs are generally not present in this type except for an occasional green rabbitbrush. Perennial grasses average 11 percent cover of which Sandberg's bluegrass is dominant. On drier, lower elevation sites, bottlebrush squirreltail and bluebunch wheatgrass are common associates. On upper elevation sites with northerly or easterly aspects, Idaho fescue is present.

Perennial forbs average about 5 percent cover with Stansbury phlox, western hawksbeard and Douglas draba being common. Annual grasses and annual/biennial forbs are not a conspicuous component of the low sagebrush vegetation type.

Burned Low Sagebrush Community

The burned low sagebrush community (145 acres) occupies sites similar to the unburned counterpart, primarily convex to straight ridges and slopes with shallow, rocky soil. Since the low sagebrush type occurs interspersed with the mountain big sagebrush type and, to a lesser extent, with the basin big sagebrush type, mapping type boundaries where the area has burned is difficult and the burned low sagebrush type was frequently mapped as a mosaic of two burned sagebrush types.

Total vegetation cover at 33 percent is similar to the unburned low sagebrush type at 35 percent; however, cover by morphological class varies between burned and unburned stands. Shrub cover is 3 percent on burned sites compared to 22 percent on unburned areas. Low sagebrush and mountain big sagebrush each represent 1 percent cover in the burned plot sampled. Mountain big sagebrush appears to be a seral species occupying burned low sagebrush sites apparently establishing more rapidly than low sagebrush.

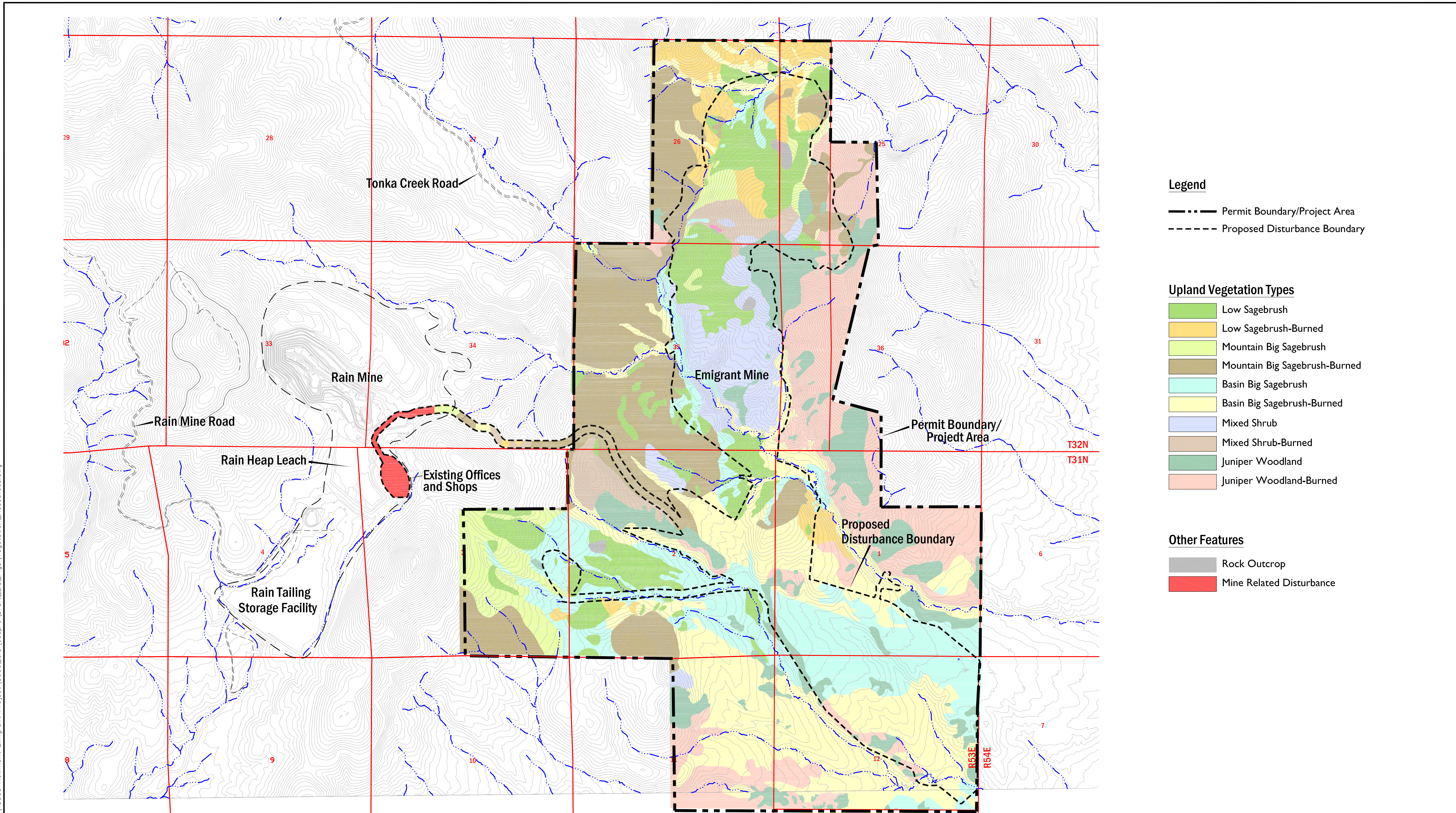
Grass cover is higher on burned sites at 25 percent, compared to 11 percent on unburned sites. Dominant grasses include Sandberg's bluegrass (15 percent), bottlebrush squirreltail (8 percent), and bluebunch wheatgrass (2 percent). Perennial forb cover is slightly higher on burned sites at 8 percent compared to 5 percent on unburned areas. Stansbury phlox is the dominant forb.

In contrast to other burned sagebrush types, annual grasses and annual/biennial forbs are not a conspicuous component of the burned low sagebrush type. This is likely due to the minor presence of these increaser species in the unburned low sagebrush type.

Mountain Big Sagebrush Community

The unburned mountain big sagebrush community (138 acres) is a minor type community in the western and northern portions of the Study Area, primarily because most of the type has been burned. It is found on shallow to deep soil on variable aspects and slope configurations. It occurs on moderately steep, to steep slopes.

Total vegetation cover is about 42 percent of which shrubs represent 25 percent. Mountain big sagebrush provides 20 percent cover with green rabbitbrush at 5 percent cover. Perennial grass and forb cover varies considerably depending on slope, aspect and soil. The site sampled has 10 percent cover of perennial grasses and 11 percent cover of perennial forbs. Moister sites on northerly and easterly aspects have higher herbaceous cover. Dominant grasses on drier sites include Sandberg's



Vegetation Data Source: Westech 2004a.

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U.S. Department of the Interior
Bureau of Land Management
Elko District Office
Elko, Nevada

Upland Vegetation
Emigrant Project
Elko County, Nevada
FIGURE 3-10

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bluegrass and bluebunch wheatgrass, while moister sites have higher cover of Idaho fescue. Common forbs include spurred lupine and Stansbury phlox.

Burned Mountain Big Sagebrush Community

The burned mountain big sagebrush community is an extensive type (636 acres) covering expansive areas in the western portion of the Study Area. It frequently occurs with the burned low sagebrush vegetation type and is often mapped as a mosaic of the two types.

Total vegetation cover averages 29 percent compared to 42 percent for unburned sites. Shrub cover is low at 9 percent compared to 25 percent cover in an unburned stand. Green rabbitbrush is the dominant shrub in most burned mountain big sagebrush areas because of its ability to resprout following fire and, in some areas, is abundant enough to constitute a green rabbitbrush seral community. Mountain big sagebrush is present in most burned areas although cover is generally low.

Perennial grass cover is 8 percent, slightly lower than the 10 percent recorded in an unburned stand. Dominant grasses include Sandburg's bluegrass, bluebunch wheatgrass, Idaho fescue, and bottlebrush squirreltail. Perennial forb cover is also slightly lower in burned stands at 8 percent compared to 11 percent in the unburned plot. Annual grass and annual/biennial forb cover totals 6 percent compared to less than 1 percent in the unburned plot. Species that have increased following fire include cheatgrass, autumn willow-herb, tumblemustard, prairie pepperweed, and fireweed fiddleneck.

Basin Big Sagebrush Community

The basin big sagebrush community is the dominant unburned vegetation type occupying (540 acres) in the southern portion of the Study Area. It occurs in valley bottoms and on terraces, benches, and gentle to moderately steep slopes generally on deeper soil. Elevation ranges from 5,640 to 6,500 feet although the type extends to higher elevations (6,800 feet) in swales with deeper soil and increased moisture. Configuration is generally straight or concave and aspect is variable.

Total vegetation cover of this community is 50 percent. Basin big sagebrush dominates with 35 percent cover. In valley bottoms with deeper soil, shrub height averages 4 to 6 feet; on less productive sites, shrub height decreases to 3 to 4 feet. Scattered Utah juniper is present in some stands.

Common understory species include bottlebrush squirreltail, Sandberg's bluegrass, basin wildrye, Thurber needlegrass, and spreading phlox. Because this type occurs on gentle slopes, benches and valley bottoms easily accessible to cattle, livestock use is prevalent. Perennial grasses have low cover with corresponding increases in annual and biennial forbs and grasses. With increasing elevation the basin big sagebrush vegetation type integrates with the mountain big sagebrush vegetation type forming a zone where both species occur.

Burned Basin Big Sagebrush

The basin big sagebrush community is highly flammable and large areas of the type have burned during the past 5 to 15 years. The burned basin big sagebrush vegetation type is extensive, covering 810 acres throughout the Study Area on broad expanses in the southern portion and along drainages and moist microsites in the northern and central portions of the Study Area.

Vegetation composition is variable depending on age of burn, fire intensity and site conditions. Shrub reestablishment occurs fairly rapidly, because the basin big sagebrush type occurs on more productive sites. Total vegetation cover averages 31 percent compared to 50 percent in an unburned stand. Stands sampled have shrub cover from 5 to 19 percent averaging 13 percent. Basin big sagebrush is the dominant shrub averaging 10 percent cover, with green and rubber rabbitbrush at average cover of 2 and 1 percent, respectively. In some areas, especially older burns, green and rubber rabbitbrush have become well established, forming a seral rabbitbrush vegetation type. Dominant understory species include Sandburg's bluegrass, basin wildrye, bottlebrush squirreltail, and clasping pepperweed. Portions of the burned basin big sagebrush vegetation type were seeded with the exotic crested and intermediate wheatgrass and these species are well established in some areas of the burn.

Annual grasses and forbs are a conspicuous component of the burned type, with cheatgrass cover quite high in some areas. Other common annuals in burned basin big sagebrush include clasping pepperweed, desert alyssum, and alfilaria.

Mixed Shrub Community Type

The mixed shrub community covers 140 acres, primarily in the northern half of the Study Area, and is found at mid to upper elevations on sites with variable aspect, configuration, and soil. This type is characterized by a mix of two or more sagebrush species and green rabbitbrush. Antelope bitterbrush is a diagnostic species for the mixed shrub vegetation type and was used in mapping to differentiate mixed shrub from the floristically similar mountain big sagebrush type.

Total vegetation cover averages about 42 percent. Shrubs dominate the type with 28 percent cover. Sagebrush species are conspicuous with mountain big sagebrush at 10 percent, low sagebrush at 6 percent, and basin big sagebrush at 5 percent. Antelope bitterbrush averages 5 percent and green rabbitbrush has 3 percent cover.

Perennial grasses average about 8 percent cover with 1 to 2 percent cover provided by bottlebrush squirreltail, Sandberg's bluegrass, bluebunch wheatgrass, basin wildrye, and Idaho fescue. Perennial forbs average 6 percent cover and include western hawksbeard, arrowleaf balsamroot, and spurred lupine, each averaging 1 to 2 percent cover.

Burned Mixed Shrub Community

Burned mixed shrub is a common type, occupying 80 acres at mid to upper elevations throughout the Study Area. Floristically it is very similar to the burned mountain big sagebrush type, except that basin big sagebrush and occasionally low sagebrush are reestablishing in burned areas.

Total vegetation cover averages about 30 percent, substantially less than the 42 percent cover in the unburned counterpart. Perennial forbs and shrubs each average about 12 percent cover. Common forbs include spreading phlox, arrowleaf balsamroot, and spurred lupine. Shrubs exceeding 1 percent include green rabbitbrush, basin big sagebrush, and mountain big sagebrush. Fire has effectively eliminated antelope bitterbrush in most of this community. Annual grass and annual/biennial forb cover is not substantially different between burned and unburned sites.

Juniper Woodland Community

The juniper woodland vegetation type is common (364 acres) in the east-central portion and as smaller stands in the southern portion of the Study Area. It was more extensive prior to large fires. This community typically occurs on shallow, rocky soil generally with moderately steep-to-steep, variable-aspect slopes. On more gentle slopes with deeper soil, Utah juniper occurs as more widely spaced trees with basin big sagebrush forming a juniper/basin big sagebrush subtype.

On very steep, lower slopes above drainage bottoms, some sites are essentially barren. Total vegetation cover is 37 percent, comprised primarily of Utah juniper at 25 percent cover and singleleaf pinyon having 1 percent cover. Perennial grasses are generally sparse, averaging only 5 percent cover. Although numerous grass species were recorded in this community, only basin wildrye and Sandberg's bluegrass averaged more than 1 percent cover.

Perennial forbs averaged about 7 percent cover with composition and cover highly variable. One site on a limestone ridge has 17 percent cover by 10 species, while two sites on differing substrates have 1 to 3 percent cover with much lower diversity. Annual grasses and annual/biennial forbs each average less than 1 percent cover.

Shrub cover is also variable among stands with essentially no shrubs in some areas, especially very steep southern exposures. On more level sites with deeper soil, basin big sagebrush is abundant. At mid to upper elevations, mountain big sagebrush and antelope bitterbrush are present although cover is generally low.

Burned Juniper Woodland Community

Large portions (492 acres) of the juniper woodland in the east central and southwestern portions of the Study Area have burned. Total vegetation cover is reduced in burned areas at 21 percent compared to 37 percent in unburned areas. The primary difference is the lack of trees in burned stands with tree cover at only about 1 percent in burned areas, while unburned areas average 26 percent tree cover. Some regeneration of Utah juniper is present, however, especially peripheral to unburned areas or where isolated, seed-producing junipers were missed by fire.

Perennial grass cover is comparable between burned and unburned stands with both averaging about 5 percent cover. Sandberg's bluegrass, bottlebrush squirreltail, basin wildrye, and bluebunch wheatgrass each average 1 to 2 percent cover in burned juniper woodland. Perennial forb cover is somewhat lower in burned areas averaging 4 percent cover compared to 7 percent cover in unburned areas. Perennial forbs averaging about 1 percent cover in burned juniper woodland include spurred lupine, pointed cryptantha, and spreading phlox.

Annual grass and annual/biennial forbs are more prevalent in burned areas totaling about 5 percent cover compared to only 1 percent cover in unburned stands. Cheatgrass is the dominant annual increaser in the burned area.

Average shrub cover also increased in burned juniper woodland to about 8 percent, while sampled unburned stands average only 2 percent cover. Basin big sagebrush and green rabbitbrush have generally increased post-burn. Shrub response, however, is variable between burned areas with some sites having low shrub cover and other sites with much higher shrub cover.

Invasive, Non-Native Species

Noxious weeds are defined under Nevada law (NRS 555.005) and the federal Noxious Weed Act of 1974, amended by Section 15 of the U.S. Farm Bill, Management of Undesirable Plants on Federal Lands, as any species of plant that is or is likely to be detrimental or destructive and detrimental to control or eradicate. Noxious weeds are damaging to the environment and local economy, and replace desirable vegetation.

Often noxious weeds proliferate where native vegetation has been removed or disturbed.

Forty-four species of noxious weeds have been identified in Nevada (NRS 555.101). Common species in Elko County include leafy spurge (*Euphorbia esula*), Scotch thistle (*Onopurdum acantheum*), tall pepperweed (*Lepidium latifolium*), musk thistle (*Carduus nutans*), spotted knapweed (*Centaurea maculosa*), Russian knapweed (*Centaurea repens*), hoary cress (*Cardaria draba*), and Dyer's woad (*Isatis tinctoria*).

Two noxious weed species were found in the Study Area: Scotch thistle and hoary cress. Scotch thistle is abundant along the Rain Mine pipeline/powerline corridor through the Study Area and along the road to Emigrant Springs. It is common along other roads, exploration trails, and drill sites. Scotch thistle is spreading into adjacent native vegetation, especially burned areas. This species was observed several hundred feet from the Emigrant Springs road and throughout the basin big sagebrush and burned basin big sagebrush vegetation types along the main drainage in the Study Area.

Hoary cress was reported by EIP Associates (1997) for the Study Area based on field work conducted in 1993. Hoary cress was recorded on the drainage below Emigrant Springs just upstream from where the drainage crosses the main north/south road through the Study Area. This population was not found in August 2004. Cheatgrass is present in small amounts in the Study Area.

Special Status Plant Species

The Study Area for Special Status Plants is the proposed mine permit area. There are no plants listed as threatened or endangered under the Endangered Species Act of 1973 known or with potential to be present in the Study Area (Cedar Creek Associates 1997); however habitat for nine plants listed as sensitive by BLM may be present in the Study Area (**Table 3-22**).

Searches of the Study Area found no sensitive species (Westech 2004a). Four cactus populations were found during the survey. Two populations are *Pediocactus simpsonii* var. *simpsonii* and two are *Opuntia erinacea* var. *erinacea*. A Nevada Native Species Site Survey Report was completed and submitted for these populations. All cacti are protected by Nevada state law (NRS 527.060-.120).

Habitat for wooly fleabane and Lewis buckwheat may be present at the highest elevations of the Study Area. Habitat for Elko rockcress, Osgood Mountain milkvetch, grimy mousetail, and Leiberg clover may be present on rock outcrops and gravelly deposits. Habitat for Owyhee prickly phlox may be present on steep cliffs and canyon walls. Habitat for Meadow Pussytoes and least phacelia may be present around seeps and springs. These species were not identified during surveys of the Study Area (Cedar Creek Associates 1997; Westech 2004a).

TABLE 3-22
Sensitive Plants with Suitable Habitat in Emigrant Project Area

Common Name	Scientific Name	Habitat
Meadow Pussytoes	*Antennaria arcuata*	Sparsely vegetated seasonally dry seeps, springs and parts of moist alkaline meadows.
Elko rockcress	*Arabis falcifructa*	Dry, densely vegetated, relatively undisturbed soils with soil crust, in sagebrush communities; 5300-6100 feet elevation.
Osgood Mountains milkvetch	*Astragalus yoder-williamsii*	Dry, open granodiorite soils in sagebrush communities; 5660-7300 feet elevation
Wooly fleabane	*Erigeron lanatus*	Alpine and subalpine talus slopes
Lewis buckwheat	*Eriogonum lewisii*	Dry open ridges in central Nevada at elevations 6470-9720 feet
Grimy mousetail	*Ivesia rhypara var. rhypara*	Dry, barren outcrops and badlands, cobbly riverbed deposits, and shallow gravel, 5370-6200 feet elevation
Owyhee prickly phlox	*Leptodactylon glabrum*	Crevices in steep to vertical canyon walls; 4710-5300 feet elevation.
Least phacelia	*Phacelia minutissima*	Vernally saturated, sparsely vegetated swales in sagebrush zone; 6240-8900 feet elevation
Leiberg clover	*Trifolium leibergii*	Dry, shallow, barren soils of crumbling volcanic outcrops, mostly on upper slopes at elevations of 6560-7800 feet.

DIRECT AND INDIRECT IMPACTS

Proposed Action

The Proposed Action would directly affect about 1,400 acres of upland plant communities as a result of excavation of mine pits, and construction of waste rock disposal, heap leach, and other ancillary facilities (**Table 3-23**). Most of the vegetation disturbed by proposed mine development would be dominated by sagebrush (1,064 acres) of which 510 acres have been burned in recent fires. Other plant communities that would be removed by the Proposed Action include juniper woodlands and mixed shrub communities.

Dust from roads and mining activities could coat vegetation in areas adjacent to or downwind from dust sources. Dust on vegetation predisposes some species to insect infestation. Typically, communities of big sagebrush have proven difficult to re-establish on reclaimed land (Schuman and Booth 1998; Vicklund *et al*. 2004). Control of fugitive dust on roads through use of water and chemical binders would reduce the amount of dust that would settle on vegetation.

TABLE 3-23 Plant Communities Affected by Proposed Action Emigrant Project		
Community Type[1]	**Area Affected (acres)**	**Percent Cover Type Affected**
Low Sagebrush (LS)	211	62
Burned Low Sagebrush (LS-B; LS-B/LS; LS/LS-B)	58	40
Mountain Big Sagebrush (MBS; MBS/MBS-B)	30	22
Burned Mountain Big Sagebrush (MBS-B; MBS-B/BBS-B; MBS-B/LS-B; MBS/LS)	139	22
Basin Big Sagebrush (BBS; BBS/MSB)	313	58
Burned Basin Big Sagebrush (BBS-B; BBS-B/BBS; BBS-B/JW-B; BBS-B/MBS-B; BBS/BBS-B)	313	39
Mixed Shrub (MS)	126	90
Burned Mixed Shrub (MS-B)	41	51
Juniper Woodland (JW; CC; JW/BBS; JW/MS; MS/JW)	136	37
Burned Juniper Woodland (JW-B)	45	9
Total Acres	**1,412**	**38**

Note: LS = Low Sagebrush; LS-B = Low Sagebrush Burned; MBS = Mountain Big Sagebrush; MSB-B = Mountain Big Sagebrush – Burned; BBS = Big Basin Sagebrush; BBS-B = Big Basin Sagebrush – Burned; MS = Mixed Shrub; MS-B = Mixed Shrub – Burned; JW = Juniper Woodland; JW-B = Juniper Woodland – Burned; CC = Chokecherry.

[1] Specific acreage for community types are contained in the Vegetation Report (Westech 2004a).

Concurrent revegetation during and after mining would likely re-establish permanent and stable vegetation cover within 5 to 10 years, with the exception of areas revegetated with big sagebrush; assuming livestock use in the area is deferred and noxious weeds are controlled. Reclaimed plant communities would likely differ in species composition from native pre-mining communities. Reclaimed areas would be dominated by grasses with low densities of native forbs, shrubs, and trees. Big sagebrush, a dominant shrub in the Study Area, would likely be present at lower densities following mining.

Invasive, Non-Native Species

Disturbed sites and recently seeded areas are candidates for invasion by undesirable species such as noxious weeds and cheatgrass. Indirect effects of the Proposed Action would include potential movement of weedy species from reclaimed areas to adjacent stands of native vegetation.

Noxious weed control methods associated with the Proposed Action would control the invasion of weeds onto the mine area and reduce the potential for the mine area to be a source of noxious weed seed for adjacent, uninfested areas. Successful reclamation of the mine site would result in a vegetation community that would be less susceptible to weed invasion.

Special Status Plant Species

No special status plant species would be affected by the Proposed Action; however, populations of cactus protected under Nevada law would be removed during proposed mine development (Westech 2004a), after obtaining the appropriate state permit. A State permit may only be required if the cactus is to be sold.

No Action Alternative

Vegetation resources in the Study Area would not be impacted by implementation of the No Action alternative since no ground disturbance associated with mining activities would occur.

Invasive, Non-Native Species

Invasive, non-native species would likely spread from existing infestations in the Project area as a result of the No Action alternative.

Special Status Plant Species

Special status plant species would not be affected by implementation of the No Action alternative since no ground disturbance associated with mining activities would occur. Impacts to vegetation associated with other ground disturbing activities in the area, including livestock grazing, would continue.

POTENTIAL MONITORING AND MITIGATION MEASURES

BLM and NDEP have identified a mitigation measure that would favor establishment of big sagebrush on portions of the proposed Project site. In addition, Newmont would be required to eradicate Scotch thistle in and adjacent to the proposed Project area prior to construction. No monitoring or mitigation measures have been identified for Special Status Plant Species. Further discussion of these measures is located in the *Potential Monitoring and Mitigation Measures* section at the end of this chapter.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approximately 98 acres of the Phase VIII mining sequence would be partially backfilled. Reclamation would include grading backfill material to drain, placing growth media, and revegetation. A highwall would remain along the east and north portions of the pit offering habitat for bats and raptors.

When reclamation is completed, no irreversible or irretrievable loss of vegetation productivity is expected in areas that would be reclaimed; however, species composition of reclaimed areas would likely differ from pre-mining communities.

Invasive, Non-Native Species

Where weed infestations occur, they represent an irretrievable commitment of range productivity. Control of noxious weeds during reclamation would avoid loss of range productivity.

Special Status Plant Species

There would be no irreversible or irretrievable commitments of resources to special status plants.

RESIDUAL EFFECTS

Post-mining plant communities likely would differ in species composition from native plant communities for several decades (*i.e.*, higher density of grasses and reduced densities of native forbs, shrubs, and trees). Though increased density and productivity of grasses would benefit livestock and wildlife with affinities for grassland habitat, it would be detrimental to species dependent on shrub and tree habitats.

Invasive, Non-native Species

No residual effects to the existing native plant community beyond the current conditions resulting from invasive, non-native species have been identified.

Special Status Plant Species

No residual effects to special status plants have been identified.

WETLAND AND RIPARIAN AREAS

Affected Environment

The Study Area for Wetland/Riparian Areas includes the proposed mine permit area and portions of ephemeral drainages west of the permit boundary that flow through the mine permit area as shown on **Figure 3-11**.

Wetland and Non-Wetland Waters

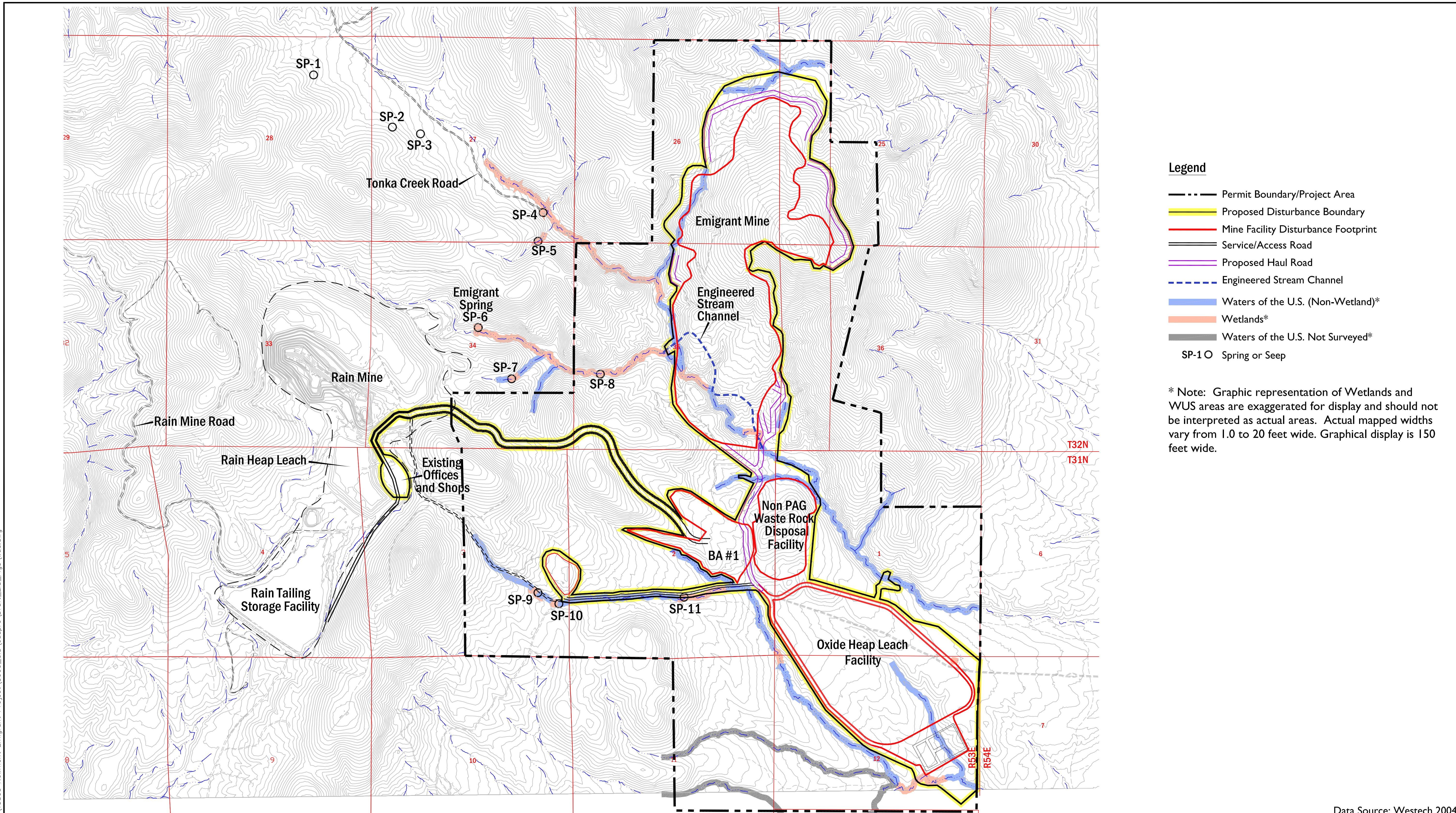
Wetlands are regulated under Section 404 of the Clean Water Act as a subset of Waters of the U.S. Wetlands are defined as areas that are inundated or saturated by surface water or groundwater at frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (U.S. Army Corps of Engineers 1987). Jurisdictional wetlands are wetlands that are contiguous with interstate waters (*i.e.*, not isolated). Isolated wetlands not connected with interstate waters are not jurisdictional.

Wetlands in the Study Area are associated with springs/seeps and perennial and intermittent drainages. Wetland surveys delineated 3.9 acres of jurisdictional wetland and 3.0 acres of non-wetland Waters of the U.S. in the Study Area (**Figure 3-11**) (Westech 2004b). Eight springs or seeps were identified within the Study Area. Springs and seeps discharge to three ephemeral drainages that drain the east flank of the Piñon Range, cross the Study Area, and eventually are confluent with Dixie Creek. The northern-most two drainages converge into a single channel near the western side of the proposed disturbance boundary. Portions of these two channels have perennial flow due to discharge from several springs and seeps near the western permit boundary (**Figure 3-4** and **Figure 3-11**).

Herbaceous wetland vegetation is associated with springs/seeps and larger drainages where seasonal flow is augmented by upstream springs. Drainages supporting wetland vegetation are flooded or saturated during spring runoff through the middle of the growing season. Wetlands are restricted to the banks and lowest stream terraces and are generally only a few feet wide. With increasing distance below the springs, wetland vegetation becomes intermittent and disappears as stream flow enters alluvium.

Dominant wetland and/or riparian plants include Baltic rush, dagger-leaf rush, Nebraska sedge, redtop, Kentucky bluegrass, cow clover, Rocky Mountain buttercup, curly dock, common dandelion, and common plantain. Vegetation along drainages downstream from the herbaceous wetlands is composed mostly of upland species, usually basin big sagebrush.

The two northern-most drainages along the west side of the Study Area contain the most wetlands. The primary source of water for these wetlands is several springs/seeps in the drainage bottoms (springs/seeps SP-4, SP-5, SP-6, SP-7, & SP-8; **Figure 3-11**). These wetlands support cattails, bulrush, and other species adapted to saturated soil conditions. Woody vegetation such as willows and wild rose are sparse. Shrubs exist where cattle have been fenced out of the wetland area around Emigrant Spring (spring SP-6; **Figure 3-11**). Livestock use has limited development of woody wetland vegetation (EIP Associates 1997; Cedar Creek Associates 1997).



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U.S. Department of the Interior
Bureau of Land Management
Elko District Office
Elko, Nevada

Wetlands and Waters of the U.S.
Emigrant Project
Elko County, Nevada
FIGURE 3-11

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Riparian Areas

Riparian areas are the vegetated areas bordering springs, streams, and other bodies of water and include wetlands, stream channels, and vegetation adapted to soil and moisture conditions transitional between uplands and wetlands. The extent to which riparian areas perform ecological functions is determined by hydrologic, vegetation, and erosion features of a riparian system such as flood frequency, sinuosity, width/depth ratios, gradient, and riparian zone width. Vegetation attributes include composition, age structure, indicator species, root masses, bank cover, vigor, and woody debris recruitment potential. Erosion attributes include floodplain and channel characteristics, point bar cover, lateral stream movement, stability, and water/sediment balance.

Riparian areas in the Study Area are generally grazed by livestock and exhibit the following indications that they are not functioning optimally:

- High stream flows cause erosion and elevated sediment load;
- Inadequate riparian vegetation to capture bedload and contribute to floodplain development;
- Inadequate vegetation to improve flood-water retention and groundwater recharge;
- Inadequate root masses to stabilize stream banks;
- Noxious weeds proliferating along some riparian reaches;
- Large unstable sediment deposits in the channel bottom; and
- Unstable and poorly vegetated stream banks.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Total area of wetlands and non-wetland Waters of the U.S. that would be permanently disturbed by proposed mine operations is 0.15 acre and 0.376 acre, respectively (**Figure 3-11**). Jurisdictional determination of Waters of the U.S. is based on the presence of bed and bank.

The proposed replacement channel would be constructed as a 5,000-ft long engineered stream channel excavated in bedrock. A detailed description of the engineered stream channel is included in Chapter 2 – *Proposed Action*.

A slurry cut-off wall would be constructed in the alluvium at the upstream end of the new engineered stream channel to prevent dewatering of the alluvium upstream of the mine pit (see Chapter 2 – *Proposed Action*). This would be accomplished by trenching down to bedrock across the alluvium at the head of the engineered stream channel and installing a slurry cut-off wall that would cause groundwater in the alluvium to rise to the surface at that point. This water would help create wetland and riparian habitat. The transition from the alluvium-filled valley upstream to the engineered stream channel downstream would be designed to control alluvial flow and reduce or eliminate seepage of water into the mine pit.

Wetland and riparian plant species are expected to increase in the Emigrant drainage as a result of the new engineered stream channel. The existing natural channel is degraded as a result of livestock grazing practices and a lack of perennial flow. The new engineered stream channel includes placement of rock weirs and step pools which would pond water and support increased retention and flow of water.

Planted and naturally colonizing riparian species including willows are expected to trap sediment, increasing the ability of the system to support vegetation and store and capture water from runoff.

No Action Alternative

Implementation of the No Action alternative would result in no additional impacts to wetland/riparian areas in the proposed Project area. Impacts to wetland/riparian areas associated with other ground disturbing activities in the area would continue.

POTENTIAL MONITORING AND MITIGATION MEASURES

BLM and NDEP have identified a mitigation measure to require fencing of wetland and riparian areas adjacent to the proposed Project area that would reduce effects of livestock on vegetation and stream banks. Further discussion of this measure is contained in the *Potential Monitoring and Mitigation Measures* section at the end of this chapter.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The Proposed Action would result in removing or filling approximately 0.15 acre of wetlands and 0.376 acre of non-wetland Waters of the U.S. Loss of riparian and wetland habitat associated with removal of the natural stream channel would be offset by proper construction of the engineered stream channel to achieve natural conditions including re-establishment of riparian vegetation. If stable riparian habitat does not develop, Newmont would be required to implement plans to restore riparian areas in the engineered stream channel. Newmont is seeking a Section 404 Permit (pursuant to the Clean Water Act) from the U.S. Army Corps of Engineers to address potential loss of jurisdictional wetlands.

RESIDUAL EFFECTS

If stated design and mitigation efforts are successful, there would be no residual effects to wetland or riparian areas.

FISHERIES AND AQUATIC RESOURCES

Affected Environment

The Study Area for fisheries and aquatic resources includes the proposed Project area, drainages immediately adjacent to and flowing through the proposed Project area, and lower Dixie Creek to its confluence with South Fork Humboldt River (**Figure 3-4**).

Most of the Emigrant Project area is drained by two channels that extend eastward from the Piñon Range through the proposed Project area and eventually join Dixie Creek approximately 5 miles east of the Project area (**Figure 3-4**). The northern tributary channel trends through the proposed mine pit area, whereas the southern channel is located immediately west and south of the proposed heap leach facility.

Both channels west of the proposed mine pit area contain flow most of the year owing to the presence of several seeps and springs in the drainage bottoms, the most prominent of which is Emigrant Spring, located in the upper end of a tributary channel west of the proposed mine pit area (**Figure 3-11**). Flow in the drainages often disappears a short distance below the springs and seeps except during periods of snowmelt and major rain events. Both drainages trending through the Project area eventually join the lower reach of Dixie Creek. This reach of Dixie Creek is typified by discontinuous flow to its confluence with South Fork Humboldt River. Dixie Creek exhibits continuous flow seasonally during snowmelt or runoff events.

Previous Surveys

Recent (1996 and 2004) fish population surveys were conducted in the vicinity of the Emigrant Project by NDOW. These studies assessed fisheries in the South Fork Humboldt River and Dixie Creek. SWCA (2004) conducted a survey of approximately 7 miles of Dixie Creek upstream from the confluence of South Fork Humboldt River. Maxim (2004b) conducted a fisheries survey of the northern tributary channel in the Project area. A summary of these surveys and previous surveys identifying fish presence in the vicinity of the Emigrant Project is presented in **Table 3-24**.

TABLE 3-24
Results of Fish Surveys in Aquatic Resources Study Area
Emigrant Project

Stream	Agency/Entity	Year	Species Present
South Fork Humboldt River	NDOW	1996 1999 2003	Smallmouth bass (*Micropterus dolomieu*) Brown trout (*Salmo trutta*) Rainbow/cutthroat hybrids Lahontan cutthroat trout (*Onorhynchus clarki henshawi*)[1] Rainbow trout (*Oncorhynchus mykiss*) Lahontan speckled dace (*Rhinichthys osculus*) Lahontan redside shiner (*Richardsonius egregious*) Lahontan mountain sucker (*Catostomus platyrhynchus*) Tahoe sucker (*Catostomus tahoensis*) Tui Chub (*Gila bicolor*)
Lower Dixie Creek	NDOW	1997	Lahontan mountain sucker Tahoe sucker Lahontan speckled dace
Lower Dixie Creek	SWCA	2004	Lahontan speckled dace Lahontan redside shiner Tahoe sucker
Permit Boundary Area Drainage Tributary to Dixie Creek	Maxim Technologies	2004	Lahontan speckled dace Lahontan redside shiner

[1] Lahontan cutthroat trout present in the South Fork Humboldt River were hatchery stock planted in South Fork Reservoir for sport fishing. Stocking no longer occurs and this population is not targeted for recovery under the 1995 Lahontan Cutthroat Trout Recovery Plan.
Note: NDOW – Nevada Department of Wildlife
Source: Evans 2007.

Project Area Drainages

Until 2004, indications were that fish were not present in the northern tributaries transecting the Project area. Maxim (2004b) identified two fish species present in this northern drainage in a one-mile reach of stream from below Emigrant Spring to below the confluence of the two forks comprising the northern drainage system (**Figure 3-4**). Lahontan speckled dace and Lahontan redside shiner were collected at eight locations within this area. The channel below this area was dry at the time of field observation, as was the southern drainage within and near the Project area.

Lower Dixie Creek

SWCA (2004) completed a survey that concentrated on searching for cutthroat trout and/or nonnative salmonids entering lower Dixie Creek from South Fork Humboldt River as nonnative salmonids could threaten the pure Lahontan cutthroat trout population in Upper Dixie Creek. During this study, investigators identified several fish species in a reach of the stream between its confluence with South Fork Humboldt River to a point approximately 7 miles upstream. Identified species included Lahontan speckled dace, Lahontan redside shiner, and Tahoe sucker. Juveniles of all three species were found, indicating that lower Dixie Creek supports self-sustaining populations of these native fish. Although not documented, Elliott (2004) suggests Lahontan cutthroat trout could enter Lower Dixie Creek from South Fork Humboldt River by an individual drifting down from the South Fork Humboldt River dam or as the result of downstream drift from Upper Dixie Creek during periods when flow is present throughout the Dixie Creek drainage.

The USGS hydrograph from 1989-1996 (**Figure 3-5**) shows that lower Dixie Creek becomes intermittent in late summer, which limits trout habitat (see *Water Quantity and Quality* section). In addition, SWCA (2004) indicated there was no recent evidence of spawning by trout in lower Dixie Creek, presumably because of the stream's intermittent nature. However, resting and feeding habitats were identified by SWCA, beginning about 3 miles upstream from the confluence of Dixie Creek and South Fork Humboldt River. In this location, which is approximately 5 miles upstream, BLM has fenced Dixie Creek to restrict cattle access and has reduced the frequency and duration of hot season livestock grazing in the area. This action has revegetated the riparian area and is providing water quality benefits such as lower stream temperatures and sediment retention (Evans 2004). Additionally, perennial reaches in this area allows for year-round presence of aquatic life (fish, macroinvertebrates and periphyton), small mammals, birds, reptiles and amphibians, and a variety of other species that use riparian habitats.

Macroinvertebrates

Limited data are available concerning macroinvertebrates in and around the Project area. In conjunction with the fisheries survey conducted by Maxim (2004b), aquatic macroinvertbrate samples were collected at three locations in the channel below Emigrant Spring near the proposed mine site using the EPA Rapid Bioassessment Macroinvertebrate Protocol described in Barbour *et al*. (1999). Macroinvertebrate samples were collected for laboratory analysis to identify species, relative abundance, number of taxa, dominant taxa, and percent dominant taxa. Further analyses were performed to calculate biotic integrity indices, ratios of functional groups (scraper, shredder, and filtering taxa), ratios of Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisfly), and Chironomidae (midges) taxa (EPT), tolerance quotients, tolerance values, and community similarity indices (Maxim 2004b).

Results of the macroinvertebrate survey (**Table 3-25**) indicate poor or stressed water quality conditions are present at all sites sampled within the channel that contains Emigrant Spring. The Shannon-Weaver index, which evaluates effects of stress on aquatic communities of invertebrates (Klemm *et al.* 1990), displayed scores below 1.0 at all sites. This index generally has values ranging from 0 to 4.0, with values less than 1.0 indicating severe stress, and values greater than 2.5 indicating a healthy invertebrate population. The low scores likely reflect degraded stream and riparian habitat conditions.

TABLE 3-25
Macroinvertebrate Data Summary
Emigrant Project

Site	Corrected Abundance (# ind/m2)	Dominant Community Composition (% Order)	Dominant EPT Taxa (% Order)	Richness (# species)	Shannon-Weaver Index (H')	Dominant FFG (% FFG)
Emigrant Spring Creek 1	1776	5.07 Diptera	2.70 Ephemeroptera	15	0.27	94.82 Gatherers
Emigrant Spring Creek 2	596	35.57 Diptera	1.17 Ephemeroptera	16	0.67	81.88 Gatherers
Emigrant Spring Creek 3	1617	42.8 Diptera	4.02 Ephemeroptera	26	0.81	61.41 Gatherers

Notes: #ind/m^2 = number of individuals per square mile; EPT = Ephemeroptera-Plecoptera-Trichoptera; FFG = Functional Feeding Group.
Source: Maxim 2004b.

Habitat

Habitat surveys were conducted at three locations on the northern tributary channel within and near the Project area where fish were observed and captured (Maxim 2004b). The habitat surveys conducted were primarily qualitative and included an assessment of channel dimensions, riparian condition, and pool conditions. Results of the surveys are summarized in **Table 3-26**.

Habitat in the drainage hosting Emigrant Spring has been created by variable seasonal flow. The G4 channel type (Rosgen 1996) consisted of boulders, cobbles, gravel, and silt. In general, the reaches evaluated were determined to consist of stable meanders with low-gradient riffle-pool morphology. Pools were typically of the straight or lateral scour type, the later formed by the influence of boulders present within the bankfull-width of the channel. Large woody debris recruitment potential was observed to be low to nonexistent. This drainage exhibits a degraded channel subject to variable seasonal flows with erodible streambanks. Outside of the fenced livestock enclosure around Emigrant Spring, there is potential for increased erosion rates.

TABLE 3-26
Summary of Stream Channel Habitat Conditions
Emigrant Project

Site ID	Reach 1	Reach 2	Reach 3
Width/Depth Ratio	7.46	4.94	4.65
Wetted Width (cm)	72.64	82.80	60.34
Bankfull Width (cm)	371.35	219.96	173.73
Streambank Condition[1]	36.67	67.50	51.67
Channel Characteristics[2]	G4	G4	G4
Bed-form Type	Alluvial Pool, Riffle	Alluvial Pool, Riffle	Alluvial Pool, Riffle

1 Estimates percent (%) of lineal distance eroding at the active channel height on both sides of a transect.
2 According to Rosgen (1996).
Note: Reach 1 is within a fenced enclosure around Emigrant Spring, Reaches 2 and 3 are outside and downstream of the enclosure.
Source: Maxim 2004b.

Riparian vegetation consists of various shrubs and grasses within the enclosure (Reach 1), which provides cover for aquatic life. Vegetation outside of the enclosure is dominated by shrub/scrub (sagebrush and chokecherry) with little herbaceous vegetation in evidence due to the presence of livestock.

Recent observations (Evans 2008) as well as habitat surveys conducted by BLM (1995) on lower Dixie Creek show development of improved stream and riparian habitat conditions along a 5-mile reach below its confluence with drainages from the Project area in response to changes in livestock management initiated in 1990. Streambanks within this area are stable and well vegetated and exhibit willows and herbaceous riparian species. The floodplain in this area has become saturated and is effective at capturing sediment and dissipating flow while wet meadow/beaver dam complexes provide habitat conditions for wildlife. Conditions are poor on the intermittently flowing 2-mile stretch of lower Dixie Creek below the restoration area and immediately upstream of the confluence with South Fork Humboldt River.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Aquatic resources (i.e., Lahontan speckled dace, Lahontan redside shiner, and aquatic invertebrates) and their habitat would be removed from a portion of a tributary stream channel in the northern portion of the Project area.

Approximately 5,000 feet of a natural drainage channel would be removed by the proposed mine pit and replaced with an engineered stream channel that incorporates natural features (*e.g.*, riffles, pools, and meanders). Approximately 1,000 lineal feet of the existing channel (0.15 acre) that would be removed supports aquatic habitat. Additional aquatic habitat would remain upstream (west) of the undisturbed portion of the drainage. These undisturbed stream channels are fed by several small springs and seeps (including Emigrant Spring) and would not be affected by proposed mine development.

Construction of a new channel that incorporates natural features (*e.g.*, step pools, roughness features, and substrate development) would replace aquatic habitat removed by mine development. A detailed description of the engineered stream channel is included in Chapter 2 – *Proposed Action*. The proposed channel design would allow establishment of aquatic life and riparian vegetation. Design features would provide hiding cover and an environment conducive to production of benthic invertebrates (*e.g.*, aquatic insects and snails), the primary food of many fish. Benthic invertebrate production is dependent on suitable aquatic vegetation and streambed substrate.

Stream channel segments upstream from the proposed mine disturbance that typically contain year-round flow would be temporarily isolated from downstream portions of the drainage that extend to Dixie Creek during periods of construction. Seasonal or long-term isolation of the tributary drainage upstream from the mine area would increase the probability that speckled dace and redside shiner could be extirpated from the drainage by climatic factors (*i.e.*, drought or ice formation to the bottom of pools). Habitat in tributary channels west of the Project area (including the fenced Emigrant Spring exclosure) appears to be marginal for fish and likely subject to periodic fish die-offs during dry times in summer and cold periods in winter. During the life-of-mine, the proposed Project could limit potential for fish from downstream areas (originating in Dixie Creek) to move upstream through the new engineered stream channel, and to upstream drainages west of the Project area. The channel design incorporates features that are intended to restore fish movement. Reconstruction of the Emigrant Exclosure would improve habitat for fish and macroinvertebrates and may offset impacts to these resources resulting from relocation of the natural drainage.

No Action Alternative

Potential impacts to fisheries and aquatic resources that would result from development of the Emigrant Project would not occur under the No Action alternative. Impacts to fisheries and aquatic resources associated with other ground disturbing activities (*i.e.*, grazing) in the area would continue.

POTENTIAL MONITORING AND MITIGATION MEASURES

BLM and NDEP have identified a mitigation measure that would require Newmont to review the status of native fish and macroinvertebrate populations in the Emigrant drainage and engineered stream channel every five years. Further discussion of this measure is contained in the *Potential Monitoring and Mitigation Measures* section at the end of this chapter.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Aquatic resources (fish, macroinvertebrates, periphyton, vegetation) are generally considered renewable; however, loss of aquatic habitat resulting from mine pit development could temporarily reduce the ability of the area to support fish and other aquatic organisms at levels that existed prior to development. The engineered stream channel is designed to restore aquatic habitat and fish movement and reestablish riparian habitat lost to mine development.

RESIDUAL EFFECTS

No residual effects to fisheries/aquatic resources have been identified by BLM.

TERRESTRIAL WILDLIFE

Affected Environment

The Study Area for terrestrial and special status wildlife species encompasses an area extending 1 to 3 miles from the proposed Project area.

Mammals

BLM's list of mammals recorded in the Elko District totals 76 species, including five shrews, 33 rodents, 15 carnivores, 12 bats, 5 rabbits and hares, and 6 ungulates. Of this total, 60 species could be expected to occur in the Study Area.

Wildlife species occupying the Study Area are typically associated with sagebrush and grassland communities and juniper woodlands, often in relatively steep terrain. Springs, seeps, and riparian areas provide important foraging for wide-ranging upland species. Mammals observed during a May 2010 survey included mule deer, pronghorn, coyote, badger, black-tailed jackrabbit, and ground squirrel (AMEC Geomatrix 2010b). Other small mammals common in the area include deer mice, kangaroo rat, northern pocket gopher, bushy-tailed woodrat, and least chipmunk (Cedar Creek Associates 1997).

No burrows with associated rabbit pellets were observed and the density of burrows in 2010 made by ground squirrels, badgers, coyotes, and other mammals was substantially lower than observed in a survey conducted in 2008 (AMEC Geomatrix 2010b).

The Study Area is year-around habitat for mule deer, which are present at low densities, most often in sagebrush and juniper habitats. During fall and winter, mule deer also migrate through the Study Area from the north and west; however, no critical deer habitat has been documented by NDOW in the Study Area.

The Study Area provides habitat for pronghorn antelope, which are present year-around. Sagebrush habitats are critical browse sources for pronghorn in winter; however, the steepness of terrain limits use by pronghorns in portions of the Study Area.

Seven species of bats have been documented in the Study Area. Bats forage over upland and riparian habitats and roost in trees and rock crevices (see *Special Status Wildlife Species* in this section).

Birds

Birds in the Study Area include game species (*i.e.*, sage grouse, chukar, and mourning doves), raptors (golden eagle, turkey vulture, red-tailed hawk, prairie falcon, Swainson's hawk, northern harrier, kestrel, great horned owl, and long-eared owl), and numerous passerine birds associated with grassland, sagebrush, and riparian habitats. Although not reported for the Study Area, Herron *et al*. (1985) indicate that the Study Area is part of a larger area near Carlin, supporting relatively high nesting densities of barn owls and prairie falcons.

Bird species observed during a May 2010 survey include: lark sparrow, chipping sparrow, Vesper sparrow, starling, robin, raven, Clark's nutcracker, red-shafted flicker, spotted towhee, killdeer, Brewer's blackbird, chukar, loggerhead shrike, western kingbird, and meadow lark. A golden eagle was observed one mile east of the proposed Project area eating a black-tailed jackrabbit (AMEC Geomatrix 2010b).

Five raptor species were also observed in the proposed Project area during the May 2010 survey; red-tailed hawk, kestrel, sharp-shinned hawk, turkey vulture, and great horned owl (AMEC Geomatrix 2010b). An active great horned owl nest was documented on a power pole within the proposed Project area and an active red-tailed hawk nest was found on a rock outcrop in the Emigrant Spring drainage, just outside the proposed Project boundary. A sharp-shinned hawk was observed capturing a small bird and turkey vultures soared over the northern one-half of the proposed Project area. Red-tailed hawks and kestrels, were regularly observed hunting over the southern part of the area (AMEC Geomatrix 2010b).

Chukars are an introduced game bird that occupies steep terrain near perennial seeps and springs. Mourning doves nest in tall shrubs and trees, often in association with intermittent drainages. Common birds in the Study Area include western kingbird, Say's phoebe, horned lark, lark sparrow, western meadowlark, sage sparrow, and sage thrasher. Additional species that may also be present in the Study Area are listed in a breeding bird survey conducted in 2004 along Dixie Creek and is hereby incorporated by reference (Bradley 2004).

Migratory Birds

Migratory birds in the Study Area that nest and forage in sagebrush, grassland and juniper woodland habitats include the species listed in the previous section.

Amphibians and Reptiles

Amphibians and reptiles observed in the Study Area include Pacific tree frog, western fence lizard, and western rattlesnake (Maxim 2004b). Pacific tree frogs were present in the wetlands and drainages originating from Emigrant Spring. Based on distribution maps (Stebbins 1985), the following species also could be present in the Study Area: northern desert horned lizard, western terrestrial garter snake, Great Basin collared lizard, Great Basin whiptail, long-nosed leopard lizard, Nevada side-blotched lizard, Basin spadefoot, western toad, northern leopard frog, sagebrush lizard, western skink, western whiptail, rubber boa, striped whipsnake, western yellow-bellied racer, gopher snake, long-nosed snake, ground snake, and night snake.

Special Status Wildlife Species

Special Status species include wildlife listed as threatened, endangered, or candidate species under the Endangered Species Act of 1973 and those species listed by BLM as sensitive. Federally-listed and BLM sensitive species known or with potential to occur on or near the Study Area, or having suitable habitat present, are listed in **Table 3-27**. Only species with suitable habitat in or near the Study Area or where direct or indirect effects from the proposed Project are likely to occur are addressed in this EIS.

TABLE 3-27
Special Status Species with Potential to Occur In or Near Emigrant Project Study Area

Species	Status	Habitat
Species Documented in the Study Area		
Sage grouse (*Centrocercus urophasianus*)	BLM sensitive; Present in the mine permit area.	Sagebrush habitat and wet meadows and riparian areas for brood rearing
White-faced ibis (*Plegadis chihi*)	BLM sensitive; nesting and foraging habitat present along Dixie Creek.	Wetlands and riparian areas with emergent vegetation
Pallid bat (*Antrozous pallidus*)	BLM sensitive; present in the mine permit area.	Roosts in caves, mineshafts, buildings, under bridges and in trees; forages in woodlands over water and desert washes.
Big brown bat (*Eptesicus fuscus*)	BLM sensitive; present in the mine permit area.	Roosts in caves, mineshafts, trees, buildings, under bridges; forages over water and in woodlands.
Western red bat (*Lasiurus blossevillii*)	BLM sensitive; present in the mine permit area.	Roosts in trees; forages over water and in woodlands
Hoary bat (*Lasiurus cinereus*)	BLM sensitive; present in the mine permit area.	Roosts in trees, cliffs, mines, caves, and talus; forages over water and in woodlands.
Western small-footed myotis (*Myotis ciliolabrum*)	BLM sensitive; present in the mine permit area.	Forages along cliffs, rocky slopes and sometimes over water. Roosts/breeds in rock crevices, talus, caves, mine adits, abandoned buildings,
Western long-eared myotis (*Myotis evotis*)	BLM sensitive; present in the mine permit area.	Roosts in trees, caves, crevices, buildings, and under bridges; forages over water and in woodlands.
Long-legged myotis (*Myotis volans*)	BLM sensitive; present in the mine permit area.	Conifer forests and piñon-juniper woodlands. Roosts under loose tree bark, in buildings, caves, rock crevices and mines
California floater (*Anodonta californiensis*)	BLM sensitive; present in South Fork Humboldt River; shells found in Dixie Creek, but live specimens not documented.	Rivers with fish including South Fork Humboldt River and possibly Dixie Creek.
Lahontan cutthroat trout (*Orthorynchus clarki henshawi*)	Threatened; native population present in upper Dixie Creek.	Cool relatively pristine streams and lakes

TABLE 3-27
Special Status Species with Potential to Occur In or Near Emigrant Project Study Area

Species	Status	Habitat
Species Not Documented but with Suitable Habitat and within Range of Occurrence		
Bald eagle (*Haliaeetus leucocephalus)*	BLM sensitive, may occasionally be present in Study Area during winter.	Periodic seasonal migrant in winter, present near open water where favored prey (waterfowl and fish) are present or where carrion is available.
Northern goshawk (*Accipiter gentilis*)	BLM sensitive, not known to nest in Study Area; suitable nesting habitat is present.	Nests in aspen stands, usually near streams
Ferruginous hawk (*Buteo regalis*)	BLM sensitive, not known to nest in Study Area; suitable nesting habitat is present.	Prefers to nest at interface of piñon -juniper zone and desert shrub communities
Swainson's hawk (*Buteo swainsoni*)	BLM sensitive, not known to nest in Study Area.	Nests in deciduous trees and shrubs in riparian areas or around springs
Burrowing owl (*Athene cunicularia hypugaea*)	BLM sensitive, not known to nest in Study Area, but habitat is present	Nests in grasslands and shrublands, often in association with ground squirrels and badgers, which excavate burrows it uses for nesting
Yuma myotis (*Myotis yumanensis*)	BLM sensitive, not documented in Study Area, but suitable foraging habitat may be present	Forages in riparian areas near forest edges, roosts and breeds in buildings, caves, mines, and under bridges
Spotted bat (*Euderma maculatum*)	BLM sensitive, not documented but suitable habitat present at Emigrant Spring and un-named drainages	Low deserts to montane forests with rock outcrops and cliffs. Forages over water and among trees
Preble's shrew (*Sorex preblei*)	BLM sensitive, not documented in Study Area, but suitable habitat is present in Elko County	Sagebrush, grassland, riparian habitats and marshy areas
Pygmy rabbit (*Brachylagus idahoensis*)	BLM sensitive, uncertain if present in Study Area, but suitable habitat is present and it has been found locally.	Relatively tall, dense big sagebrush communities with deep soils suitable for establishing burrows
Little brown myotis (*Myotis lucifugus*)	BLM sensitive, not documented in Study Area, caves, mines, and buildings not present.	Prefers to forage over water. Usually hibernates in caves and mines, often roosts and breeds in buildings.
Western pipistrelle (*Pipistrellus hesperus*)	BLM sensitive.	Roosts in trees, caves, buildings, and under bridges; forages over water, desert washes, and in woodlands.
Silver-haired bat (*Lasionycteris noctivagans*)	BLM sensitive.	Roosts in trees, caves, mines, buildings, and under bridges; forages over water and in woodlands.
Brazilian free-tailed bat (*Tadarida braziliensis*)	BLM sensitive.	Roosts in trees, caves, buildings, and under bridges; forages over water and desert washes and in woodlands.
Fringed myotis (*Myotis thysanodes*)	BLM sensitive; documented in Elko County.	Breeds and roosts in mines, buildings, rock crevices, caves, and under tree bark; forages in desert scrub and juniper woodlands.
Townsend's big-eared bat (*Corynorhinus townsendii*)	BLM sensitive, not documented in Study Area. foraging habitat; unlikely to be present.	Roosts and breeds mines, caves, and under bridges; returns yearly to same roost sites.
Nevada viceroy (*Limenitis archippus lahontani*)	BLM sensitive, suitable willow habitat is lacking in the Study Area but is present along Dixie Creek and South Fork Humboldt River.	Riparian habitats in association with willow and cottonwoods, host plants for larvae of this species.

Source: Harvey *et al.* 1999; Erhlich *et al.* 1988; Sibley 2001; Herron *et al.* 1985; Nevada Natural Heritage Program 2004a; Cedar Creek Associates 1997; Nevada Bat Working Group 2002; Lamp 2004; Maxim 2004b.

In comments on the Draft EIS, the U.S. Fish and Wildlife Service and Nevada Department of Wildlife recommended that studies on raptors, bats, sage grouse, and pygmy rabbits be updated to reflect current conditions. To comply with this request, additional studies on sage grouse, pygmy rabbits, and raptors were conducted in May 2010 (AMEC Geomatrix 2010b). A previous survey conducted by Geomatrix (2008), found burrows with fecal pellets that may have indicated the presence of pygmy rabbits in a stand of tall, dense big sagebrush. This area was surveyed again in May 2010.

The survey conducted in May 2010 (AMEC Geomatrix 2010b) did not detect the presence of pygmy rabbit or sage grouse or evidence of their presence in the Emigrant Project area. No sage grouse, sage grouse fecal pellets, feathers, leks, nest sites, brooding areas, or winter use areas were documented within the proposed Project area. No pygmy rabbits or evidence of pygmy rabbit activity (burrows, pellets) were observed in the surveyed areas.

An active great horned owl nest with two chicks was documented near the best pygmy rabbit habitat in the Project area. The lack of cottontail and pygmy rabbits or their sign in the survey area may have been due, in part, to predation by great horned owls (AMEC Geomatrix 2010b).

Threatened and Endangered Species

Lahontan Cutthroat Trout (Threatened)

The Lahontan cutthroat trout is an inland subspecies of cutthroat trout endemic to the physiographic Lahontan basin of northern Nevada, eastern California, and southern Oregon and was listed by the USFWS as endangered in 1970 (Federal Register Vol. 35, p. 13520). This species was subsequently reclassified as threatened in 1975 to facilitate management and allow regulated angling (Federal Register, Vol. 40, p. 29864). There is no designated critical habitat. The species has been introduced into habitats outside its native range, primarily for recreational fishing purposes (USFWS 1995).

Based on geographic, ecological, behavioral, and genetic factors, the USFWS determined that three distinct vertebrate population segments of Lahontan cutthroat trout exist including the Western Lahontan basin, Northwestern Lahontan basin, and the Humboldt River Basin. Genetic and morphometric differentiation of Lahontan cutthroat trout native to the Humboldt River basin warrants formal recognition and classification as a unique subspecies of cutthroat trout (USFWS 1995).

Historically, Lahontan cutthroat trout occupied streams throughout the Humboldt River watershed. Habitat degradation, water development projects, and introduction of non-native trout have eliminated this species over much of its historic range. Stream surveys within the South Fork Humboldt River drainages have identified 20 streams with approximately 58 miles of occupied habitat (USFWS 1995).

Upper Dixie Creek supports a small population of Lahontan cutthroat trout with an average of approximately 80 fish per mile (BLM 1998). The existing population of Lahontan cutthroat trout is located approximately 15 miles upstream of the confluence of Dixie Creek and the unnamed tributary within the Study Area. The upper reaches of Dixie Creek provide better habitat than the lower reaches with the exception of about 5 miles of restored habitat located on public land below the confluence of the Emigrant drainages, which currently are not occupied by Lahontan cutthroat trout. Since 1990, BLM has worked with local livestock interests to restore the aforementioned 5 miles of Dixie Creek on public land. The upper reaches are improving in response to management actions initiated through the Agreement for Management of the El Jiggs (Dixie Creek) Allotment issued in 1998. BLM is improving habitat to potentially sustain populations of Lahontan cutthroat trout throughout the creek, not just the headwaters.

Much of the remaining habitat on lower Dixie Creek is located on private land and is limited by impacts from grazing, degraded physical habitat, and flow. Dixie Creek could be accessed by nonnative salmonids including brown and rainbow trout from South Fork Humboldt River. However, there is no evidence of recent spawning by trout in the lower reaches of Dixie Creek (SWCA 2004), and a fish barrier to preclude access to the stream by nonnative salmonids was constructed just above the confluence of Dixie Creek with the South Fork Humboldt River in 2008.

Sensitive Species

Bats

Most bat species listed in **Table 3-27** have potential to use habitat in the Study Area for foraging, roosting, and breeding. Seven bat species were documented in the Study Area during an August 2004 survey (Butts 2004). Wetlands and surface water associated with springs and seeps, sagebrush grasslands, juniper woodlands, and rocky outcrops may provide habitat for some or all bat species listed as sensitive in **Table 3-27**. Rock crevices may provide roosting habitat and marginal breeding habitat. Caves, mines, and abandoned buildings optimum for roosting and breeding for colonies of bats have not been documented in the Study Area.

Three species, Western small-footed myotis, long-legged myotis, and Western long-eared myotis, were captured in mist nets. These species were also most common, based upon acoustic recordings. Four species, big brown bat, pallid bat, hoary bat, and Western red bat, were documented acoustically. A number of other bat species may occur in the Study Area, but were not documented. These species include little brown, Yuma myotis, fringed myotis, spotted, western pipistrelle, Townsend's big-eared, Brazilian free-tailed, and silver-haired bats.

Water sources are critical to bats because they drink from open water and insects are more abundant around wetlands and open water. Studies in desert habitats have found that bat activity is 40 times greater near wetlands and riparian areas than in upland areas (Nevada Bat Working Group 2002). Even high-elevation tree roosting bats fly to open water, wetlands, and riparian areas to drink and forage.

Species of bats with potential to occupy habitat in the Study Area vary in the degree to which their populations and habitats are at risk. According to the Nevada Bat Working Group (2002), species at high risk are the fringed myotis, Western red bat, and Townsend's big-eared bat.

Preble's Shrew

The ecology, life history, and habitat characteristics of Preble's shrew are not well known (Foresman 2001; Clark and Stromberg 1987); however, it has been found mostly in sagebrush and grassland habitats and occasionally in coniferous forest, marshes, and riparian areas. Suitable habitat appears to be present in the Study Area and the species has been documented to be present in Elko County (Nevada Natural Heritage Program 2004b).

Pygmy Rabbit

Pygmy rabbits prefer areas of relatively tall, dense sagebrush with deep soil suitable for excavating burrows. Sagebrush is the primary food of pygmy rabbits, but they also eat grasses and forbs depending on the seasonal availability. In Nevada, pygmy rabbits are generally found in sagebrush-dominated broad valley floors, stream banks, alluvial fans, and other areas with friable soil. There have been individual sightings of pygmy rabbits at higher elevations and within juniper woodland habitat (Burton 2008). Searches of the Study Area (Westech 2004c; AMEC Geomatrix 2010) did not detect the presence of pygmy rabbits or evidence of pygmy rabbit activity (burrows, pellets) in the surveyed areas.

Bald Eagle

On June 28, 2007, the Secretary of the Interior announced that the bald eagle was being removed from the federal list of threatened and endangered species. The final rule delisting the bald eagle was published on July 9, 2007, and became effective on August 8, 2007 (72 FR 37346). After delisting, bald eagles will continue to be protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Since August 2007, BLM policy considers the bald eagle as a BLM Sensitive Species.

Bald eagles usually winter near bodies of water because fish and waterfowl are common prey. In the absence of waterfowl and fish, bald eagles eat carrion or prey upon small mammals such as black-tailed jackrabbits (BLM 2002a). Bald eagles winter along the Humboldt River and possibly forage in the Project area (Lamp 2008).

Sage Grouse

Sage grouse forage, nest, and winter in the Study Area; however, there are no known traditional breeding grounds ("leks"). The closest lek is 1.25 miles southwest of the Rain Mine, and seven other leks are within 6 miles of the Study Area. Sage grouse are obligately linked to sagebrush, which is their primary food in fall and winter. In spring and summer, sage grouse also feed on herbaceous vegetation and insects. Wetland and riparian areas are important brood-rearing areas for sage grouse. Female sage grouse with broods were observed in 1995 and 2004 at Emigrant Spring (Westech 2004c). Fires over the past few years have reduced the spatial extent and quality of large acreages of sagebrush habitat locally and regionally.

Swainson's Hawk

Swainson's hawks are seasonal residents and nesters in the Study Area, migrating to South and Central America in winter (Ryser 1985). This hawk nests in clumps of trees, often in agricultural and riparian areas or near springs. Swainson's hawks feed mostly on large insects and small mammals; however, they also take bats, birds, and amphibians. This hawk may forage in the Study Area, but is not known to nest in the Study Area.

Burrowing Owl

Burrowing owls nest in underground burrows excavated by ground squirrels, badgers, and other mammals, but are also able to excavate their own burrows. They usually occupy sagebrush and grassland habitats and often use the same nesting burrow for a number of years. Although burrowing owls can often be seen perched on or near their burrow during the day, they forage at night for nocturnal small mammals, spadefoot toads, and insects. Burrowing owls usually migrate south from Nevada in winter, but there are records of them over wintering in their burrows in a state of torpor (Ryser 1985). Burrowing owls have not been observed in the Study Area but have been identified near Tonka Creek (Spence 2004).

Ferruginous Hawk

Ferruginous hawks nest in scattered juniper trees at the interface of the piñon-juniper zone and desert shrub communities overlooking broad open valleys (Herron *et al.* 1985). The ferruginous hawk preys mostly on rodents and rabbits, but will also take birds and reptiles. Ferruginous hawks may forage in the Study Area, but there are no known nests (Lamp 2004; Westech 2004c).

California Floater

The California floater is a freshwater mussel that lives in shallow areas of lakes, ponds, and rivers. They burrow into soft, silty substrates and feed on bacteria, plankton, and detritus, which it strains from the water with its gills. The life cycle of this mussel includes a parasitic larval stage, during which it is dependent on upon host fish, usually native minnows. The decline of freshwater mussels has been attributed to declines in native host fish species, increases in sedimentation, predation by introduced fishes, and effects of dams. Live California floaters are present in South Fork Humboldt River and shells have been found in Dixie Creek (Evans 2004).

White-faced Ibis

The white-faced ibis is a wading bird of freshwater marshes, ponds, and rivers, where it feeds on insects, aquatic invertebrates, amphibians, and fish. During the nesting season, they are colonial, constructing nests among aquatic plants or floating mats of vegetation. The white-faced ibis has been documented in wetlands along Dixie Creek (Bradley 2004).

Nevada Viceroy

This butterfly inhabits moist open or shrub areas such as riparian wetlands, willow thickets, and wet meadows. Host plants for the caterpillar of the Nevada viceroy are trees and shrubs such as willow and cottonwood. Early in the season when few flowers are available, viceroys feed on aphid honeydew, carrion, dung, and decaying fungi. Later in the season they feed on nectar from flowers, favoring species of the sunflower family. Habitat for this species is present along Dixie Creek and South Fork Humboldt River.

DIRECT AND INDIRECT IMPACTS

Proposed Action

The Proposed Action would result in direct loss of approximately 1,400 acres of upland habitat and approximately 0.15 acre of riparian and wetland habitat, until such habitat is reclaimed or replaced (in the case of the engineered stream channel). Habitat removed would include sagebrush communities (1,064 acres), juniper woodlands (181 acres), and mixed shrub communities (167 acres). Reclamation of riparian habitat is contingent on the proposed mitigation of using a natural design for the drainage adequately facilitating reestablishment of riparian vegetation. Loss of habitat would reduce local availability of forage, security, and breeding cover for wildlife inhabiting the area. All species dependent on these disturbed sites would be killed or displaced. Displaced animals may be incorporated into adjacent populations, depending on variables such as species behavior, density, and habitat quality. Adjacent populations may experience increased mortality, decreased reproductive rates, or other compensatory or additive responses.

There would be a loss of habitat from mine development until reclamation is successful; consequently, the capacity of the Study Area to support current levels of wildlife would be reduced until suitable habitat (including sage brush, other shrubs, and trees) has re-established. Vegetation on reclaimed areas would likely be dominated by grasses with low densities of native forbs, shrubs, and trees. Sagebrush and other shrubs, typically, are difficult to re-establish on mined lands (see *Upland Vegetation* section in this chapter) and areas burned by wildfire (Vicklund *et al.* 2004; Schuman and Booth 1998; NDOW 2003).

Species that would experience the greatest impacts from loss of sagebrush habitats include black-tailed jackrabbit, mountain cottontail, sage grouse, mule deer, sagebrush obligate songbirds, and pronghorn antelope. These species depend on sagebrush and other shrubs for food and cover, especially in winter. During spring and early summer when newly planted grasses and forbs on reclaimed areas are succulent and rapidly growing, mule deer, pronghorn, rabbits and other small mammals would be attracted to reclaimed areas because of the seasonably abundant forage. During late summer, fall, and winter reclaimed areas would become desiccated and provide little forage or cover for most wildlife species, other than mice, voles, and other small mammals. The availability of adequate shrub-dominated habitat in winter is critical to survival of mule deer, pronghorns, sage grouse, and rabbits.

Mule deer and antelope using the Study Area for year-round and wintering habitat would be displaced. Migration of mule deer through the Study Area likely would be impeded by the mine, ancillary facilities, and service road between the Rain Mine and Emigrant Project area; however, mule deer would not be entirely prevented from migratory movements. The access road from the Rain Mine to the Emigrant Project would have sporadic traffic and be constructed to a width of 70 feet and have berms with breaks. Mule deer are seen around the Project area and movement across roads occurs. Traffic on the haul road from the mine pit to the heap leach pad would pose a mortality risk to deer and other wildlife.

Lizards, snakes, and insects could be killed by construction activities and vehicle traffic. Often lizards and snakes seek cover underground and removal of soil and rock would result in direct mortality. There have been no reptiles identified in the Study Area for which reduced population viability or reduction in habitat poses a threat to their continued existence regionally and locally.

Raptors that forage over sagebrush and grassland habitats would experience a reduced prey base due to a reduction in sagebrush/grassland and juniper woodland habitats until vegetation is established. Raptors would also be affected by loss of potential nesting habitat in juniper woodlands. Typically, reclaimed land is rapidly invaded by small mammals, often within 1 to 2 years following the start of reclamation (Hingtgen and Clark 1984a, 1984b). Populations of small mammals on reclaimed land would provide a prey base for raptors, even during early stages of reclamation. No known raptor nests would be directly affected by the Proposed Action. Some chukar habitat (steep, rocky slopes) would be lost, but this loss would be a relatively small incremental effect when compared with habitat availability in the region. Loss of sagebrush habitats would also have potential to impact chukar nesting, brooding, and winter cover habitat (BAER 1999).

Mourning doves would be affected by loss of nesting habitat with removal of 181 acres of juniper woodland. Removal of riparian vegetation associated with the drainage from Emigrant Spring would reduce foraging opportunities for mourning doves. The Proposed Action would result in a reduced capacity of the Study Area to support mourning doves. This loss would be an incremental effect that would have minor effects on regional populations of mourning doves.

Stipulations associated with the Industrial Artificial Pond Permit program administered by NDOW specify that wildlife access to lethal solutions must be precluded. Daily monitoring and reporting of wildlife mortality from heap leach facilities would be required under this permit.

Noise levels associated with the Proposed Action would increase, displacing some animals an unknown distance from the noise source. Some individuals would likely abandon habitat near high levels of noise and human disturbance; whereas, others would become accustomed to noise and associated human activity and resume their use of otherwise unaffected habitat.

Migratory birds would experience losses of foraging and nesting habitats in sagebrush-grasslands and juniper woodlands.

Depending on its configuration, the engineered stream channel constructed through the mine pit area could potentially affect wildlife by inhibiting movement and increasing the mortality risk to small mammals. Small mammals, reptiles, and amphibians could also be inhibited from crossing the channel if the sides are too steep. Construction of the channel with slopes of variable steepness and width would allow animals that enter the channel to escape.

Special Status Wildlife Species

Lahontan Cutthroat Trout (Threatened)

While Lahontan cutthroat trout (LCT) could drift downstream into Lower Dixie Creek from headwater areas, the area in question is currently considered unoccupied and there is no indication that the Proposed Action may affect LCT. All known occupied habitat is located approximately 15 miles upstream from the Project area. LCT were not found during surveys of Lower Dixie Creek in 1997 or 2004 (surveys were conducted during runoff conditions when LCT would most likely be present). LCT would not be affected by the Proposed Action, however, opportunities to establish cutthroat in lower Dixie Creek may be reduced if increased sediment or other water quality impacts from the proposed Emigrant Project affect Dixie Creek. Incorporation of natural habitat features including riparian vegetation and surface water control structures would prevent sediment from leaving the proposed Project area, thereby reducing potential for impacts to water quality in Dixie Creek and South Fork Humboldt River.

Bats (Sensitive)

Seven species of bats would experience reduced habitat quality through the removal of juniper trees and fractured rock faces. Bats would lose roosting habitat (*e.g.*, trees and fractured rock faces) and foraging areas over upland and wetland habitats removed by proposed mine development. With the exception of the big brown bat and long-legged myotis, potentially affected species would be at moderate to high risk. The Western red bat, a species whose populations and habitat are at high risk, would have the greatest potential to be affected by a loss of foraging and roosting habitat (Nevada Bat Working Group 2002). The Western red bat is dependent on trees for nesting and breeding. Aspen and cottonwoods are generally thought to be favored by the Western red bat. Over the life of the mine, bat diversity and density in the Study Area would decrease as bats currently using the Project area would be displaced. The pit highwall that would remain at the end of mining and closure of the Project would create a fractured rock face that could support roosting habitat for some species of bats.

The Industrial Artificial Pond Permit program administered by NDOW specifies that lethal levels of cyanide solutions not be accessible to bats, birds, and other wildlife. No caves, mine adits, or abandoned buildings, often used as nursery colonies or hibernation sites for some bat species, would be affected by the Proposed Action. Removal of wetlands would reduce the drinking water availability and foraging area for bats.

Riparian habitat is disproportionately important to wildlife, particularly in arid environments (Thomas *et al.* 1979). Increased productivity and structural complexity of riparian areas fosters increased abundance and richness of insect species for foraging bats. Removal of upland, wetland, and riparian habitat would reduce bat foraging opportunities until reclamation is successful. Additional mitigation is proposed that involves fencing wetlands and riparian areas within and adjacent to the proposed mine disturbance area to allow for recovery of streambanks and vegetation impacted by livestock. Such mitigation would also improve bat foraging habitat and help offset the lost riparian habitat in other areas.

Pygmy Rabbit (Sensitive)

Pygmy rabbit habitat along the tributary drainage from Emigrant Spring would be removed under the Proposed Action; however, it is uncertain if pygmy rabbits are present in the Study Area. Fecal pellets from rabbits and burrows are present, but there has not been visual confirmation that pygmy rabbits are present. Proposed reclamation would not likely establish sagebrush communities with densities similar to pre-mining conditions; therefore there would be a decrease in quality of pygmy rabbit habitat in the Study Area. The loss of sagebrush habitat would be a small incremental reduction locally. This should not affect the viability of this species.

Preble's Shrew (Sensitive)

Potential habitat for Preble's shrew would be removed by the Proposed Action. It is not known if the Preble's shrew is present on the Study Area; if present, proposed mine development could result in direct mortality through excavation and other construction activities. No monitoring or additional studies for Preble's shrew are anticipated.

Burrowing Owl (Sensitive)

Potential habitat for the burrowing owl includes sagebrush and grassland habitats in the Study Area with sufficient friable soil for burrows to be constructed for nesting. Mine development would remove potential nesting and foraging habitat until reclamation is achieved. The degree to which nesting habitat would be suitable in reclaimed areas would depend on vegetation characteristics, soil texture, and degree of compaction. Loss of nesting and foraging habitat during mining would have negligible effects on burrowing owls because they are not known to be present in the Study Area.

Swainson's and Ferruginous Hawks (Sensitive)

The Proposed Action would remove foraging habitat for Swainson's and ferruginous hawks, but no known nest sites would be affected. Removal of juniper trees would affect potential nesting habitat for ferruginous hawks. The incremental reduction in the prey base of these species by the Proposed Action would reduce the foraging area for these raptors, but this reduction would be minimal in a regional context and would not likely affect population density.

Bald Eagle (Sensitive)

Bald eagles are primarily associated with aquatic habitats due to the presence of fish and waterfowl, their favored winter prey, but also forage over upland sites for rodents and carrion. The Proposed Action would not affect bald eagles because they have not been documented in the Study Area and no nesting habitat is present.

Sage Grouse (Sensitive)

No known sage grouse courtship sites (leks) would be affected by the Proposed Action; however, sagebrush, grassland, and riparian habitats that would be removed do provide nesting, brood rearing, and wintering habitat. The reduction in density and extent of sagebrush could reduce the capability of the Study Area to support sage grouse, because sage grouse are dependent exclusively on sagebrush as a winter food source. The Proposed Action would likely result in the long-term (20 to 50 years) reduction of habitat quality for sage grouse. Fencing springs, reclamation of sagebrush on the remainder of the post mine area, and mitigation involving sagebrush enhancement within and adjacent to the proposed mine disturbance area would improve sage grouse habitat and offset the reduced sagebrush density in other areas.

<u>White-faced Ibis (Sensitive)</u>

Impacts to the white-faced ibis could result if the Proposed Action increases sediment delivery to Dixie Creek and South Fork Humboldt River. Removal of vegetation and soil disturbance associated with construction and operation of proposed mine development would have potential to increase sediment levels in ephemeral drainages that discharge to Dixie Creek and the South Fork Humboldt River via Dixie Creek. Increased sediment levels could reduce food sources (aquatic invertebrates, amphibians, and fish), reduce foraging efficiency, and adversely affect vegetation providing hiding and nesting cover for the ibis. Effects of possible increased sediment delivery from the Project area would depend on the timing and magnitude of sediment increases. Sediment increases would have the greatest potential to affect the white-faced ibis during nesting and brood-rearing periods. Design of the engineered stream channel to incorporate riparian vegetation, surface water control structures, and other BMP measures would reduce potential for impacts to water quality in Dixie Creek and South Fork Humboldt River (see *Proposed Action* in Chapter 2).

<u>California Floater (Sensitive)</u>

Impacts to the California floater could result if the Proposed Action increases sediment delivery to the South Fork Humboldt River. Removal of vegetation and soil disturbance associated with construction and operation of proposed mine development would have potential to increase sediment levels in ephemeral drainages that discharge to Dixie Creek and ultimately to the South Fork Humboldt River. Sediment could impair feeding behavior and the ability of this mussel to strain food from the water. Prolonged increased sediment levels could also adversely affect populations of native minnows, the host for mussel larvae. Magnitude and duration of potential water quality impacts would depend on levels of sediment that the proposed Project would contribute to Dixie Creek and South Fork Humboldt River. Sediment retention measures would be designed and constructed to control soil movement from the mine area and reduce potential for impacts to water quality in Dixie Creek and South Fork Humboldt River (see *Proposed Action* in Chapter 2).

<u>Nevada Viceroy (Sensitive)</u>

The Proposed Action would not affect the Nevada viceroy or its habitat.

No Action Alternative

Under the No Action alternative, potential impacts to terrestrial wildlife and special status wildlife species from development of the Project would not be realized. Impacts from previously authorized activities would continue under the No Action alternative.

POTENTIAL MONITORING AND MITIGATION MEASURES

Further wildlife monitoring will be identified in the final monitoring plan developed by BLM in consultation with NDOW, and in the Record of Decision. BLM and NDEP have identified mitigation measures that would require Newmont to establish bat roosting habitat in highwalls and implement measures that favor establishment of big sagebrush on portions of the site. Further discussion of the measures is contained in the *Potential Monitoring and Mitigation Measures* section at the end of this chapter.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible and irretrievable loss of wildlife (including special status wildlife species) habitat from post-mine highwalls would result in a loss of habitat for some species (*e.g.*, mule deer, small mammals); however, the highwall could provide habitat for other species such as bats and raptors. The change in habitat represented by the pit highwall is not expected to permanently reduce the potential of the Study Area to support the diversity of wildlife species that it currently supports. Densities of species dependent on shrub and tree habitats may decline if reclamation does not re-establish plant communities dominated by sagebrush, juniper, and pinyon pine to pre-mine levels.

RESIDUAL EFFECTS

Impacts of mitigation measures described above would generally be positive. Species composition and structure associated with reclaimed habitat may be sub-optimal for wildlife species dependent on sagebrush and other shrubs over the long-term (decades) because of reduced densities of big sagebrush and other shrubs. These species may take longer to mature and attain maximum productivity and vigor than herbaceous species.

RECREATION

Affected Environment

The Study Area for recreation is shown on **Figure 3-12** and consists of the BLM Elko District (which includes Elko County and northern portions of Eureka and Lander counties). The Elko District extends over 12 million acres, about one-sixth of Nevada's total area. BLM administers approximately 7.5 million acres of public land in the district that consists primarily of high desert and mountainous areas.

Outdoor recreational areas and facilities in the Study Area include those managed by BLM, Nevada Division of Forestry, Nevada Division of State Parks, U. S. Forest Service (USFS), United States Fish and Wildlife Service, Bureau of Indian Affairs (BIA), and private operators (**Figure 3-12**). Public land within these areas provide diverse recreational activities, including fishing, sightseeing, hunting, cross-country skiing, horseback riding, mountain biking, white water rafting, photography, rockhounding, and off-highway vehicle use (BLM 2010b).

BLM has designated six Special Recreation Management Areas which warrant intensified management. The nearest resource management area to the proposed Emigrant Project is South Fork Canyon, approximately 12 miles east of the Project area. South Fork Canyon encompasses 3,360 acres and has no developed facilities. The Zunino/Jiggs Reservoir Special Resource Management Area is approximately 20 miles southeast of the Project area and has a restroom, picnic tables, barbecues, and campground. The Wilson Reservoir Special Resource Management Area is 85 miles north of the Emigrant Project and includes a boat ramp, restrooms, campground, and drinking water source. Wild Horse Special Resource Management Area, located approximately 85 miles northeast of the Project area, includes a BLM campground. Campgrounds and boat ramps are also located on BIA-administered land at Wild Horse State Recreation Area at Wild Horse Reservoir. The South Fork Owyhee River Special Resource Management Area is located 90 miles north of the Project area and has a narrow corridor along the river, which is eligible for Wild and Scenic River designation. Salmon Falls Creek Special Resource Management Area is approximately 100 miles from the Project area near the town of Jackpot, Nevada.

The BLM Back Country Byways Program identifies historical and scenic routes on public land. The program is designed to encourage use of existing back roads through greater public awareness. In the northeast corner of the Elko District Office area, the California Trail Back Country Byway provides over 80 miles of scenic travel paralleling the original California Trail. The trail was a major route used by pioneers traveling from the midwest to California and Oregon. The Carlin Canyon Historical Wayside includes interpretative signs describing the geology and history of the area.

BLM has completed construction of the California Trail interpretive center located at the Hunter exit on Interstate 80, about 6 miles west of Elko. The center encompasses 40 acres and includes a building, access road, interpretive plaza, 65-car parking lot, 1.5-mile walking trail, amphitheater, and day use area. BLM estimates approximately 65,000 people/year will visit the center once all exhibits are in place by 2010 (Jamiel 2007).

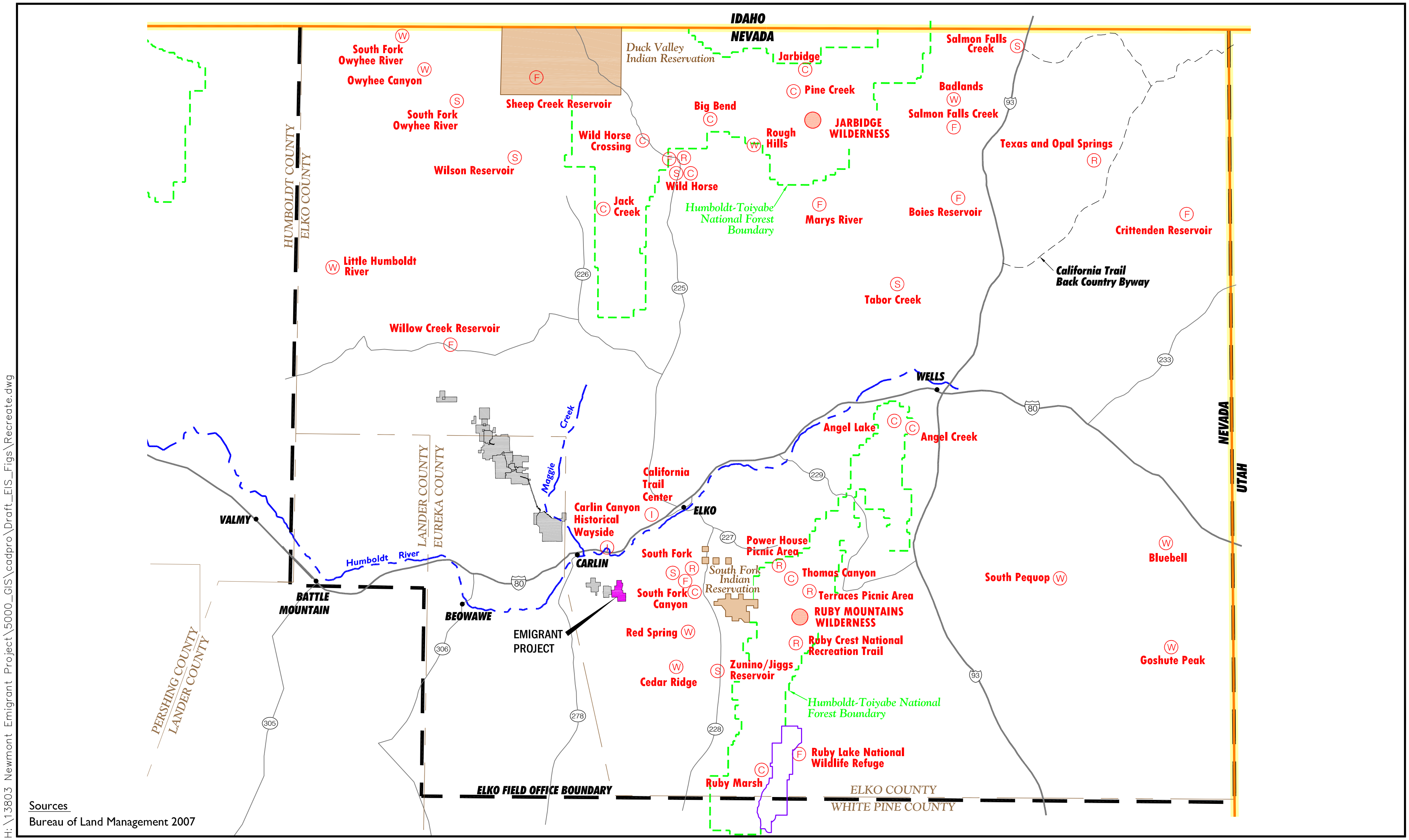
The USFS has three ranger districts in Elko County: Ruby Mountains, Mountain City, and Jarbidge. Of the three districts, Ruby Mountains Ranger District experiences the heaviest recreational use. Located within 20 miles of Elko and Interstate 80, the Ruby Mountains Ranger District has 121 campsites in four campgrounds, two picnic areas, and two wilderness areas. The Lamoille Canyon Scenic Byway provides 12 miles of paved access in the Ruby Mountains with three pullouts and interpretive signs. At the end of the scenic byway, a trailhead provides access to the 40-mile-long Ruby Crest National Recreation Trail (USDA/HTNF 2007).

The Mountain City Ranger District has three campgrounds. The Jarbidge Ranger District has two campgrounds and one wilderness area. Both districts experience recreational use on weekends (USDA/HTNF 2007).

Willow Creek Reservoir, in Elko County is approximately 50 miles northwest of the Emigrant Project. Willow Creek Reservoir is owned by Barrick Goldstrike Mining Company and is open to the public. NDOW manages the reservoir as a warm water fishery and periodically stocks it with crappie and channel catfish. Camping is allowed at the reservoir; however there are no developed facilities (Lamp 2004).

The South Fork State Recreation Area is 15 miles east of the proposed Project area adjacent to BLM's South Fork Canyon Special Resource Management Area. Facilities at the South Fork Reservoir include a boat ramp, campground, and administrative facility. The 80-acre Wild Horse State Recreation Area is approximately 85 miles northeast of the Project area and is located on the northeast shore of Wild Horse Reservoir just off Nevada Highway 225. Amenities include a campground and restrooms.

The communities of Carlin and Elko (including Spring Creek) have a number of recreational facilities. Carlin has an archery range, three baseball fields, a park and playground area, a moto-cross track, a tennis court, and a



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Interpretive Site
Campground
Fishing Area
Recreation Area
Special Recreation Management Area
Plan Boundaries
Wilderness Study Area
Wilderness Area

U.S. Department of the Interior
Bureau of Land Management
Elko District Office
Elko, Nevada

Recreation Areas
Emigrant Project
Elko County, Nevada
FIGURE 3-12

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volleyball court. Elko has numerous baseball fields, a BMX track, two bowling alleys, fairgrounds, five gyms, two golf courses (one of which is operated by the county), an indoor horse arena, movie theaters, five parks, rifle and pistol range, several soccer complexes and tennis courts, trap and skeet range, and a swimming pool (ECEDA 2007). Snobowl Ski and Winter Recreational Area is located 6 miles north of Elko and provides opportunity for alpine and cross-county skiing, sledding, tubing, and snowmobiling. According to the Preliminary Draft Parks, Recreation, and Open Space Plan, additional acreage within the city limits has been set aside to meet community demands for parks, open space, and recreational facilities beyond 2010 (City of Elko 2007).

DIRECT AND INDIRECT IMPACTS

Proposed Action

The Emigrant Project would result in incremental withdrawal of approximately 3,900 acres from recreational access and dispersed use. This area would be within the boundary fence shown on **Figure 2-2**. This area would not be available for recreation until mining and reclamation are completed. Consequently, public access would be restricted for safety and security reasons. Land within the proposed Project vicinity does not offer unique outdoor recreation opportunities. Portions of the Study Area outside the Carlin Trend active mining district, including land within BLM's Elko District contains large areas of similar land available to the public for dispersed recreation.
Regional recreation opportunities, including campgrounds and other facilities, would be minimally impacted. The Project would bisect the Tonka Creek road precluding continuous or "loop" travel through the area during active mining operations. Upon completion of mining the road segment would be reconstructed and relocated to connect with the existing route and re-establish "loop" travel through the area. During the life of the Emigrant Project and prior to completion of reclamation, the area within the fenced boundary of the mine site would not be available for hunting.

No Action Alternative

Under the No Action alternative, no additional disturbance to private or public land or direct impacts to recreation resources would occur. Impacts from previously authorized activities would continue under the No Action alternative.

POTENTIAL MONITORING AND MITIGATION MEASURES

Newmont would provide funding for interpretive signs to be placed at the South Fork Special Recreation Management Area.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irretrievable or irreversible impacts to recreational uses within the Study Area are expected as a result of the Proposed Action.

RESIDUAL EFFECTS

There would be no residual effects to recreational opportunities as a result of the Proposed Action.

GRAZING MANAGEMENT

Affected Environment

Grazing allotments are areas of public and unfenced private land used by permittees for livestock grazing. Grazing within these allotments is permitted and administered by BLM.

The Project area lies within the Emigrant Springs Grazing Allotment #5417 and Tonka Allotment #5468 (Maggie Creek and Tomera Ranches). Stonehouse Division of Tomera Ranches, Inc. is the permittee for the Emigrant Springs Allotment. The Emigrant Springs Allotment encompasses 26,766 acres (13,520 private/13,246 public) and is comprised of six pastures supporting a total of 1,286 Animal Unit Months (AUMs). An AUM is the amount of forage required to sustain one cow and calf for one month. Approximately 100 acres of the proposed mine permit area lies within Tonka Allotment # 5468.

The Crawford Mountain, Scott Seeding Federal Fenced Range, and Brush Corral Federal Fenced Range (FFR) pastures would be affected by proposed mine development. Range improvements, AUMs, and seasonal restrictions, are shown in **Table 3-28** and **Figure 3-13**. Grazing restrictions in the allotment include 50 percent utilization on grass species during the grazing season.

TABLE 3-28
Emigrant Springs Grazing Allotment No. 5417
Emigrant Project

Pasture	Acres		Animal Unit Months (AUMs)	Range Improvements	Season of Use
	Public	Private			
Crawford Mountain	5,046	1,034	537	Cattle guard, Section 12, T31N, R53E	April 16 – Nov. 30
Scott Seeding (North)	480	1,120	47		April 1 – Nov. 30
Brush Corral FFR	80	4,320	13		April 1 – Nov. 30

FFR = Federal Fenced Range
Source: Scheetz 2008.

The Emigrant Springs Grazing Allotment contains five vegetation enclosures, four of which are outside the proposed mine permit boundary. The Emigrant Spring enclosure lies within the Crawford Mountain pasture in Sections 34 and 35, Township 32 North, Range 53 East, between the Rain Mine and proposed Project area.

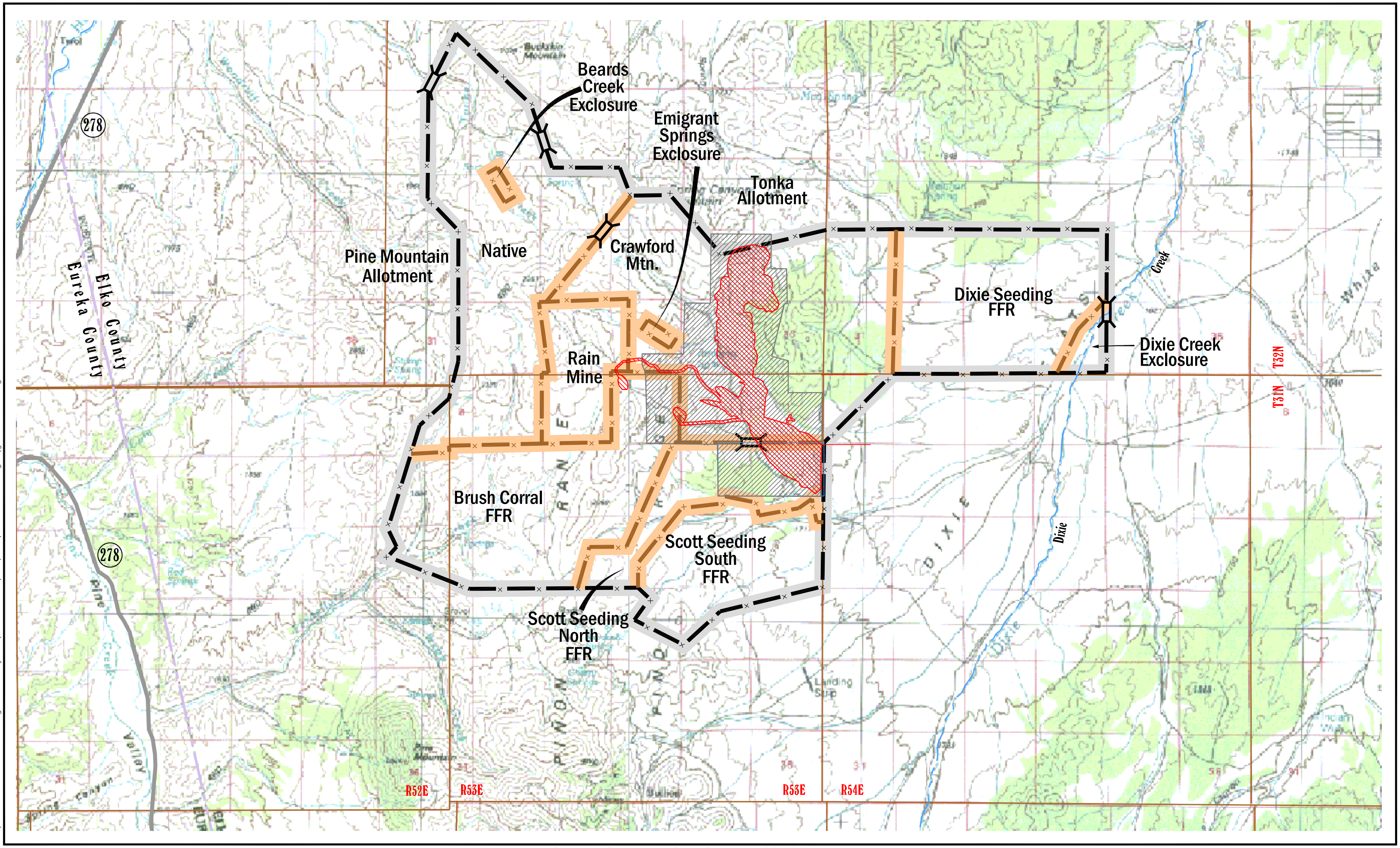
DIRECT AND INDIRECT IMPACTS

Proposed Action

Grazing capacity would be reduced by incremental withdrawal of up to 3,466 acres from the Emigrant Springs Allotment No. 5417 and 100 acres from Tonka Allotment No. 5468. Withdrawal of these areas would likely occur in two phases corresponding to relocation of the mine perimeter fence as shown on **Figure 2-3**.

Areas withdrawn from allotments and pastures affected by development of the Emigrant Project are shown in **Table 3-29**.

Grazing capacity would be reduced by withdrawal of 3,466 acres representing 306 AUMs in Emigrant Springs Allotment No. 5417. No reduction of AUMs in Tonka Allotment No 5468 would occur. Carrying capacity of the Emigrant Springs Allotment would be reduced until reclamation is complete and vegetation re-established on disturbed areas. Implementation of the Proposed Action would result in withdrawal of 2,647 acres of public land from the Crawford Mountain pasture and 701 acres (public land) in the North Scott Seeding Federal Fenced Range pasture. There is no public land or AUMs in the Brush Corral FFR that would be affected by the proposed Project.



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Basemap Source: Sure!MAPS RASTER 1:100,000 Nevada Map

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U.S. Department of the Interior
Bureau of Land Management
Elko District Office
Elko, Nevada

Emigrant Springs Allotment Fence

Pasture Fence

Cattle Guard

FFR = Federal Fenced Range

Emigrant Mine Permit Boundary/Project Area

Emigrant Mine Proposed Disturbance Boundary

Grazing Allotment
Emigrant Project
Elko County, Nevada
FIGURE 3-13

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TABLE 3-29
Grazing Allotments Affected by Proposed Permit Boundary
Emigrant Project

Pasture	Phase I		Phase II		Total	
	Acres	Public AUMs	Acres	Public AUMs	Acres	Public AUMs
Emigrant Springs Allotment No. 5417						
Crawford Mtn Pasture	2,143	194	504	65	2,647	259
Scott Seeding North[1]	701	47	-0-	-0-	701	47
Brush Corral FFR[2]	118	-0-	-0-	-0-	118	-0-
Subtotal	**2,962**	**241**	**504**	**65**	**3,466**	**306**
Tonka Allotment No. 5468						
Tonka Pasture	-0-	-0-	100	-0-	100	-0-
Total	**2,962**	**241**	**604**	**65**	**3,566**	**306**

FFR = Federal Fenced Range; AUM = animal unit month.
[1] Includes all AUMs on public land in this pasture. [2] No public land or AUMs in this pasture affected by the proposed Project.
Source: Scheetz 2008.

No Action Alternative

Implementation of the No Action alternative would not affect current grazing management practices or range resources in the Project area. No additional disturbance to soil or vegetation would occur and current stocking rates would continue as permitted. Impacts from previously authorized activities would continue under the No Action alternative.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures for grazing management beyond those described in the Proposed Action have been identified by BLM. Fencing of springs, construction of pipelines and troughs, and maintenance of an east side corridor for movement of cattle in the vicinity of the proposed Project are discussed in *Reasonably Foreseeable Future Activities* in the *Grazing* section of Chapter 4 – *Cumulative Effects*.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Grazing capacity on mine-related disturbance areas would be lost until reclamation is completed and vegetation becomes established.

RESIDUAL EFFECTS

Residual effects to grazing management would be the post-mine highwall, which would not be reclaimed for an end use of livestock grazing.

ACCESS AND LAND USE

Affected Environment

The Study Area for access and land use is the Emigrant Project area (**Figure 2-2**).

Access

The proposed Emigrant Mine Project is located approximately 10 miles southeast of Carlin and is accessed via the Rain Mine road from Highway 278 south of Carlin. The Tonka Creek road, which passes through the Project area extends from the Newmont Rain road through the proposed mine area into Dixie Creek and provides continuous or "loop" travel through the area (**Figure 2-2**). Numerous two-track roads provide access throughout the area to support livestock grazing operations and public access for recreational purposes.

BLM has issued two rights-of-way to Newmont in the Project area. Right-of-way N-47282 was issued for a water well, buried water pipeline, overhead powerline, and access road. Two water supply production wells (RPW-1 and RPW-2) were installed by Newmont during 1988 along Dixie Creek to provide water for the Rain Mine. Water from these production wells is transported 6 miles to the Rain Mine by a 12-inch diameter buried pipeline located within the right-of-way. Right-of-way N-47290 was issued for a communication site and access road.

Land Use

Dominant land uses in the Project area include mining, livestock grazing, and outdoor recreation. Although mining has occurred in the area throughout the last century, the only major mine development in the portion of the Carlin Trend located south of Interstate-80 is the Rain Mine where mining operations were initiated in 1987. The Rain Mine lies immediately west of the proposed Emigrant Mine and is currently in closure (**Figure 2-2**).

DIRECT AND INDIRECT IMPACTS

Proposed Action

Access

Development of the Emigrant Project would bisect the Tonka Creek road, which passes through the Project area. This route extends from the Newmont Rain road through the proposed mine area into the Dixie Creek drainage basin and would effectively preclude continuous or "loop" travel through the area during mining operations. Use of some two-track roads throughout the area to support livestock grazing operations and public access for recreational purposes would not be allowed within the mine permit boundary area.

A 12-inch diameter water pipeline, overhead powerline, and access road associate with right-of-way N-47282 would be relocated around the proposed heap leach facility in portions of Sections 1, 2 and 12, Township 31 North, Range 53 East. Right-of-way N-47290 would not be affected by proposed mine operations.

Land Use

Potential impacts to Land Use would be the same as those described under the Recreation and Grazing Management sections.

No Action Alternative

The No Action alternative would result in no additional impacts to land use and access. Impacts from previously authorized activities would continue under the No Action alternative.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures beyond those described in the Proposed Action have been identified for access and land use issues by BLM.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There would be no irreversible or irretrievable commitment of access and land use associated with implementation of the Proposed Action.

Pre-mine land uses including wildlife habitat, dispersed recreation, and grazing, are expected to resume following mine reclamation.

RESIDUAL EFFECTS

There would be no residual effects to access and land use from implementation of the Proposed Action.

WASTES, HAZARDOUS OR SOLID

Affected Environment

The Study Area for Solid and Hazardous Wastes is the proposed Emigrant Project area. No solid or hazardous wastes are currently located in the Project area.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Implementation of the Emigrant Project would result in the transportation, storage, and disposal of solid and hazardous wastes. A detailed description of the types and volumes of hazardous wastes that would be used in the proposed Project area are described in the *Proposed Action* section of Chapter 2.

No direct or indirect impacts have been identified that would result from the transportation, storage, and disposal of solid and hazardous wastes associated with the Proposed Action. Implementation of management and spill response measures described in Chapter 2 for these materials would eliminate or reduce the effects of release of wastes to the environment.

No Action Alternative

Under the No Action alternative, solid and hazardous wastes would not be transported, stored, or disposed in the Project area.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures beyond those included in the Proposed Action for management of solid and hazardous waste have been identified by BLM.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irretrievable or irreversible commitment of resources resulting from the transportation, storage, or disposal of solid and hazardous wastes have been identified.

RESIDUAL EFFECTS

No residual effects resulting from management of solid and hazardous wastes have been identified.

VISUAL RESOURCES

Affected Environment

The Project is located on the eastern slopes of the Piñon Range in the Dixie Creek Basin. The visual resources of the area include views of steep mountains giving way to gentle slopes and rolling hills bisected by several drainages. Vegetation consists of sagebrush, rabbitbrush, single leaf piñon, and various grasses that color the hills in shades of green, gold, and brown. Grey, brown, and black indicate areas of sparse vegetation, bare soil, and rocks.

The Project area is located in a steep canyon not readily visible from any major roadway or recreation area. The prominent view of the mine would be from the main access road, making the primary viewers mine employees and/or mine service contractors. Occasionally, recreationalists and hunters may catch a view of the mine as they pass by.

Visual resources are identified through the Visual Resource Management (VRM) inventory. This inventory consists of a scenic quality evaluation, sensitivity level analysis, and delineation of distance zones. Based on these factors, BLM-administered land is placed into four visual resource inventory classes: VRM Classes I, II, III, and IV. Classes I and II are the most valued, Class III represents a moderate value and Class IV is of the least value. VRM classes serve two purposes: (1) as an inventory tool that portrays the relative value of visual resources in the area, and (2) as a management tool that provides an objective for managing visual resources.

The Project area is located in Visual Resource Management Class IV (BLM 1986). The Class IV VRM objective is to allow for management activities which involve major modification of the existing character of the landscape. The level of contrast can be high, dominating the landscape and the focus of viewer attention. However, every attempt should be make to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements of the characteristic landscape.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Major changes in the landscape would accompany mining practices at the proposed Emigrant Project. Terraced, flat-topped waste rock disposal facility and rock faces would present moderate to strong contrasts with the existing landform and line of steep canyons and gentle slopes. Moderate to strong form contrasts would impact visual resources in a localized manner. Views of most mining activity would be hidden by canyon walls and higher ridge land forms to the south and east. The color and texture of the reclaimed area would be a moderate contrast to the existing landscape. The disturbed soil associated with mining activity is not expected to be highly contrasted with the undisturbed soil color. Reclamation activities would include shaping the edges of the disturbance areas to blend with the surrounding land forms and revegetation. Class IV VRM objectives would be met by the proposed reclamation.

No Action Alternative

Under the No Action alternative, no visual impacts would occur at the Emigrant Project beyond those already present.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures beyond those described in the Proposed Action have been identified for visual resources by BLM.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irretrievable commitment of visual resources would occur during construction and active mining period until reclamation is successful. Impacts on visual resources would be reduced through implementation of reclamation and mitigation measures. Unreclaimed rock faces would represent an irreversible commitment of visual resources as compared to the existing landscape.

RESIDUAL EFFECTS

Following reclamation, the Non-PAG waste rock disposal facility, heap leach pad, and pit highwall would be the most noticeable residual effect of the Proposed Action. Weak contrasts in form, line and color could remain. Weak contrasts would result from the prismoidal forms and straight lines of the reclaimed Non-

PAG waste rock disposal and heap leach facilities. Finer and more uniform soil in this area would also create weak contrasts in texture with the existing landscape.

CULTURAL RESOURCES

Affected Environment

Cultural resources are locations of past human activity, occupation, or use. Prehistoric resources reflect activities that occurred prior to introduction of written records. Since written documentation is absent, archaeological sites are the only source of data concerning prehistoric societies. Historic resources reflect Euro-American and Asian-American occupation. The scientific value of these resources relates to their potential to inform on how human societies operate and change. In addition to their scientific value, cultural resources may have aesthetic and cultural value. Aesthetic values may be expressed in rock art sites, or in standing structures of architectural significance. Historic sites may have cultural value if they link a living community to a place that conveys a sense of cultural identity.

Prehistoric Overview

James (1981), Elston and Budy (1990), Elston and Drews (1992), Schroedl (1995), Hockett and Morgenstein (2003), and McGuire *et al.* (2004) provide regional overviews of prehistory. Schroedl (1995) divides regional prehistory into six chronological periods. The Pre-Archaic Period (12,250 to 8,000 B.C.) was a period marked by cool, moist conditions. Originally thought to represent an adaptation to pluvial lakeshore environments, Pre-Archaic sites have been recognized in other settings.

Subsistence revolved around lakeshore-marsh resources and taking of large game. Population density was low, and groups were mobile. Sites in this period have not been identified in or adjacent to the proposed Project area.

Environmental conditions changed toward the end of the Pre-Archaic as temperatures increased and available surface water decreased. The Early Archaic Period (8000 to 4500 B.C.) appears to have been a time of limited occupation in the north-central Great Basin. Period sites are few and not common regionally. The appearance of ground stone implements is evidence of subsistence diversification brought on by the reduced carrying capacity of local environments. Variety of site types encountered increased during this period, again suggesting diversity in resource procurement strategies.

The Middle Archaic Period (4500 to 850 B.C.) corresponds to the onset of a cooler period when increased precipitation caused expansion of some resources associated with lakes and marshes. Local manifestations of the Middle Archaic are referred to as the South Fork Phase. Trends during the period include population increases and broadening economic activities. While hunting was an important subsistence focus, the processing of plant foods took on greater importance as evidenced by the abundance of ground stone artifacts and increased use of upland resources.

The Late Archaic Period (850 B.C. to A.D. 700) corresponds with the James Creek Phase. Technologically, this period is marked by increased diversification in ground stone artifacts and a greater emphasis on the use of small flake tools. Subsistence and settlement changes appear to reflect increased local and regional population. This prompted an intensification and diversification in localized subsistence practices. Resources seldom used during earlier periods were added to the diet. Regional use of piñon became pronounced during this period.

The Late Prehistoric Period is divided into two sub-periods. The early sub-period (A.D. 700 to A.D. 1300) corresponds with the Maggie Creek

Phase and exhibits a general continuity with the previous era. Occupation levels were consistent with or higher than previous periods. The appearance of smaller Rosegate series projectile points suggests that the bow and arrow was introduced during this period. A general emphasis on smaller tools may evidence the gradual diminishment of quality lithics and/or a burgeoning population that forced an increased reliance upon the taking of smaller animals.

The latter sub-period of the Late Prehistoric (from A.D. 1300 to historic times) corresponds with the Eagle Rock Phase. Occupational levels appear to have declined during this period; assemblages are small and lack evidence of much diversity. Local materials are not abundant suggesting a mobile subsistence practice. This period saw expansion of Numic groups throughout most of the Great Basin from a homeland in the southwest. While there is little dispute that this event occurred, there is disagreement over its mechanics and timing.

Historical Overview

Patterson *et al.* (1969) and Vlasich (1981) represent sources that address local history. Topical references of relevance include Cline (1963) on early exploration; Cline (1974) on Peter Ogden; Goodwin (1965) on emigration; Myrick (1962) on railroads; Lincoln and Horton (1966), Elliot (1966), and Hill (1916) on mining; and Vestrom and Mason (1944), Sawyer (1971), and Young and Sparks (1985) on ranching and agriculture.

Economic interests fostered early exploration of the region. Acting on behalf of the Hudson's Bay Company, Peter Skene Ogden made several incursions into the Great Basin during the 1820s and 1830s. Others exploring the general Humboldt region included John Work and Joseph Walker. Exploration of a different sort occurred during the 1840s through the 1860s, when military expeditions traversed the region in search of scientific information or transportation routes. Leaders of these expeditions included Captain John C. Fremont, Lieutenant E. Beckwith, Captain James Simpson, Clarence King, and Lieutenant George Wheeler.

Beginning in the 1840s, Euro-Americans moved through Nevada on their way to Oregon and California. The number of people moving along these trails swelled in the 1850s and 1860s after the discovery of gold in California and then Nevada. The first Euro-American settlers in Nevada were traders that established posts along emigrant trails. Farmers, ranchers, and miners moved from these posts into the hinterlands. Construction of the transcontinental railroad in the 1860s saw establishment of new population centers and incentives for local and regional development. Nearby Carlin was established as a location for major railroad facilities.

Ready access to the railroad spurred development of the livestock industry throughout the state, but especially in northeast Nevada. Access to regional and national markets prompted an increased demand for extensive rangeland. Ranching operations in northeast Nevada came to depend on the ready availability of this land for both summer and winter pasture. This pattern continued into the 1890s, after which the character of ranching shifted due to changes in federal land management, regional and national economics, and private land ownership patterns.

Mining has played a major role in the history of Nevada. While evidence of this industry is fairly ubiquitous across the state, there are specific areas where major ore bodies were discovered, prompting substantial levels of development. The Railroad Mining District, located south of the proposed Emigrant Project, was the nearest area that experienced a pronounced level of development. The district was organized in

1869, shortly after the discovery of silver ore. The towns of Highlands Camp and Bullion City were soon established. Similar to mineral deposits in the Eureka area, ore from the Railroad District required smelting. The first smelter was erected in 1870 and upgraded smelters began operation in 1872. The district produced regularly through the 1870s and early 1880s, yielding more than $3 million in silver, lead, copper, and gold (Paher 1970). The mines were reopened in 1904 and produced intermittently through the 1910s (Emmons 1910; Lincoln and Horton 1966; Couch and Carpenter 1943).

Cultural Resources in Area of Potential Effect

Compliance with regulations affecting cultural resources requires definition of an Area of Potential Effect. For the proposed Emigrant Project, the Area of Potential Effect is defined as the permit boundary as shown on **Figure 2-2**. This area is further divided into areas that would be subject to direct impacts (the proposed disturbance boundary) and areas that could be subject to indirect impacts (outside the proposed disturbance boundary but within the permit boundary). Certain classes of cultural resources could be subject to impact even if located outside the permit boundary. For example, resources eligible to the National Register based on criteria A, B, or C may be impacted due to the introduction of visual or audible intrusions. Also, increased access and visibility may result in increased vandalism.

Archival data were collected to determine the location and nature of prehistoric, historic, and architectural resources present within both the direct and indirect impact areas of the Area of Potential Effect. Project and site records maintained by BLM were examined. **Table 3-30** lists the 16 intensive (Class III) inventories conducted within or overlapping some portion of the Area of Potential Effect. The entire Area of Potential Effect has been examined for the presence of cultural resources.

Cultural resources within the proposed disturbance boundary are listed in **Table 3-31.** Forty-two sites and isolates have been recorded, of which 22 are prehistoric period sites, and 20 are prehistoric period isolates. No historic period sites or isolates have been recorded within this portion of the Area of Potential Effect. Of the prehistoric sites, one contains a component that can be assigned to a specific period. That component represented the Proto-historic period. BLM, in consultation with the Nevada State Historic Preservation Office, has determined that three of the identified sites (CrNV-12-13259, 13261, and 13272) are eligible for listing on the National Register of Historic Places. As noted in a state protocol agreement between BLM and the Nevada State Historic Preservation Office, isolated artifacts and features are categorically ineligible for listing on the National Register.

Cultural resources outside the proposed disturbance boundary but within the permit boundary are listed in **Table 3-32**. Forty-seven sites and isolates have been recorded in this area. Of those, 28 are prehistoric period sites, 18 are prehistoric period isolates, and one is a historic period isolate. Of the prehistoric period sites, eight sites contain one or more components that can be assigned to a specific period. Periods represented by components include the Middle and Late Archaic, and the Proto-historic. BLM, in consultation with the Nevada State Historic Preservation Office, has determined that nine of the identified sites (CrNV-12-11043, 13254, 13255, 13258, 13260, 13264, 13265, 13269, and 13270) are eligible for listing on the National Register of Historic Places.

TABLE 3-30
Previous Cultural Resource Studies Conducted in Area of Potential Effect
Emigrant Project

BLM Report Number	Author	Date	General Project Area
1-337	Nelson	1980	Tram Line
1-408	Rieger	1981	Emigrant Gravel Pit
1-447	Ellis and Tullis	1981	Seismic Lines
1-1026	Clay and Furnis	1986	Rain Project Area
1-1121	Burke	1987	Utility Corridor, Rain Project
1-1613	Newsome	1997	East of Emigrant Springs
1-1627	Newsome and Schroedl	1992	Emigrant Parcel
1-1706	Deitz	1992	Fire Rehabilitation Fence
1-1769	Tipps and Newsome	1993	Emigrant Parcel Addition
1-1774	Dillingham and Hockett	2000	Emigrant Springs Probing
1-1862	Whisenhunt	1994	Emigrant Aspen Enclosure
1-1920	Newsome	1994	Emigrant Springs Area
1-2067	Wiseman and Braley		Mud Springs Fence
1-2157	Schroedl	2001	Emigrant Springs Data Recovery
1-2324	Birnie	2003	Emigrant Parcels
1-2376	Birnie, Knoll, Tipps, and Field	2004	Emigrant Addition

TABLE 3-31
Previously Identified Cultural Resources Within Proposed Disturbance Boundary
Emigrant Project

Site Number (CrNV-12-)	Site Period	Site Type	Report Reference	National Register Eligibility
6226	Prehistoric	Lithic Scatter	BLM1-1121 & 1-1627	Not Eligible
11022	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11026	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11028	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11029	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11040	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11042	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11044	Prehistoric	Lithic Scatter with Ground Stone	BLM 1-1627	Not Eligible
11045	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11046	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11047	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11048	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11049	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11060	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11542	Prehistoric	Lithic Scatter	BLM 1-1769	Not Eligible
11543	Prehistoric	Lithic Scatter	BLM 1-1769	Not Eligible

TABLE 3-31
Previously Identified Cultural Resources Within Proposed Disturbance Boundary
Emigrant Project

Site Number (CrNV-12-)	Site Period	Site Type	Report Reference	National Register Eligibility
11941	Prehistoric	Lithic Scatter with Ground Stone	BLM 1-1920	Not Eligible
11942	Prehistoric	Lithic Scatter	BLM 1-1920	Not Eligible
13256	Prehistoric	Lithic Scatter	BLM 1-2376	Not Eligible
13259	Prehistoric	Lithic Scatter	BLM 1-2376	Eligible (d)
13261	Prehistoric	Lithic Scatter with Ground Stone	BLM 1-2376	Eligible (d)
13272	Prehistoric – Proto-historic	Lithic Scatter	BLM 1-2376	Eligible (d)
Isolates				
EIF – 1226	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF – 1227	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF – 1242	Prehistoric – Elko	Projectile Point	BLM 1-1627	Not Eligible
EIF – 1243	Prehistoric	Biface Fragment	BLM 1-1627	Not Eligible
EIF – 1244	Prehistoric	Core	BLM 1-1627	Not Eligible
EIF – 1247	Prehistoric	Biface Fragment	BLM 1-1627	Not Eligible
EIF – 1248	Prehistoric	Biface Fragment	BLM 1-1627	Not Eligible
EIF – 1249	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF – 1260	Prehistoric	Core	BLM 1-1627	Not Eligible
EIF – 1262	Prehistoric – Elko	Projectile Point	BLM 1-1627	Not Eligible
EIF – 1263	Prehistoric	Biface Fragment	BLM 1-1627	Not Eligible
EIF – 1265	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF – 1692	Prehistoric	Point Fragment	BLM 1-1613	Not Eligible
EIF – 1725	Prehistoric	Debitage	BLM 1-1769	Not Eligible
EIF – 4679	Prehistoric	Debitage	BLM 1-2376	Not Eligible
EIF – 4680	Prehistoric	Debitage	BLM 1-2376	Not Eligible
EIF – 4681	Prehistoric	Modified Flake	BLM 1-2376	Not Eligible
EIF – 4682	Prehistoric	Modified Flake	BLM 1-2376	Not Eligible
EIF – 4683	Prehistoric – Elko	Projectile Point	BLM 1-2376	Not Eligible
EIF – 4690	Prehistoric	Debitage	BLM 1-2376	Not Eligible

One resource within the proposed permit boundary has been the subject of detailed study. Site CrNV-12-11043 was first recorded by Newsome and Schroedl (1992) and subsequently tested by Dillingham and Hockett (2000). The site is National Register eligible and a treatment plan was prepared by Tipps and Bright (2000) and implemented by Schroedl (2001).

Clay and Furnis (1986) located sites CrNV-12-5404 and 5440 in the area now occupied by the Rain Tailing Storage Facility, and in proposed Borrow Area #3. Those sites, determined not to be National Register eligible, were eradicated during development of the storage facility. Although listed in **Table 3-32**, these resources are no longer of management concern.

TABLE 3-32
Previously Identified Cultural Resources Outside Disturbance Boundary, But Within Permit Boundary
Emigrant Project

Site Number (CrNV-12-)	Site Period	Site Type	Report Reference	National Register Eligibility
5404	Prehistoric – Middle & Late Archaic	Large Lithic Scatter	BLM 1-1026	Not Eligible
5440	Prehistoric	Lithic Scatter	BLM 1-1026	Not Eligible
6227	Prehistoric – James Creek	Lithic Scatter with Ground Stone	BLM 1-1121 & 1-1627	Not Eligible
11023	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11024	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11025	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11027	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11041	Prehistoric – Late Archaic	Lithic Scatter	BLM 1-1627	Not Eligible
11043	Prehistoric	Lithic Scatter	BLM 1-1627	Eligible (d)
11061	Prehistoric – Late Archaic	Lithic Scatter	BLM 1-1627	Not Eligible
11062	Prehistoric	Lithic Scatter	BLM 1-1627	Not Eligible
11269	Prehistoric	Lithic Scatter	BLM 1-1706	Not Eligible
11269	Prehistoric	Lithic Scatter	BLM 1-1920	Not Eligible
13254	Prehistoric	Lithic Scatter with Ground Stone	BLM 1-2376	Eligible (d)
13255	Prehistoric	Lithic Scatter with Ground Stone	BLM 1-2376	Eligible (d)
13257	Prehistoric	Lithic Scatter	BLM 1-2376	Not Eligible
13258	Prehistoric	Lithic Scatter with Ground Stone	BLM 1-2376	Eligible (d)
13260	Prehistoric – Middle Archaic	Lithic Scatter	BLM 1-2376	Eligible (d)
13262	Prehistoric	Lithic Scatter	BLM 1-2376	Not Eligible
13263	Prehistoric	Lithic Scatter	BLM 1-2376	Not Eligible
13264	Prehistoric	Lithic Scatter	BLM 1-2376	Eligible (d)
13265	Prehistoric – Late Prehistoric	Lithic Scatter	BLM 1-2376	Eligible (d)
13266	Prehistoric	Lithic Scatter	BLM 1-2376	Not Eligible
13268	Prehistoric	Lithic Scatter	BLM 1-2376	Not Eligible
13269	Prehistoric – Proto-historic	Lithic Scatter	BLM 1-2376	Eligible (d)
13270	Prehistoric – Late Archaic, Proto-historic	Lithic Scatter with Pottery	BLM 1-2376	Eligible (d)
13271	Prehistoric	Lithic Scatter with Ground Stone	BLM 1-2376	Not Eligible
13273	Prehistoric	Lithic Scatter	BLM 1-2376	Not Eligible
Isolates				
EIF-1225	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF-1228	Prehistoric	Scraper	BLM 1-1627	Not Eligible
EIF-1229	Prehistoric – Gypsum	Projectile Point	BLM 1-1627	Not Eligible
EIF-1240	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF-1241	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF-1245	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF-1246	Prehistoric	Debitage	BLM 1-1627	Not Eligible

TABLE 3-32
Previously Identified Cultural Resources Outside Disturbance Boundary, But Within Permit Boundary
Emigrant Project

Site Number (CrNV-12-)	Site Period	Site Type	Report Reference	National Register Eligibility
EIF-1261	Prehistoric – Elko	Projectile Point	BLM 1-1627	Not Eligible
EIF-1264	Prehistoric	Debitage	BLM 1-1627	Not Eligible
EIF-1726	Prehistoric	Debitage	BLM 1-1769	Not Eligible
EIF-2344	Prehistoric - Gatecliff	Projectile Point	BLM 1-1920	Not Eligible
EIF-4684	Prehistoric	Stone Tool	BLM 1-2376	Not Eligible
EIF-4685	Prehistoric	Debitage	BLM 1-2376	Not Eligible
EIF-4686	Prehistoric	Ceramic	BLM 1-2376	Not Eligible
EIF-4687	Prehistoric	Debitage	BLM 1-2376	Not Eligible
EIF-4688	Prehistoric	Debitage	BLM 1-2376	Not Eligible
EIF-4689	Prehistoric	Debitage	BLM 1-2376	Not Eligible
EIF-4691	Historic	Hole-in-cap can	BLM 1-2376	Not Eligible
EIF-4692	Prehistoric - Humboldt	Projectile Point	BLM 1-2376	Not Eligible

DIRECT AND INDIRECT IMPACTS

Proposed Action

Identified cultural resources present within the Proposed Disturbance Boundary are shown in **Table 3-31.** Forty-two cultural resources are located within the APE. Of these, three prehistoric period resources (CrNV-12-13259, 13261, and 13272) have been determined eligible to the National Register based on Criterion D. All three resources are located within the proposed heap leach facility and would be impacted during construction of that facility. As a result, a data recovery plan was prepared and approved by BLM in consultation with the Nevada SHPO (Varley 2005). The data recovery plan was implemented in 2005, and scientific excavations occurred at CrNV-12-13259, -13261 and -13272 (Schmitt *et al.* 2005) In a letter dated January 5, 2006, the Nevada SHPO concurred with BLM's determination that the latter document recovered the National Register values of these three historic properties, As a result, the Emigrant Project would have no adverse effect on historic properties.

Resources present outside the Proposed Disturbance Boundary but within the Permit Boundary are listed in **Table 3-32.** Of the 47 recorded in this area, nine (CrNV-12-11043, 13254, 13255, 13258, 13260, 13264, 13265, 13269, and 13270) are eligible for listing on the National Register of Historic Places. Because these resources are eligible based on Criterion D, therefore, it is unlikely that they would be impacted due to the introduction of visual or audible intrusions. They may be subject to indirect impacts due to increased access and visibility may result in increased vandalism.

No Action Alternative

There would be no direct effect on National Register eligible sites under the No Action alternative.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures beyond those described in the Proposed Action have been identified for cultural resources by BLM.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The Proposed Action would result in the loss of cultural resources that are ineligible for listing on the National Register. Loss of these sites would constitute an irreversible and an irretrievable commitment of a resource. These sites have been recorded to current BLM standards and the site information has been integrated into agency and statewide data repositories.

Impacts to National Register eligible properties have been reduced through preparation and implementation of data recovery and/or mitigation plans. However, their information potential cannot be retrieved fully. As a result, post-treatment impacts to these properties as a result of the Proposed Action would result in an irreversible and an irretrievable commitment of a resource. Several of the proposed Project elements are fenced. This would limit human activity outside the immediate activity area. This would serve to protect eligible resources located near the proposed facilities. Distance and difficulty of access would serve to protect others.

RESIDUAL EFFECTS

Data recovery activities have occurred at three National Register eligible, prehistoric properties. Even after implementation of data recovery activities, non-renewable resources would have been expended. This represents a direct and a residual effect of the Proposed Action.

NATIVE AMERICAN CONCERNS

Affected Environment

In accordance with Federal legislation and executive orders, Federal agencies must consider the impacts their actions may have to Native American traditions and religious practices. Consequently, BLM must take steps to identify locations having traditional/cultural or religious values to Native Americans and insure that its actions do not unduly or unnecessarily burden the pursuit of traditional religion or traditional life-ways.

The National Historic Preservation Act (P.L. 89-665), the National Environmental Policy Act (P.L. 91-190), the Federal Land Policy and Management Act (P. L.94-579), the American Indian Religious Freedom Act (P.L. 95-341), the Native American Graves Protection and Repatriation Act (P.L. 101-601) and Executive Order 13007 require that BLM provide tribes opportunities to actively participate in the decision making process.

The proposed Emigrant Project lies within the traditional territory of the Western Shoshone. However, BLM has limited information regarding any specific spiritual/cultural/traditional activities and sites or Traditional Cultural Properties within or in close proximity to the Project boundary. Ethnographic sources that discuss Western Shoshone in broad terms, but do not include ethnographic information tied specifically to the Project area include: Chamberlain (1911), Steward (1937, 1938, 1941, and 1943), and Harris (1940). Murphy and Murphy (1960), the Inter-Tribal Council of Nevada (1976), Janetski (1981), Thomas *et al.* (1986), and Crum (1994) provide recent ethnographic reviews. Information on world view and religious beliefs is contained in Miller (1983a, 1983b), Hultkrantz (1986), Clemmer (1990), and Rusco and Raven (1992).

Ethnographic Background

Members of the Western Shoshone Uto-Aztecan linguistic family inhabited an area extending from southeast California into northwest Utah. Their territory was bordered to the north by the Northern Shoshone, to the east by the Ute, to the south by the Southern Paiute, and to the west by the Northern Paiute.

The nuclear family was the basic unit of Shoshone society. Nuclear families conducted most subsistence activities and were largely self-sufficient. Three to 10 families jointly occupied semi-permanent camps during the winter months and foraged together for parts of the year. The Shoshone joined into larger groups only when resources were sufficiently concentrated to allow cooperative harvests. These gatherings were often the occasion for fandangos, festivals that provided an opportunity for courtship, socializing, and dancing.

The Shoshone used a flexible subsistence and settlement system, one based on the scheduling of activities according to the seasonal availability of food. In the spring, Shoshone dispersed in family groups each of which foraged for greens and roots on valley floors. Small mammals were an important meat source that could be hunted with bow and arrow, snares, or deadfalls. In some cases, burrows were flooded or animals were dug out.

Summer gathering strategies focused on ripening grass seeds. These became available on valley bottoms first and then upslope as the season progressed. Seeds were harvested either by knocking them into burden baskets or by cutting seed heads from stalks. Seeds were winnowed, ground, and either prepared for consumption or stored. Berries and roots were gathered in late summer and early fall. Small animals continued to be an important resource through out the summer. Small groups ambushed mountain sheep from blinds, while individual hunters often stalked deer.

The character of the subsistence pattern changed in the fall. Multiple families assembled to procure large amounts of food for storage at winter base camps. Piñon was an important plant resource in the fall. Long hooked poles were used to shake cones from trees, while other cones could be picked from the ground. As necessary, cones were roasted to release the seeds. Cones often were stored in aboveground caches or open pits, while nuts were stored in sealed underground pits. Groups often traveled long distances to secure the seeds, which were then transported back to winter village sites. After the piñon harvest, people sometimes gathered for antelope and jackrabbit drives on valley bottoms. Jackrabbits were driven into nets where they were clubbed. Antelope were driven into large corrals and then dispatched by archers. Western Shoshone also made occasional forays to the Snake River to fish for salmon during the fall spawning run.

The Shoshone depended on stored food during winter months. Piñon and other stored seeds could be supplemented by collecting cactus and the roots of marsh plants such as cattails and bulrush. Mountain sheep could be hunted at lower elevations in the winter and ice fishing sometimes occurred along the Humboldt River.

World View

The Western Shoshone trace their occupation of the Great Basin back to when "animals were people" (Miller 1983a). The coyote and wolf figure in creation stories, with prominent mountain peaks honored as sacred places connected with their creation.

The belief that supernatural power (*Puha*) has permeated the earth since its creation is a central feature in Western Shoshone religious beliefs. Religious behavior revolves around the acquisition of *Puha*. Sources of *Puha* are numerous, including sources of water, prominent mountain peaks, and caves. Animals and, to a lesser extent, plants have power and this power can be conveyed to people by supernatural spirits who control individual species. Power is attracted to life, and therefore, remains present in places where people have lived, particularly around graves. Power sources are associated with spirits. As noted, animal and plant species have spirits, and fixed places such as water sources, mountains, caves, are viewed as power spots. Other forms of spirits include guardian spirits, little men and water babies.

Religious expression takes several primary forms: ceremonies; individual prayer to the spirits of plants, animals, water, power spots, and little men; and use of power spots for vision questing (acquisition of a guardian spirit); curing; and doctoring. The most frequent form is the individual prayer. Prayer is especially important in connection with places where spirits may live, or that are regarded as power spots. Individuals who exhibit discipline and strength may obtain special power. Most people participated in a variety of rituals associated with hunting, gathering, attending a birth, or burying and mourning the dead.

Power also may be used for non-legitimate, malevolent, purposes. Also, certain spirits may, in some circumstances, act in a malevolent manner. For example, little men can be benevolent or malevolent, depending on how they are treated. Correcting neglected or abused relationships between humans and spirits is a major aspect of Western Shoshone religion. Many rituals are directed at controlling and use of power and balancing the potentially dangerous spiritual powers that pervade nature. Shoshone religion depends on maintaining the integrity of power spots, maintaining the presence of little men, maintaining their relationship with the owner-spirits of plants and animals, and maintaining life-giving forces such as the sun, earth, and water.

Consultation Activities

The BLM Elko District Office initiated formal Native American consultation by sending a notification letter to the following groups: Te-Moak Tribe of Western Shoshone Tribal Chair and Environmental Department, Battle Mountain Band Chair and Environmental Department, Elko Band Chair and Environmental Department, South Fork Band Chair and Environmental Department, Wells Band Chair and Environmental Department, Duck Valley Sho-Pai Tribe Chair and Cultural Resources Department, and the Dann Family. A field tour to the Project site, with participating tribal entities, was also conducted on June 7, 2004. Since that time, the South Fork, Wells, Elko, and Battle Mountain Bands remained the most active via phone, email, informal meeting, and field tour communication. Detailed Tribal coordination and communication files are on file at the BLM Elko District Office and are considered confidential.

To date, formal and informal consultation efforts have not identified any specific Western Shoshone Traditional Cultural Properties within or in close proximity to the Emigrant Project boundary. However, participating tribal entities have expressed concern regarding the proposed diversion of a stream to allow for mining activities within the Emigrant Mine pit. Since the stream intermittently flows into Dixie Creek, which is a tributary of lower South Fork Humboldt River, water quality concerns are shared by all parties.

South Fork Band of the Te-Moak Tribe of the Western Shoshone Environmental Department hand-delivered their comments regarding the Emigrant Project to BLM on October 18, 2004 (see **Table 1-2**).

DIRECT AND INDIRECT IMPACTS

Proposed Action

Collection of information from Native Americans is ongoing. Based on comments received to date, the Proposed Action could have the following impact, identified as an area of Native American concern:

An un-named intermittent stream course would be relocated to accommodate construction of the proposed Emigrant Mine pit. Quality of water (increased sediment and/or temperature) in the engineered stream channel could be affected. Information contained in the EIS allows BLM to address this concern. Protective measures proposed by Newmont (compliance with all applicable state and federal design parameters; implementation of Best Management Practices) are expected to reduce impacts resulting from the Proposed Action.

As more resource information becomes available (through the on-going consultation process), and given comments received during public and agency review of the EIS, it may be possible to further refine this discussion. Any such modifications would be contained in the Final EIS and would be subject to Section 106 consultation.

No Action Alternative

The No Action alternative would result in no further direct or indirect impacts on Native American religious or traditional values, practices, properties, human remains, or cultural items that may occur or be associated with the proposed Project area.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures for Native American Concerns have been identified for by BLM.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible or irretrievable commitment of resources associated with Native American Concerns would occur as a result of the Proposed Action.

RESIDUAL EFFECTS

No residual impacts to Native American Concerns would occur as a result of the Proposed Action.

SOCIAL AND ECONOMIC RESOURCES

Affected Environment

The Study Area for socioeconomic effects encompasses Elko County, the cities of Elko, Carlin, and the Spring Creek residential area, The Study Area is defined as the geographical area in which the potential direct and indirect socio-economic effects of the Proposed Action and Alternative for the Emigrant Project are likely to occur. The purpose of documenting the socio-economic setting of the Study Area is to provide an understanding of the social and economic forces that have shaped the area and to provide a frame of reference necessary to estimate the social and economic effects of the Proposed Action and alternatives.

Social Life

The socioeconomic character and cultural diversity of Elko County and surrounding northeastern Nevada reflects a history of occupations and nomadic use by Native Americans followed by the advancement of the railroad and an influx of explorers and settlers. An important change in the Elko economy came with Nevada's legalization of casino gambling in

1931. Gaming and entertainment in Elko County casinos are highly visible social and economic institutions.

Mining has been a source of income in Elko County since the 1850s. Mining and related development in the 1980s and 1990s caused rapid population growth in the cities of Elko and Carlin and was a dominant force in shaping the socioeconomic character of the area. The in-migration of new residents has created changes in some aspects of daily life, such as increased traffic, overcrowded parks, and higher crime rates. Low unemployment rates, greater diversity of services, and increased business opportunities were also a result of increased economic development.

With a population greater than 47,000, Elko County, located in the northeastern corner of Nevada, is a growing area with a high quality of life. It contains the cities of Carlin, Elko, Wells, and West Wendover, as well as the unincorporated communities of Spring Creek, Jackpot, Montello, and Mountain City. The area has a sense of community and the citizens enjoy a four-season climate, moderate cost of living, 120 acres of public parks, education and health care facilities, and economic growth.

Elko is the largest urban area and center of commerce and government in northeastern and north central Nevada. The town serves as the county seat for Elko County, the fourth largest county (by area) in the country (ECEDA 2007).

Carlin is the gateway to the Carlin Trend gold mining district, the most productive district in the western hemisphere. Mining became a major employment base in the early 1960s. The mining area boasts two of the largest open pit old mines in the world, Newmont's Gold Quarry Mine and Barrick's Betze/Post Mine. The Elko Band Colony of the of the Te-Moak Tribe of Western Shoshone is also located in Elko County in the high desert of northeastern Nevada, near the Humboldt River. The reservation encompasses 192.80 noncontiguous acres adjacent to the City of Elko. The Elko Colony was established by Executive Order on March 25, 1918, which reserved 160 acres for Shoshone and Paiute Indians living near the town of Elko. Today, 192.8 acres are in federal trust.

Social stratification in Elko County is often defined by income, length of residence, educational background, and ethnicity. Local residents earning high incomes are considered to be influential in the community. Groups viewed by residents as making decisions about the area's future include federal and state government, county commissioners, environmental organizations, and large corporations (BLM 2002a).

Population Trends and Demographic Characteristics

The population of Nevada has grown over 30 percent in the last decade, and is one of the fastest growing states (U.S. Bureau of the Census 2010). Similar to the state, the population of Elko County has increased from 33,530 in 1990 to 45,291 in 2000, a 35 percent increase. Elko County has increased an estimated 4.0 percent from 2000 to 2009 to 47,896 residents (**Table 3-33**).

The City of Elko experienced growth of 13 percent in population between 1990 (14,736) and 2000 (16,708). Population estimates for the City of Elko for 2005 indicate a weakening in the historically declining trend with 16,685 residents. Population in Carlin, the community closest to the mine site, decreased by 6 percent from 2,220 in 1990 to 2,083 in 2005(U.S. Bureau of the Census 2001; Nevada State Demographer's Office 2004).

TABLE 3-33
Population Estimates for Elko County and State of Nevada
Emigrant Project

Characteristic	Elko County	City of Elko	City of Carlin	Spring Creek	State of Nevada
Total population (2009) estimate - Cities of Carlin and Elko 2005)	47,896	16,685	2,083	14,000	2,643,085
Percent Population change (April 1, 2000 to July 1, 2009 - Cities of Carlin and Elko July 1, 2005)	4.0	-0.1	-3.6	32.7	32.3
Total population (2000 Census)	45,291	16,708	2,161	10,548	1,998,260
Total population (1990 Census)	33,530	14,736	2,220	5,866	1.201.833

Source: U.S. Bureau of the Census 2010; Nevada State Demographer's Office 2004: City of Elko 2007: City of Carlin 2007: Elko County Planning Commission 2006).

Spring Creek, designated as a Census Designated Place (CDP), has steadily increased population since 1990, nearly doubling in size by 2000. Comparison of the 2000 population estimate of 10,548 and the Elko County Zoning Director's estimated population of 14,000 residents in 2006 represents a growth rate of over 32 percent. The U.S. Bureau of the Census does not estimate population during intercensal years for CDPs, but subdivision growth in the area indicates increasing populations.

Demographics of Elko County differ from the state (**Table 3-34**) with respect to gender (a higher percent of males than females live in the county than in the state); age (a higher population of residents less than 18 years of age live in the county than in the state); and ethnicity (higher percent of Caucasian and Native American populations live in the county than in the state). The percentage of high school graduates (and higher) increased over six percent since 2000 (79.1%) (U.S. Bureau of the Census 2010).

TABLE 3-34
Demographic Estimates for Elko County and the State of Nevada
Emigrant Project

Demographic	Elko County	Percent in Elko County	Nevada	Percent in Nevada
Gender, 2008				
Male	24,260	52.2	1,294,137	50.8%
Female	22,259	47.8	1,252,098	49.2
Age, 2008				
Persons under 5 Years of Age	3,404	7.3	195,056	7.7
Persons18 Years of Age and Over	33,578	72.2	1,890,066	74.2
Persons 65 Years of Age and Over	3,567	7.7	285,604	11.2
High School graduate or higher, 2008		85.9		83.7
White persons, not Hispanic, percent 2009		69.0		55.8
Persons of Hispanic or Latino origin, percent, 20059		23.0		26.5
American Indian and Alaska Native persons, percent, 2009		5.6		1.5
Black persons, percent 2009		1.3		8.3

Source: U.S. Bureau of the Census 2010.

The Elko Band Colony estimates that 1,143 people are enrolled members of which 729 live on the Colony (64 percent) in 2000. Almost 55 percent of the population is female. Almost nine percent of the population living on the Colony is under 5 years of age; over 21 percent of the population is under 18 years of age. The working population, persons between 19 and 64 living on the Colony, is estimated to be 62 percent while less than 5 percent of the population living on the Colony is over 65 years of age (U.S. Bureau of the Census 2000).

Twenty-six percent of Colony speaks a language other than English in their homes and almost 42 percent of the population over the age of 25 has a high school diploma or the equivalent (U.S. Bureau of the Census 2004).

Housing

In 2000, there were 18,456 housing units in Elko County; 85 percent were occupied, and 15 percent were vacant. Of the occupied housing units, 70 percent were owner-occupied and 30 percent renter-occupied. In 2005 estimates for Elko County included 19,066 housing units, of which 70 percent were owner-occupied (U.S. Bureau of the Census 2007). The median value of owner-occupied housing units was $123,100 (U.S. Bureau of the Census 2007).

Spring Creek is an unincorporated area south of Elko which had over 10,000 residents in 2000. Following a review of the Spring Creek Lamoille Master Plan by the Elko County Planning and Zoning Director in 2006, it was estimated approximately 14,000 people lived in this area. The Plan estimates that potential population in this area could reach between 35,000 - 40,000 people based on the number of parcels from 2½ to 10 acres in size. In March of 2006 the County Zoning Director indicated that the Spring Creek Subdivision contained 6,400 lots, of which 4,480 (70 percent) have already been developed. Another 1,920 lots remain to be developed in the 120 square mile development area (Elko County Planning Commission 2006).

Community Service Providers

Education

The Elko County School District operates 13 schools in the socioeconomic Study Area. Seven elementary schools provide education to students enrolled in kindergarten through grade 5 or 6 depending on location. Flagview Intermediate School serves grades 5 and 6 in Elko; Adobe Middle School serves grades 7 and 8 in Elko; Spring Creek Middle School serve grades 6 through 8; while Elko and Spring Creek High Schools serve grades 9 through 12. The Carlin Combined School provides education to students in kindergarten through grade 12.

Education of children in kindergarten through grade 12 from the Elko Band Colony is provided through the Elko County School District via the local school system. A Head Start Program is housed and operated at the Colony for children aged 3 through 5. Under contract with the Bureau of Indian Affairs, the Elko Band Council provides higher education and an adult vocational program at the Colony.

Great Basin College offers 4-year baccalaureate degrees in agricultural management, Digital Information Technology, Instrumentation, Land Surveying/Geomatics, and Management in Technology; Nursing and Social Work; Post baccalaureate teacher certificates in elementary and secondary education; and a wide variety of Associate degrees and Certificate Programs.

Law Enforcement

The Nevada Highway Patrol, Elko County Sheriff's Department, Elko City Police, Carlin City Police, and Bureau of Indian Affairs Police provide law enforcement services to community residents. The Highway Patrol is responsible for law enforcement activities on state highway systems. The Sheriff's Department is accountable for Elko County including the unincorporated towns (17,135 square miles) and is aided in search and rescue operations and emergency situations by the Sheriff's Posse and Reserves. The Elko County Jail, operated by Elko County Sheriff's Department, is located in Elko (BLM 2009).

The Elko and Carlin City Police are restricted to the city limits (Approximately 14 square miles and 9 square miles, respectively). The BIA Police is accountable for law enforcement on the Elko Band Colony.

Fire Protection

Fire protection in the cities of Elko and Carlin is provided by the Elko City Fire Department, Carlin City Volunteer Fire Department (a combined fire, ambulance, and rescue unit), BLM, USFS, and Northeastern Fire Protection Department of the Nevada Division of Forestry. The Elko and Carlin fire departments primarily serve residents within their city limits and the Elko Band Colony; however, both departments maintain mutual aid/cooperative agreements with other firefighting agencies in the area. The BLM is primarily responsible for fighting wildfires (BLM 2009).

Ambulance Services

Ambulance services are available in Elko and Carlin for ground transportation of patients. Fixed-wing ambulance aircraft and a helicopter are also available at the Elko Airport and Northeastern Nevada Regional Hospital, respectively.

Health Care

The Northeastern Nevada Regional Hospital opened in September 2001. The hospital is situated on a 50-acre campus in the City of Elko. Services at the hospital include 24-hour emergency care, physical therapy, full-service laboratory, intensive care unit, pediatric unit, inpatient pharmacy, obstetrics and gynecology, 24-hour radiology, MRI and CAT Scan, nuclear medicine, mammography, ultrasound, chemotherapy, neurology, sleep medicine program, inpatient and outpatient surgery, cardio-pulmonary therapy, pulmonary function testing, stress treadmill testing, and nutrition counseling (Northeastern Nevada Regional Hospital 2009).

The hospital, under contract with the Indian Health Service (IHS), provides medical care and emergency services to Native Americans. In addition, comprehensive medical care through IHS is provided at the Elko Band Colony by the Health Center which opened in July 1992. The Center houses a pharmacy, dental rooms with a laboratory, and other support services.

Public Assistance

Public assistance in Elko County is provided by Elko County Social Services and the Nevada State Welfare Department. Other smaller organizations provide temporary assistance to residents suffering hardships. The Elko Band Council, under contract with the BIA, provide eligible Native Americans with general welfare assistance, adult institutional care, Indian child welfare (including foster care and institutional placements), indigent burial assistance, counseling services, and assistance with Social Security, disability, and death benefits, and state Medicare and Medicaid benefits (BLM 2009).

Water Supply

Elko City water is provided from 18 deep-water wells. Water is stored in ten tanks with a total capacity of 25 million gallons. The system has a maximum production capacity of 14.5 million gallons per day (Mgd) with current usage ranging from 3 Mgd to a peak of 13 Mgd. Spring Creek residents are served by nine public wells. A deep well and natural springs provide Carlin with water. Water is stored in a 2-million-gallon tank. Peak production capacity is 980 gal/min, or approximately 1.4 Mgd, averaging 450 gal/min. Residents in outlying areas depend on private wells for domestic water supply (BLM 2009).

Wastewater Treatment Facilities

Both Elko and Carlin have wastewater treatment facilities. Elko has a "fixed film" biological treatment plant averaging 3.5 Mgd. Approximately 60 percent of treated water is reused for irrigation. Carlin uses two lagoons with rapid infiltration basins. Many Spring Creek subdivision residents use individual septic systems.

Solid Waste

The regional landfill in the City of Elko is the only landfill in the county. The estimated life of the landfill, at 1,000 tons of solid waste per day, is approximately 94 years. Currently, the landfill is accepting approximately 110 tons of solid waste per day (NDEP 2004).

Energy Generation and Distribution Systems

Sierra Pacific Power Company provides electrical service. Natural gas is provided by Southwest Gas Corporation.

Employment and Income

Employment in Nevada is dominated by service industries (72 percent) and specifically the leisure and hospitality industries with 26 percent of the workforce in the sector. The gaming industry drives Nevada's economy. Gaming, hotel, and recreation areas employ the largest numbers of workers in the state (339,192). The next largest employment sector is trade, transportation, and utilities with 18 percent of the jobs statewide. Approximately one percent of jobs statewide were in the natural resource and mining industries (Nevada Department of Employment, Training, and Rehabilitation 2008). Employment by major industry with statewide employment by the same sector is shown in **Table 3-35**

Mining has been and continues to be important to the economic well-being of Nevada. Nevada leads the nation in production of gold, silver, and barite. Mining provides the highest average salary of any industry in Nevada. Average annual earnings for workers in the gold mining industry in Elko and Eureka counties during 2007, was $79,500. By contrast, the average annual wage in Elko and Eureka counties for an employee in the Service sector was $35,828 in 2007 (**Table 3-36).**

Employees of mining companies do not necessarily live in the closest community to their employment nor do they live in the local governmental unit which receives increased tax revenues as a result of the facility. According to Sonoran Institute (2007), commuting data suggest that Elko County is a bedroom community where 15.5 percent of the total income in the county is derived from people commuting to jobs out of the county. The majority of workers commuting to work may be going to Eureka County, which the Sonoran Institute (2007) considers to be an employment hub. In Eureka County income is derived from people commuting into the county that exceeds the income from people commuting out of the county. The net difference represents 603.2 percent of total income in the county.

The Elko Band is not directly involved with ownership or operation of mines in the Elko area. However, the tribal community relies upon the employment opportunities provided by the mining industry.

TABLE 3-35
Employment by Sector
Elko and Eureka Counties and the State of Nevada, 2007

Sector	Elko County		Eureka County		State of Nevada	
	Employees	Percent	Employees	Percent	Employees	Percent
Private Sector Industries						
Natural Resources and Mining	2,396	11.3	3,917	78.0	14,423	1.1
Construction	1,319	6.2	NA	NA	133,807	10.4
Manufacturing	216	1.0	NA	NA	50,119	3.9
Trade, Trans., Warehouse & Util.	3,739	17.6	100	2.0	231,714	18.0
Information	208	1.0	NA	NA	15,831	1.2
Financial Services	535	2.5	NA	NA	64,673	5.0
Prof. & Business Services	890	4.2	13	0.3	158,906	12.4
Educational & Health Services	1,225	5.8	NA	NA	92,011	7.2
Leisure & Hospitality	6,291	29.7	45	0.9	339,192	26.4
Other Services	597	2.8	8	0.2	29,169	2.3
Not Disclosed or Undetermined	*10*	*0.0*	*742*	*16.7*	*1,512*	*0.1*
Total Private	**17,426**	**82.2**	**4,825**	**96.1**	**1,131,357**	**88.1**
Government	**3,782**	**17.8**	**197**	**3.9**	**152,894**	**11.9**
Total All Industries	**21,208**	**100.0**	**5,022**	**100.0**	**1,284,251**	**100.0**

NA - Information not available
Note: Employment numbers are based on work location not place of residence.
Source: Nevada Department of Employment, Training, and Rehabilitation 2008.

TABLE 3-36
Income and Earnings Data
Elko and Eureka Counties, and State of Nevada

Characteristic	Elko County	Eureka County	State of Nevada
Average Annual Wages, All Industries, 2007	$37,960	$73,424	$42,172
Average Annual Wages, Other Services (except Public Admin.), 2007	$38,012	$33,644	$30,576
Average Annual Wages, Natural Resources & Mining, 2007	$76,492	$76,232	$75,088
Average Annual Wages, Metal Ore Mining, 2007	$82,628	$76,232	$80,184
Average Annual Wages, Gold Ore Mining, 2007	$82,732	$76,232	$80,600

Source: Nevada Department of Employment, Training, and Rehabilitation 2008 - Quarterly Employment and Wages.

Supplies and Services

As a large company in Northern Nevada, Newmont procures work and services from various contractors and suppliers. Newmont's total expenditure in Northern Nevada on services and supplies in 2004 included $294.5 million, which represented 47 percent of total spending. Newmont spent $83.3 million in North-Central Nevada, which represented 28.3 percent of total Northern Nevada spending. In 2006, Newmont spent approximately $900,000 for supplies in Nevada and approximately $151 million for contract labor. The company averaged 600 contractors for the year although the number varies seasonally (Pettit 2007).

Public Finance

Elko County is governed by a five member elected Board of Commissioners. Both the City of Elko and Carlin have city councils and city managers. County residents also elect the trustees of the Elko County School District. Residents in the Spring Creek Association elect a Board of Directors to manage the area.

Taxes paid by mining operations are a primary source of revenue for the State of Nevada, counties, and local governments. Based on information from the Nevada Department of Taxation and industry surveys, estimated state and local taxes paid by the mining industry in 2007 increased by nearly 3.7 percent over 2006. This increase follows a 45 percent increase in estimated taxes paid in 2006 over 2005, which represents the highest estimate over the past two decades. Total estimated taxes paid by mining companies in the state of Nevada in 2007 were $199.5 million, up from $194.2 million in 2006. These figures include only taxes paid by mining companies and does not include taxes paid by industry employees or suppliers (Dobra 2007).

Tax categories paid by mining companies include: employment taxes, Net Proceeds of Minerals (NPM) taxes, sales and use taxes on purchases, and property taxes. NPM taxes are paid to the county where the ore is mined, not the county where employees live. For example, NPM taxes are generated in Eureka County by the major mines of the Carlin Trend, including the Betze/Post, Gold Quarry, Leeville, and Genesis-Bluestar operations, but most employees live in Elko County. Companies pay property taxes based on the location of the property and sales taxes at the point of purchase. Since most companies providing services to the mines are located in Elko County and the majority of mining employee's live and purchase products and services in Elko County, the county receives substantial mining related tax revenue.

Net proceeds taxes distributed to Elko and Eureka counties are shown in **Table 3-37**. Mining activity has increased in Eureka County and decreased in Elko County over the time period. Future distributions will depend on continued mining and discoveries of new ore deposits.

In 2007, Newmont paid $4.8 million in net proceeds taxes to Eureka County and $367,000 to Elko County. Sales and use taxes paid by Newmont in 2007 include $14.5 million to Eureka County and $6.2 million to Elko County. Newmont paid $172,000 in property taxes to Elko County and $4.2 million in property taxes to Eureka County (Newmont 2008e). In the period from 2006-2007, these payments represent 0.5 percent of Elko County's total property tax revenue ($29.8 million) and 34 percent of Eureka County's total property tax revenue ($12.3 million). Total taxes paid by Newmont in 2007 to Elko and Eureka counties were $30.2 million.

TABLE 3-37
Net Proceeds Tax Distributed to Elko and Eureka Counties and State of Nevada

Fiscal Year	Elko	Eureka	State of Nevada/Total County Distribution
1999-2000	$3,189,780	$1,911,738	$14,525,017
2000-2001	2,891,062	2,968,354	14,114,324
2001-2002	1,264,908	1,278,428	11,425.034
2002-2003	1,561,131	1,222,059	13,756,888
2004	2,049,505	3,331,918	19,093,251
2005	2,003,547	3,356,887	21,886,103
2006	2,044,142	5,272,665	23,357,518
2007	2,489,641	8,089,017	32,345,089
2008	1,207,086	9,946,215	36,624,590

Source: Nevada Department of Taxation 2008.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Population and Demography

Implementation of the Emigrant Project would extend existing employment for 12 years which would tend to maintain current population levels during that period. Following completion of the Emigrant Project, if no other employment were available, the local population would begin to decrease as laid-off employees leave the area to seek employment and as retirees relocate.

Income, Employment, and Economy

Newmont currently employs about 1,300 workers at surface operations in the Carlin Trend and would employ approximately 180 people at the Emigrant Project (Newmont 2007a). The initial construction work force for the Emigrant Project would be approximately 100 people decreasing to about five employees at the end of construction. Construction and development are expected to require approximately 12 months. Active mining and leaching would occur over a 10 to 14 year period. The Proposed Action, together with other Newmont activities, would provide for long-term operations in the area, with potential for stable employment levels for approximately 15 years. At the end of active mining, a relatively small number of employees would be tasked to complete final reclamation and closure of the Project.

Based on the average annual salary ($79,500) the proposed Emigrant Project would continue employment producing an average of more than $14 million in annual wages for the area over the lifetime of the Project. Each mine employee would generate an additional 0.85 indirect or induced job in the Elko/Eureka counties economy (Price and Harris 2007). Each $1.00 of direct labor income from the hard rock mining industry generates an additional $0.37 of indirect/induced labor income (Price and Harris 2007). Based on these multipliers, the proposed Project would support continuation of about 150 secondary jobs in Elko and Eureka counties' economy during the 10 years of operation, providing an additional $5.3 million of indirect and induced wages annually. Thus direct and indirect employment provided by the Emigrant Project would average 330 jobs and $19.3 million in annual wages. At the end of the Emigrant Project, if no replacement employment is available, the remaining jobs associated with the Emigrant Project would be lost. The additional 10 years of employment would allow additional time for new industry to develop in the Elko area and perhaps provide alternative employment when mining winds down.

Housing

With no change in permanent employment or population, there would be no substantive change in the demand for permanent housing as a result of the Proposed Action. If the national economic situation of high or worsening unemployment continues, housing in Elko could see increasing demand because the local economy, with its high paying mining jobs and relatively strong economy would continue to attract those from areas where the economy is not as prosperous. At the end of the Emigrant Project, assuming no replacement employment, demand for housing would decrease sharply as laid-off workers seek employment elsewhere. This effect would be the same as for the No Action alternative but delayed by 10 years.

Community Facilities and Services

The proposed Emigrant Project would have no long-term effect on community facilities and service demands because Newmont's work force is already resident in the community. At the end of the Emigrant Project, assuming no additional mining, the effects of closure of the mine would be approximately the same as the No Action alternative, but delayed by 10 years.

Public Finance

The proposed Emigrant Project would continue to provide tax revenues to the state and local governments for an additional 10 to 14 years. After this period, the revenue status would be very similar to that of the No Action alternative. The amount of tax revenue depends on numerous unpredictable variables including the price of gold and the ability of the mining company to sustain production. Sales and property taxes paid by workers living in Elko County would continue to support local governments and businesses during the life of the Project.

Social Conditions

Continuation of mining activity at the Emigrant Project would sustain existing social conditions for approximately 10 to 14 years. The community generally considers existing social conditions to be positive, given the high pay for mining employees and the growing economy. After completion of the Project, if there is no replacement employment, social conditions would begin to decline as increased unemployment occurs, laid-off employees leave for other opportunities, and total community income decreases. This effect is similar to the No Action alternative but would occur 10 to 14 years later.

No Action Alternative

Under the No Action alternative, the Emigrant Project would not be approved. Since most of the work force for the Project would come from the existing mine-related work force in the Carlin Trend, impacts under the No Action alternative would include increased unemployment, reduced wages spent in the local economy, decreased revenue to local and state jurisdictions, increased stress on public assistance programs, and decreased quality-of-life for some residents.

It is not possible to quantify the extent of economic and social affect that would result from implementation of the No Action alternative. Ongoing mineral exploration and development throughout northern Nevada may offer employment opportunities in the region thereby offsetting the effect of the No Action alternative.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures beyond those described in the Proposed Action have been identified for social and economic issues by BLM.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible and irretrievable commitment of socioeconomic resources has been identified as a result of the Emigrant Project.

RESIDUAL EFFECTS

No residual effects to social and economic resources are expected as a result of the Proposed Action.

ENVIRONMENTAL JUSTICE

Affected Environment

The Study Area for environmental justice encompasses Elko County, including the cities of Elko and Carlin, and the Elko Band Colony of the Te-Moak Tribe of Western Shoshone Indians.

Identification of Minority and Low Income Populations

The Council on Environmental Quality identifies groups as environmental justice populations when either (1) the minority or low-income population of the affected area exceeds 50 percent, or (2) the minority or low-income population percentage in the affected area is meaningfully greater than the minority population percentage in the general population or appropriate unit of geographical analysis. In order to be classified meaningfully greater, a formula describing the environmental justice threshold as being 10 percent above the State of Nevada rate for Elko County and 10 percent above Elko County rate for communities within the county rate is applied to local minority and low-income rates. For purposes of this section, minority and low-income populations are defined as follows:

Minority populations are persons of Hispanic or Latino origin of any race, Blacks or African Americans, American Indians or Alaska Natives, Asians, and Native Hawaiian and other Pacific Islanders.

Low-income populations are persons living below the poverty level. In 2000, the poverty weighted average threshold for a family of four was $17,603 and $8,794 for an unrelated individual (U.S. Bureau of the Census 2002). Estimates of these two populations were then developed to determine if environmental justice populations exist in the Study Area.

The Proposed Action is located in Block Group 1 of Census Tract 9516. Interstate Highway 80 (I-80) defines the north edge of the block group. The east edge extends circuitously from I-80 south along Dixie Creek. The west edge follows Nevada State Route 278 (SR 278) through Pine Valley. The Emigrant Project is located approximately in the center of the block group. Portions of the community of Carlin located south of I-80 are included in this block group. The Proposed Action extends into two census blocks (1190 and 1229). Twenty other census blocks are located in the area immediately surrounding the Emigrant Project (1088, 1184, 1189, 1190 through 1194, 1205 through 1210, 1225 through 1228, and 1230 through 1233). Review of the 2000 census revealed that of 22 census tract blocks located within the immediate vicinity of the Emigrant Project, none are populated. As a result, Block Group 1 of Census Tract 9516 will be reviewed as the potentially impacted population.

Minority Composition

Information regarding the ethnic composition of populations located within Block Group 1 is provided in **Table 3-38**. Comparative information is also provided for the cities of Elko and Carlin and the State of Nevada. Elko County is representative of the State of Nevada with exception of American Indians (5 percent for the county as compared to 1 percent for the state – see below for a full description). When compared to Elko County data, Census Tract 9516 and Block Group 1 are less diverse ethnically. Whites are predominant (90 percent within the tract and the block group, as compared to 82 percent for Elko County).

TABLE 3-38
Minority and Low-income Populations,
Jurisdictions in the Study Area and the State of Nevada, 2000
Emigrant Project

Jurisdiction	Total Population	Percent Minority	Percent Below Poverty (1999)
Elko County	47,114	28	8
Elko	16,708	27	6
Carlin	2,161	8	8
Census Tract 9516	2,347	10	8
Block Group 1	1,048	10	6
State of Nevada	2,495,529	40	11

Source: U.S. Bureau of the Census 2007.

The community of Carlin is located partially within Block Group 1 of Census Tract 9516. The town, identified in the census as a "census designated place," was summarized separately (**Table 3-34**) to determine if disproportionately large ethnic populations are present there. Review of that data indicates that ethnic populations are under-represented when compared to the census tract or Elko County. As a result, for the purpose of screening for environmental justice concerns, non-White populations in Carlin do not represent minority populations.

Economic Data

The second element of environmental justice is the potential for disproportionate impacts to populations living below the poverty level. Poverty data provided by the Census Bureau characterize only a portion of the overall population. Groups not included in the poverty data are unrelated individuals under the age of 15; individuals living in group quarters such as correctional centers, institutions, college dorms, or military barracks; or individuals in living institutions without conventional housing. Data on persons living below poverty level in and adjacent to the assessment area are presented in **Table 3-38**.

As noted previously, census blocks located in and around the Emigrant Project are not populated; they do not contain representatives of this population that are living below the poverty level. As a result, the Proposed Action would not have potential to disproportionately impact a low-income population located elsewhere in the block group.

Elko Band Colony

In Elko County, members of the Elko Band Colony of the Te-Moak Western Shoshone tribe meet the description of environmental justice populations for both minority and poverty status **(Table 3-39**). The percent of minority persons and percent of people below the poverty level are more than 10 percent above Elko County and State of Nevada rates.

TABLE 3-39
Minority and Low-income Populations
Elko Band Colony, 2000

Band	Total Population	Percent Minority	Percent Below Poverty (1999)
Elko Band Colony[1]	730	86%	23%
Elko County	16,708	27%	6%
State of Nevada[2]	2,495,529	40%	11%

Source: [1]Sonoran Institute 2007; [2]U.S. Bureau of the Census 2007.

Impacts due to construction and operation of the Proposed Action to this tribe are evaluated, as described in the *Native American Concerns* section of this chapter.

DIRECT AND INDIRECT IMPACTS

Proposed Action

Direct and indirect impacts associated with the Proposed Action would not have a disproportionate affect on minority or low income populations in the Study Area. Census data for 2000 were reviewed to determine if disproportionately high minority and low income populations are present within an assessment area defined to surround the location of the Proposed Action. Review of Census Tract 9516 indicates that census blocks located in and around the Emigrant Project are not populated and do not contain representatives of a minority population or a population living below the poverty level. As a result, the Proposed Action would not have potential to disproportionately impact a minority or low income population.

No Action Alternative

Impacts relating to environmental justice would not occur under the No Action alternative. Impacts from previously authorized activities would continue under the No Action alternative.

POTENTIAL MONITORING AND MITIGATION MEASURES

No monitoring or mitigation measures for environmental justice have been identified by BLM. However, if impacts to any unknown (prior to any authorized mining activity) Traditional Cultural Properties or sites of cultural/spiritual/traditional use occur, mitigation and monitoring measures would be addressed on a site specific basis.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There would be no irreversible or irretrievable environmental justice impacts as a result of the Proposed Action.

RESIDUAL EFFECTS

Implementation of the Proposed Action would not result in residual environmental justice effects.

POTENTIAL MONITORING AND MITIGATION MEASURES

This section describes potential monitoring and mitigation measures identified by BLM and/or NDEP to reduce or minimize potential impacts of the Proposed Action. Potential impacts from implementation of these mitigation measures are also identified. No monitoring or mitigation measures have been identified by BLM or NDEP for the following resources:

- Air Quality;
- Special Status Plant Species;
- Grazing Management;
- Access and Land Use;
- Wastes, Hazardous or Solid;
- Visual Resources;
- Cultural Resources;
- Native American Concerns;
- Social and Economic Resources; and
- Environmental Justice.

POTENTIALLY ACID-GENERATING (PAG) WASTE ROCK MANAGEMENT

To address discrepancies in the acid generation potential of certain waste rock lithologies, Newmont in consultation with NDEP and BLM, developed an Adaptive Management Plan (AMP) for Waste Rock to verify predicted waste rock behavior associated with development of the proposed Emigrant Project.

The AMP identifies future waste rock characterization and monitoring associated with the project and options that could be employed to manage potentially acid generating (PAG) waste rock should the volume of PAG waste rock differ from the current plan or a revised method for managing PAG waste rock be warranted. The AMP is included in **Appendix A.**

All waste rock determined to be PAG would be placed in Encapsulation Cells consistent with the method described in Newmont's Plan of Operation (Newmont 2007a) and monitored and managed in accordance with the Waste Rock Management Plan and/or a plan developed by BLM and NDEP in response to Supplemental Waste Rock Characterization (SWRC) results.

A primary component of the Encapsulation Cell design is the placement of a 10-foot thick drainage layer comprised of Encapsulation Material (*e.g.*, Non-PAG waste rock that exhibits an ANP/AGP ratio of at least 3:1 to surround the PAG waste rock). Encapsulation Material would be produced during each mine phase and would be stockpiled as necessary to meet requirements for each Management Action. The amount of Encapsulation Material needed for each Management Action and the amount produced over the life of mine is described in the AMP (**Appendix A**). Adequate Encapsulation Material would be produced during the life of the operation to meet encapsulation requirements for each of the Management Actions.

SWRC results would be used to revise the monitoring plan included in the Waste Rock Management Plan as necessary. Any revision to the Waste Rock Management Plan would require approval of NDEP.

Should SWRC studies indicate greater amounts of PAG material than currently identified, one or more of the following Management Actions would be implemented to address the volume of PAG waste rock or the timeframe in which PAG waste rock would be produced:

- Management Action No. 1 - would be implemented to manage up to 10Mt of PAG waste rock through increasing the size and number of PAG cells that would be constructed in backfilled pits in the Emigrant Project.

- Management Action No. 2 - would address PAG tonnage that exceeds the 10Mt amount associated with *Management Action No. 1* by approximately 4Mt requiring expansion of an existing PAG rock encapsulation cell and construction of an additional cell. Depending on the particular pit sequence timing, available PAG encapsulation capacity, and pit backfill sequencing at the time that the additional PAG would be generated, other options may be available to manage PAG rock other than placement in an external waste rock disposal facility.

- Management Action 3 - would be implemented to address management of PAG waste rock during the initial Phases of mining (Phases I – III) where results of the SWRC study indicate that the volume of PAG that would be produced in initial years of mining exceeds the availability of mined-out pit areas for placement of PAG under the mine pit sequence included in the Plan of Operations. Approximately 125,000 tons of PAG waste rock would be temporarily placed on a lined facility with appropriate engineering controls. PAG placed on the lined facility would be re-handled and returned to the PAG encapsulation cells as the mining sequence allows.

The following resources would potentially be affected by implementation of the Management Actions described in the AMP.

Geology and Minerals

Implementation of Management Action No. 1, 2, and 3 would require excavation, stockpiling, and management of adequate amounts of Encapsulation Material (material that exhibits an ANP/AGP ratio of at least 3:1) to construct additional PAG encapsulation cells (Management Action Nos. 1 and 2) or a separate lined facility with appropriate engineering controls for PAG waste rock (Management Action No. 3). Selective handling and temporary stockpiling of Encapsulation Material to meet the encapsulation requirements for each PAG cell (*i.e.*, 10-foot thick drainage layer surrounding the PAG material) would be accomplished within the proposed permitted disturbance boundary.

Air Quality

Impacts associated with implementation of Management Action Nos. 1 and 2 would be the same as those described for the Proposed Action. Management Action No. 3 would result in an increase in fugitive dust emissions from re-handling PAG material temporarily placed on a lined facility with appropriate engineering controls.

Temporary placement and re-handling of PAG waste rock associated with Management Action No. 3 would result in emissions similar to those associated with the Proposed Action. Haul distances and the number of trips to and from the lined facility would not be substantially different than those identified in the Proposed Action.

Water Quantity and Quality

Implementation of Management Action Nos. 1 and 2 would have the same effect on water quantity and quality as the Proposed Action. The design and construction of encapsulation cells would be consistent with the encapsulation cell design included in the Proposed Action with use of Encapsulation Material to form a drainage layer around PAG waste rock. This layer is designed to intercept and drain infiltrating water away from PAG material (**Appendix A**).

Implementation of Management Action No. 3 would not affect water resources because placement of PAG waste rock on the lined facility with appropriate engineering controls would be temporary. Once an appropriate portion of the mine pit area becomes available for backfill, the PAG waste rock would be removed and placed as pit backfill. In circumstances where precipitation or snow melt contacts the temporary PAG stockpile, seepage that may flow from the stockpile would be collected on the liner system and allowed to evaporate or would be pumped to the leach process pond system. Eventual removal of the PAG waste rock from the lined facility would eliminate this potential source of seepage.

Soil

The volume of growth media that would be needed to meet the minimum 2-foot replacement depth requirement for PAG encapsulation cells associated with implementation of Management Actions 1and 2 would be approximately 162,000 cubic yards (cy) and approximately 235,500cy respectively. This volume of growth media is available within the proposed disturbance area for the Emigrant Project. Implementation of reclamation activities and BMPs outlined in the Proposed Action would be applied to these Management Actions and would reduce potential soil loss associated with the Emigrant Project.

Under Management Action No. 3 approximately 125,000 tons of PAG waste rock would be temporarily placed on a lined facility with appropriate engineering controls. This material would be re-handled and incorporated into Encapsulation Cells associated with Management Actions 1 and 2 and would not require additional growth media for reclamation.

OTHER POTENTIAL MONITORING AND MITIGATION MEASURES

Other potential monitoring and mitigation measures for resources and resource uses are discussed below.

Geology and Minerals

A waste rock management report that summarizes mining progress and disposition of waste rock would be submitted to BLM and NDEP annually. This report would describe testing completed to characterize PAG waste rock, and how such rock was segregated from other waste rock. Newmont would collect waste rock characterization data required under the Emigrant Project Waste Rock Management Plan for the Water Pollution Control Permit. These data would be provided to BLM and NDEP on a quarterly basis. Quarterly compliance inspections of the mine site would be conducted by NDEP and BLM.

Water Quantity and Quality

BLM and NDEP would require Newmont to monitor total suspended solids (TSS) and other chemical constituents in surface water at locations upstream and downstream of the proposed Emigrant Project site and in natural stream channels located in Dixie Creek drainage, but outside the influence of the proposed Project. Samples would be collected during periods when flow is occurring at these monitoring locations. Results of the monitoring episodes would be provided to BLM periodically throughout the monitoring period.

Data would be reviewed to determine whether sediment is being contributed by the proposed Project at levels that exceed TSS levels measured in stream channels that are unaffected by the Emigrant Project or if there is a substantial change in TSS levels as measured in the upstream versus downstream monitoring stations. Since natural TSS levels in area streams are elevated during certain periods of the year, the evaluation of TSS levels at selected monitoring stations would require site specific assessments.

In the event that monitoring identifies sediment contribution from the proposed Project site, BLM and NDEP personnel would review the sediment control system with Newmont to identify the source of sediment contribution and to implement corrective actions as necessary. Corrective actions could include construction of additional sediment pond capacity, modification of the run-off control ditch system, and/or revegetation to bind soil to slopes.

The need for and location of additional groundwater and/or surface water monitoring wells will be determined by NDEP and BLM.

Upland Vegetation

Reclamation measures would be implemented that favor establishment of big sagebrush on portions of the site. These measures would decrease the time required to establish sagebrush communities that are comparable to pre-mining levels. These measures could include application of mulch, inoculation with *arbusucular mychorrizae*, reduced competition with herbaceous species (lower seeding rate of grasses and forbs), and direct-placement of topsoil during salvage. These measures have been successful in specific applications where timing of seeding and suitability of the growth media have been favorable. The methods described are considered state-of-the-art for establishment of sagebrush communities on mined land.

Special measures, such as planting small patches of sagebrush among areas seeded with rapidly growing forbs and grasses, would be coordinated with BLM and NDOW to control soil loss associated with the slow establishment of big sagebrush after planting.

Best management practices would be implemented so that atomizers used to disperse heap leach drain-down fluids would not be used during periods of high wind in order to keep solutions within areas designed for containment to avoid affecting surrounding vegetation.

Invasive, Non-Native Species

Eradicate Scotch thistle in and adjacent to Project area prior to commencing construction. Eradication methods, including spraying noxious weeds with herbicides, have been shown to be effective in addressing invasive species such as Scotch thistle.

Wetland and Riparian Areas

Local ranchers currently use springs in the area for livestock watering, which has caused degradation of riparian areas. Degradation of these areas would be reduced if exclosures were constructed allowing natural recovery of the springs. Fencing wetland and riparian areas adjacent to proposed mine-disturbance areas would reduce effects of livestock on vegetation and stream banks. Excluding livestock access to streams and wetland/riparian areas has been demonstrated to allow rapid recovery of riparian vegetation, increase shade along stream banks, and lower water temperatures. These sites include springs at the following locations as shown on **Figure 3-11**:

- NE¼ of Section 28, Township 32 North, Range 53 East
- SW¼NW¼ of Section 27, Township 32 North, Range 53 East

- SW¼NW¼ of Section 27, Township 32 North, Range 53 East.

The Emigrant Spring exclosure would be reconstructed/maintained using wildlife friendly pipe rail fencing. Ongoing weed control would be conducted in the Emigrant Spring exclosure.

Reestablishment of riparian zones within the engineered stream channel has the potential to mitigate for loss of wetlands and non-wetland waters of the US under Newmont's 404 Permit Application the Corps of Engineers (COE). The COE is currently evaluating the adequacy of the riparian zone establishment in the engineered channel to meet the mitigation requirements. Other wetland mitigation options which may be considered include an *In-Lieu* Fee mitigation. This mitigation measure would provide financial support for conducting wetland establishment at other locations to mitigate loss of wetlands and non-wetland waters of the US associated with the Emigrant Project. Successful rehabilitation of riparian vegetation within an engineered stream channel is shown in Photos No. 1 and 2 in Chapter 2 of this Final EIS.

Fisheries and Aquatic Resources

Newmont would review status of native fish and macroinvertebrate populations in the Emigrant drainage and engineered stream channel with BLM and NDOW every 5 years. Fish and/or macroinvertebrate populations would be re-introduced into the channel as necessary or warranted. Reconstruction of the Emigrant Exclosure would improve habitat for fish and macroinvertebrates and may offset impacts to these resources resulting from relocation of the natural drainage.

Terrestrial Wildlife

Monitoring

- The scope, frequency, and intensity of further wildlife monitoring will be identified in the final monitoring plan developed by BLM in consultation with NDOW, and in the Record of Decision.

Mitigation

- Construct rock piles and drill or blast holes for bat roosting in highwalls and other rock faces. These techniques have been effective in creating roosting areas for bats and in some cases, raptor species.

- Implement reclamation measures that favor establishment of big sagebrush in portions of the site. Special measures would be coordinated with BLM and NDOW to control soil loss associated with the slow establishment of big sagebrush after planting.

Recreation

Newmont would provide funding for interpretive signs to be placed at the South Fork Special Recreation Management Area.