2002 YEAR-END REPORT

for

LEVIATHAN MINE
Alpine County, California

Prepared By:

The Leviathan Mine Unit
Lahontan Regional Water Quality Control Board
South Lake Tahoe, CA

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LEVIATHAN MINE

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BACKGROUND

Leviathan Mine is an inactive sulfur mine that the State Water Resources Control Board acquired in 1984 for purposes of cleaning up water quality problems caused by historic mining. The State Water Resources Control Board has delegated authority over cleanup work at Leviathan Mine to the California Regional Water Quality Control Board, Lahontan Region (RWQCB).

The former sulfur mine is located on the eastern slope of the Sierra Nevada Mountains in Alpine County, California. The State owned property encompasses approximately 450 acres with mining disturbance on approximately 231 acres. The former sulfur mine includes a portion of Sections 14, 15, 22, and 23, in Township 10 north of Range 21 east of the Mount Diablo Meridian, Alpine County, Mineral Survey Nos. 6365A and 6365B. Leviathan Mine is approximately six miles east of Markleeville, California and five miles west of Topaz Lake, Nevada. The United States Department of Agriculture, Forest Service, Humboldt-Toiyabe National Forest (USFS) owns the majority of surrounding land, with the exception of ten private parcels adjacent to the south end of the state-owned property.

Historic mining activities at Leviathan Mine resulted in the exposure of pyrite contained in the native soil and rock, to air and water. Exposure of pyrite to air and water can lead to the generation of acidic drainage, also referred to as acid mine drainage (AMD). As AMD travels through the ground, it dissolves and carries metals contained in the native soil and rock. If left unabated, the metal-rich AMD discharges to nearby creeks (Leviathan and Aspen) and causes adverse effects.

Leviathan and Aspen Creeks flow across the mine site and merge downstream of the mine as shown in Figure 1. The combined flow of Leviathan and Aspen Creeks merges with Mountaineer Creek approximately 1.5 miles below the Leviathan-Aspen confluence. The confluence of Leviathan and Mountaineer Creek is considered the starting point of Bryant Creek. Bryant Creek flows across the Nevada state line and into the East Fork Carson River. There is an irrigation structure located on Bryant Creek just below the confluence of Bryant Creek and Doud Springs. The irrigation structure is used during the summer and fall months to divert the majority of flow out of Bryant Creek. The diverted flow is carried via an irrigation ditch to ranch lands located adjacent to the East Fork Carson River. The diverted flow is applied as irrigation water to pasture land.

In 1985, the RWQCB completed construction of a pollution abatement system at Leviathan Mine to address specific problem areas (see Figure 2). The 1985 project included the following measures to reduce pollution:

- Re-grading, compacting, and constructing a storm water collection system to reduce the movement of water through acid generating soils;

- Constructing a concrete channel (approximately 1/2-mile in length) to convey Leviathan Creek through the site to prevent erosion of mining waste and the movement of creek flows through acid generating materials;

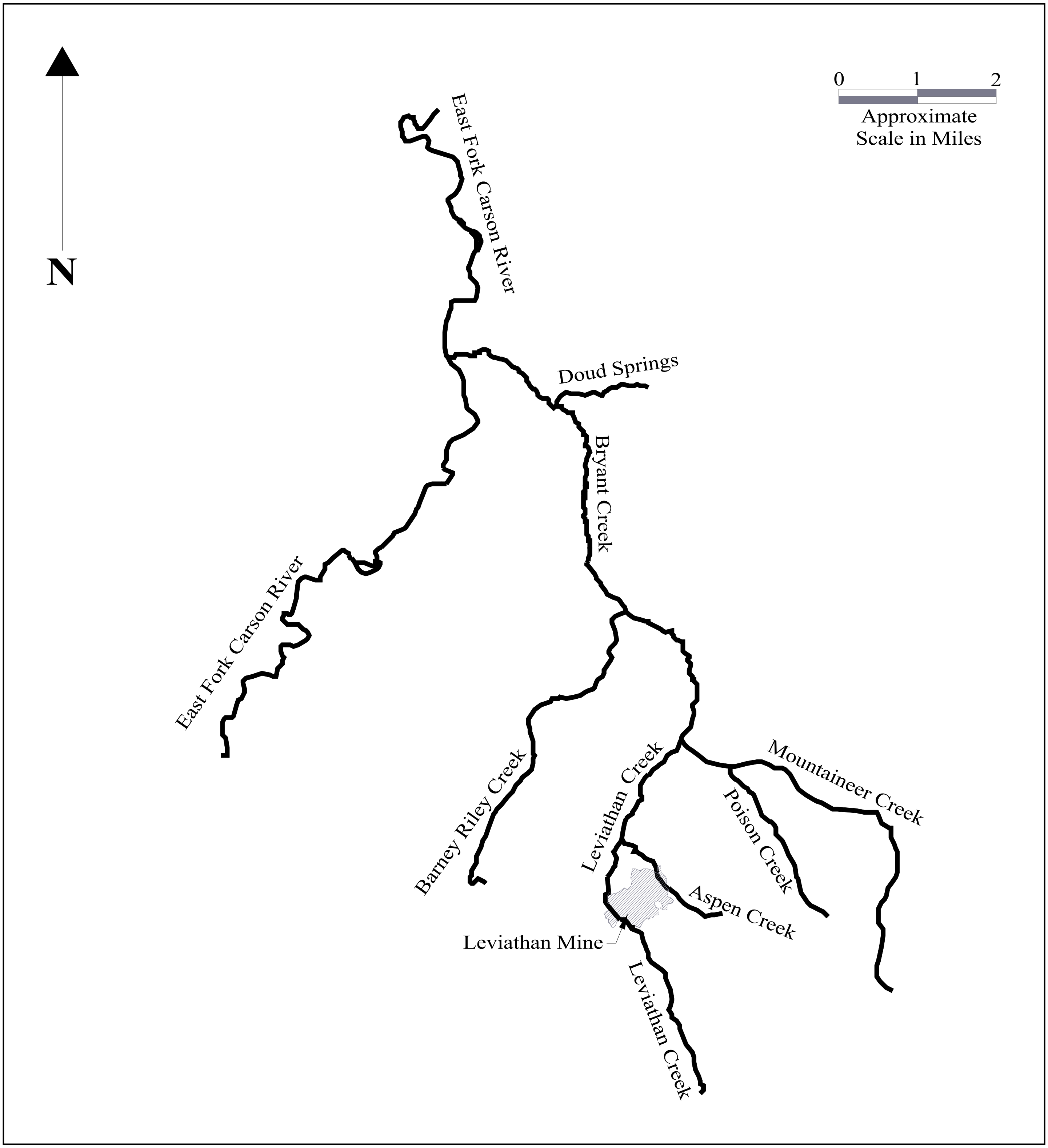

Figure 1. Leviathan Creek and Receiving Waters

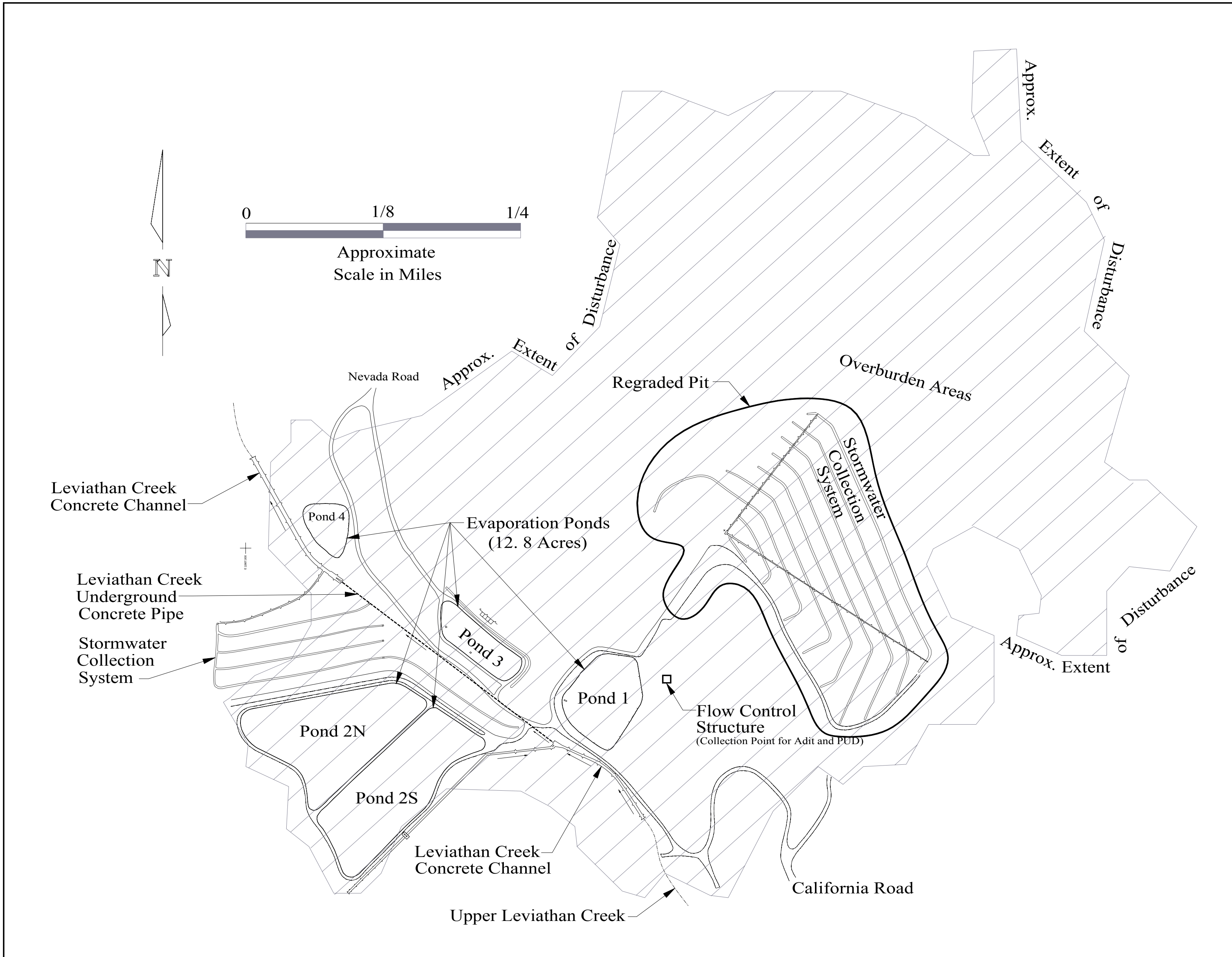

Figure 2. 1985 Site Improvements

- Regrading to eliminate depression storage and percolation of water through overburden materials;

- Constructing lined ponds (approximately 12 acres in surface area) to capture and evaporate AMD from underground mine workings, and to prevent the movement of water (rain and snow) through acid generating materials;

- Revegetating disturbed areas, including the mine pit, to prevent erosion and increase evapotranspiration.

The 1985 project reduced the pollutant load to receiving waters; however, the project did not address all sources of pollution. Following construction of the pollution abatement system, RWQCB staff continued to operate, maintain, and monitor the project. Surface water quality monitoring and visual observations since 1985 confirm that the abatement system reduced water quality impacts to Leviathan, Aspen, and Bryant creeks, but that additional work is necessary to address pollution sources that were beyond the scope of the 1985 abatement project.

Since 1998, and concurrent with the allocation of additional funds for abatement work at Leviathan Mine, the RWQCB has completed and continues to implement several projects, including the following:

- Installation and operation/maintenance of a lime treatment system to treat AMD contained in evaporation ponds as a means to prevent pond overflow (installed July 1999, operation/maintenance is on-going);

- Installation, maintenance, and operation of continuous flow recording devices throughout the site and vicinity (installed October 1998, monitoring is on-going);

- Monthly surface water quality monitoring (on-going);

- Construction and operation/maintenance of a semi-passive treatment system (bioreactor) sized to treat AMD emanating from overburden piles (constructed October 1998, operation/maintenance through June 30, 2001);

- Revegetation efforts to establish/enhance vegetation on 5 acres per year (on-going);

- Site maintenance activities, including fence/gate repair, road re-surfacing, storm water ditch cleaning;

- Geotechnical assessment of the Delta Slope for purposes of determining slope stability and the need for corrective actions (on-going);

- Structural assessment of Leviathan Creek Channel for purposes of detecting the need for corrective actions (on-going);

- Assessment of synthetic liners on evaporation ponds, starting with pipe penetrations of pond liners (commenced 2002, on-going).

In May 2000, the United States Environmental Protection Agency (USEPA) placed Leviathan Mine on the National Priorities List, thus making Leviathan Mine a federal Superfund site. Because the State of California is the present property owner, the USEPA has identified the State as a Potentially Responsible Party. USEPA has also identified Atlantic Richfield Company (ARC) as a Potentially Responsible Party for Leviathan Mine. ARC is the successor to a previous mine owner/operator, Anaconda Mining Company. Anaconda conducted the open pit extraction of sulfur ore at Leviathan Mine during the 1950s.

USEPA may direct Potentially Responsible Parties to take certain actions to characterize and abate pollution at Superfund sites. On July 19, 2000, pursuant to its authority under the Comprehensive Environmental Response, Compensation, and Liability Act, USEPA issued an Administrative Abatement Action (AAA) to the RWQCB and, thereby, directed the RWQCB to implement certain pollution abatement activities (including pond water treatment) at Leviathan Mine. With only slight modification, USEPA reissued the AAA in 2001, and thereby, directed the RWQCB to treat pond water during the 2001 and 2002 field seasons. It is expected that USEPA will continue to direct the work of both the RWQCB and ARC through annual reissue of AAAs, or by some other mechanism, until a remedy addressing all releases of hazardous substances at Leviathan Mine has been implemented.

This report (*2002 Year-End Report*) documents and certifies that all work required by USEPA, as specified in their July 2001 AAA, has been completed in full satisfaction of the requirements of the AAA and USEPA's July 11, 2002 Removal Action Memorandum.

2002 SITE ACTIVITIES

In keeping with USEPA's July 2001 AAA and their July 11, 2002 Removal Action Memorandum, the RWQCB performed the following activities during the 2002 season:

- Pond Water Treatment
- Site Monitoring:
  - Flow Recording
  - Surface Water Quality Monitoring
  - Biological Monitoring (aquatic macro-invertebrates)
  - Meteorological Monitoring
- Site Maintenance
- Revegetation

The RWQCB conducted each of the above-listed activities in accordance with Work Plans submitted to the USEPA in May 2002. It is important to note that in some cases the actual work completed may have varied from the work proposed in the Work Plan.

POND WATER TREATMENT

Background

As mentioned previously, the RWQCB completed a pollution abatement system at Leviathan Mine in 1985 that addressed specific problem areas. The 1985 abatement system included construction of five lined evaporation ponds to capture and evaporate AMD from remnant underground mine workings. The primary sources of AMD to the pond system are the "Adit" and the Pit Under Drain (PUD). The Adit is a remnant tunnel from underground mining work that occurred in the 1930s. The PUD is a made up of a series of rock filled trenches and perforated pipes that were installed as part of the State's 1985 project to drain shallow groundwater from the bottom of the open pit mine. Drainage from the Adit and the PUD is acidic with pH in the range from 2.4 to 3. The Adit typically discharges to the pond system in the range between 10 and 20 gallons/minute (gpm). The PUD typically discharges at less than 1 gpm.

Given the limited usable area at the mine site, the evaporation ponds could not be sized to provide 100 percent containment of influent flows (consisting of AMD from the Adit and PUD, and direct rain/snow onto the ponds). The evaporation ponds cover a cumulative surface area of approximately 12.8 acres with a cumulative holding capacity of approximately 16 million gallons (ARCO Environmental Remediation, LLC, 1999). During the time period between November 1 and June 1, the Adit and PUD will contribute approximately 4.5 million gallons (assuming an average flow rate of 15 gpm) and direct rain/snow will contribute approximately 5.2 million gallons (assuming 15 inches of rain/snow) to the pond system, for a total of 9.7 million gallons. It follows then, the ponds are likely to overflow if 9.7 million gallons of storage capacity are not available in the pond system on November 1. The evaporation ponds were intended to prevent the discharge of AMD until the flow in receiving waters was expected to provide the greatest attenuation. Following completion of the 1985 project and up until 1999, discharge of AMD from the pond system (pond overflow) routinely occurred during the spring months when pond inflow exceeded the storage and evaporative capacities of the pond system.

To prevent pond overflows, the RWQCB assessed a treatment process that enabled the treatment and discharge of treated pond water during the summer months, as a means to increase pond storage capacity for the subsequent winter and spring months. The RWQCB assembled a treatment system during the 1999 field season on the north east corner of Pond 1 and tested the process at full-scale during the 1999 and 2000 field seasons. The typical field season at Leviathan Mine runs from mid-June through mid-October. The RWQCB successfully operated the treatment system during the 2001 and 2002 field seasons and the ponds have not overflowed since initiation of the RWQCB's summer treatment program in 1999.

The process employed by the RWQCB for the treatment of AMD contained in the pond system can be described as biphasic neutralization. In this process, a source of alkalinity, such as calcium hydroxide, is mixed into the AMD (from the pond system) at two distinct points in the process. The addition of alkalinity causes a series of beneficial chemical reactions including an increase in pH and the precipitation of dissolved metals contained in the AMD. The precipitated metals are then separated from the solution, and the final product is a nearly metal-free effluent with near neutral pH (7.0), and a waste sludge containing metals.

The biphasic neutralization process had been identified through laboratory and field-testing as a means to treat pond water, produce high quality effluent, and control the quality of the sludge produced by the process. While the neutralization of AMD by the addition of alkalinity has long been accepted as an effective means to raise pH and remove metals in AMD, laboratory and field-testing of pond water demonstrated that neutralization of pond water by adding alkalinity at one point in the process (monophasic neutralization) would produce a large volume of sludge that would be considered hazardous by California standards. Laboratory and field-testing demonstrated that the sludge produced by monophasic neutralization would exceed the Total Threshold Limit Concentration (TTLC) for arsenic (As). When the total concentration of any constituent equals or exceeds its TTLC, by California standards, the waste is considered to be hazardous. Biphasic neutralization (adding alkalinity at two points in the process) provides a means to treat pond water and significantly reduce the volume of hazardous sludge generated by the process.

The biphasic process consists of neutralizing AMD by the addition of lime (calcium hydroxide [$Ca(OH)_2$]) at two points in the treatment process. Sludge is produced in both phases of the biphasic process. While sludge generated during the first phase of treatment of pond water exhibits hazardous characteristics, based on the concentration of As, the volume of Phase 1 sludge is relatively low. During the 2002 treatment season, Phase 1 sludge comprised approximately 5 to10 percent of the total volume of sludge generated by the biphasic process. The second phase sludge does not exhibit hazardous characteristics. During the 2002 field season, Phase 2 sludge comprised approximately 90 to 95 percent of the total volume of sludge from the process.

In the first phase (Phase 1) of the biphasic process, lime is added to raise the pH from 2.5 to approximately 2.8. At this pH, dissolved iron (Fe) in the AMD precipitates out of solution as iron hydroxide ($Fe[OH]_3$). During this precipitation, the As "co-precipitates" or is adsorbed to the $Fe(OH)_3$ to form Phase 1 sludge. In the second phase (Phase 2) of the biphasic process, additional lime is added to raise the pH of the partially treated AMD to approximately 8.5. This increase in pH causes the remaining metals to precipitate out of solution as metal hydroxides, forming Phase 2 sludge. The bulk of Phase 2 sludge is made up of gypsum (calcium sulfate [$CaSO_4$]).

In accordance with the RWQCB's *Project Work Plan for 2002 Pond Water Treatment*, the RWQCB operated the treatment system from July 11, 2002 through September 24, 2002 and, during that time period, discharged approximately 3.8 million gallons of treated pond water to Leviathan Creek. The RWQCB's treatment effort combined with natural evaporation resulted in complete evacuation of the pond system.

Discharge from the biphasic treatment system to Leviathan Creek had to comply with discharge standards in USEPA's 2002 Removal Action Memo, as shown in Table 1.

Table 1. Discharge Criteria for Biphasic Treatment

Water Quality Parameter	MAXIMUM	AVERAGE
pH	--	Between 6.0 – 9.0 SU$_{f2}$
Arsenic	0.34 mg/l$_{f1}$	0.15 mg/l$_{f4}$
Aluminum	4.0 mg/l$_{f1}$	2.0 mg/l $_{f4}$
Cadmium	0.009 mg/l$_{f1}$	0.004mg/l $_{f4}$
Chromium	0.97 mg/l$_{f1}$	0.31 mg/l $_{f4}$
Copper	0.026 mg/l$_{f1}$	0.016 mg/l $_{f4}$
Iron	2.0 mg/l$_{f1}$	1.0 mg/l $_{f4}$
Lead	0.136 mg/l$_{f1}$	0.005 mg/l$_{f4}$
Nickel	0.84 mg/l$_{f1}$	0.094 mg/l $_{f4}$
Selenium (Total Recoverable)	Not Promulgated$_{f3}$	0.005 mg/l $_{f4}$
Zinc	0.21 mg/l$_{f1}$	0.21 mg/l $_{f4}$

f1...... Dissolved metals concentration in a daily grab sample that has been field-filtered (0.45 micron) and acid fixed.
f2...... pH measurement based on 24-hour average discharge.
f3...... Total recoverable concentration in a daily grab sample that is acid fixed, but not filtered.
f4...... The sum of the detected concentration in four daily grab samples, from four consecutive discharge days, divided by four.

Biphasic Process Flow Description

A 5-horsepower (hp) electric pump conveyed AMD from Pond 1 to a 10,000-gallon fiberglass Phase 1 reaction tank (R-1). A pH probe installed in R-1 measured pH in R-1 and controlled the amount of lime slurry added to R-1. A 3-hp mixer on R-1 brought the AMD and lime slurry into intimate contact. The lime slurry raised the pH of the AMD from 2.5 to approximately 2.8.

Increasing the pH had the desired effect of precipitating out 60 to 80 percent of the dissolved Fe (as $Fe(OH)_3$) and simultaneously co-precipitating over 90 percent of the As (as verified by field monitoring). The treated AMD then gravity flowed to a two-chambered, Phase 1 combination flash/flocculation mix tank. A polymer solution (Superfloc A-1849 RS Anionicpolyacrylamide water-in-oil emulsion) was metered into the flash mix portion of the Phase 1 flash/flocculation mix tank to bring the AMD and polymer into intimate contact. In the flocculation mix portion of the tank, a low-speed mixer allowed the size of the floc particles containing the precipitated metals to increase. From the flocculation mix tank, the AMD flowed into a Lamella clarifier (CL-1) where the Phase 1 floc particles settled out.

Two 1.5-inch air diaphragm pumps transferred solids (Phase 1 sludge) from the bottom of CL-1 to one of two 8,500 gallon cone-bottom holding tanks (T-3A/B). A 1.5-inch air diaphragm pump then transferred the solids from the T-3A/B tanks to the Phase 1 pneumatic filter press (FP-1). FP-1 was positioned such that the filter cakes generated would drop directly into 10-cubic yard roll-off bins. When full, the bins were pulled from underneath the filter press, stored on site, and eventually transported off site for disposal at a Class 1 hazardous waste facility in Beatty, Nevada.

Supernatant from CL-1 gravity flowed to the Phase 2 reaction tank (a second 10,000-gallon fiberglass tank) referred to as R-2. A pH probe in R-2 measured pH and controlled the amount of lime slurry added to R-2. A 7.5-hp mixer on R-2 brought the partially treated AMD and lime slurry into intimate contact. The lime slurry raised the pH of the AMD to approximately 8.5, which caused all but trace amounts of remaining metals to precipitate out of solution.

Treated AMD then gravity flowed through the Phase 2 flash/flocculation mix tank and into the Phase 2 Lamella clarifier (CL-2). Two 10-hp mud pumps transferred the water/solid mixture from the bottom of CL-2 to the Pit Clarifier. Polymer solution (Superfloc A-1849 RS Anionicpolyacrylamide water-in-oil emulsion) was injected into the sludge slurry line just upstream of the two 10-hp mud pumps.

The Pit Clarifier is an earthen reservoir located in the Leviathan Mine open pit. The Pit Clarifier has plan dimensions of approximately 150-feet x 150-feet, and includes a perforated pipe and gravel/sand underdrain. During normal operations, the sludge slurry from CL-2 was pumped to the Pit Clarifier. Solids were allowed to settle out in near quiescent conditions. Clean water was decanted from the Pit Clarifier via an adjustable outlet and conveyed by gravity to the flow control structure adjacent to Pond 1 for final effluent monitoring and discharge. If discharge from the Pit Clarifier was found to be out of compliance, a valve prior to discharge was used to divert the discharge back to Pond 1 for re-treatment. Once treatment ended, and discharge through the adjustable outlet (decant outlet) ended, treated water was then discharged via the Pit Clarifier underdrain. Daily sampling of the discharge from the underdrain occurred until the flow rate out of the underdrain dropped below 1 gpm.

Effluent and Sludge Analysis

In accordance with the RWQCB's 2002 *Project Work Plan for Pond Water Treatment*, the RWQCB collected daily grab samples of treated effluent and both Phase 1 and Phase 2 sludge. Also, the RWQCB collected and analyzed samples of the influent AMD (pond water). Specific information on sample collection/preservation and chain-of-custody procedures is included in the Work Plan.

Effluent Analysis

Laboratory Analysis: As a means to demonstrate that the treatment system was providing acceptable effluent for discharge to Leviathan Creek, the RWQCB collected a daily grab sample of the treated effluent. A portion of the grab sample was field filtered and acid fixed, and submitted to the RWQCB contract laboratory to be analyzed for dissolved aluminum (Al), arsenic (As), copper (Cu), chromium (Cr), cadmium (Cd), nickel (Ni), iron (Fe), lead (Pb), and zinc (Zn). A unfiltered portion of the daily grab sample was acid fixed and submitted to be analyzed for Total Recoverable Selenium (Se). Table 2 presents the results of laboratory confirmation analysis.

Table 2 presents the concentration of particular metals detected in daily grab samples of treated effluent. These results were generated by the RWQCB's contract laboratory by applying standard analytical methods to daily grab samples of treated effluent. Table 2 also presents 4-day average concentrations for the listed metals. RWQCB staff obtained the 4-day average concentrations mathematically by averaging the analytical results for the daily grab samples over four consecutive discharge days. In order to be consistent with standard quality assurance and quality control procedures, when the detected concentration in a daily grab sample (obtained via analytical methods) was less than the laboratory detection limit, ½ the detection limit for that sample was used in calculating the 4-day average concentration. Based on the data presented in the Table 2, the following statements can be made:

- Aluminum (Al): Table 2 indicates that on 7/31, the discharge exceeded the average criteria for Al. It should be noted that at no time did the discharge exceed the maximum discharge criteria for Al. Based on the operator log, R2 experienced a brief jump in pH (up to 9.2) on 7/30. The pH jump on 7/30 may have caused Al to re-dissolve; thus elevating the concentration of Al detected in the daily grab sample from 7/31. The detected concentration on 7/31 was high enough to cause the calculated 4-day average concentration to exceed the average discharge criteria.

- Arsenic (As): At no time did the discharge exceed the discharge criteria for As.

- Cadmium (Cd): At no time did the discharge exceed the discharge criteria for Cd.

- Chromium (Cr): At no time did the discharge exceed the discharge criteria for Cr.

- Copper (Cu): Table 2 indicates that on 7/25 the discharge exceeded both the maximum and average criteria for Cu. RWQCB staff believe that this was most likely due to a laboratory error, because the reported concentration of Cu on 7/25 was highly irregular from previous and subsequent analysis of daily grab samples. The RWQCB requested a re-run of this sample, but the laboratory did not have enough sample to re-run the analysis.

- Iron (Fe): At no time did the discharge exceed the discharge criteria for Fe.

- Lead (Pb): At no time did the discharge exceed the discharge criteria for Pb.

- Nickel (Ni): Table 2 indicates that on 9/13, 9/16, and 9/17 the discharge exceeded the average discharge criteria for Ni. It is important to note, at no time did the discharge exceed the maximum criteria for Ni. Based on the operator's log, it appears that an under dosing of lime in phase 2 may have occurred due to instrument problems. This condition may have reduced Ni removal.

- Zinc (Zn): At no time did the discharge exceed the discharge criteria for Zn.

- Selenium (Se): At no time did the discharge exceed the discharge criteria for Se.

Twice per week, the RWQCB submitted samples of treated effluent and samples of untreated influent for the following analysis: sulfate (SO_4), total dissolved solids, hardness as $CaCO_3$, dissolved Al, As, Cu, Cr, Cd, Ni, Fe, Pb, Zn, calcium (Ca), manganese (Mn), magnesium (Mg) (metals by Method 200.7 or 200.8), and Total Recoverable Se. Table 3 presents the analytical results for metals (for which discharge criteria were specified) in untreated influent.

<u>Field Analysis</u>: As a means to provide "real-time" information regarding metals concentrations and other parameters in the treated effluent, each day that the system was discharging to Leviathan Creek, the RWQCB collected and field-analyzed at least two grab samples of the effluent for pH, dissolved As, Al, Cu, Fe, and sulfate (SO_4). The results of field analytical work are available from the RWQCB, but have not been included in this report. pH measurements taken in the field confirm that the discharge of treated effluent to Leviathan Creek was within USEPA's discharge criteria throughout the project.

Sludge Analysis

The RWQCB sampled sludge generated in both Phase 1 and Phase 2 of the biphasic process in order to track compliance with the following thresholds: Total Threshold Limit Concentration (TTLC), the Toxicity Characteristic Leaching Procedure (TCLP), and the Soluble Threshold Limit Concentration (STLC) for metals. Results of sludge analyses are presented in Tables 4 and 5.

Phase 1: In accordance with the RWQCB's *2002 Pond Water Treatment Work Plan*, the RWQCB collected a daily grab sample of Phase 1 sludge from the Phase 1 bin. Once every week, a composite of five daily grab samples of the Phase 1 sludge was shipped to the RWQCB's contract lab for TTLC, STLC and TCLP analysis for Title 22 Metals, Al and Fe. The results of Phase 1 sludge analysis are presented in Table 4. Sampling and analysis confirm that the Phase 1 sludge generally exceeded the TTLC for arsenic.

Phase 2: In accordance with the RWQCB's *2002 Pond Water Treatment Work Plan*, the RWQCB collected a daily grab sample of Phase 2 sludge slurry as it was discharged to the Pit Clarifier. Once every week, a composite of five daily grab samples of the Phase 2 sludge slurry was shipped to the RWQCB's contract lab for TTLC, STLC and TCLP analysis for Title 22 Metals, Al and Fe. Late in the treatment season, the RWQCB determined that although the samples of Phase 2 slurry were educational, given the high water content of these samples, they were probably not the best measure of metals concentration in the Phase 2 sludge. In an effort to better characterize the Phase 2 sludge in the Pit Clarifier, the RWQCB collected three grab samples from various locations in the Pit Clarifier. The collection of Phase 2 sludge samples occurred approximately six weeks after the biphasic treatment system was shutdown. At the time of sampling, there was no discharge from the Pit Clarifier underdrain. Table 5 contains the results of TTLC, TCLP, and STLC analysis of three grab samples collected from the Pit Clarifier. The three grab samples did not contain metals in excess of the TTLC, TCLP, and STLC standards.

Summary

Implementation of pond water treatment in 2002 was consistent with the RWQCB's 2002 *Project Work Plan for Pond Water Treatment at Leviathan Mine*. The biphasic treatment plant was operated from early-July 2002 through September 24, 2002. At the time of shutdown, approximately 3.8 million gallons of treated pond water were discharged to Leviathan Creek, and Ponds 1, 2N, 2S, and 3 were free of standing water (Pond 4 was being used by ARC as part of their efforts to treat other sources of AMD). The biphasic treatment plant operated for a total of 43 days treating approximately 100 to 200 gpm. At the time of shutdown, the estimated total capacity in Ponds 1, 2N, and 2S was 12.8 million gallons.

The 2002 treatment effort generated approximately 50 tons (wet tonnage) of Phase 1 sludge and approximately 600 cubic yards (wet volume) of Phase 2 sludge. Phase 1 sludge was disposed of at a Class 1 permitted hazardous waste facility in Beatty, Nevada. Phase 2 sludge was contained in the Pit Clarifier. The Pit Clarifier was constructed as part of the 2001 treatment effort. Approximately 800 to 900 cubic yards of Phase 2 sludge were removed from the Pit Clarifier and placed in a storage cell within the historic mine pit prior to system start-up in 2002. The

2002 treatment effort consumed approximately 75 dry tons of lime ($Ca[OH]_2$), 4,846 pounds of polymer, 3,074 gallons of diesel fuel and 492 gallons of gasoline. It is yet to be demonstrated that monophasic treatment of pond water (comprised of Adit, PUD and direct precipitation) will produce a sludge that passes the TTLC for As.

System improvements recommended after operating the treatment plant in 2001 were incorporated into the 2002 treatment system design. The most notable improvement was the use of electric pumps in place of air diaphragm pumps for the transfer of:

- AMD from Pond 1 to the treatment system;
- Phase 2 sludge slurry from CL-2 to the Pit Clarifier;
- lime slurry to the reaction tanks (R-1 and R-2).

Electric peristaltic pumps were used for the transfer of lime slurry to the reaction tanks. The peristaltic pumps were capable of pumping relatively large particles of semi-solid and solid lime without clogging. The former air operated pumps were prone to clogging by such particles. Use of electric pumps as an alternative to air operated pumps resulted in lower compressed air requirements allowing the use of a smaller air compressor which resulted in reduced maintenance and fuel requirements. In addition, the use of electric pumps in place of air operated pumps resulted in reduced noise levels.

System alterations incorporated in the 2002 treatment system were initiated in an effort to streamline the treatment process. One treatment system alteration included discontinuing the use of the Phase 2 flash/floc mixers in the Phase 2 flash/floc tank. The discontinued use of the Phase 2 flash/floc mixers eliminated maintenance and electrical requirements for two electric mixers. Adequate mixing of polymer with the final slurry stream was accomplished by injecting polymer directly into the slurry line prior to the two 10-hp mud pumps used to convey slurry to the Pit Clarifier. Other system alterations included moving the AMD intake system from the Flow Control Structure to Pond 1 in conjunction with the use of the new 5-hp influent pump. Minor system alterations included installing an improved recirculation system on the utility water supply line and eliminating a 1,800-gallon surge tank near the effluent monitoring point.

The most significant reoccurring issue that occasionally hampered the 2002 treatment effort was scaling in piping and other system appurtenances from R-2 to the final discharge point. Piping, hose, pump, and reactor vessel surfaces in direct contact with Phase 2 treated water enroute to the Pit Clarifier would become encrusted with scale. Occasionally and without warning, scale would dislodge from system-wetted surfaces and clog downstream appurtenances. The clogged or partially clogged appurtenances would not allow adequate flow rates through the treatment system and would necessitate an unscheduled shutdown of the treatment plant to remove the blockage. Engineered solutions for scaling issues are being investigated and will be integrated into the treatment system during system assembly for the 2003 treatment season.

There remain some unavoidable issues mostly related to the remoteness of the mine site. The remote location always results in logistical obstacles for the delivery of: 1) hardware items for system setup and maintenance (pipes, valves, controls, etc.), and 2) consumables for plant operation (lime, fuel, etc.). Rough road conditions can also hamper site access. The RWQCB is working with the USFS and ARC to improve road conditions along the California road (USFS Road 052). In particular, the RWQCB, ARC, and USFS plan to pave portions of the California road during the 2003 field season.

Table 2. Results of Confirmation Analysis on Treated Effluent

All values reported in milligrams/liter.
Shaded cell indicates the detected conc. was less than the value shown (the detection limit).
<u>Bold and underlined indicates the detected concentration exceeded the discharge criteria.</u>

	Date Collected	Al Daily Composite	Al 4-day Average	As Daily Composite	As 4-day Average	Cd Daily Composite	Cd 4-day Average	Cr Daily Composite	Cr 4-day Average	Cu Daily Composite	Cu 4-day Average
Discharge Criteria:		4.0000	2.0000	0.3400	0.1500	0.0090	0.0040	0.9700	0.3100	0.0260	0.0160
Influent:	7/17/02	390.0000		2.0000		0.0490		0.6800		1.7000	
Sample Description:											
Treated effluent in Pit Clarifier.	07/11/02	0.8400		0.0036		0.0017		0.0038		0.0250	
Treated effluent in Pit Clarifier.	07/12/02	1.3000		0.0010		0.0010		0.0020		0.0130	
Treated effluent in Pit Clarifier.	07/16/02	0.1000		0.0130		0.0010		0.0034		0.0100	
Treated effluent in Pit Clarifier.	07/17/02	0.1400		0.0170		0.0010		0.0031		0.0075	
Treated effluent in Pit Clarifier.	07/18/02	0.6400		0.0088		0.0010		0.0018		0.0084	
Treated effluent in Pit Clarifier.	07/19/02	1.0000		0.0032		0.0010		0.0015		0.0110	
Treated effluent in Pit Clarifier.	07/22/02	0.8700		0.0034		0.0010		0.0011		0.0100	
Treated effluent in Pit Clarifier.	07/23/02	1.4000		0.0060		0.0010		0.0010		0.0120	
Discharge to Creek Started 7/23/02											
Decant from Pit Clarifier.	07/24/02	1.3000	1.1425	0.0052	0.0045	0.0010	0.0005	0.0010	0.0009	0.0100	0.0095
Decant from Pit Clarifier.	07/25/02	1.2000	1.1925	0.0076	0.0056	0.0040	0.0009	0.0040	0.0010	**<u>0.0420</u>**	**<u>0.0173</u>**
Decant from Pit Clarifier.	07/26/02	2.4000	1.5750	0.0040	0.0052	0.0040	0.0013	0.0040	0.0013	0.0040	0.0153
Decant from Pit Clarifier.	07/29/02	2.4000	1.8250	0.0040	0.0042	0.0040	0.0016	0.0040	0.0016	0.0040	0.0128
Decant from Pit Clarifier.	07/30/02	1.8000	1.9500	0.0200	0.0054	0.0040	0.0020	0.0500	0.0078	0.0100	0.0128
Decant from Pit Clarifier.	07/31/02	1.7000	**<u>2.0750</u>**	0.0085	0.0056	0.0040	0.0020	0.0500	0.0135	0.0100	0.0035
Shut down for lime.	08/01/02	1.7000	1.9000	0.0200	0.0076	0.0040	0.0020	0.0500	0.0193	0.0100	0.0043
Shut down for maintenance.	08/02/02										
Shut down for maintenance.	08/05/02										
Shut down for maintenance.	08/06/02										
End of 2-week Startup Period											
Decant from Pit Clarifier.	08/07/02	0.3300	1.3825	0.0200	0.0096	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/08/02	3.8000	1.8825	0.0200	0.0096	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Shut down for maintenance.	08/09/02										
Decant from Pit Clarifier.	08/12/02	0.9500	1.6950	0.0360	0.0165	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/13/02	1.0000	1.5200	0.0200	0.0165	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/14/02	0.6200	1.5925	0.0200	0.0165	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/15/02	0.4200	0.7475	0.0470	0.0258	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/16/02	1.2000	0.8100	0.0200	0.0193	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/19/02	0.2500	0.5913	0.0200	0.0193	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/20/02	0.4600	0.5513	0.0200	0.0193	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Monophasic trial run	08/21/02										
Decant from Pit Clarifier.	08/22/02	0.7400	0.6313	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/23/02	0.9400	0.5663	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/26/02	0.5900	0.6825	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/27/02	0.5600	0.7075	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/28/02	1.2000	0.8225	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/29/02	0.8400	0.7975	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	08/30/02	0.2500	0.6813	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/03/02	0.2500	0.5725	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/04/02	1.2000	0.5725	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/05/02	0.2500	0.3938	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/06/02	0.2500	0.3938	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/09/02	0.2500	0.3938	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/10/02	0.2500	0.1250	0.0200	0.0125	0.0040	0.0020	0.0500	0.0250	0.0100	0.0063
Decant from Pit Clarifier.	09/11/02	0.2500	0.1250	0.0200	0.0125	0.0040	0.0020	0.0500	0.0250	0.0100	0.0063
Decant from Pit Clarifier.	09/12/02	0.2500	0.1250	0.0200	0.0125	0.0040	0.0020	0.0500	0.0250	0.0150	0.0088
Decant from Pit Clarifier.	09/13/02	0.2500	0.1250	0.0200	0.0125	0.0040	0.0020	0.0500	0.0250	0.0100	0.0088
Decant from Pit Clarifier.	09/16/02	0.2500	0.1250	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0075
Decant from Pit Clarifier.	09/17/02	0.3700	0.1863	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0075
Decant from Pit Clarifier.	09/18/02	0.4600	0.2700	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/19/02	1.1000	0.5138	0.0200	0.0100	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/20/02	0.6800	0.6525	0.0240	0.0135	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/23/02	0.6100	0.7125	0.0200	0.0135	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/24/02	0.4700	0.7150	0.0200	0.0135	0.0040	0.0020	0.0500	0.0250	0.0100	0.0050
Decant from Pit Clarifier.	09/25/02	0.2500	0.4713	0.0200	0.0135	0.0040	0.0020	0.1000	0.0438	0.0100	0.0050
Underdrain from Pit Clarifier.	09/26/02	0.2500	0.3325	0.0200	0.0100	0.0040	0.0020	0.0500	0.0438	0.0100	0.0050
Underdrain from Pit Clarifier.	09/27/02	0.2500	0.2113	0.0200	0.0100	0.0040	0.0020	0.0600	0.0525	0.0100	0.0050
Underdrain from Pit Clarifier.	09/30/02	0.2500	0.1250	0.0200	0.0100	0.0040	0.0020	0.0500	0.0525	0.0100	0.0050
Underdrain from Pit Clarifier.	10/01/02	0.2500	0.1250	0.0200	0.0100	0.0040	0.0020	0.0500	0.0338	0.0100	0.0050
Underdrain from Pit Clarifier.	10/02/02	0.2500	0.1250	0.0200	0.0100	0.0040	0.0020	0.0500	0.0338	0.0100	0.0050

Table 2. Results of Confirmation Analysis on Treated Effluent (Continued)

All values reported in milligrams/liter.
Shaded cell indicates the detected conc. was less than the value shown (the detection limit).
Bold and underlined indicates the detected concentration exceeded the discharge criteria.

	Date Collected	Fe Daily Composite	Fe 4-day Average	Pb Daily Composite	Pb 4-day Average	Ni Daily Composite	Ni 4-day Average	Zn Daily Composite	Zn 4-day Average	Se Daily Composite	Se 4-day Average
Discharge Criteria:		2.0000	1.0000	0.1360	0.0050	0.8400	0.0940	0.2100	0.2100	n/a	0.0050
Influent:	7/17/02			0.0050		6.6000		1.1000		0.0020	
Sample Description:											
Treated effluent in Pit Clarifier.	07/11/02	0.1000		0.0025		0.0440		0.0140		0.0020	
Treated effluent in Pit Clarifier.	07/12/02	0.5000		0.0010		0.0500		***0.2300***		0.0038	
Treated effluent in Pit Clarifier.	07/16/02	0.1000		0.0010		0.0100		0.0100		0.0060	
Treated effluent in Pit Clarifier.	07/17/02	0.1000		0.0050		0.0200		0.0058		0.0020	
Treated effluent in Pit Clarifier.	07/18/02	0.1000		0.0010		0.0320		0.0095		0.0060	
Treated effluent in Pit Clarifier.	07/19/02	0.5000		0.0010		0.0660		0.1300		0.0020	
Treated effluent in Pit Clarifier.	07/22/02	0.0500		0.0010		0.0500		0.0500		0.0020	
Treated effluent in Pit Clarifier.	07/23/02	0.1000		0.0010		0.0500		0.0500		0.0033	
Discharge to Creek Started 7/23/02											
Decant from Pit Clarifier.	07/24/02	0.5000	0.2063	0.0010	0.0005	0.0500	0.0353	0.1810	0.0903	0.0020	0.0016
Decant from Pit Clarifier.	07/25/02	0.1000	0.1563	0.0040	0.0009	0.0500	0.0250	0.0700	0.0753	0.0050	0.0020
Decant from Pit Clarifier.	07/26/02	0.1000	0.1625	0.0040	0.0013	0.0360	0.0278	0.0290	0.0763	0.0050	0.0023
Decant from Pit Clarifier.	07/29/02	0.1000	0.1625	0.0040	0.0016	0.0230	0.0273	0.0290	0.0773	0.0050	0.0021
Decant from Pit Clarifier.	07/30/02	0.5000	0.1000	0.0050	0.0021	0.0720	0.0390	0.1000	0.0445	0.0020	0.0021
Decant from Pit Clarifier.	07/31/02	0.5000	0.1500	0.0050	0.0023	0.0500	0.0390	0.1000	0.0395	0.0020	0.0018
Shut down for lime.	08/01/02	0.5000	0.2000	0.0050	0.0024	0.0500	0.0363	0.1000	0.0448	0.0050	0.0018
Shut down for maintenance.	08/02/02										
Shut down for maintenance.	08/05/02										
Shut down for maintenance.	08/06/02										
End of 2-week Startup Period											
Decant from Pit Clarifier.	08/07/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0368	0.1000	0.0500	0.0050	0.0018
Decant from Pit Clarifier.	08/08/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0250	0.1000	0.0500	0.0050	0.0021
Shut down for maintenance.	08/09/02										
Decant from Pit Clarifier.	08/12/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0250	0.1500	0.0750	0.0050	0.0025
Decant from Pit Clarifier.	08/13/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0250	0.1000	0.0875	0.0050	0.0025
Decant from Pit Clarifier.	08/14/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0313	0.1500	0.1125	0.0050	0.0025
Decant from Pit Clarifier.	08/15/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0313	0.1000	0.1125	0.0050	0.0025
Decant from Pit Clarifier.	08/16/02	1.2000	0.4875	0.0050	0.0025	0.0500	0.0313	0.1000	0.0875	0.0050	0.0025
Decant from Pit Clarifier.	08/19/02	0.5000	0.4875	0.0050	0.0025	0.0500	0.0313	0.1000	0.0750	0.0050	0.0025
Decant from Pit Clarifier.	08/20/02	0.5000	0.4875	0.0050	0.0025	0.0500	0.0313	0.1000	0.0500	0.0050	0.0025
Monophasic trial run	08/21/02										
Decant from Pit Clarifier.	08/22/02	0.5000	0.4875	0.0050	0.0025	0.0530	0.0383	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	08/23/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0383	0.1900	0.0850	0.0050	0.0025
Decant from Pit Clarifier.	08/26/02	0.5000	0.2500	0.0050	0.0025	0.0520	0.0450	0.1200	0.1025	0.0050	0.0025
Decant from Pit Clarifier.	08/27/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0388	0.1000	0.1025	0.0050	0.0025
Decant from Pit Clarifier.	08/28/02	0.5600	0.3275	0.0050	0.0025	0.0540	0.0390	0.1000	0.1025	0.0050	0.0025
Decant from Pit Clarifier.	08/29/02	0.5000	0.3275	0.0050	0.0025	0.0500	0.0390	0.1000	0.0675	0.0050	0.0025
Decant from Pit Clarifier.	08/30/02	0.5000	0.3275	0.0050	0.0025	0.0500	0.0323	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/03/02	0.5000	0.3275	0.0050	0.0025	0.0500	0.0323	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/04/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0250	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/05/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0250	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/06/02	0.5000	0.2500	0.0050	0.0025	0.0700	0.0363	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/09/02	0.5000	0.2500	0.0050	0.0025	0.0540	0.0435	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/10/02	0.5000	0.2500	0.0050	0.0025	0.0790	0.0570	0.1000	0.0500	0.0076	0.0038
Decant from Pit Clarifier.	09/11/02	0.5000	0.2500	0.0050	0.0025	0.1000	0.0758	0.1000	0.0500	0.0050	0.0038
Decant from Pit Clarifier.	09/12/02	0.5000	0.2500	0.0050	0.0025	0.1300	0.0908	0.1000	0.0500	0.0050	0.0038
Decant from Pit Clarifier.	09/13/02	0.5000	0.2500	0.0050	0.0025	0.1300	**<u>0.1098</u>**	0.1000	0.0500	0.0050	0.0038
Decant from Pit Clarifier.	09/16/02	0.5000	0.2500	0.0050	0.0025	0.1200	**<u>0.1200</u>**	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/17/02	0.5000	0.2500	0.0050	0.0025	0.0540	**<u>0.1085</u>**	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/18/02	0.5000	0.2500	0.0050	0.0025	0.0510	0.0888	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/19/02	0.5000	0.2500	0.0050	0.0025	0.0560	0.0703	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/20/02	0.5000	0.2500	0.0050	0.0025	0.0510	0.0530	0.1000	0.0500	0.0050	0.0025
Decant from Pit Clarifier.	09/23/02	0.5000	0.2500	0.0050	0.0025	0.0550	0.0533	0.1700	0.0800	0.0050	0.0025
Decant from Pit Clarifier.	09/24/02	0.5000	0.2500	0.0050	0.0025	0.0760	0.0595	0.1000	0.0800	0.0050	0.0025
Decant from Pit Clarifier.	09/25/02	0.5000	0.2500	0.0050	0.0025	0.1200	0.0755	0.1000	0.0800	0.0050	0.0025
Underdrain from Pit Clarifier.	09/26/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0690	0.1000	0.0800	0.0050	0.0025
Underdrain from Pit Clarifier.	09/27/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0615	0.1000	0.0500	0.0050	0.0025
Underdrain from Pit Clarifier.	09/30/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0488	0.1000	0.0500	0.0050	0.0025
Underdrain from Pit Clarifier.	10/01/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0250	0.1000	0.0500	0.0050	0.0025
Underdrain from Pit Clarifier.	10/02/02	0.5000	0.2500	0.0050	0.0025	0.0500	0.0250	0.1000	0.0500	0.0050	0.0025

Table 3. Results of Analysis on Untreated Influent

All values reported in milligrams/liter.
Shaded cell indicates the detected conc. was less than the value shown (the detection limit).

Sample I.D.	Date Collected	Measured Parameter Al Daily Composite	As Daily Composite	Cadmium Daily Composite	Chromium Daily Composite	Cu Daily Composite	Fe Daily Composite	Pb Daily Composite	Ni Daily Composite	Zn Daily Composite	Se Daily Composite
Discharge Criteria		4.0000	0.3400	0.0090	0.9700	0.0260	2.0000	0.1360	0.8400	0.2100	n/a
Plant Influent (untreated pond water)	7/17/02	390.0000	2.0000	0.0490	0.6800	1.7000	400.0000	0.0050	6.6000	1.1000	0.0020
Plant Influent (untreated pond water)	07/22/02	360.0000	1.4000	0.0220	0.7700	2.0000	370.0000	0.0010	6.4000	1.3000	0.0020
Plant Influent (untreated pond water)	07/24/02	400.0000	2.1000	0.0450	0.9500	2.2000	440.0000	0.0050	7.5000	1.5000	0.0020
Plant Influent (untreated pond water)	07/29/02	370.0000	1.8000	0.0550	0.8700	2.2000	410.0000	0.0040	6.9000	1.3000	0.0050
Plant Influent (untreated pond water)	07/31/02	410.0000	1.8000	0.0710	0.9400	2.2000	410.0000	0.0050	7.7000	1.5000	0.0020
Plant Influent (untreated pond water)	08/07/02	440.0000	1.7000	0.0680	0.9300	1.8000	400.0000	0.0050	7.6000	1.5000	0.0050
Plant Influent (untreated pond water)	08/12/02	360.0000	0.6600	0.0420	0.7400	1.9000	300.0000	0.0050	6.5000	1.4000	0.0050
Plant Influent (untreated pond water)	08/14/02	390.0000	1.5000	0.0610	0.8000	1.9000	330.0000	0.0050	6.9000	1.4000	0.0050
Plant Influent (untreated pond water)	08/19/02	380.0000	1.1000	0.0600	0.7300	2.2000	290.0000	0.0050	6.9000	1.3000	0.0050
Plant Influent (untreated pond water)	08/26/02	430.0000	1.9000	0.0600	0.9600	2.3000	420.0000	0.0050	7.7000	1.6000	0.0050
Plant Influent (untreated pond water)	08/28/02	540.0000	3.3000	0.0870	1.5000	2.9000	610.0000	0.0050	10.0000	1.9000	0.0050
Plant Influent (untreated pond water)	09/03/02	540.0000	5.0000	0.0790	1.3000	2.1000	600.0000	0.0050	9.5000	1.7000	0.0050
Plant Influent (untreated pond water)	09/05/02	600.0000	5.3000	0.0780	1.5000	3.0000	680.0000	0.0050	10.0000	1.8000	0.0050
Plant Influent (untreated pond water)	09/09/02	400.0000	9.2000	0.0760	2.4000	5.3000	430.0000	0.0050	9.5000	1.7000	0.0050
Plant Influent (untreated pond water)	09/11/02	530.0000	4.1000	0.0710	1.2000	2.0000	550.0000	0.0050	9.1000	1.6000	0.0050
Plant Influent (untreated pond water)	09/16/02	460.0000	2.4000	0.0690	0.9800	2.3000	430.0000	0.0050	8.1000	1.5000	0.0050
Plant Influent (untreated pond water)	09/18/02	440.0000	2.6000	0.0750	0.9000	2.2000	410.0000	0.0050	7.9000	1.5000	0.0050
Plant Influent (untreated pond water)	09/23/02	280.0000	2.0000	0.0400	0.5600	1.1000	350.0000	0.0050	5.2000	0.9900	0.0050

Table 4. Analysis of Phase 1 Sludge

ND: Below the detection limit.

NP: None promulgated.

NA: Not analyzed

	Constituent: Al		Sb		As		Ba		Be		Cd		Cr		Co		Cu		Fe	
Date of Sample and Testing Procedure	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**
July 19-24, 2002																				
STLC (mg/L)	140	NP	ND	15	ND	5	ND	100	ND	0.75	ND	1	5.8	560	ND	80	0.75	25	7600	NP
TTLC (mg/kg)	8800	NP	ND	500	1400	500	ND	10000	ND	75	ND	100	290	2500	ND	8000	ND	2500	260000	NP
TCLP (mg/L)	ND	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	0.85	NP
July 26-August 1, 2002																				
STLC (mg/L)	160	NP	ND	15	13	5	ND	100	ND	0.75	0.12	1	6.6	560	ND	80	0.86	25	6100	NP
TTLC (mg/kg)	3800	NP	ND	500	33	500	ND	10000	ND	75	5.4	100	100	2500	5.9	8000	23	2500	98000	NP
TCLP (mg/L)	ND	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	ND	NP
August 7-14, 2002																				
STLC (mg/L)	230	NP	ND	15	4.3	5	ND	100	ND	0.75	ND	1	7.7	560	0.61	80	1	25	8100	NP
TTLC (mg/kg)	7400	NP	ND	500	1700	500	ND	10000	ND	75	ND	100	150	2500	12	8000	48	2500	17000	NP
TCLP (mg/L)	ND	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	ND	NP
August 16-22, 2002																				
STLC (mg/L)	420	NP	ND	15	ND	5	ND	100	ND	0.75	0.16	1	8	560	0.8	80	1.9	25	6900	NP
TTLC (mg/kg)	9500	NP	ND	500	810	500	ND	10000	ND	75	5.6	100	220	2500	16	8000	61	2500	180000	NP
TCLP (mg/L)	0.47	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	0.51	NP
August 22-29, 2002																				
STLC (mg/L)	280	NP	ND	15	6.6	5	ND	100	ND	0.75	ND	1	7.8	560	ND	80	ND	25	6900	NP
TTLC (mg/kg)	4100	NP	ND	500	1100	500	ND	10000	ND	75	2.7	100	130	2500	9.5	8000	27	2500	120000	NP
TCLP (mg/L)	ND	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	ND	NP
August 30-Sept. 5, 2002																				
STLC (mg/L)	290	NP	ND	15	14	5	ND	100	ND	0.75	ND	1	12	560	ND	80	ND	25	9600	NP
TTLC (mg/kg)	4800	NP	ND	500	150	500	ND	10000	1.9	75	ND	100	160	2500	13	8000	31	2500	120000	NP
TCLP (mg/L)	ND	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	ND	NP
September 6-12, 2002																				
STLC (mg/L)	280	NP	ND	15	10	5	ND	100	ND	0.75	ND	1	7.9	560	ND	80	ND	25	5400	NP
TTLC (mg/kg)	5000	NP	ND	500	750	500	ND	10000	ND	75	ND	100	140	2500	9.3	8000	30	2500	93000	NP
TCLP (mg/L)	ND	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	ND	NP
September 12-19, 2002																				
STLC (mg/L)	520	NP	ND	15	ND	5	ND	100	ND	0.75	ND	1	6.6	560	ND	80	2.8	25	3600	NP
TTLC (mg/kg)	6200	NP	ND	500	380	500	ND	10000	ND	75	ND	100	83	2500	15	8000	34	2500	48000	NP
TCLP (mg/L)	15	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	ND	NP
September 20-26, 2002																				
STLC (mg/L)	1200	NP	ND	15	ND	5	ND	100	ND	0.75	ND	1	6	560	2.5	80	3.4	25	2200	NP
TTLC (mg/kg)	23000	NP	ND	500	380	500	ND	10000	ND	75	ND	100	94	2500	38	8000	63	2500	45000	NP
TCLP (mg/L)	160	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	ND	NP	ND	NP	6.4	NP

Table 4. Analysis of Phase 1 Sludge (continued)

ND: Below the detection limit.

NP: None promulgated.

NA: Not analyzed

	Constituent:																	
	Pb		**Mo**		**Ni**		**Se**		**Ag**		**Hg**		**Tl**		**V**		**Zn**	
Date of Sample and Testing Procedure	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**	**Result**	**Reg. Limit**
July 19-24, 2002																		
STLC (mg/L)	ND	5	ND	350	0.70	20	ND	1	ND	5	NA	0.2	4.1	7	2.0	24	ND	250
TTLC (mg/kg)	ND	1000	ND	3500	ND	2000	ND	100	ND	500	NA	20	ND	700	ND	2400	ND	5000
TCLP (mg/L)	ND	5	ND	NP	0.57	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP
July 26-August 1, 2002																		
STLC (mg/L)	0.98	5	ND	350	1.1	20	ND	1	ND	5	ND	0.2	ND	7	1.7	24	ND	250
TTLC (mg/kg)	14	1000	ND	3500	22	2000	ND	100	5.9	500	ND	20	0.71	700	33	2400	7.8	5000
TCLP (mg/L)	ND	5	ND	NP	0.53	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP
August 7-14, 2002																		
STLC (mg/L)	ND	5	ND	350	2.5	20	ND	1	ND	5	ND	0.2	ND	7	1.9	24	ND	250
TTLC (mg/kg)	ND	1000	ND	3500	46	2000	ND	100	ND	500	NA	20	1.3	700	59	2400	16	5000
TCLP (mg/L)	ND	5	ND	NP	0.89	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP
August 16-22, 2002																		
STLC (mg/L)	ND	5	ND	350	3.2	20	ND	1	ND	5	ND	0.2	ND	7	1.4	24	1.5	250
TTLC (mg/kg)	25	1000	ND	3500	59	2000	ND	100	7	500	ND	20	0.81	700	43	2400	16	5000
TCLP (mg/L)	ND	5	ND	NP	1.5	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP
August 22-29, 2002																		
STLC (mg/L)	ND	5	ND	350	2.8	20	ND	1	ND	5	ND	0.2	ND	7	ND	24	ND	250
TTLC (mg/kg)	18	1000	ND	3500	35	2000	ND	100	5.1	500	ND	20	0.63	700	47	2400	7.1	5000
TCLP (mg/L)	ND	5	ND	NP	ND	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP
August 30-Sept. 5, 2002																		
STLC (mg/L)	ND	5	ND	350	3.5	20	ND	1	ND	5	ND	0.2	ND	7	3.1	24	4.5	250
TTLC (mg/kg)	13	1000	ND	3500	46	2000	ND	100	ND	500	ND	20	0.91	700	45	2400	8	5000
TCLP (mg/L)	ND	5	ND	NP	1.3	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP
September 6-12, 2002																		
STLC (mg/L)	ND	5	ND	350	3.4	20	ND	1	ND	5	ND	0.2	ND	7	ND	24	3.6	250
TTLC (mg/kg)	ND	1000	ND	3500	38	2000	ND	100	ND	500	ND	20	ND	700	35	2400	ND	5000
TCLP (mg/L)	ND	5	ND	NP	ND	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP
September 12-19, 2002																		
STLC (mg/L)	ND	5	ND	350	7.4	20	ND	1	ND	5	ND	0.2	ND	7	ND	24	ND	250
TTLC (mg/kg)	ND	1000	ND	3500	66	2000	ND	100	ND	500	ND	20	1.1	700	23	2400	8.2	5000
TCLP (mg/L)	ND	5	ND	NP	1.4	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP
September 20-26, 2002																		
STLC (mg/L)	ND	5	ND	350	12	20	ND	1	ND	5	ND	0.2	ND	7	ND	24	ND	250
TTLC (mg/kg)	ND	1000	ND	3500	180	2000	ND	100	ND	500	ND	20	0.63	700	22	2400	12	5000
TCLP (mg/L)	ND	5	ND	NP	3.5	NP	ND	1	ND	5	ND	0.2	ND	NP	ND	NP	ND	NP

Table 5. Analysis of Phase 2 Sludge from the Pit Clarifier

ND: Below the detection limit.

NP: None promulgated.

Samples collected November 5, 2002.

Pit Clarifier Sample Location and Testing	Constituent: Al		Sb		As		Ba		Be		Cd		Cr		Co		Cu		Fe	
	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit
East Corner (0-20")																				
STLC (mg/L)	540	NP	ND	15	0.15	5	ND	100	ND	0.75	0.07	1	1.4	560	5.6	80	3.7	25	260	NP
TTLC (mg/kg)	92000	NP	ND	500	120	500	ND	10000	2.7	75	12	100	150	2500	630	8000	460	2500	38000	NP
TCLP (mg/L)	27	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	1.7	NP	0.12	NP	ND	NP
North Corner (0-																				
STLC (mg/L)	550	NP	ND	15	0.12	5	ND	100	ND	0.75	0.076	1	1.2	560	5.7	80	3.4	25	220	NP
TTLC (mg/kg)	83000	NP	ND	500	82	500	ND	10000	2.4	75	11	100	120	2500	570	8000	400	2500	31000	NP
TCLP (mg/L)	16	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	1.7	NP	0.1	NP	ND	NP
West Corner (0-																				
STLC (mg/L)	540	NP	ND	15	0.23	5	ND	100	ND	0.75	0.066	1	1.3	560	4.9	80	3.4	25	260	NP
TTLC (mg/kg)	62000	NP	ND	500	110	500	ND	10000	1.9	75	8.6	100	110	2500	430	8000	310	2500	29000	NP
TCLP (mg/L)	36	NP	ND	NP	ND	5	ND	100	ND	NP	ND	1	ND	5	1.8	NP	0.15	NP	ND	NP

Pit Clarifier Sample Location and Testing	Constituent: Pb		Hg		Mo		Ni		Se		Ag		Tl		V		Zn	
	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit	Result	Reg. Limit
East Corner (0-20")																		
STLC (mg/L)	ND	5	ND	0.2	ND	350	13	20	ND	1	ND	5	ND	7	ND	24	3.2	250
TTLC (mg/kg)	ND	1000	ND	20	ND	3500	1600	2000	ND	100	ND	500	ND	700	7.2	2400	300	5000
TCLP (mg/L)	ND	5	ND	0.2	ND	NP	3.8	NP	ND	1	ND	5	ND	NP	ND	NP	0.78	NP
North Corner (0-																		
STLC (mg/L)	ND	5	ND	0.2	ND	350	13	20	ND	1	ND	5	ND	7	ND	24	3	250
TTLC (mg/kg)	ND	1000	ND	20	ND	3500	1400	2000	ND	100	ND	500	ND	700	6.9	2400	270	5000
TCLP (mg/L)	ND	5	ND	0.2	ND	NP	4.2	NP	ND	1	ND	5	ND	NP	ND	NP	0.82	NP
West Corner (0-																		
STLC (mg/L)	ND	5	ND	0.2	ND	350	12	20	ND	1	ND	5	ND	7	ND	24	2.6	250
TTLC (mg/kg)	ND	1000	1.2	20	ND	3500	1100	2000	ND	100	ND	500	ND	700	6.7	2400	210	5000
TCLP (mg/L)	ND	5	ND	0.2	ND	NP	3.7	NP	ND	1	ND	5	ND	NP	ND	NP	0.94	NP

SITE MONITORING

Implementation of site monitoring was consistent with the RWQCB's *2002 Site Monitoring Work Plan*. The RWQCB continued their efforts to monitor flow and water quality at several locations in the vicinity of Leviathan Mine. In addition, and under contract with the RWQCB, Dr. Herbst conducted an aquatic macroinvertebrate bioassessment during spring and fall of 2002.

Flow Recording

Flow monitoring for the 01-02 water year (October 1, 2001 through September 30, 2002) at Leviathan continued under an ongoing contract between the RWQCB and the United States Geological Survey (USGS). Flow monitoring occurred as delineated in Table 6. All flow data collected by the USGS is forwarded to ARC for incorporation into the Leviathan Mine database. Flow from the CUD was directed into the ARC treatment system beginning June 26, 2002, thus there was no flow to the creek from that date until the end of September 2002.

Table 6. 2001-2002 Continuous Flow Recorder Locations

STATION LOCATION/DESCRIPTION	EQUIPMENT	USGS STARTUP DATE
Leviathan Creek above the mine **(Station 1)**	Continuous flow recorder and appurtenances, solar power supply.	October 98
Pit Under Drain at the flow control structure **(PUD)**	Continuous flow recorder and appurtenances, solar power supply, telemetry.	October 99
Adit at the flow control Structure **(Adit)**	Continuous flow recorder and appurtenances, solar power supply, telemetry.	October 99
Pond 1 Stage	Continuous stage recorder and appurtenances, solar power supply, telemetry.	October 99
Channel Under Drain **(CUD)**	Continuous flow recorder and appurtenances, solar power supply, telemetry.	October 99
Leviathan Creek Above its confluence with Aspen Creek **(Station 15)**	Flow recorder and appurtenances, solar power supply, telemetry.	October 98
Aspen Creek above its confluence with Leviathan Creek **(Station 16)**	None. Monthly flow measurements to establish relationship w/STA 15.	October 98
Overburden (Aspen) Seep, above the Bioreactors **(OS)**	Continuous flow recorder and appurtenances, solar power supply.	October 98
Bryant Creek just below the confluence of Mountaineer and Leviathan Creeks **(Station 25)**	Continuous flow recorder and appurtenances, solar power supply.	October 98
Leviathan Creek just above the confluence of Mountaineer and Leviathan Creeks **(Station 23)**	Continuous flow recorder and appurtenances, solar power supply	November 99
Mountaineer Creek just above the confluence of Leviathan and Mountaineer Creeks **(Station 24)**	None. Monthly flow measurements to establish relationship w/STA 23.	December 99
Bryant Creek just above confluence with Doud Springs **(Station 26)**	Continuous flow recorder and appurtenances, solar power supply	August 01

Surface Water Monitoring Program

The RWQCB continued monthly water quality monitoring through the 01-02 water year (October 1, 2001 through September 30, 2002). Sampling conducted after June 2002, was performed in accordance with the RWQCB's *2002 Site Monitoring Work Plan* and the RWQCB's *Draft Quality Assurance Project Plan (QAPP) for Surface Water Quality Monitoring at Leviathan Mine Superfund Site (March 2002)* (these documents are not included in this report, but copies may be obtained from the RWQCB). Sampling conducted prior to the approval of the Work Plan was conducted according to the June 15, 2000 and August 15, 2001 amendment, *Standard Operating Procedure for Surface Water Quality Monitoring for the Leviathan Mine Site*. The RWQCB's surface water quality monitoring program is summarized in Table 7.

Monthly sampling events were coordinated with the USGS monthly site visits except for the months of November and December 2001. High flow sampling was conducted on April 5, 2002 at Stations 23, 24, and 25. All surface water data collected by the RWQCB is forwarded to ARC for input into the Leviathan Mine database.

Table 7. Surface Water Quality Sampling Stations

RWQCB Station ID	Site Description	Sampling Frequency	Parameters Measured
Station 1	Leviathan Creek above Leviathan Mine.	Monthly	Total and Dissolved Metals for Al, As, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Zn; Total Recoverable Se; Hardness (as $CaCO_3$ and calculated using Dis. Mg and Ca); Total Dissolved Solids (TDS); Sulfate; field: pH, temperature, electrical conductivity, and specific conductance.
Adit	Drainage from Tunnel #5 (the Adit), prior to entering evaporation ponds.	Monthly	Same as above.
Pit Under Drain (PUD)	Drainage from shallow ground water collection pipes in pit, prior to entering evaporation ponds.	Monthly	Same as above.
Channel Under Drain (CUD)	Discharge from channel underdrain below Leviathan Creek concrete channel.	Monthly	Same as above.
Station 15	Leviathan Creek, above the confluence of Leviathan and Aspen creeks.	Monthly	Same as above.
Station 16	Aspen Creek, above the confluence of Leviathan and Aspen creeks.	Monthly	Same as above.
Station 17	Leviathan Creek, just below the confluence of Leviathan and Aspen creeks.	Monthly	Same as above.
Station 22	Aspen Creek above Leviathan Mine.	Monthly	Same as above.
Overburden Seep (OS)	Overburden seepage (a.k.a. Aspen Seep), above the bioreactors.	Monthly	Same as above.
Station 23	Leviathan Creek above the confluence of Leviathan and Mountaineer creeks.	Monthly	Same as above.
Station 24	Mountaineer above the confluence of Leviathan and Mountaineer creeks.	Monthly	Same as above.
Station 25	Bryant Creek below the confluence of Leviathan and Mountaineer creeks.	Monthly	Same as above.
Station 26	Bryant Creek above the confluence of Doud Springs and Bryant Creek.	Semi-annually	Same as above.

Biological Monitoring

Under contract with the RWQCB, Dr. Dave Herbst of the Sierra Nevada Aquatic Resources Laboratory conducted aquatic macroinvertebrate bioassessment during the Spring and Fall of 1995, 1997, 1999, 2000, and 2002. In 2001, Dr. Herbst conducted a single assessment in the spring. The most recent report from Dr. Herbst is titled, "*Bioassessment Monitoring of Acid Mine Drainage Impacts in Streams of the Leviathan Mine Watershed for Spring and Fall 2000*". A report for the data collected spring 2001 and the spring and fall 2002 will be completed in September 2003.

Herbst's report for monitoring conducted spring and fall 2000 documented:

- continued improvements in Aspen Creek below the mine and Bryant Creek downstream of the Mountaineer Creek confluence;
- recovery of Bryant Creek from any detectable biological effects due to AMD by the time Bryant flows into the East Fork Carson River (local impacts such as livestock grazing, road crossings, and agricultural diversion affect these sites); and
- a framework for a streamlined long-term bioassessment monitoring for the Bryant Creek watershed.

Dr. Herbst's 2003 report will be made available for public review.

Meteorological Monitoring

The RWQCB experienced various technical difficulties in the establishment of a weather station such that no meteorological data was collected during the 01-02 water year. However, during November 2002, the RWQCB installed an entirely new weather station at the site near Pond 1. This system, a Davis Integrated Sensor Suite, has been operational since installation. The system measures the following conditions: wind speed, wind direction, rainfall, outside temperature, outside humidity, ultraviolet radiation, and solar radiation. The data from this weather station shall be transmitted to ARC for incorporation into the master database for Leviathan Mine.

SITE MAINTENANCE

The RWQCB conducted site maintenance work during the 2002 field season in accordance with the *2002 Site Maintenance Work Plan*. These activities are necessary to prevent failures and to ensure proper performance of the 1985 pollution abatement system. Routine maintenance activities include repairing perimeter fencing, removing sediment from storm water ditches, covering exposed pond liners, repairing roads, and assessing/repairing concrete structures.

Repairing Perimeter Fencing

A barbed wire fence surrounds the Leviathan Mine site. During the 2002 field season, RWQCB staff walked and observed the entire fence line and repaired several sections. By late June 2002, the fence was continuous around the entire site and a fourth strand of barbed wire was installed on approximately half of the fence surrounding the site. Additional reinforcement work was performed on the California and Nevada entrance gates to fortify the hinges preventing further damage to the gates.

Storm Water Ditch Cleaning

In the fall of 2002, the RWQCB hired a contractor to remove sediment from the storm water ditches in the pit and around Pond 1. Sediment had accumulated in the ditches to where it impaired the storm water capacity of the ditches. The ditch cleaning work was completed in October 2002. The ditch cleaning effort included the filling of rills that had been created by overland flow. This work will continue under the same contract during the 2003 field season.

Covering Exposed Liner

RWQCB staff visually monitored the edge of each pond as a means to detect areas where earthen cover had eroded. The amount of exposed liner was considered to be minimal, and RWQCB staff placed small amounts of earthen material over the liner where it was exposed.

Roads

RWQCB work on roads was limited to developing a road maintenance agreement and the placement of boulders as vehicle barriers along USFS Road 052. Significant progress has been made on the development of an agreement between the RWQCB, USFS, and ARC to conduct road maintenance and improvement work on USFS Road 052 (along the Highway 89 access route, between Highway 89 and Leviathan Mine). The U.S. Forest Service road that goes around the eastern perimeter of Leviathan mine also has several unofficial turnouts that approach an unstable pit wall. To prevent vehicle traffic from getting to close to the pit wall, the RWQCB had large boulders placed in turnout areas to prevent vehicles from using them.

Leviathan Creek Channel Assessment

The RWQCB worked with the Department of General Services to establish a contract to remove sediment from the lower portions of the Leviathan Creek channel. This work is necessary to enable inspection of the channel bottom. A contract for the channel clearing was awarded late in the 2002 field season. Given the late contract award date and the potential for winter weather to hamper the project, the RWQCB decided to postpone the channel clearing work until the 2003 field season. The work will be conducted during low flow conditions. Both the California Department of Fish and Game and the United States Fish and Wildlife Service have been consulted with regard to this project.

Leviathan Creek Channel Drop Inlet

RWQCB staff hired a contractor to repair broken welds on the grated platform above the Leviathan Creek Drop Inlet Structure. The Drop Inlet Structure receives flow from the upper portions of the Leviathan Creek concrete channel and diverts the flow into two 72-inch diameter pipes. This work was completed in October of 2002.

Assessment of Pipe Penetrations on Ponds 1, 2N, 2S, and 3

Under contract with the Department of General Services, and on behalf of the RWQCB, Kleinfelder, Inc. conducted an assessment of the pipe penetrations to Ponds 1, 2N, 2S, and 3. The intent of this investigation was to assess the integrity of pond liners and the booted inlets and outlets to the ponds. The assessment was conducted in October 2002 and the results of the assessment are presented in Kleinfelder's January 8, 2003 report titled, "*Geomembrane Boot Inspection Report, Leviathan Mine Ponds, Alpine County, California*". The report concludes that the geomembrane used to seal pipe penetrations to the pond liner are in need of repair. The pond liner appears to be in good condition. Working through the Department of General Services, the RWQCB intends to hire a contractor to design necessary repairs, and to develop a bid package for the repair work. The design work is expected to be completed during the 2003 field season, and the actual repair work is scheduled to occur during the 2004 field season.

REVEGETATION

The RWQCB implemented portions of the work specified in the *2002 Revegetation Work Plan.* The revegetation goal for the 2002 field season was to treat 3 to 6 acres by either stimulating new growth of existing plants (by incorporating nutrients into the soil), or by amending and planting bare areas.

Amending and Planting Bare Area

RWQCB focus during the 2002 field season was on amending and planting bare areas in the open pit (approximately 6 acres), and on amending overburden materials (approximately 1 acre). Soil amendment (incorporation of lime and compost) was accomplished by spreading lime and compost in specified amounts over known areas. Incorporation of the lime and compost was accomplished by cross ripping the areas with a tracked dozer to a depth of 15-inches. This technique was applied throughout the pit (on the pit benches). In the pit, the lime application rate was in excess of 35 tons per acre and the compost application rate was 40 cubic yards per acre. The total area amended in the pit was approximately 6 acres, as shown in Figure 3. Following the incorporation of lime and compost, the pit benches were hydro-seeded with a seed mix containing the below-listed species. The seeds were hydro-seeded with a tackifier ("*Fish Bond*") and an application rate of 500 pounds of wood fiber ("*Ecofiber*") per acre. The benches were then planted with a mix of about 500 Mountain Mahogany and Tobacco Brush plants.

Squirrel Tail	Elymus elymoides
Great Basin wildrye	Elymus cinerus
Yarrow	Achillea millefolium
Big basin sage	Artemisia tridentata
Tahoe Lupine	Lupine meionanthus
Sulfur buckwheat	Eriogonum umbellatum

Additionally, one acre on the overburden area was amended with both lime and compost (see Figure 4). The area was amended in the same manner as the pit with approximately 30 tons of lime and 30 cubic yards of compost. This area did not receive any seeds or plants.

Other Revegetation Work

Per the Work Plan, on August 13, 2002, the El Dorado County Department of Agriculture, Weights and Measures spot sprayed an herbicide (*Telar*) to eradicate Tall Whitetop on approximately 0.3 acres. Tall Whitetop is an invasive exotic plant that both California and Nevada organizations wish to control.

The RWQCB continued to monitor the 1997 revegetation test plots. During the 2002 field season, Karen Wiese with the Office of Mine Reclamation monitored test plots created in 1997. The monitoring data is currently under review. Data from the 2001 field season showed that plants in areas that received deep lime ripping and injection had similar top growth to plants in areas that received surface lime with deep ripping. The hypothesis is that plants in areas that receive deep lime ripping and injection will have deeper root penetration.

Variation from the Work plan

There were two variations from the Work Plan and they were the direct fertilization of the slope above Pond 4 and seed collection. Instead of direct fertilization around Pond 4, the RWQCB concentrated on amending soils in pit and on overburden areas, as described above. Seed collecting did not occur during the 2002 field season due to logistical issues that caused the RWQCB to miss the window of opportunity for collecting target seeds. Currently, 40 pounds of seeds are available to the RWQCB for use at Leviathan Mine.

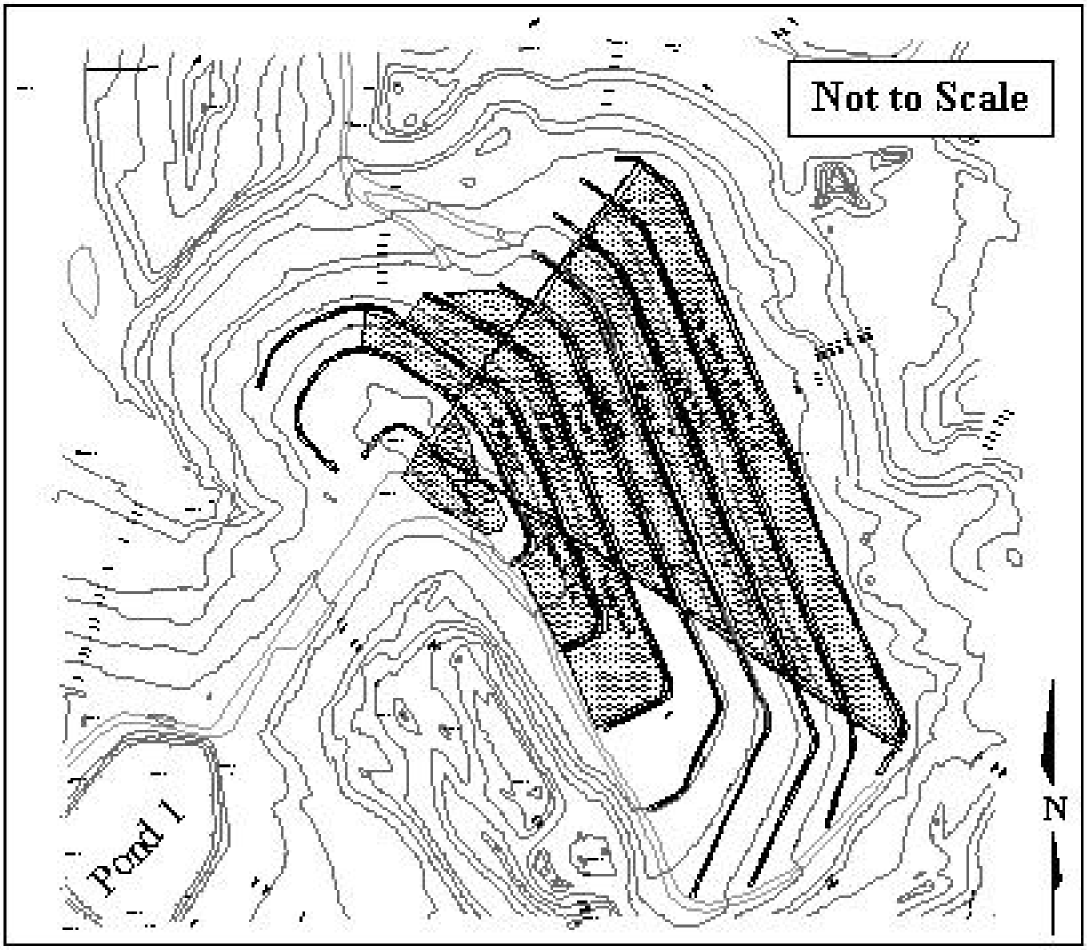

Figure 3. Revegetation in the Pit

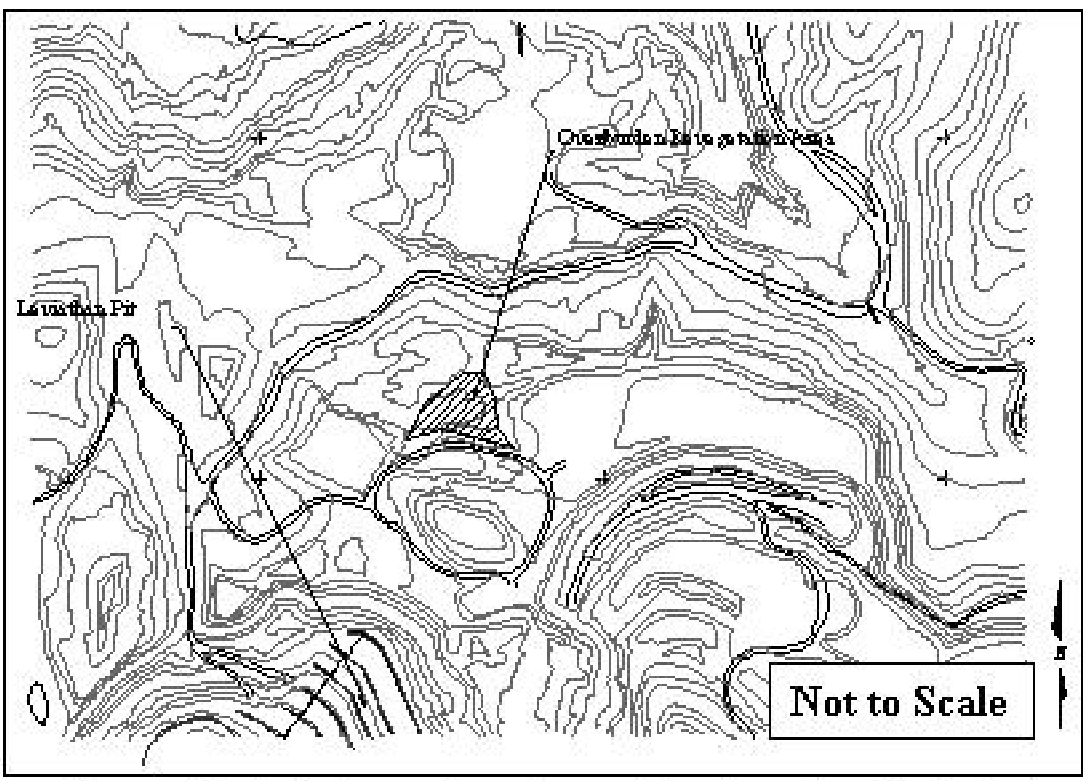

Figure 4. Soil Amendments on Overburden Material