1.0 INTRODUCTION

The Elko Field Office of the Bureau of Land Management (BLM) is currently preparing three environmental impact statements (EISs) for mining operations within their jurisdiction. These documents are Barrick Goldstrike Mines Inc.'s Betze Project Supplemental EIS, Newmont Gold Company's South Operations Area Project Amendment EIS, and Newmont Gold Company's Leeville Project EIS. During the preparation of these three EISs, the BLM determined the potential exists for cumulative environmental impacts associated with the ground water pumping and water management operations of these mines. To facilitate preparation of these EISs, the BLM directed the three third-party EIS contractors to cooperatively prepare this cumulative impact analysis (CIA) report to address potential cumulative dewatering and discharge impacts for all three mine projects.

This document analyzes the cumulative impacts associated with the dewatering and water management activities at the Goldstrike Mine (including the Betze-Post Pit and the Meikle Mine); the South Operations Area Project Amendment (SOAPA), which is an expansion of the Gold Quarry Mine; and the proposed Leeville Mine. In addition, the BLM considered the potential effects of other past, present, and reasonably foreseeable future actions that may potentially affect ground water and surface water resources within the area of potential effect, including the Humboldt River.

The objective of this report, as a stand-alone document, is to identify the potential cumulative impacts to environmental resources associated with the Goldstrike, Gold Quarry, and Leeville mines in the case of ground water drawdown, and the Goldstrike, Gold Quarry, Leeville, and Lone Tree mines in the case of dewatering discharge to the Humboldt River. This report identifies and describes the potential cumulative impacts associated with all of these projects and does not identify the incremental direct or indirect impacts associated with one or more individual projects. The discussions of the cumulative impacts associated with mine dewatering and dewatering discharge in the three individual EISs will reference and summarize the impacts discussed in this document. In addition, each individual EIS will identify the incremental direct and indirect dewatering and discharge impacts of that individual project; each EIS also will discuss the other types of cumulative environmental impacts (i.e., non-dewatering-related impacts) associated with the Proposed Action and project alternatives analyzed in that EIS.

This document addresses the environmental impacts to resources potentially affected by water management operations. Resources addressed in this analysis include geology, ground and surface water resources, riparian areas and wetlands, terrestrial wildlife, aquatic habitat and fisheries, special status species, livestock grazing, socioeconomics, and Native American religious concerns.

Cumulative impacts are those effects on the environment that result from the incremental impact of each operation when added to the impacts of past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or private entity undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 Code of Federal Regulations [CFR] 1508.7); as specified in the document *Considering Cumulative Effects under the NEPA* (Council on Environmental Quality [CEQ] 1997), cumulative effects must be evaluated along with direct and indirect effects. BLM Instruction Memo NV-90-435 specifies that

impacts must first be identified for an individual project before cumulative impacts with interrelated projects can occur.

1.1 Cumulative Study Area

The geographic area for cumulative impacts is determined primarily by: 1) the direct impact area of the existing and proposed water management operations; 2) the location of the potentially interrelated projects that are being considered in the analysis; and 3) the resources potentially affected. In this case, the interrelated actions comprise other projects with the potential for cumulative hydrologic or water quality impacts associated with ground water drawdown, ground water mounding, and/or surface water discharge.

Resource-specific cumulative study areas were developed for each resource, as appropriate, and are discussed in Chapters 2.0 through 10.0.

1.2 Interrelated Projects

Interrelated projects are defined in this document as those activities that could interact with water management operations of the individual projects in a manner that would result in cumulative impacts.

1.2.1 Mining Projects

The Carlin Trend mining area of Nevada extends from the Hollister Mine, approximately 38 miles northwest of Carlin, to the Rain Mine, approximately 10 miles southeast of Carlin (see Figure 1-1). Mineral exploration and development has been ongoing within the Carlin Trend since the 1870s, with most of the activity occurring since approximately 1980 (BLM 1993b).

Based on past and planned future dewatering activities, and the ground water modeling conducted for the Goldstrike, Gold Quarry, and proposed Leeville mines, these three operations would have potential cumulative ground water and surface water impacts associated with ground water drawdown and mounding. Four mining operations would have potential cumulative impacts associated with dewatering discharges to the Humboldt River; these operations are the Goldstrike Mine, Gold Quarry Mine, Lone Tree Mine, and the proposed Leeville Mine. The locations of these projects are shown in Figure 1-1. The operation of these mines together with continuing irrigation and other demands for Humboldt River water comprise past, present, and reasonably foreseeable future actions with potential cumulative impacts. These projects are summarized in the following sections and in Tables 1-1 and 1-2. Project locations are shown in Figure 1-1.

Table 1-1 summarizes both the historic and projected future dewatering and water management activities for the Goldstrike Mine, Gold Quarry Mine, and proposed Leeville Mine. The historic activities extend from the initiation of ground water pumping for the mines through the end of 1998. The projected future dewatering and water management activities extend from 1999 through the currently projected end date for ground water pumping and water management activities for each operation. The values presented under the columns labeled “Most Recent Estimates” and “Proposed Action” represent the current estimates

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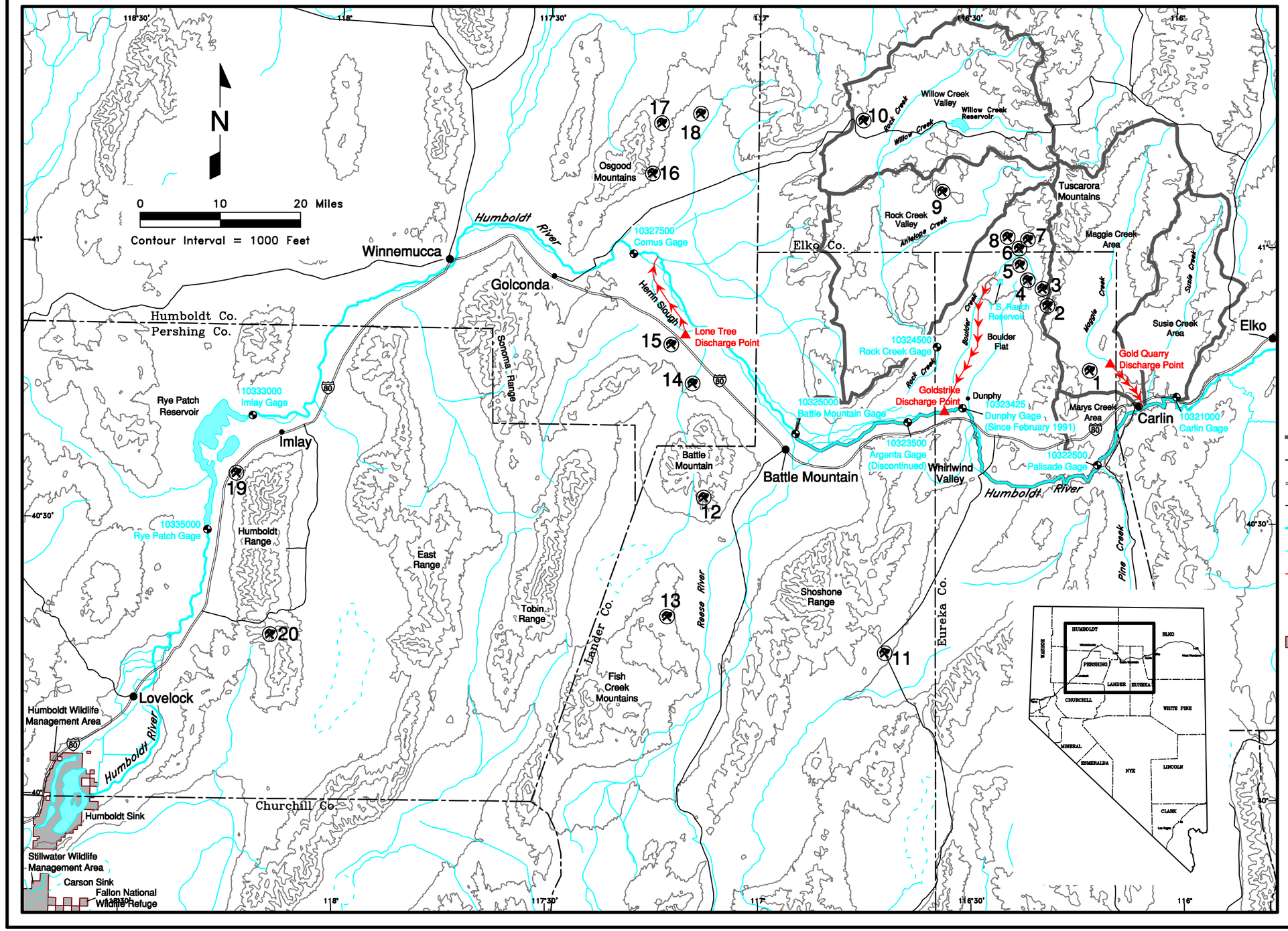

Figure 1-1

Basin Boundaries and Humboldt River Features

Table 1-1
Dewatering and Water Management Summary Table
(Summary of Historic and Projected Future Maximum Dewatering Rates and Drawdown From the Goldstrike Mine, Gold Quarry Mine, and Proposed Leeville Mine)

	Units	Goldstrike Mine		Gold Quarry Mine		Leeville Mine
		Betze Project EIS (1991)	Most Recent Estimates	SOAP EIS (1993)	Proposed Action	Proposed Action
Pumping Periods and Rates						
Start Year (Pumping for Water Supply)	Year	~1988	1987	1988	1988	2000
Start Year (Active Dewatering)	Year	N/A	1990	1994	N/A	2000
Planned End Year (Active Dewatering)	Year	2000	2010	2001	2012	2018
Maximum Projected Dewatering Rate	gpm	29,300	69,000	42,000	25,000	25,000
Planned Post Mining Pumping Period (for Water Supply)	StartYear/EndYear	2000-2010	2010-2020	2002-2009	2012-2017	None
Average Post Mining Pumping Rate	gpm	4,500	2000	N/A	2,500	None
Drawdown						
Estimated Premining Ground Water Surface at Mine	Feet AMSL	~5,300	5,265	~5,050	5,100	5,267
Ground Water Elevation End of 1998 at Mine	Feet AMSL	N/A	3,738	N/A	4,442	4,907
Maximum Drawdown End of 1998	Feet	N/A	1,527	N/A	658[1]	360[3]
Projected End of Mining Ground Water Surface Elevation	Feet AMSL, at mine	4,140	3,576	4,275	3,725	3,800
Maximum Planned Drawdown	Feet, at mine	1,160	1,689	775	1,375[1]	1,467
Pumped Volume						
Pumped Volume as of End of 1998	Acre-Feet	N/A	621,000	N/A	156,000	0
Total Projected Future Pumped Volume 1999 through End of Mine[2]	Acre-Feet		464,000		439,000	306,000
Total Planned Pumped Volume At Closure**	Acre-Feet	285,000	1,085,000	~500,000	595,000	306,000
Reinfiltration Volume (injection, infiltration at ponds and during irrigation)						
Project Reinfiltration Volume End of 1998	Acre-Feet	N/A	391,000	N/A	N/A[4]	0

Table 1-1 (Continued)

	Units	Goldstrike Mine		Gold Quarry Mine		Leeville Mine
		Betze Project EIS (1991)	Most Recent Estimates	SOAP EIS (1993)	Proposed Action	Proposed Action
Total Projected Future Infiltration Volume 1999 through End of Mine	Acre-Feet	N/A	173,000	N/A	N/A[4]	212,000
Total Project Reinfiltration Volume	Acre-Feet	N/A	564,000	18,500	N/A[4]	212,000
Pit Lake						
Projected Water Level of Recovered Pit lake	Feet AMSL	N/A	5,196	5,050	5,091	N/A
Predicted Area of Recovered Pit Lake	Acres	N/A	985	190	400	N/A
Predicted Volume at Recovery	Acre-Feet	N/A	405,000	N/A	175,000	N/A
Estimated Avg. Evaporation at Recovery	Acre-Feet/Year	N/A	2,900	627	1,117	N/A

[1]Includes approximately 76 feet of drawdown that occurred from pumping between 1988 and 1992
[2]Includes post-mining pumping
[3]Drawdown has resulted from pumping at the Goldstrike and Gold Quarry mines.
[4]Reliable estimates are not available; preliminary estimates suggest volumes on the order of 4,700 (through the end of 1998), 12,000 (1999-End of Mine), and a total volume of 16,700 acre-feet.
N/A Not applicable or not available
Sources of information: Barrick 1998c, 1999b, 1999c; Newmont 1999a, 1999b and 1998; HCI 1999b; MMA 1998; Radian International and Baker Consultants, Inc. 1997a; BLM 1991a, 1993b.

Table 1-2
Humboldt River Discharge Summary
(Summary of Historic and Projected Humboldt River Discharge from the Goldstrike Mine, Gold Quarry Mine, Proposed Leeville Mine, and Lone Tree Mine)

		Goldstrike Mine		Gold Quarry Mine		Leeville Mine	Lone Tree Mine
	Units	Betze Project EIS (1991)	Most Recent Estimates	SOAP EIS (1993)	Proposed Action	Most Recent Estimates	Most Recent Estimates
Discharge Summary							
Discharge Location		None	Humboldt River	Lower Maggie Creek	Lower Maggie Creek	Humboldt River (Barrick Discharge Outfall)	Iron Point Relief Canal to Herrin Slough Tributary to Humboldt River
State Date	Month/Year	N/A	Sept. 1997	April 1994	April 1994	9/2000	May 1992
Planned or Projected End Date	Year	N/A	March 1999[1]	2002	2011	2003[1]	2006
Discharge Rate							
Estimated Maximum Rate	gpm	0	56,810	46,500	23,800	25,000	70,400
Permitted Rate	gpm	0	70,000	46,500	46,500	[2]	75,000
Period of Peak Discharge	Year, Month(s)	N/A	4th Quarter 1997	Fall, Winter 1999-2001	2000	2001	2006
Discharge Volume							
Total Discharge Volume through 1998	Acre-Feet	0	72,000	N/A	77,000	0	243,000
Total Projected Future Discharge Volume 1999 through End of Mine	Acre-Feet	N/A	9,000	N/A	365,000	47,000	686,000
Total Planned Discharge Volume	Acre-Feet	0	81,000	~300,000	442,000	47,000	929,000

[1]Based on most recent projection; discharge could occur after this date

[2]Leeville discharge will be at the Barrick outfall, under Barrick's discharge permit

N/A: Not Available or Not Applicable

Sources of information: Barrick 1998c, 1999b, 1999c; Newmont 1999a, 1999b and 1998; HCI 1999b; MMA 1998; Radian International and Baker Consultants, Inc. 1997a; BLM 1991a, 1993b.

presented in the source documents listed at the bottom of the table. These estimates and the associated development of these projects are subject to economic and other future variables.

Table 1-2 summarizes the historic and projected future Humboldt River dewatering discharge activities from the Goldstrike Mine, Gold Quarry Mine, Lone Tree Mine, and proposed Leeville Mine. For the Humboldt River, the historic period includes all discharge activities that have occurred through the end of 1998. The projected future discharge information for these four projects is based on recently revised estimates provided by Barrick and Newmont for the Goldstrike, Gold Quarry, Leeville, and Lone Tree mines (Barrick 1999b, 1999c; Newmont 1999a, 1999b). It is important to understand that the analysis of potential future dewatering discharge impacts to the Humboldt River presented in this document is based on earlier estimates of mine dewatering discharge (Riverside Technology, inc. [RTi] 1998). Compared to the earlier estimates (RTi 1998), the current mine discharge scenarios indicate that 1) the Goldstrike Mine would no longer discharge to the Humboldt River after the first quarter of 1999 (earlier estimates assumed Goldstrike would discharge from 1999 through 2011); 2) the average annual discharge from Gold Quarry would be up to 24 percent greater than earlier projections; the period of discharge (1999-2011) would be unchanged; 3) Leeville would discharge at a similar range of rates for 4 years (through 2003) instead of 19 years; and 4) Lone Tree would discharge for the same period and at similar average rates. Overall, the current scenarios represent a reduction of total future discharge (1999-2018) of approximately 16 percent over the period of 1999 to 2018 compared to earlier estimates. For the purposes of estimating potential impacts to the Humboldt River, this analysis used the slightly higher discharge scenario based on the information provided in the RTi 1998 report. This discharge scenario is considered to be environmentally conservative, since it accounts for higher cumulative discharge rates and a higher cumulative discharge volume.

Mineral exploration is ongoing in the Humboldt River Basin, and future project development is subject to the uncertainties of ore body definition and the international gold marketplace. If such projects become more firmly anticipated and planned, their proposed actions and alternatives would likely be subject to appropriate site-specific and cumulative National Environmental Policy Act (NEPA) compliance as determined by lead agencies at that time.

1.2.1.1 Goldstrike Mine

Barrick's Goldstrike Mine is located on the western flank of the Tuscarora Mountains in the Little Boulder Basin, approximately 23 miles northwest of Carlin, Nevada (Figure 1-1). The Goldstrike Mine includes the Betze-Post Pit and the underground Meikle Mine. The BLM prepared an EIS for the Betze Project in 1991 and an EA for the Meikle Mine in 1993. Since the Betze EIS was issued, Barrick's ground water pumping and water management operations and its monitoring of ground water elevations have provided new information regarding increased pumping requirements and dewatering rates and the potential environmental impacts of Barrick's water management operations.

Barrick and Elko Land and Livestock Company (ELLCO) have submitted an application to the BLM to amend an existing right-of-way (ROW) for the construction and operation of a 3,936-foot water pipeline. The amendment seeks to expand the existing ROW width from 40 to 80 feet for the installation of a second

pipeline to segregate water from Barrick's water treatment plant from water to be used for irrigation purposes without treatment.

The BLM is preparing a Betze Project Supplemental EIS to analyze the impacts of Barrick's ongoing water management operations and the impacts of the proposed water pipeline.

Key elements of Barrick's existing water management operations are summarized in Tables 1-1 and 1-2 and include:

- Continued ground water pumping to maintain a ground water level in the area of the Betze-Post Pit and Meikle Mine of approximately 3,600 feet above mean sea level (amsl). This ground water level would be maintained until project mining is completed in 2010. Once mining is completed, pumping would continue at an average rate of approximately 2,000 gallons per minute (gpm) for 10 additional years to complete milling and beneficiation of stockpiled ore.

- Continued piping of water to Boulder Valley for irrigation during the growing season.

- In cooperation with Newmont, continued infiltration of excess water into the rhyolite formation in Boulder Valley of up to 20,000 gpm (on an annual average), subject to limits based on water levels in a monitoring well (TS-2) and flow rates in the Sand Dune Canal.

- Discharge to the Humboldt River of up to 70,000 gpm in compliance with Barrick's approved National Pollutant Discharge Elimination System (NPDES) permit, **if necessary** to dispose of dewatering water in excess of the water used for mining and milling or irrigation, or infiltrated in Boulder Valley.

1.2.1.2 Gold Quarry Mine

The Gold Quarry Mine is located in the Maggie Creek Basin on the eastern slope of the north-south trending Tuscarora Mountains. Gold Quarry is located within Newmont's South Operations Area, approximately 6 miles northwest of the Town of Carlin (Figure 1-1). Newmont submitted an application to amend their operating plan to allow expansion and deepening of the Gold Quarry Mine, and expansion of leaching and waste rock disposal facilities. The BLM is preparing an EIS for the SOAPA; approval of the SOAPA would allow continued mining at Gold Quarry, and continued mine dewatering and discharge to Maggie Creek. Dewatering and discharge activities for the Gold Quarry Mine are summarized in Tables 1-1 and 1-2.

Key elements of Newmont's proposed amendment for water management include:

- Continued ground water pumping to maintain a ground water level below the mine floor at approximately 3,725 feet amsl. Dewatering rates of up to 25,000 gpm are forecast until the year 2011. Following completion of Gold Quarry mining operations, pumping would continue for approximately 5 years at a rate of 2,500 gpm to support process operations.

- Continued discharge of water into Maggie Creek at a rate of approximately 20,000 gpm in compliance with Newmont's NPDES permit.

- Continued irrigation of Hadley Field.

1.2.1.3 Leeville Mine

Newmont's proposed Leeville Mine is located within the Little Boulder Basin on the western flank of the Tuscarora Mountains (Figure 1-1). The Leeville Mine would include development and operation of an underground mine and mine dewatering system, and installation of a water pipeline from the Leeville Mine dewatering well system to the TS Ranch Reservoir. The BLM is currently preparing an EIS for this proposed project. As described in Section 1.2.1, Barrick and Newmont have agreed on the allocation of infiltration capacity and the parameters for infiltration management of water in Boulder Valley, subject to limits based on monitored ground water levels and flow rates in the Sand Dune Canal. If excess water requires discharge to the Humboldt River, Newmont would use Barrick's Boulder Valley discharge outfall. The Leeville Mine is projected to begin mine dewatering in 2000 and continue through an 18-year mine life. The dewatering and discharge activities for the Leeville Mine are summarized in Tables 1-1 and 1-2.

1.2.1.4 Lone Tree Mine

Cumulative impacts to the Humboldt River would result from discharge of dewatering water from the Lone Tree Mine. The Lone Tree Mine is located approximately 34 miles east of Winnemucca south of Interstate 80 (Figure 1-1). Dewatering water that is not consumed is treated to reduce arsenic and is discharged to the Humboldt River via the Iron Point Relief Canal and Herrin Slough, which enters the Humboldt River approximately 11 miles northwest of the Lone Tree Mine. The Lone Tree Mine discharge activities are summarized in Table 1-2.

1.2.2 Other Projects and Activities

In addition to mining projects affecting water resources in the Humboldt River Basin, the agricultural, domestic, and municipal demands will continue. These sectors comprise the dominant water uses within the basin, and predictions of their needs have varied (Nevada Division of Water Planning 1992a, 1992b, 1998). If demand (water withdrawn for use) or consumption (water not returned to the system after use) increases from these sectors, then the potential for additional impacts on water resources of the basin would occur.

The potential restoration of the Argenta Marsh area is an additional project along the river that would use water resources in the basin. The project is in a preliminary conceptual stage, but it has support from a number of public and private organizations. Significant water supply, habitat, and land ownership issues need to be examined and resolved before the marsh restoration project can become a reality. During the life of the mines described herein, it is conceivable that additional flows from the mine dewatering discharges of the upstream operations could contribute to the water necessary to reestablish wetland habitats in the Argenta area. Long-term water supply to the marsh restoration project after the cessation of mine dewatering discharges is an issue that remains to be examined. The potential impacts from the restoration

project are not further analyzed in this assessment, given that the project is in early conceptual stages and has a number of issues to be resolved before implementation can proceed. If work proceeds on the Argenta Marsh restoration, appropriate environmental analyses will be conducted.

1.3 Existing Monitoring Programs and Mitigation Measures

The following monitoring programs and mitigation measures are associated with the water management operations of the existing Goldstrike, Gold Quarry, and Lone Tree mines.

1.3.1 Goldstrike Mine

1.3.1.1 Monitoring Programs

In 1990, Barrick established the Boulder Valley Monitoring Plan (BVMP) in support of the Water Management Plan submitted by Barrick, Newmont, and ELLCO to the Nevada State Engineer. The BVMP includes water level measurements at 104 ground water monitoring locations and water quality sampling at 22 wells. The BVMP also includes monitoring of 19 surface water monitoring locations. The BVMP data are compiled and reported quarterly to the BLM and the Nevada State Engineer. BVMP data are also used by Barrick to calibrate the mathematical model developed to simulate the effects of ground water pumping and water management operations.

In addition to the BVMP, Barrick also monitors surface and ground water quantity and quality as required by the Nevada Department of Environmental Protection (NDEP) and the BLM. Seep and spring monitoring includes annual site visits to 36 seeps and springs located in the Tuscarora Mountains. During each of the seep and spring inventories, site conditions are evaluated, flows are measured, vegetation transects are monitored, and water samples are collected for analysis. The data collected during the annual monitoring are compiled and presented in a report submitted to the BLM.

As provided in the U.S. Corps of Engineers' (USCOE) concurrence with Nationwide Permit coverage for the outfall structure to the Humboldt River, Barrick has agreed to cooperate with the U.S. Fish and Wildlife Service's (USFWS's) efforts to implement an aquatic biota monitoring study on the Humboldt River. The monitoring program provides for collection of aquatic biota samples (including bird eggs, juvenile bird livers, fish, and invertebrates) from a series of monitoring locations beginning near Elko and extending to the Humboldt Sink. In addition, water quality and quantity data are collected and provided to the USFWS by Barrick, the Nevada Department of Conservation and Natural Resources, and the U.S. Geological Survey (USGS). The USFWS will analyze the data collected and prepare a report in the year 2000.

In order to ensure that the BLM had adequate funding for monitoring following closure of the Betze-Post Pit, Barrick established a $250,000 trust fund in 1991 to pay for monitoring of potential environmental impacts of operations at the Betze-Post Pit after December 31, 2030. In the year 2080, or earlier if the BLM determines that long-term monitoring is no longer required, the remaining funds are to be transferred to the long-term mitigation fund (see below).

1.3.1.2 Mitigation Measures

The Record of Decision for the Betze Project Plan of Operations, issued on June 14, 1991, contained 33 mitigation stipulations. The stipulations described in this section were developed to mitigate the potential effects of Barrick's water management operations.

- Wetland Mitigation Fund and Monitoring. In 1991, Barrick established a trust fund of $660,000 that is available to the BLM to pay for the onsite or offsite protection or enhancement of replacement riparian and wetland areas to mitigate the impacts of Barrick's ground water pumping and water management operations.

  Barrick identified 19 seep and spring sampling locations that have been monitored annually since 1991 to evaluate flow rate, water quality, and vegetation. These sampling locations are situated along the crest and flanks of the Tuscarora Mountains to the east of the Goldstrike property. In addition, beginning in 1995 Barrick initiated monitoring of an additional 17 stream, seep, and spring sampling locations that are situated north and west of the Goldstrike property. The results of each year's monitoring are compiled in a written report and presented to the BLM. Barrick will continue the seep and spring monitoring program during the period of active mine operations until the year 2030, an additional 20 years after mining is projected to be completed.

- Riparian Vegetation. In addition to the mitigation fund and monitoring of seeps and springs, Barrick committed to spend up to $40,000 to purchase and plant seedlings or container plants in riparian or wetland areas to accelerate revegetation of areas adversely affected by Barrick's ground water pumping and water management operations.

- Wildlife Water Sources. Barrick committed to contribute up to $50,000 to assist the BLM and the Nevada Division of Wildlife (NDOW) in acquiring and installing alternative sources of water for wildlife in the area that may be affected by Barrick's ground water pumping and water management operations. To date, $50,000 has been spent to purchase and install 23 guzzlers for wildlife use.

- Sage Grouse Habitat Improvements. Barrick agreed to contribute up to $50,000 to assist the BLM with habitat improvement projects for sage grouse to mitigate potential impacts from Barrick's mining or ground water pumping and water management operations. To date, $1,500 has been invested in seeding burn areas to maintain the native grasses and avoid cheatgrass invasion.

- Mule Deer Habitat Improvements. Barrick agreed to contribute up to $125,000 to assist the BLM with habitat improvement projects for mule deer to mitigate potential impacts from Barrick's mining or ground water pumping and water management operations. To date, approximately $86,000 has been invested in seeding, overseeding, and fencing specified areas in order to improve mule deer habitat.

- Pit Water Studies. Barrick committed to fund research of issues related to postmining pit water quality at $50,000 per year for 10 years. The BLM solicited research proposals and funded a 3-year study by the

University of Nevada-Reno that was completed in 1995. The BLM recently selected a second research proposal from the University of Idaho.

- Long-Term Mitigation Fund. In 1991, Barrick established a $1 million trust fund that is available to the BLM to pay for the review, monitoring, or mitigation of potential impacts from Barrick's operations that were not specifically addressed in the mitigation stipulations or reclamation plan for the Betze Project.

- Long-Term Monitoring. As a condition of the Record of Decision, Barrick agreed to conduct monitoring of surface waters, ground water observation ports, process solutions as required by other permits and approvals granted by state agencies, and to provide the results of this monitoring to the BLM.

1.3.2 Gold Quarry Mine

1.3.2.1 Monitoring Programs

Monitoring of surface and ground water began in 1989 at and near the Gold Quarry Mine. Newmont established the Maggie Creek Basin Monitoring Plan (MCBMP) in 1992 in support of their water management plan for the SOAP activities. The MCBMP includes four hydrologic basins: Maggie Creek, Marys Creek, Susie Creek, and Boulder Flat Basin. The monitoring plan includes field measurements and water quality sampling at designated wells, piezometers, streams, and the Humboldt River. Monitoring data are compiled and reported quarterly to the BLM and the Nevada State Engineer. Monitoring data are also used by Newmont's modeling contractor to calibrate the mathematical model developed to simulate the effects of ground water pumping. Details on the hydrologic monitoring plan are included in the original EIS for the SOAP (BLM 1993a). Monitoring of water resources would continue after cessation of mining activities in the South Operations Area.

Newmont also conducts additional monitoring as required by the NDEP and the BLM. This monitoring includes visits to designated springs and seeps. Newmont began monitoring springs and seeps in 1990. A total of 62 springs are monitored annually in the fall, 23 are monitored in the spring, and 8 springs have been monitored quarterly since 1995. The spring and seep monitoring includes characterization of site conditions, flow rates, and water quality sampling. Newmont prepares two reports a year for NDEP and the BLM that document the data collected. Baseline water quality has been established at nine sites.

Newmont has a permit to discharge ground water to Maggie Creek issued by the State Engineer (up to 42,000 gpm). The water is cooled, monitored for quality and, when necessary, treated to remove arsenic. Newmont holds a stormwater permit that regulates stormwater discharges from the facilities. Best Management Practices, developed by the Nevada Department of Conservation and Natural Resources, are used to control stormwater discharges.

1.3.2.2 Mitigation Measures

The Record of Decision for the SOAP Plan of Operations, issued on November 19, 1993, contained 16 different mitigation programs for water resources. These were developed to mitigate the potential effects

of Newmont's water management activities. The mitigation plan was published in 1993 (Newmont 1993b) and modified as part of each subsequent plan of operations amendment (Newmont 1997b). Although provisions for improvements of Maggie Creek on private land owned by the Maggie Creek Ranch were identified in the SOAP Mitigation Plan, no actions were implemented. In addition, although portions of Susie Creek owned by the Maggie Creek Ranch were fenced by Newmont in support of the Mitigation Plan, grazing practices within the fenced area have not changed.

- Riparian and Wetland Areas. 1) The Maggie Creek Watershed Restoration Project (MCWRP), a program to improve streams, riparian habitat, and watershed conditions in the Maggie Creek subbasin through a cooperative effort among Newmont, the BLM, the TS Ranch, the Maggie Creek Ranch, and others. 2) The Susie Creek Riparian Enhancement Project. 3) The Marys River Riparian Project. 4) The Sand Dune Springs Riparian Study Preserve (in cooperation with Barrick). 5) A seep and spring enhancement and flow augmentation program.

- Springs and Seeps. Provision of replacement flows at impacted springs and seeps. Spring flow mitigation would continue at impacted springs until the applicable trigger well returns to within 10 feet of its pre-impact level (based on existing monitoring data) or until the BLM determines that mitigation is no longer necessary, whichever is sooner (BLM 1993a). Because the Carlin "Cold" Springs are the primary source of water for the town of Carlin, Newmont has agreed to maintain an adequate supply of potable water should any deficiency occur due to dewatering activities.

- Streams and Rivers. 1) Establishment of a comprehensive ground water monitoring network. 2) Contribution toward the cost of a BLM staff hydrologist. 3) Mitigation of potential baseflow losses to area creeks, including Maggie, Susie, James, Soap, and others through riparian improvement projects and, if necessary to protect riparian and aquatic values, through streamflow augmentation to middle Maggie Creek and to Susie Creek. 4) Provision of replacement flows at impacted seeps and springs through the use of ground water wells and guzzlers. 5) Prevention of adverse impacts to Humboldt River water rights holders by subordination of a portion of Newmont's senior irrigation water rights equivalent to baseflow reductions in the Humboldt River due to dewatering. 6) Prevention of increased sediment loading to the Humboldt River through implementation of channel stabilization measures and creation of polishing wetlands at the base of Maggie Creek. Note: Newmont has constructed two wetlands, one at the base of Maggie Creek and one at the railroad tunnel area several miles east of Carlin. 7) Prevention of temperature increases by construction of up to two cooling towers.

- Aquatic Habitat and Fisheries. 1) The MCWRP and the Susie Creek Riparian Enhancement Project (both mentioned above) to enhance aquatic habitat in those watersheds; 2) Recolonization of depleted sections of the Humboldt River using indigenous invertebrates; 3) Prevention of increased sediment loading to the Humboldt River through implementation of channel stabilization measures and creation of polishing wetlands at the base of Maggie Creek (mentioned above); and 4) Prevention of temperature increases by construction of up to two cooling towers (mentioned above). As noted above, no enhancement of Susie Creek has occurred under provisions of the SOAP Mitigation Plan.

As part of the Mitigation Plan for the SOAP development, Newmont Gold Company, in conjunction with the Elko BLM and Elko Land and Livestock Company, developed the MCWRP to improve streams, riparian habitats, and watershed conditions within the Maggie Creek subbasin (BLM 1993b). The MCWRP was designed to enhance 1,982 acres of riparian habitat, over 40,000 acres of upland watershed, and 82 miles of stream channel within the Maggie Creek subbasin (BLM 1993b). Components of the plan included exclosure and pasture fencing for livestock grazing management, conservation easements, water developments, water augmentation, riparian plantings, and other measures. Restoration of Lahonton cutthroat trout (LCT) habitat was a key consideration in development of the plan.

The MCWRP includes the management and monitoring of stream and riparian habitats associated with Maggie, Coyote, Indian, Jack, Little Jack, and Simon creeks. An additional 23 springs sites were fenced and developed where possible to provide alternate sources of water for livestock.

Since the MCWRP was implemented in 1993, improvement of riparian habitat, including streams occupied by LCT, has been excellent (BLM 1997a, 1999). Streams that were once characterized by eroding streambanks and a wide, shallow channel profile now support healthy functioning riparian zones and stable, well vegetated streambanks. Where biological criteria have been established for the reintroduction of grazing, standards have been met, and grazing has been applied on a prescription basis since 1997. Currently, LCT are abundant in both Little Jack Creek and Coyote Creek. A new LCT population has been discovered in Indian and Jack creeks in 1997.

1.3.3 Lone Tree Mine

Monitoring and mitigation measures for the Lone Tree Mine are specified in the Final EIS for the Lone Tree Mine Expansion Project (BLM 1996b). The measures associated with water management activities are described below.

1.3.3.1 Monitoring Programs

Monitoring of water resources is a major component of the overall monitoring program at the Lone Tree Mine. Ground water wells and springs provide most of the water monitoring sites established by Newmont, with supplemental surface water data obtained by the USGS on the Humboldt River. Approximately 120 piezometers are monitored weekly, monthly, or quarterly for water levels and/or quality characteristics. Five of these are part of the leak detection system for the tailings impoundment. Monitoring surface water in the Humboldt River is intended to evaluate compliance with the discharge permit, as well as evaluate possible impacts to fisheries and avian and aquatic life. Riverbank erosion potential is monitored in the vicinity of the discharge location.

Water monitoring requirements have been established by the NDEP for excess mine water that is discharged to the Humboldt River; the monitoring and discharge requirements are specified in Newmont's NPDES permit. Quality of water in the postmine pit lake and ground water quality surrounding the mine pit will be monitored per requirements of the NDEP water pollution control permit. The Lone Tree Mine will

continue to update and recalibrate the numerical ground water model and pit lake geochemical model as new data and monitoring results become available.

1.3.3.2 Mitigation Measures

Mitigation measures for the Lone Tree Mine are included in the Final EIS (BLM 1996b) for the mine expansion. Water resource mitigations include: a) deepen or replace private wells adversely affected by lowered ground water levels; b) replace water from springs that have reduced flows and for which water is beneficially used; c) correct mine-related source problems that may cause significant adverse impacts to ground water quality; d) implement more erosion control measures if the discharge causes erosion problems in the Humboldt River; and e) replace wildlife water sources that are adversely affected by mine-related activities.