2013 Oversight Summary Report
Leviathan Mine Superfund Site
Alpine County, California

Prepared for

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ACRONYMS AND ABBREVIATIONS

Atlantic Richfield	Atlantic Richfield Company
ARWS	Atlantic Richfield Work Season
AS	Aspen Seep
ASBR	Aspen Seep Bioreactor
Burleson	Burleson Consulting, Inc.
CUD	Channel Underdrain
CWSD	Carson Valley Water Subconservancy District
Decon	Decon Environmental Inc.
DS	Delta Seep
Eh	Oxidation reduction potential
EDCDA	El Dorado County Department of Agriculture
EPA	U.S. Environmental Protection Agency
ERA	Early response action
Forest Service	U.S. Department of Agriculture, Forest Service
GFEP	Ground fault equipment protection
gpm	gallons per minute
HDPE	High Density Polyethylene
H_2S	Hydrogen Sulfide
HDS	High Density Sludge
HMI	Human Machine Interface
HSSE	Health Safety Security and Environment
IOP	Infiltration/Overflow Pond
LAS	Limited Access Season
Leviathan Mine	Leviathan Mine Superfund Site
LIDAR	Light Detection and Ranging
mV	millivolt
mg/L	Milligram per liter
MRAM	Modified Removal Action Memorandum
NREL	National Renewable Energy Laboratory
ORP	Oxidation-reduction potential
O&M	Operations and Maintenance
PLC	Programmable Logic Interface
PUD	Pit Underdrain
PWTS	Pond Water Treatment System
PPM	Parts per million

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ACRONYMS AND ABBREVIATIONS (continued)

RAM	Removal action memorandum
RAWP	Removal action work plan
RCTS	Rotating cylinder treatment system
Regional Board	California Regional Water Quality Control Board- Lahontan Region
RI	Remedial Investigation
SC	Specific conductance
SCADA	Supervisor Control and Data Acquisition
SDB	Sludge Drying Bed
SPLP	Synthetic Precipitation Leaching Procedure
STLC	Soluble Threshold Limit Concentrations
TCLP	Toxicity Characteristic Leaching Procedure
Tetra Tech	Tetra Tech EM Inc.
TSIT	Treatability Studies and Interim Treatment Work Plan
UPS	Uninterruptible Power Supply
USACE	U.S. Army Corps of Engineers, Sacramento District
µS/cm	microSiemen per centimeter
USFS	U.S. Forest Service
USGS	U.S. Geological Survey

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1.0 INTRODUCTION

This oversight summary report describes the activities completed and the information collected during Burleson Consulting, Inc. (Burleson) field oversight at the Leviathan Mine Superfund Site (Leviathan Mine) in Alpine County, California. Field oversight was provided from April 11, 2013, through November 6, 2013. Burleson performed oversight for the U.S. Environmental Protection Agency (EPA), Region IX, under contract with the U.S. Army Corps of Engineers (USACE), Sacramento District (Contract No. W91238-08-D-0012). Burleson personnel were on site an average of once every four weeks during the 2013 Leviathan Mine construction and water treatment season (April to November). The primary focus of field oversight was to: (1) monitor the effects of mine drainage capture and treatment on the quality of Leviathan Creek and associated creeks downstream from the mine and (2) confirm that work conducted by the California Regional Water Quality Control Board—Lahontan Region (Regional Board) and Atlantic Richfield Company (Atlantic Richfield) followed the approved work plans.

1.1 LOCATION AND BACKGROUND

The Leviathan Mine is located in Alpine County, California, five miles east of Markleeville (Figure 1), and encompasses 32 patented mineral claims and a patented mill site (Regional Board 2010). Native sulfur was extracted from the Leviathan Mine by underground and open-pit mining methods, which ceased in 1962 (Regional Board 1975). Leviathan Creek flows through the mine site, where the water quality becomes impaired as water contacts sulfur- and metals-bearing rock. Acidic, metals-bearing seepage discharges to the creek from known sources including a collapsed adit, the Pit Underdrain (PUD), the Channel Underdrain (CUD), Delta Seep (DS), and Aspen Seep (AS). Additional unidentified sources of contaminants may further impair surface water quality. Acid-generating mine waste in the creek bed appears to affect Leviathan Creek, although the mine waste and water contact was reduced through remediation activities conducted by the Regional Board in 1984. Leviathan Creek flows into Bryant Creek about two miles north of the mine. Downstream, Bryant Creek flows across the Nevada state line and into the East Fork of the Carson River approximately nine miles north of the mine. The Leviathan Mine was listed as an EPA Superfund site on May 11, 2000. A site map of the Leviathan Mine is presented as Figure 2. A light detection and ranging (LIDAR) map of pond area features is presented as Figure 3.

Early response actions (ERA) implemented during previous years resulted in an improved appearance in Leviathan Creek during treatment. CUD discharge has been captured and treated for various durations during each treatment season since 2001. DS discharge was captured and treated during a 4-day trial in November 2002, for the duration of the 2003 treatment season, for more than half of the 2004 treatment season, and for the entire 2007, 2008, 2009, 2010, 2011, 2012, and 2013 treatment seasons. Previous ERAs resulted in reduced cloudiness and chemical staining in Leviathan and Bryant Creeks downstream of the mine (Tetra Tech 2002; 2003; 2004; 2005; 2006b; 2007; USACE 2008; Burleson 2009, 2010, 2011, 2012, and 2013). However,

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CUD and DS discharges were returned to Leviathan Creek at the end of each treatment season and discharged continuously until treatment resumed during the following spring.

1.2 PURPOSE AND OBJECTIVES

This report summarizes Burleson's 2013 field oversight activity and presents photographic documentation of site activities. Field measurements were collected during oversight at the on-site water treatment systems (located at Pond 1, Pond 4, and AS) and to provide insight into the effectiveness of the systems in treating acidic, metals-bearing water generated on site. Field measurements were also collected at monitoring points on Leviathan, Aspen, Mountaineer, and Bryant Creeks (Figure 2) before, during, and after the treatment season. These field measurements are useful for evaluation of the effectiveness of the early response actions and also provide insight into the watershed's response to the capture and treatment of acidic, metals-bearing water and the release of effluent from the treatment systems. This insight will be used to evaluate long-term options for acid drainage treatment at the Leviathan Mine and the resulting improvement in downstream water quality in Leviathan and associated creeks.

Burleson's field oversight included maintaining communication with EPA, Regional Board, and Atlantic Richfield personnel; visiting and inspecting the treatment systems and site infrastructure; and monitoring surface water quality during the treatment season. Field observations were documented in dedicated field notebooks, on field data sheets, and in photographs. A brief oversight summary was prepared after each oversight period and was delivered to EPA and USACE. Oversight summaries and photographs are presented in Appendices A and B. Information presented in this report was acquired during field oversight and telephone calls with the Regional Board, Atlantic Richfield, and both parties' contracted personnel. Though information is accurate to the best of Burleson's knowledge, year-end reports prepared by the Regional Board and Atlantic Richfield contain information that was unavailable to Burleson during oversight.

1.3 REPORT ORGANIZATION

This report presents a summary of activities observed during field oversight at the Leviathan Mine throughout the operating season in 2013. This report is organized into the following sections:

- Section 1.0 provides an overview of the Leviathan Mine and describes objectives of oversight.
- Section 2.0 describes site activities conducted by Atlantic Richfield in 2013.
- Section 3.0 describes site activities conducted by the Regional Board in 2013.
- Section 4.0 describes site activities conducted by EPA in 2013.
- Section 5.0 describes Burleson's oversight activities and findings in 2013.

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- Section 6.0 summarizes activities at Leviathan Mine in 2013 and presents conclusions and recommendations for future investigations and activities.

- Section 7.0 presents references cited in this report.

Figures and tables are presented after the report text. This report also includes the following appendices:

- Appendix A, Oversight Summaries

- Appendix B, Oversight Photographs

- Appendix C, Field Instrument Calibration Records and Field Water Quality Measurements

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2.0 ATLANTIC RICHFIELD COMPANY SITE ACTIVITIES

This section describes early response actions (ERA) conducted at the Leviathan Mine by Atlantic Richfield during the 2013 operating season. The scope, objectives, and procedures for 2013 ERA activities are presented in Atlantic Richfield's 2013 Removal Action Work Plan (AMEC 2013). The scope of Atlantic Richfield's 2013 ERAs included:

- Collection of information to evaluate reliable and suitable treatment methodologies that may be incorporated into the long-term remedy for the site.
- Treat the previously identified CUD, DS, and AS flows to discharge criteria previously established for the site to the extent practicable for a treatability study.

The basic objectives of Atlantic Richfield's ERAs in 2013 included the following for the DS and CUD (AMEC 2013):

- Maintain the DS collection area to optimize flow capture.
- Maintain the CUD collection area to optimize flow capture.
- Spring commissioning, startup, and operations and maintenance of the high density sludge (HDS) treatment system for treatment of collected CUD and DS flows.
- Manage waste streams from the HDS treatment system.
- Try to extend the length of the water treatment season for the CUD and DS flows to the extent practicable while gathering information on the operational and performance reliability of the HDS Treatment System, including the CUD and DS capture and conveyance equipment, during potential limited access season (LAS) cold weather conditions.
- Modifications of the HDS influent system.
- Shutdown and winterization of the HDS treatment system.

The basic objectives of Atlantic Richfield's ERAs in 2013 included the following for the Aspen Seep (AMEC 2013):

- Maintain the AS collection area including the former USGS weir.
- Management the waste streams from the ASB treatment system including sludge and miscellaneous waste.
- Perform routine operation and maintenance of the ASB treatment system to maintain treatment of collected AS flows.

Burleson observed field activities associated with Atlantic Richfield's objectives identified above, but did not review data obtained by Atlantic Richfield during treatment (such as

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laboratory analytical data, technical operational data, or cost information). Information gained through Burleson's oversight of Atlantic Richfield's site activities at Leviathan Mine in 2013 is presented in the following sections. Analytical and technical data are presented in Atlantic Richfield's year-end report (Copper Environmental Consulting [Copper] and Broadbent 2014).

2.1 CHANNEL UNDERDRAIN AND DELTA SEEP TREATMENT

The HDS commenced operations during the LAS after Atlantic Richfield completed mobilization during March and April. LAS operations began on April 8, 2013, with snow removal and road clearing (Copper Environmental Consulting and Broadbent 2014). The HDS plant commissioning started on April 11 and was completed on May 10. Atlantic Richfield captured CUD and DS discharges and conveyed captured water to Pond 4 from May 1 to October 31, 2013. The HDS Plant treated the combined flows from May 10 through October 31, 2013. The HDS plant began discharging treated Pond 4 water to Leviathan Creek on May 15, 2013, and continued to discharge to Leviathan Creek through October 27 (Copper and Broadbent 2014).

Intercepted flows of the CUD and DS were about 17 gallons per minute (gpm) and 8.8 gpm, respectively, in May; and 8.3 gpm and 6.4 gpm, respectively, by October. Captured water was retained in Pond 4 and allowed to accumulate to support periodic campaign treatment during the LAS and ARWS. Periodic HDS plant discharge varied from about 50 gpm in early-May to about 30 gpm in late October. Atlantic Richfield treated about 6.2 million gallons of water from the CUD and DS including the water collected over the previous winter in Pond 4 between November 2011 and April 2012. The durations of CUD and DS treatment seasons since 2001 are summarized in Table 1.

Atlantic Richfield contracted AMEC, Copper, and Broadbent to manage and conduct CUD and DS treatment. Contractor personnel operated the HDS treatment system. CUD and DS treatment - including road maintenance, site preparation, commissioning and operation of the HDS system, effluent discharges to Leviathan Creek, sampling, disruptions during treatment, HDS system evaluation and improvements, Pond 4 activities, and winterization- are discussed in the sections below.

2.1.1 Road Maintenance

In accordance with their US Forest Service (USFS) permit, Atlantic Richfield maintained the access roads to Leviathan Mine during the 2013 field season. AMEC cleared snow from Leviathan Mine Road to start treatment during the LAS. The surface of the Leviathan Mine Road from Nevada and California was bladed, as necessary, to maintain a smooth surface. Base rock was added to the road surface where necessary and graded and compacted to provide a cushion over exposed bedrock. Ditches and culverts were cleaned and a new culvert to control storm water runoff was added to the Aspen Seep approach road near Aspen Seep.

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Monuments at the paved section of road known as the 'hair pin' near the confluence of Aspen and Leviathan creeks were measured to assess movement. Net annual horizontal expansion of about 0.4 to 0.6 inches was observed June to November of each year (2011 to 2013); and net horizontal contraction of about 0.1 to 0.3 inches was observed December through May of each year (Copper and Broadbent 2014).

Dust control in the vicinity of residences near Highway 395 in Nevada included minor grading and spraying a dust suppressant.

2.1.2 Pond 4 Site Preparation

Preparation of the Pond 4 area and CUD treatment system began in April 2012. Remaining snow was removed from the Pond 4 area, HDS generators were commissioned, and office trailers were installed.

The water in Pond 4 before treatment in 2013, was a combination of (1) treated water left at the end of the treatment season in 2012; (2) direct precipitation that fell on the pond through the winter; and (3) acid drainage that may have discharged into Pond 4 from the influent standpipe, which was found to be a minor source of contamination in previous years (Brown and Caldwell 2002). Photographs B-1 and B-2 in Appendix B show Pond 4 and the HDS Plant before early in the 2013 treatment season.

CUD and DS treatment began on May 10, 2013, about four weeks after Contractors reported beginning mobilization efforts. Because of the dry winter, CUD and DS flows were captured and accumulated in Pond 4 starting on May 1 to ensure sufficient influent flow from Pond 4 to operate the HDS Plant. CUD and DS capture were briefly interrupted from May 1 to May 3 to allow necessary generator testing.

2.1.3 HDS Treatment System Operations

The HDS plant was re-commissioned and operated in the spring of 2013. A process flow diagram for the HDS plant at Pond 4 is provided in Figure 4. Photographs B-1 through B-3 in Appendix B show the HDS plant and Pond 4 area during 2013.

Pre-commissioning activity included de-winterization of the HDS plant, reconnection and leak testing of plant piping, inspection and maintenance of all electrical connections, servicing of plant motors and gearboxes, set up and testing of the lime and flocculant delivery systems, reinstallation and calibration of sensitive electrical equipment such as pH and turbidity probes, reinstallation of system control computers.

The HDS plant was designed to receive influent water from Pond 4. To minimize chemical fluctuations and equalize flows to the HDS plant, Pond 4 acts as a storage pond used to store a mixture of raw CUD and DS water prior to treatment during HDS operations. The HDS plant was designed to operate optimally within a flow range of 60 to 100 gpm. During prior years, when the combined influent flow rate fell below 25 gpm, the plant was operated intermittently

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(intermittent discharge or recycle mode) to remain within optimal operating conditions. The HDS plant was operated intermittently during 2013 due to low influent flows. HDS discharge is described in Section 2.1.4 below.

Influent is pumped from Pond 4 (Figure 4) to the lime sludge mix tank where it mixes with lime and sludge from the clarifier (initial operations do not include sludge). The mixture then flows to the reactor tank where solids form as the lime and oxygen continue to mix with the solution. Reactor tank effluent enters the clarifier where flocculent is added and solids agglomerate and settle. Water from the clarifier then flows to the effluent tank. Effluent can be used to mix flocculent, can be discharged to Pond 4, or can be discharged to Leviathan Creek. Part of the sludge is diverted to the sludge bins and part of the sludge is recirculated to the lime/sludge mix tank. Decant water from the sludge bins is pumped back to the reactor tank, and dried sludge is profiled and disposed off site. The HDS plant was designed to gravity-drain to Pond 4 in the event of unexpected shutdown.

Operation of the HDS plant began on May 10, 2013, by treating water from Pond 4. The HDS system operated to treat and discharge about 6.2 million gallons of CUD and DS flows and generated approximately 13.8 tons of sludge (Copper and Broadbent 2014). Dewatered HDS treatment system solids had 58% moisture content by weight which equated to approximately 5.8 tons of dry solids (Copper and Broadbent 2014).

2.1.4 Discharges of Treated Water to Leviathan Creek

The HDS plant discharges directly to the concrete lined channel of Leviathan Creek. Prior to 2010, discharges from treatment systems at Pond 4 varied with plant operations and the range of discharge volume varied significantly throughout the treatment season. This resulted in distinct peaks in discharge and stage at downstream locations in Leviathan Creek. To provide for less drastic fluctuation in downstream flow conditions, the HDS plant has assumed a more consistent discharge mode since the 2010 treatment season. During the 2013 treatment season intermittent HDS discharge generally ranged from about 15 gpm to 100 gpm (Figure 5). Discharges were intermittent to allow operations in recirculation mode due to low CUD and DS flows throughout the treatment season. Interruptions to HDS plant operations (and HDS discharge) are summarized in Section 2.1.7. Figure 5 shows the relationship between discharges from on-site sources (including untreated waters and treatment system effluents) and flow at Station 15 in Leviathan Creek.

Atlantic Richfield reported HDS discharges on the following dates:

- May 15 to May 20
- May 23 to May 31
- June 1 to June 4
- July 1 to July 1

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- July 11 to July 24
- July 29 to July 30
- August 6 to August 11
- August 13 to August 16
- August 19 to August 20
- September 3 to September 5
- September 9 to September 13
- September 23 to September 27
- October 1 to October 3
- October 7 to October 17
- October 22 to October 25
- October 30 to October 31

2.1.5 Atlantic Richfield Sampling Activities

Atlantic Richfield mobilized to begin LAS operations during mid-April 2013, and HDS operations were performed under the *2013 Removal Action Work Plan Leviathan Mine Site Alpine County, California* (RAWP) (AMEC 2013). Table 6 of the RAWP specified the water quality parameters and analytes monitoring, and sampling requirements during the HDS operations, and Table 7 of the RAWP specified the location and frequency of sampling during the HDS operations. Sampling was performed in accordance with the RAWP during the 2012 treatment activities at Pond 4. Water samples from the HDS were analyzed for field parameters (pH, temperature, dissolved oxygen, specific conductance [SC], oxidation-reduction potential [ORP], and ferrous iron to ferric iron ratio); laboratory analysis included acidity, alkalinity, aluminum, arsenic, cadmium, calcium, chloride, chromium, copper, hardness, iron, lead, magnesium, nickel, selenium, sulfate, total dissolved solids, total suspended solids, and zinc. Samples were analyzed in the field and laboratory to ensure compliance with the objectives in the removal action memorandum (RAM) (EPA 2001) and Modified Removal Action Memorandum (MRAM) (EPA 2008) and to obtain process information useful for evaluating long-term treatment options. Sludge in the filtration and disposal bins was sampled for laboratory analysis (total metals, leachable metals, and physical properties).

The RAWP listed the following sampling locations and frequencies:

- CUD and DS Flows: field parameters measured monthly and samples submitted for laboratory analysis monthly.

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- Pond 4: Field parameters measured once per month with pH measured on a weekly basis and samples submitted for laboratory analysis monthly.

- HDS Plant discharge to Leviathan Creek: Field parameters measured once per week for the first four weeks of operation and then measured once per month thereafter with pH and iron measured twice weekly during discharge. Samples submitted for laboratory analysis; once per week during the first four weeks of operation and then once per month thereafter.

- Treatment solids (solids in filtration and disposal bins): total (total threshold limit concentration [TTLC]), and leachable (toxicity characteristic leaching procedure [TCLP], Soluble Threshold Limit Concentration [STLC], Synthetic Precipitation Leaching Procedure [SPLP]) metals, moisture content, and paste pH.

Burleson observed HDS treatment system operators collecting field parameter measurements during several site visits. In addition, conversations with operators during oversight visits indicated that samples were being collected in accordance with the RAWP.

2.1.6 Interruptions during 2013 Treatment

The following interruptions to water treatment at Pond 4 that occurred during the 2013 treatment season were reported:

May 1: Return of CUD and DS flows to Leviathan Creek until May 3 during scheduled non-routine generator maintenance.

May 1 through May 13: Periodic loss of CUD capture due to damaged fiber optic system contact.

May 20: Short term HDS plant interruption to address high effluent turbidity concerns. No loss of capture.

June 4: HDS Treatment System shut down to complete Influent Conveyance Modifications. No loss of capture.

June 27: Incorrect operation of the low flow influent flowmeter which produced erroneous readings of flow and resulted in a “High Flow” condition shutdown. No loss of capture.

July 15: Low influent flows caused flocculent dosing issues leading in turn to increased effluent turbidity. Adjustments to the flocculent dosing system resulted in normal operations. No loss of capture.

July 30: HDS Treatment System interruption due to apparent reactor tank agitator oil weep. However, on further inspection, oil was determined to be residual from servicing. No loss of capture.

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September 5: Reactor tank "High Reactor pH" alarm resulting from operator error. Additionally, HDS Treatment System shutdown occurred when attempting to clear a fault in the Primary Logic Controller which triggered a "High Reactor pH" alarm when a high pH did not exist. No loss of capture.

2.1.7 HDS Improvements and Evaluations

HDS Plant improvements during 2013 included replacement of the generator engines, upgrades to the heat trace ground fault equipment protection (GFEP), replacement of the CUD weir cover, and HDS influent conveyance system repair.

The HDS Treatment System Power Generation System consists of three 100 KW Kohler generators driven by John Deere diesel engines, a generator control panel, and a motor control center. One generator runs for approximately 1,800 hours per treatment season off of conventional engine oil. Only one generator is operated at a time rotating the active generator twice a week for even usage. Generator engine replacement began on June 17, 2013, and concluded July 3, 2013. The three generator engines were replaced with in-kind, comparable engines that are operated with synthetic engine oils. Additionally, the generator maintenance checklist was updated to monitor engine oil and coolant every 500 hours of operation.

The heat trace GFEP, which detects ground current and can also trigger the protected device, consists of nine heat trace 20 Amp circuit breakers that were upgraded and replaced with new comparable circuit breakers. Installation was completed on August 15, 2013, and evaluation, testing, and commissioning were completed between September 12 and September 20, 2013.

The existing plywood CUD weir cover was replaced with a constructed HPDE cover with handles on September 23, 2013. The new cover minimizes safety hazards encountered during weir maintenance due to the weathered plywood cover.

The HDS influent conveyance system was evaluated during 2012 to determine why the system capacity was diminishing over time. The pumps were tested and found to be functioning as designed. Inspection of the influent pipes resulted in identification of scale accumulated within the 3-inch diameter pipes (4-inch diameter influent pipes were scale free). During 2013 the influent conveyance system was modified by relocating the pumps and associated equipment to the northwest corner of Pond 4 (closer to the HDS plant), replacing existing 2 and 3 inch diameter pipes with 3-inch diameter pipes, and installing new low flow pumps.

2.1.8 Winterization

CUD and DS capture were suspended on October 31, 2013. CUD and DS discharges were returned to Leviathan Creek, and the HDS system was prepared for winter. The final day of HDS Treatment Plant operation was October 31, 2013. Conveyance pipes and tanks from DS and CUD to Pond 4 were drained, polymer and lime systems were cleaned and emptied, selected

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valves were removed for storage, electrical conveyance components (pumps and controls) were removed, packaged and stored for the winter, and field trailers were removed from the site.

The Pond 4 level was left at the minimum feasible depth to provide for maximum storage capacity to retain direct precipitation during the winter/spring seasons. Winterization of all components of the HDS plant was completed on November 15, 2013.

HDS winterization activities included:

- Draining and cleaning system tanks.
- Draining and cleaning system pipes.
- Removal and storage of system pumps.
- Removal and storage of freeze-damageable equipment.
- Protective wrapping of all electrical components including control panels, motors, and valves.
- Checking and refilling the antifreeze, motor oil, and diesel fuel day tank in the generators, removal of the generator batteries, and spraying rust protection on all exposed generator surfaces.
- Filling the diesel storage tank to reduce corrosion.
- Unused bagged dry lime was wrapped and stored inside the HDS building.
- Removing HDS sludge and sludge bins.
- Shutting down the power generation system.

Photograph B-3 in Appendix B shows Pond 4 and the HDS plant being winterized late in the treatment season.

2.2 ASPEN SEEP TREATMENT

Atlantic Richfield continued to treat water at the AS using the ASBR in recirculation mode. A diagram of the ASBR operated in recirculation mode is presented in Figure 6.

Atlantic Richfield identified the following objectives for Aspen Seep treatment during 2013 operations (AMEC 2013):

- Maintain the AS collection area including the former USGS Aspen weir.
- Manage waste streams including sludge and miscellaneous waste.

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2.2.1 Aspen Seep Bioreactor Operation

Atlantic Richfield's contractors continued to operate the ASBR in recirculation mode to treat AS discharge without significant modifications from 2013 operations. When the ASBR operates in recirculation mode, sodium hydroxide is added to the AS influent which is then mixed with sulfide-rich water and sodium hydroxide from bioreactor cell 2 in the Settling Pond (Pond 3) for precipitation of metal sulfides (Figure 6). Water is pumped from the opposite end of the Settling Pond back to the pretreatment pond at approximately two to three times the system influent rate. The ASBR is operated in this mode because most solids are precipitated within the settling pond, and recirculated water has lower metals content and higher pH than raw AS water. These parameters are ideal for biological treatment in the bioreactor cells. Ethanol is added to the recirculated water to provide a carbon source for the sulfate-reducing bacteria. Trisodiumphosphate and urea are also added to the biocells as nutrients for the bacteria. The Settling Pond (Pond 3) discharges to the next Settling Pond (Pond 4) from which bioreactor effluent is discharged along a rock-lined aeration channel to an I/O pond adjacent to and above Aspen Creek. The recirculation pumps are powered by propane generators. Photographs B-4 through B-8 in Appendix B show the ASBR during 2013.

Discharge of ASBR effluent from the I/O pond to Aspen Creek continued during 2013. Discharge seeps through the downslope infiltration pond berm into Aspen Creek. Water also overflows from the northeastern corner of the infiltration pond down a steep slope into Aspen Creek.

Approximately 2.3 million gallons of water from the AS were treated within the bioreactor and discharged to Aspen Creek during 2013 (Copper and Broadbent 2014). The AS flow rate during 2013 was lower than the 2012 AS flow rate (Figure 7). Details of the bioreactor performance are summarized in Atlantic Richfield's year-end summary report (Copper Environmental Consulting and Broadbent 2014).

2.2.2 Aspen Seep Bioreactor Improvements

The following improvements were made to the ASBR during 2013 included telemetry system upgrades, and propane generator engine evaluation and replacement.

Telemetry system upgrades included changing the satellite internet service provider and erecting a 48-inch satellite dish antennae at the ASBR. These upgrades resulted in more reliable remote communications to the site.

Generator motor testing showed the need to replace the natural-gas fired engines at the ASBR. Generator engines were replaced during October 14 through October 23.

2.2.3 Aspen Seep Bioreactor Sludge

Sludge removal and dewatering were not necessary during 2013 because the low flow rates associated with the drought resulted in sufficient volume for solids within the bioreactor. Sludge was transferred from Pond 3 to Pond 4 to provide room for 2013-2014 sludge.

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3.0 CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD – LAHONTAN REGION SITE ACTIVITIES

This section describes activities conducted at Leviathan Mine by the Regional Board during the 2013 operating season. The Regional Board's work plan (Regional Board 2013) identified three activities planned for the 2013 operating season: acid drainage collection and treatment, site maintenance, and flow monitoring.

Information gained through Burleson's oversight of the Regional Board's site activities at Leviathan Mine in 2013 is presented in the following sections. Details about 2013 site activities are presented in the Regional Board's 2013 year-end report (Regional Board 2014).

3.1 POND WATER TREATMENT

The PUD and Adit drain to Pond 1 (Figure 3). The pond water treatment system (PWTS) is located at Pond 1. Pond 1 is connected to Pond 2 north (2N) and Pond 2 south (2S) via underground PVC pipes so that the level of water in each pond is the same. Water can be transferred between the ponds through these pipes. Overflow from Pond 1, Pond 2N, and Pond 2S enters Pond 3. Pond 3 overflows through a valve to Leviathan Creek or to Pond 4. Below average precipitation during the winter of 2012-2013 resulted in excess capacity within the evaporation ponds compared to the 2012 treatment season. Average daily flow rates for the Adit and PUD are presented in Figure 8.

Pond water treatment was conducted during the summer to ensure sufficient storage capacity in the pond system to contain Adit and PUD discharges and precipitation received during the 2012-2013 winter.

3.1.1 Pond Water Treatment

Mobilization and field preparation for PWTS operations began in mid-June 2012. About 324 tons of dried sludge that was generated during pond water treatment in 2012 was removed from the pit clarifier (Regional Board 2013). An excavator was used to remove the dried sludge. Excavated sludge was temporarily stockpiled adjacent to the pit clarifier within the mine pit before it was transferred to an off-site disposal facility. The Regional Board reestablished its on-site field laboratory and office trailer. Photographs B-9 through B-12 in Appendix B show activities associated with pond water treatment in 2013.

URS used pre-mixed lime slurry delivered by tanker truck during 2013 PWTS operations. Low flows in Leviathan Creek during 2012 resulted in experimental use of PWTS effluent as utility water at the PWTS. Leviathan Creek flows were too low to supply the utility water. Results of system monitoring showed that treatment efficiency was maintained during use of effluent as utility water.

The Regional Board began treating water through the PWTS in mid-July. The first treated water entered the pit clarifier on July 8, 2013. The PWTS operated 24 hours per day, 7 days per week

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during the 2013 treatment period with the exception of the period from evening of July12 through the morning of July 14. The Pond 1 daily discharge rate averaged approximately 98 gpm through most of the treatment period. Pond 1 treatment operations were stopped on July 26, 2013. Treated water continued to be discharged from the Pit Clarifier as the accumulated sludge drained. The discharge rate from the pit clarifier underdrain had decreased well below 5 gpm by July 31.

During 2013, URS used a two point lime addition as in the 2012 treatment season. A process flow diagram for the PWTS is presented as Figure 9. PWTS effluent was first discharged from the pit clarifier to Leviathan Creek on July 8, 2013. Discharge occurred at a rate similar to the treatment rate to maintain a constant water level in the pit clarifier. Effluent was discharged through the decant structure in the central southern side of the pit clarifier and through the U-shaped underdrain. Discharge flowed through the weir and monitoring station established in 2003 and operated by the USGS. For 2013, the USGS's stage data were used to calculate treated effluent discharge volumes (Regional Board 2014). Discharge from the Pit Clarifier to Leviathan Creek occurred continuously, except for two periods (49 hours on July 12-14 and 2 hours on July 23). Periods of PWTS discharge from the pit clarifier and flow in Leviathan Creek are shown in Figure 5. The discharge rates presented in Figure 5 are based on information from the Regional Board 2013 Annual Report. The Regional Board collected effluent samples two times per week during discharge of treated water to Leviathan Creek.

The Regional Board treated a lower volume of evaporation pond water at the Pond 1 lime treatment plant during the 2013 treatment season compared to the volume of evaporation pond water treated during the 2012 treatment season and significantly lower volume than the 2011 treatment season (Table 2). An estimated 2.66 million gallons of water from Ponds 1, 2-North, and 2-South were treated and discharged to Leviathan Creek (Regional Board 2014), leaving the ponds nearly dry. A comparison with volumes of pond water treated in previous years is presented in Table 2. Treatment system operators began winterizing the PWTS shortly after treatment was complete. The treatment system tanks were emptied and cleaned and sensitive equipment was secured for the winter. Valves were left in a position that allowed Ponds 1, 2-North, and 2-South to fill in equilibrium with Adit and PUD discharge and direct precipitation.

Burleson's field parameter measurement showed the pH of the effluent in the pit clarifier was approximately 8.00 on July 18, 2013. Previous data suggest that effluent generally meets discharge criteria in the RAM when effluent pH is between 7 and 8. Analytical results for the five daily samples of pond water treatment system effluent collected during discharge in 2013 are included in the Regional Board's 2013 year-end report.

PWTS operations during 2013 consumed 47.65 tons of dry lime, 2,413 gallons of diesel fuel, 233 gallons of gasoline, and 270.4 pounds of liquid flocculent.

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3.2 ROUTINE SITE MAINTENANCE

The Regional Board's work plan (Regional Board 2013) identified site maintenance activities in 2013 including invasive plant control, fence repair, evaporation pond liners, storm water conveyance cleanout, and Pond 3 concrete repair. These activities are discussed in the subsections below.

3.2.1 Invasive Plant Control

The Regional Board's work plan (Regional Board 2012) identified invasive plant control as an objective in 2012. The El Dorado County Department of Agriculture (EDCDA) visited the Leviathan Mine in the 2002 through 2013 treatment seasons to spray for tall whitetop (*Lepidium Latifolium*). Tall whitetop, dyers woad (*Isatis tinctoria L.*), and spotted knapweed (*Centaurea biebersteinii DC*) were spot sprayed with herbicide (Telar®) by the EDCDA on June 18, August 13, and September 17.

3.2.2 Fence Repair

The Regional Board is responsible for upkeep of the barbed wire perimeter fence around the Leviathan Mine. As a result of primarily natural conditions, the fence requires repairs on an annual basis (Regional Board 2014). The perimeter fence was inspected in mid-June, and repairs were made at numerous locations mid-August (Regional Board 2014).

3.2.3 Storm Water Conveyance Cleanout

The V-ditches at Pond 2N, Pond 2S, Pond 1, and in the pit were cleaned out by early July 2013. Additionally, after a rain event in mid-August, storm water conveyances were again cleared of sediment.

3.2.4 Road Maintenance

In mid-June 3-inch crushed rock was placed at the Pit, and around Pond 1. The rock was placed between pavement and concrete V-ditches in an attempt to reduce soil erosion.

3.3 REVEGETATION EVALUATION STUDY

The Regional Board contracted with Dr. Vic Claassen of UC Davis to conduct an evaluation of revegetation efforts at Leviathan Mine. Dr. Claassen evaluated site soil and plant conditions and provided recommendations to improve revegetation success. Treatment recommendations were developed for different soil conditions, and test plots were created within the Pit, Pond 2 Slope, and Delta Slope. The test plots will be evaluated during 2014, with the goal of identifying specifications to guide future revegetation efforts at Leviathan Mine.

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3.4 FLOW MONITORING

Flow monitoring stations are located at Stations 1, 15, and 23 in Leviathan Creek; at the PUD, Adit, CUD, and Aspen Seep; at the Pit Clarifier weir box, along the upper and lower tributaries to Leviathan Creek near Ponds 2N and 2S, 4L Creek; and at two storm water conveyance discharges to Leviathan Creek near Pond 1; Station 25 in Bryant Creek; and Station 22 in Aspen Creek (above Leviathan mine). The Regional Board continued surface water flow measurements through September 2012 (in cooperation with the USGS). Pond 1 stage level recorder was also maintained by USGS. Pond 4 stage level recorder was maintained by Atlantic Richfield (though the Pond 4 stage level recorder has not worked consistently since mid-2010).

Atlantic Richfield performed flow monitoring at CUD and Aspen Seep, and stage monitoring at Pond 4. Previously, flow monitoring and stage monitoring at these sites was conducted by the Regional Board and USGS; however, discontinued in October 2012 due to health and safety concerns.

Flow monitoring data will be incorporated into the Leviathan Mine master database managed by Atlantic Richfield. Data summary reports are not generated.

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4.0 U.S. ENVIRONMENTAL PROTECTION AGENCY SITE ACTIVITIES

This section describes activities EPA conducted at the Leviathan Mine during the 2013 operating season. EPA maintained a presence on site through oversight visits. EPA also accompanied natural resource trustees during a June 5 site visit, and observed a USFWS fish survey on October 31. EPA laboratory personnel installed and maintained water quality monitoring equipment in the creek system, and performed macroinvertebrate surveys. EPA's oversight was conducted in part by Burleson and is presented in Section 5.0. Through a cooperative agreement with the US Department of Energy's National Renewable Energy Laboratory (NREL), EPA was able to have wind and solar energy monitoring equipment installed at the site during the 2010 field season to evaluate the potential for power generation at Leviathan Mine. EPA's site tours, water quality monitoring program, macroinvertebrate survey program, and a description of NREL progress are summarized below.

4.1 EPA SITE TOURS

EPA attended a site visit with natural resource trustees (including USFWS, USFS, BIA, California Fish and Wildlife, Washoe Tribe, US Department of Justice) on June 5. The trustees requested the site visit to assess site conditions and evaluate possible restoration projects. The site visit proceeded from the Pond 1 overlook, to the Pit, and Pond 4. The group hiked to the beaver ponds from the Aspen Creek-Leviathan Creek confluence and then visited the Leviathan Creek-Mountaineer Creek confluence. The day ended at Bryant Creek near the stateline location.

EPA also accompanied USFWS personnel on an October 31 fish survey. USFWS completed a fish census along selected reaches of Bryant, Leviathan, and Mountaineer Creeks for comparison with earlier fish census data. USFWS conducted survey activities from October 28 through October 31. During the census, AR representatives collected fish for tissue analysis at an off-site laboratory. Results of the fish census and tissue sampling will be reported separately.

4.2 EPA WATER QUALITY MONITORING

EPA maintains Hydrolab water quality sondes (Hydrolab®) at monitoring stations in the Leviathan Creek watershed. The Hydrolabs were installed to monitor water quality effects downstream from the Leviathan Mine during the treatment season. The Hydrolabs record temperature, pH, and SC readings every 30 to 60 minutes. EPA visited the site periodically to inspect and calibrate the units and retrieve stored data. Hydrolabs were used to monitor water quality at the following locations during 2013:

- Leviathan Creek above the beaver ponds and below the Delta Seep.
- Leviathan Creek at Station 15.
- Aspen Creek west of the unlocked cattle gate near the culvert that carries Aspen Creek under the Leviathan Mine road.

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- Bryant Creek at Station 25.

Data recorded by the Hydrolabs are periodically communicated to a data repository via satellite. Hydrolab data document effects of Leviathan Mine activities on downstream water quality. Selected events that affected downstream water quality during 2013 and apparent in Hydrolab data at Station 15 are listed below and shown on Figure 10.

- Diurnal pH fluctuations throughout the year.
- Drop in specific conductance through mid-April.
- Increase in pH and drop in specific conductance in mid-March appeared to coincide with beginning of snow melt and increased run-off.
- Increase in specific conductance (from about 0.62 milliSiemen [mS]/cm to about 1.72 mS/cm) appeared to coincide with the HDS Plant discharge.
- Increase in specific conductance (from about 1.25 mS/cm to about 3.3 mS/cm) appeared to coincide with the PWTS discharge.
- Decline of pH and from about 7.2 SU to about 4.1 SU from early June.
- Increase of pH from about 4.1 to about 5.8 in July associated with discharge from the PWTS.
- Decline of pH to about 3.4 in late July, followed by gradual pH increase to about 5.6 by late October.
- Decline of SC from about 1.75 mS to about 1.5 mS in late October after the HDS Plant was decommissioned.

4.3 EPA MACROINVERTEBRATE SURVEYS

EPA personnel perform macroinvertebrate sampling each spring/summer and fall in the Leviathan-Bryant watershed. This activity was started by Dr. David Herbst and is now being continued by EPA staff. Dr. Gene Mancini, under contract with Atlantic Richfield, also observes macroinvertebrate sampling. The following seven stream reaches are sampled:

- Bryant Creek at Stateline.
- Bryant Creek at Station 25.
- Leviathan Creek above Leviathan-Mountaineer Confluence.
- Mountaineer Creek at Station 24.
- Upper Mountaineer Creek below Indian Spring.

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- Leviathan Creek at Station 15.
- Aspen Creek at Station 16.

The time frame from sample collection to reporting the data has historically been two years, and results of 2013 surveys are not available. The macroinvertebrate sampling data will be documented in a separate report.

4.4 EPA AND NREL PROJECT

EPA and NREL personnel are collaborating to evaluate potential sources of renewable energy at Leviathan Mine. If viable renewable energy generation could be achieved, such a source could reduce or possibly eliminate the need for use of fossil fuel-powered generators during long-term remediation at the site. During the week of November 1, 2010, NREL contractors installed a new data logger and anemometer on the existing wind tower; and installed a photovoltaic system to assess the solar energy potential at the open pit. The existing wind tower was also evaluated for potential use to collect additional wind speed and duration data. These sensors remained at the site during the 2011 through 2013 field seasons, data collection continued, and data analysis was started. Results of renewable energy evaluation will be documented in a separate report.

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5.0 BURLESON SITE ACTIVITIES

This section describes activities Burleson conducted at the Leviathan Mine during the 2013 operating season. Burleson's field tasks included monitoring water quality in Leviathan and associated creeks, and collecting photographic documentation of site activities at the Leviathan Mine. Also, Burleson monitored water quality at beaver ponds upstream of the Leviathan Canyon landslide and along Aspen Creek at the infiltration/overflow pond (IOP). Burleson's site activities are summarized below.

5.1 WATER QUALITY PARAMETER MEASUREMENTS

Water quality measurements (pH, temperature, SC, and ORP) were collected along Leviathan and associated creeks. The purpose of water quality monitoring was to assess the effects of treatment on water quality in Leviathan and associated creeks during the 2013 treatment season. Similar data were collected during the 2001 through 2012 treatment seasons and are presented in the oversight summary reports (Tetra Tech 2002; 2003; 2004; 2005; 2006, 2007; USACE 2008; and Burleson 2009, 2010, 2011, and 2012). Water quality monitoring points are shown on Figure 2 and the related data are presented in the oversight summary reports (Appendix A). Photographs B-13 through B-16 in Appendix B show surface water monitoring points during the 2013 treatment season.

5.1.1 Field Equipment and Calibration

Burleson used a Hanna HI 9828 multi-parameter meter to measure water quality during 2013 oversight. The meter was calibrated before daily use according to the manufacturer's instructions to ensure that measurements were accurate in reference to known standards. Calibration was checked at the end of the day or when readings were suspected to be erroneous. The high ionic strength and low pH of on-site waters can be damaging to sensitive field equipment. Daily field instrument calibration forms are provided in Appendix C. Water quality measurements collected during this investigation are field screening data.

5.1.2 Leviathan Creek Flow Stages in 2013

Burleson conducted water quality monitoring along the creek system ten times from April 11 through November 6, 2013. Burleson measured water quality associated with three differing flow stages along Leviathan Creek during the 2013 treatment season, as shown in Table 3. The three flow stages identified during 2013 are pre/post-capture of CUD and DS flows (pre/post-capture), discharge flow, and base flow. Pre/post-capture stage flows are represented by two field oversight visits (April and November). The April measurements were dominated by seasonal runoff from snowmelt, and the November measurements represent conditions immediately after CUD and DS flows were returned to Leviathan Creek. Discharge stage flows represent periods when Station 15 flow is dominated by treatment system (HDS and/or PWTS) discharges. Discharge stage measurements were made during two site visits in 2013. Base flow measurements were made during three site visits in 2013. Creek chemistry was dependent on the

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flow sources, which changed in response to contaminant source capture, effluent discharge, and water source (Figure 5). The three creek flow stages are described below.

Pre/Post-Capture. The pre-capture measurements represent conditions before the seasonal ERAs began in 2013. Leviathan Creek flow during this period consisted of spring runoff and discharges from the CUD and DS. The pre-capture measurements were taken on April 11, 2013, before LAS capture or treatment began. At the time of these measurements, the EPA data sonde records showed that SC was beginning to increase and pH was continuing to increase. An overall decrease in pH is not observed from the EPA data sonde until mid-May. Early capture of CUD and DS on May 1, 2013, prevented the lower pH typically observed after the decline of runoff and prior to capture that started later in the season in most years before 2009. Post-capture measurements were made on November 6, 2013, after CUD and DS flows returned to Leviathan Creek for the winter.

Figures 11 and 12 show pH measurements taken at Leviathan Creek monitoring stations throughout the 2013 field season. The pre/post-capture stage pH readings in Leviathan Creek at Station 15 were 7.02 in the spring and 4.08 in the fall. The near-neutral pH during pre-capture is attributed to acid drainage dilution by spring runoff after the winter. However, due to a relatively dry year, dilution of CUD and DS by increased base flow related to rainfall in the post season sample was non-existent. The flow rate in Leviathan Creek decreased from a daily average of about 341 gpm in late April to a daily average ranging from 0 to 4.5 gpm by late-August 2013. Figure 11 shows that the pH at Station 15 decreased below 4 as Leviathan Creek flow declined or stopped. Pre/post-capture stage SC measurements at Station 15 also show effects of dilution by seasonal runoff and benefit of early capture and treatment of CUD and DS (Figure 13).

Discharge Flow. The discharge stage flow represents conditions in Leviathan Creek when stream flow consisted of creek baseflow with or without discharges from the treatment systems, and the average daily stream flow as measured at Station 15 was above 55 gpm. Discharge flow stage measurements were taken during two oversight visits in June and July 2013. Discharge flow pH measurements were 6.69 and 6.85 (average pH 6.77) at Station 15. During discharge flow conditions, field pH measurements were slightly higher at all Leviathan Creek monitoring locations, with the exception of Station 1, than during base flow or pre/post-capture conditions (Figure 11). The higher pH measured in Leviathan Creek at and above Station 15 during discharge flow conditions shows the benefits of removing and treating the CUD and DS on Leviathan Creek water quality. The continued higher pH farther downstream may be indicative of dilution influences of Aspen and Mountaineer Creeks in addition to low flows as a result of a relatively dry wet season. The SC measurements are similar in Leviathan Creek below Station 1 during discharge and pre/post capture stages (Figure 14). Baseflow SC is significantly higher than pre/post capture or discharge flow SC from Delta Seep to Station 15. This is likely due to lack of dilution of the Delta Seep discharge during baseflow conditions.

Base Flow. The base flow stage represented conditions in Leviathan Creek after seasonal ERAs began, when stream flow consisted of creek base flow or flow without discharges from the

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treatment systems, and when the average daily stream flow as measured at Station 15 was below 55 gpm. The base flow stage includes measurements taken during three Burleson oversight visits (May, August, and October visits). The average base flow pH measurement was 5.13 at Station 15 (Figure 12). Field pH measurements taken both below the CUD and below the DS were generally lower during base flow than during discharge conditions. However, the lower recorded base flow pH was not observed downstream of Station 15 which may be attributed to buffering and dilution of the system below the Aspen Creek confluence. Also, the SC of Leviathan Creek at Station 15 was higher during base flow conditions than during discharge or pre/post-capture stages (Figure 14). This is likely due to the lack of dilution of the Delta Seep discharge during base flow conditions.

Stage Summary. Water quality in Leviathan Creek remained fairly high during 2013 (based on pH and SC measurements) as the flow rate in Leviathan Creek subsided from spring runoff conditions, as shown on Figure 13. However, the poor water quality observed at Station 15 during base flow conditions (Figure 11) is attributed to low flow in Leviathan Creek upstream from the junction with Aspen Creek. USGS (2013) data show the flow rate at Station 15 decreased from more than 200 gpm in late April to about 0-4.5 gpm in early September through mid-October. While the flows decreased, an associated decrease in pH and increase in SC were observed at Station 15 during July, August, September, and October in 2013. The pH in Leviathan Creek is improved by capture and treatment of CUD and DS flows and discharge of treatment system effluent. However, lower pH and higher SC were measured in Leviathan Creek during base flow conditions during the ERA season. This observation suggests the presence of potential sources of acid drainage along Leviathan Creek between DS and Station 15 and/or potentially the need to evaluate the benefit of improving the DS collection system. Water quality monitoring in Leviathan Creek also noted significant changes in SC during the 2013 treatment season. Pond 1 and Pond 4 treatment system effluents were relatively high in dissolved solids, and effluent discharge caused an increase in SC measured at stations along Leviathan Creek upstream from Station 15 (Figure 14).

5.1.3 Water Quality Trends and Observations

Below average precipitation was measured at Monitor Pass during the winter of 2012-2013. Discharge rates from the acid drainage sources on site during 2013 were similar to those observed during 2001, and 2003, considering the amount of precipitation, as shown on Figures 7 and 8.

The range of pH measurements at the CUD and DS in 2013 was similar to the pH range observed during treatment seasons between 2001 and 2012 (Figure 15). These pH trends may reflect flushing of oxidation products from the variably saturated volume of the subsurface materials during the high rainfall years (such as 2005, 2006, and 2011) and increased retention of material above the water table during drier years (such as 2007, 2008, and 2012).

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5.2 VISUAL OBSERVATIONS

Visual observations were recorded during 2013 water quality monitoring to supplement field screening data. Visual observations included creek water clarity, the presence of unusual materials within the creek, and the presence of aquatic life.

Late winter and spring flows during 2013 were cloudy and translucent in comparison to the clearer water of Mountaineer Creek that is not affected by Leviathan Mine (Figure 15).

The visual appearance of Leviathan Creek began to improve in late May 2012 after Atlantic Richfield began capturing CUD and DS discharge and run off declined. Flow in Leviathan Creek downstream became clearer, and orange chemical staining in the creek bed began dissipating.

Burleson noted that seepage from the east bank of Leviathan Creek below and immediately up and downstream from the DS collection tank observed since 2008 continued through the 2013 treatment season. Seepage flowed freely into Leviathan Creek for about 10 feet along the stream bank, and red staining was evident in the stream bank sediment (Photograph B-15, Appendix B). The presence of the seep suggests that shallow, acidic seepage is present that is not intercepted by the DS collection system.

Burleson also documented aquatic life in Leviathan and Bryant Creeks during 2013 oversight visits. Burleson observed trout in the pool within Leviathan Creek at Station 23 as well as caddisfly (Tricoptera) larvae near Station 15 and just downstream of the CUD (June 4, 2013). Burleson's aquatic life observations are qualitative; thorough documentation of aquatic communities was outside the scope of Burleson's oversight tasks. A separate ongoing aquatic macroinvertebrate study includes sampling in the Leviathan Mine watershed in the spring and late summer each year. The macroinvertebrate study quantifies the health of the aquatic community downstream from the mine.

5.3 BEAVER DAM AND POND IMPACTS

Beavers continued to expand a series of dams along Leviathan Creek at and upstream from the Leviathan Creek landslide. Water continues to be impounded at the toe of the landslide. The upstream-most dam observed was located along Leviathan Creek downstream from 4L Creek.

Burleson measured water quality parameters to gain insight into the effects the beaver dams and ponds may have on water quality in Leviathan and associated creeks. Burleson measured the water quality parameters of the beaver ponds during all seven oversight visits from April 11, 2013, to November 6, 2013. The range of pH values recorded at the beaver ponds was 3.75 to 6.46 (Table 4). The lowest pH observation (3.75) was recorded at the "Lower" Beaver Dam during the October 9, 2013, site visit. The low pH readings here and at the other beaver pond stations are tentatively attributed to interaction of water with sulfur and sulfide minerals contained in sediment accumulated upstream of the old haul road. Figure 16 shows the locations

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of the beaver dams and water quality measurement locations. Photographs B-17 through B-20 show beaver dams and ponds in Leviathan Creek.

5.4 INFILTRATION/OVERFLOW POND WATER QUALITY SURVEY

Burleson measured water quality in Aspen Creek during one site visit in 2013 (August 28). These measurements were made to provide some baseline information in the event that ongoing investigations of the IOP result in pond modifications. The baseline information would be useful in comparing pre- and post- pond modification conditions in Aspen Creek. Figure 17 shows the IOP and associated features including water quality measurement points. Two springs were identified along this reach of Aspen Creek. One spring is located about 400 feet downstream from the IOP adjacent to Aspen Creek. The other spring is located across the access road to the north of Aspen Creek. Flow from this spring enters Aspen Creek at a point about 400 feet upstream from the IOP.

Aspen Creek pH upstream from the IOP was measured at 6.90; pH in Aspen Creek at the IOP was measured at 6.97; and pH in Aspen Creek downstream from the IOP was 7.77. The spring downstream from the IOP and adjacent to Aspen Creek yielded a pH measurement of 6.01. These measurements show that pH in Aspen Creek may increase slightly from upstream to downstream of the IOP.

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6.0 CONCLUSIONS AND RECOMMENDATIONS

Water treatment by the Regional Board and Atlantic Richfield in 2013 led to seasonal improvements in Leviathan Creek water quality downstream from the mine. Water quality monitoring and visual observations suggest that conditions in Leviathan Creek at the end of the 2013 treatment season were generally similar to conditions at the end of the 2012 treatment season. This summer was the thirteenth consecutive season of CUD capture and treatment, and sixth consecutive season of DS partial capture and treatment.

Below average precipitation resulted in decreased accumulation of water in onsite ponds compared to the accumulation observed during years with more precipitation, and resulted in decreased discharge rates from acid sources during the 2012-2013 season as compared to earlier years.

The Regional Board treated all of the available water from Ponds 2N and 2S and Pond 1. The PWTS operated 24 hours per day, 7 days per week for the 18 day operating period in 2013 (see Table 2 for a comparison with other years).

Atlantic Richfield captured CUD and DS discharges for 184 days in 2013 (see Table 1 for comparison with other years), which led to noticeable improvements in Leviathan Creek. Atlantic Richfield initiated capture of the CUD and DS flows on May 1, 2013, prior to observation of significant decrease of water quality at Station 15. The HDS treatment system was commissioned, and operated into late October before demobilization.

Burleson recommends the following:

- The surface of mine waste (overburden and waste rock) north of the pit should be evaluated to identify the feasibility of modifying the surface to minimize infiltration and promote runoff of water. This activity would likely reduce the amount of acid drainage requiring treatment at Aspen Seep.

- Impacts of storm related runoff events should be assessed to evaluate their contributions to discharge of sediment, salts, and metals to the Leviathan Creek watershed.

- Potential for remobilization of the Leviathan Creek landslide as the beaver ponds expand and pond levels (and associated pore water pressure within the landslide toe increases) should be monitored.

- Sediment accumulated at the vicinity of the beaver ponds is not well characterized. Chemical precipitates may also be accumulating within the beaver ponds. Consideration to potential effects of these sediments on the Leviathan and Bryant Creek watershed in the event of a beaver dam failure should be made.

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- Maintenance and improvements to the storm water controls at the site should continue as necessary to prevent future damage to treatment systems, reduce damage to roads, and minimize interference of run-off with treatment activities.

- CUD and DS capture should begin as soon as practicable in the LAS each year to minimize the impacts of CUD and DS discharges on Leviathan Creek as spring flows decrease from spring runoff peak flows.

- Monitoring of water chemistry and metal content should be performed during base flow conditions at the Beaver Ponds to evaluate the chemical conditions and the potential for a source of acidity in the area.

- Traffic to and from the site should continue to be coordinated between the Regional Board and Atlantic Richfield contractors to minimize the chance for accidents and/or spills.

- The Delta Seep capture system should be evaluated and improved. Monitoring of water quality in Leviathan Creek downstream from Delta Seep demonstrates that the existing collection system remains only partially effective.

- Improvement of the DS capture system should include evaluation of methods to direct runoff and sediment around the capture system. This would prevent loss of capture during runoff due to overwhelming the pump system capacity and clogging of the inlet pipes to the capture tank.

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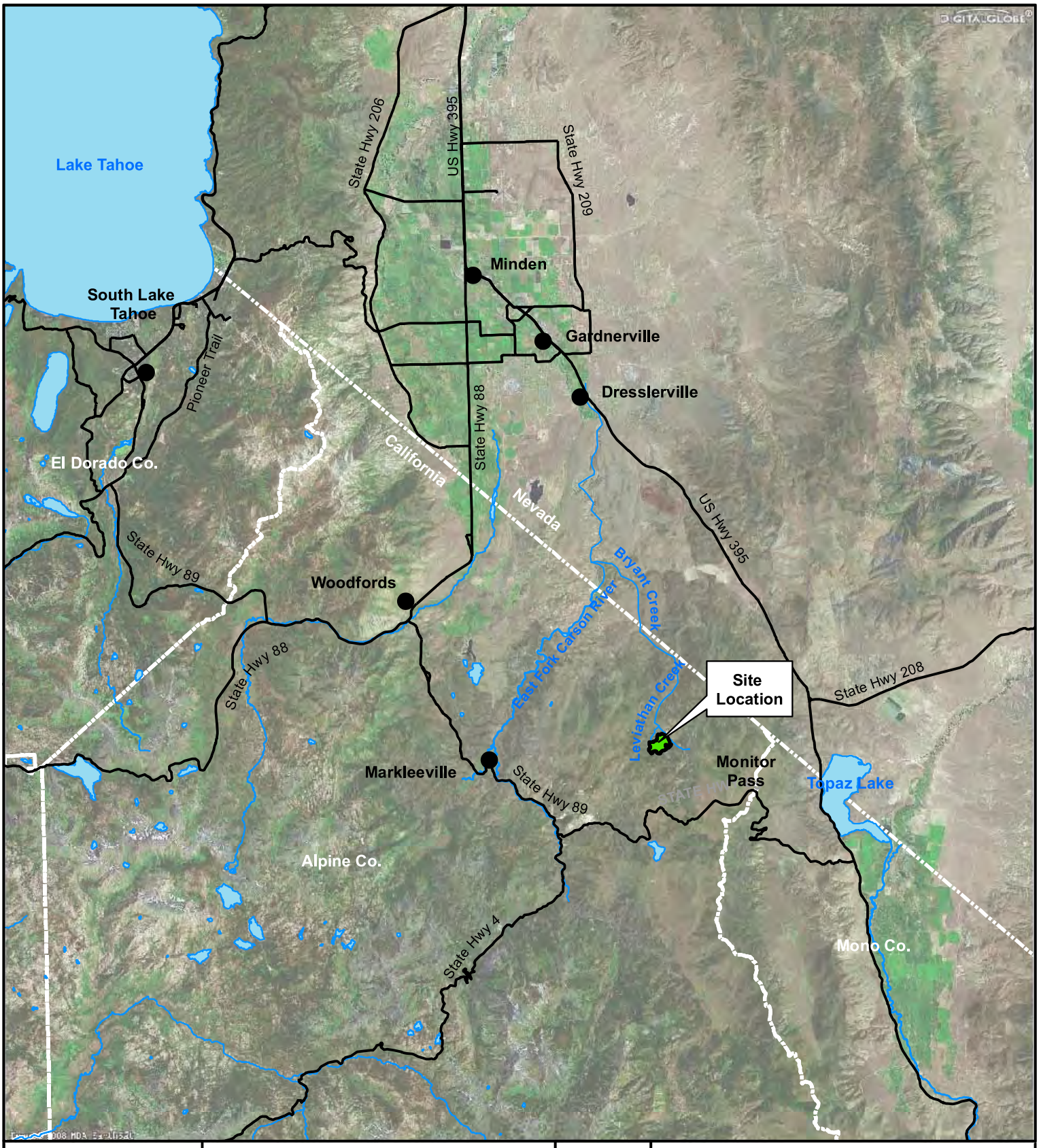
U.S. Geological Survey (USGS). 1985. "Hydrologic Data for Leviathan Mine and Vicinity, Alpine County, California, 1981-83." Open-File Report 85-160.

USGS. 2011 and 2012. USGS Real-Time and Recent Daily Water Data for California, Monitoring Stations in Alpine County. Accessed periodically during the year through: http://waterdata.usgs.gov/ca/nwis/current?type=flow

REVIEW DOCUMENT

FIGURES **17 PAGES**

REVIEW DOCUMENT



Legend

- Site Location
- Cities
- Roads
- Rivers and Creeks
- Lakes and Ponds

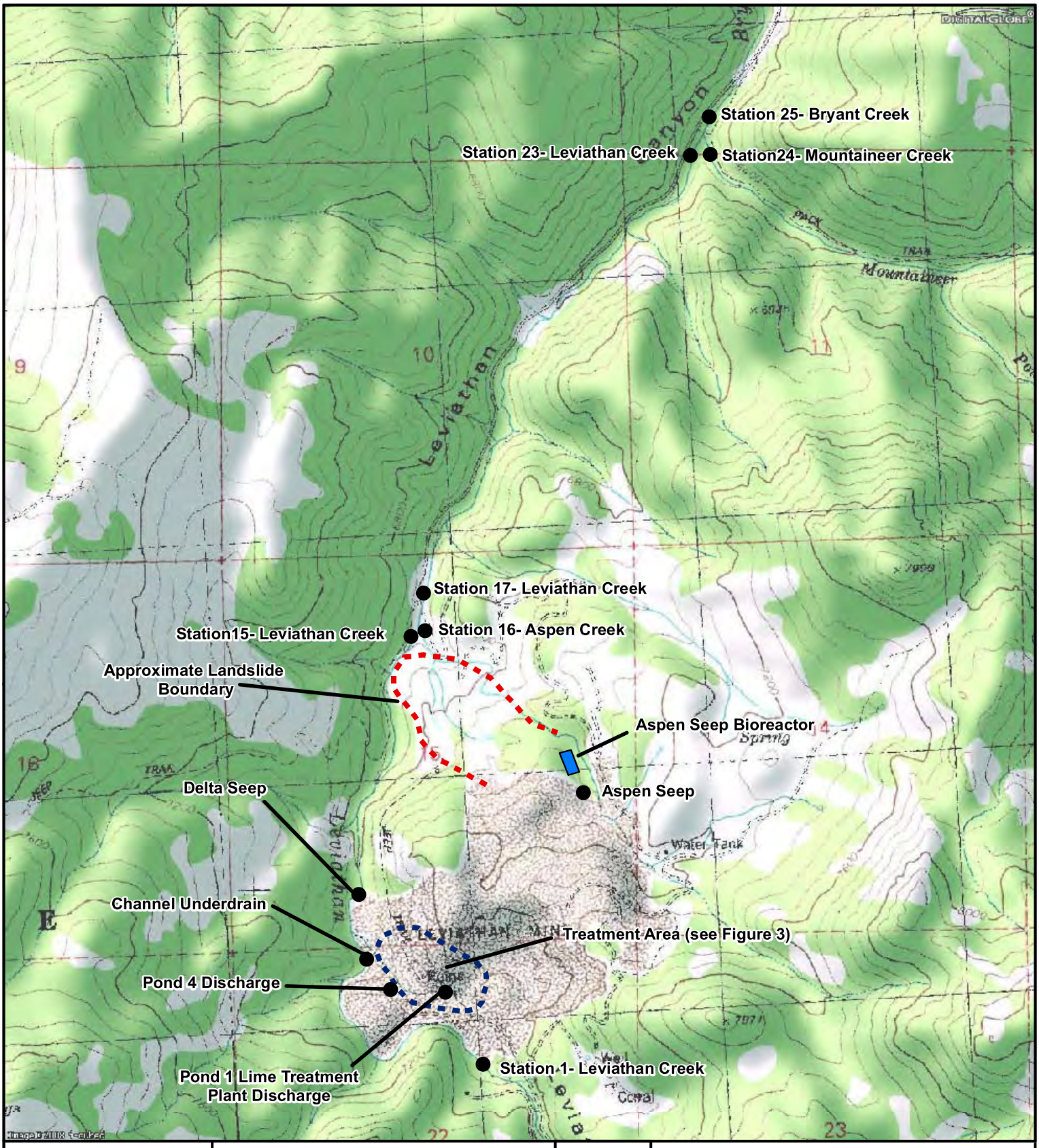
N

Figure 1

Site Location Map
Leviathan Mine Superfund Site
Alpine County, California

0 4 8 12
Miles

Burleson Consulting, Inc.



Legend

- point features
- Treatment Area
- Landslide Boundary

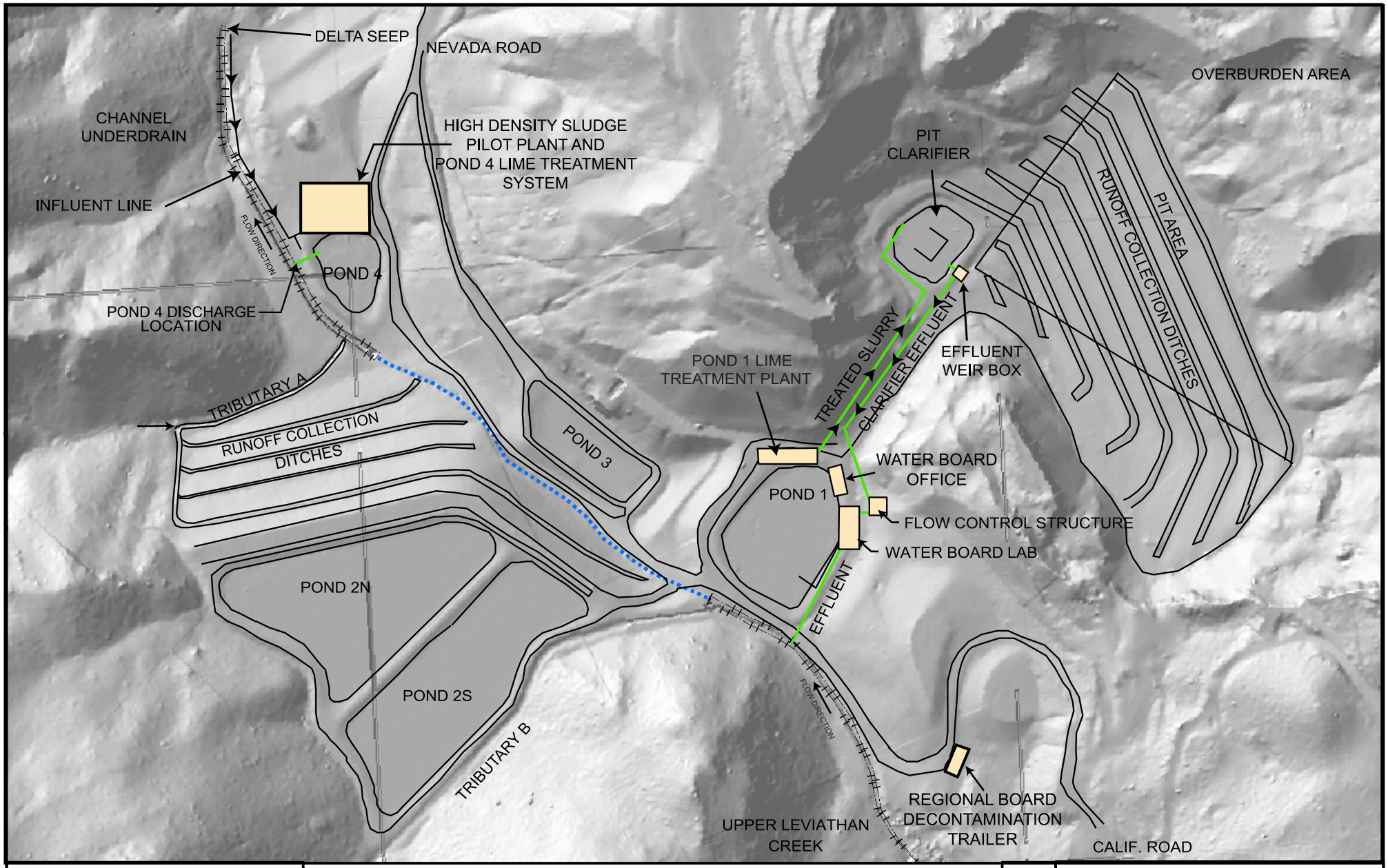
N

Figure 2

Site Map
Leviathan Mine Superfund Site
Alpine County, California

0 1,250 2,500 3,750
Feet

Burleson Consulting, Inc.



Legend

- Buildings
- Effluent Lines
- Leviathan Creek Underground
- Leviathan Creek Open Channel
- Unpaved Roads

N

Figure 3

Detailed Map of Site Features
Leviathan Mine Superfund Site
Alpine County, California

0 250 500 750
Feet

Burleson Consulting, Inc.

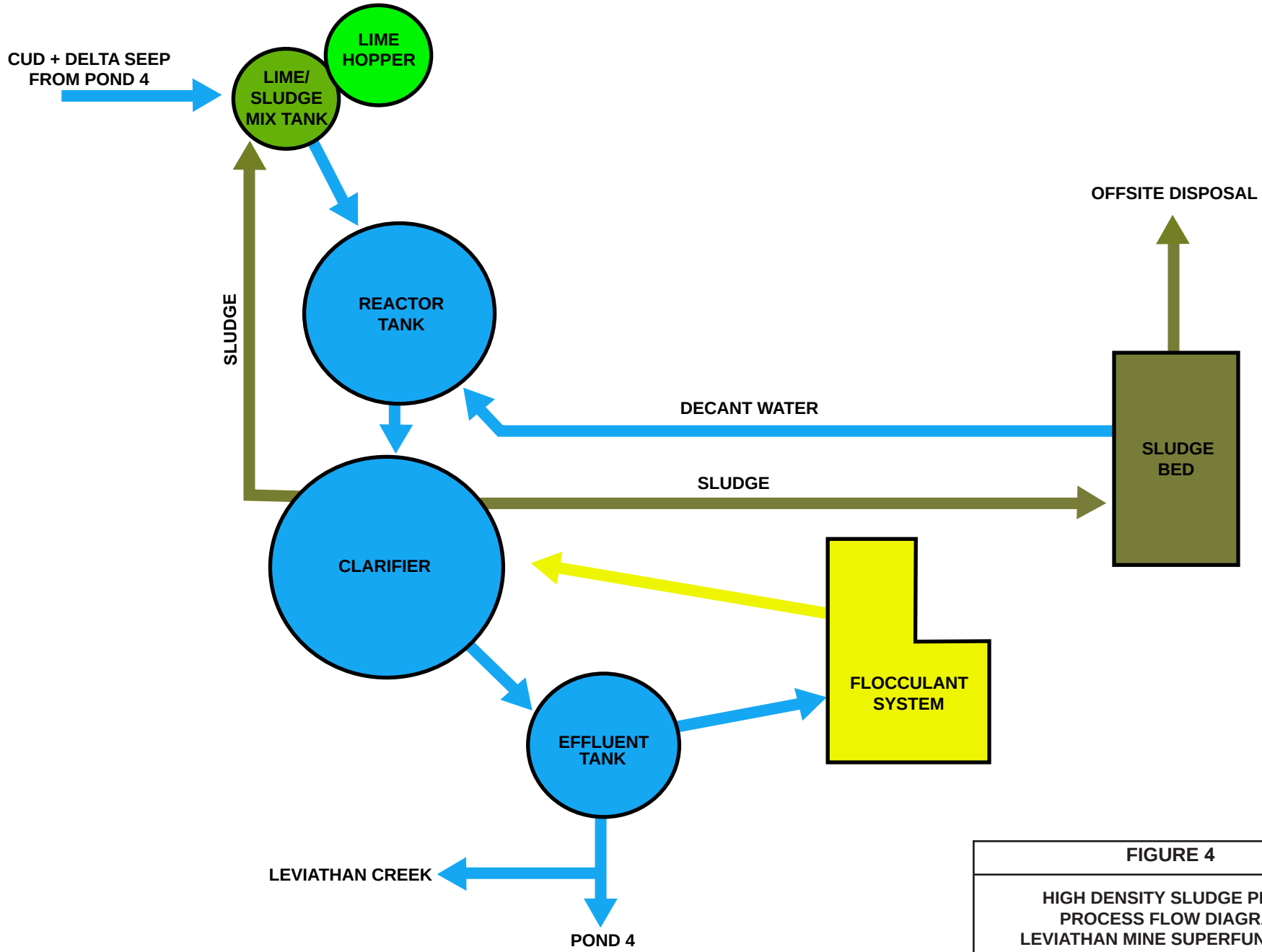


FIGURE 4

HIGH DENSITY SLUDGE PLANT
PROCESS FLOW DIAGRAM
LEVIATHAN MINE SUPERFUND SITE
ALPINE COUNTY, CALIFORNIA

Burleson Consulting, Inc.

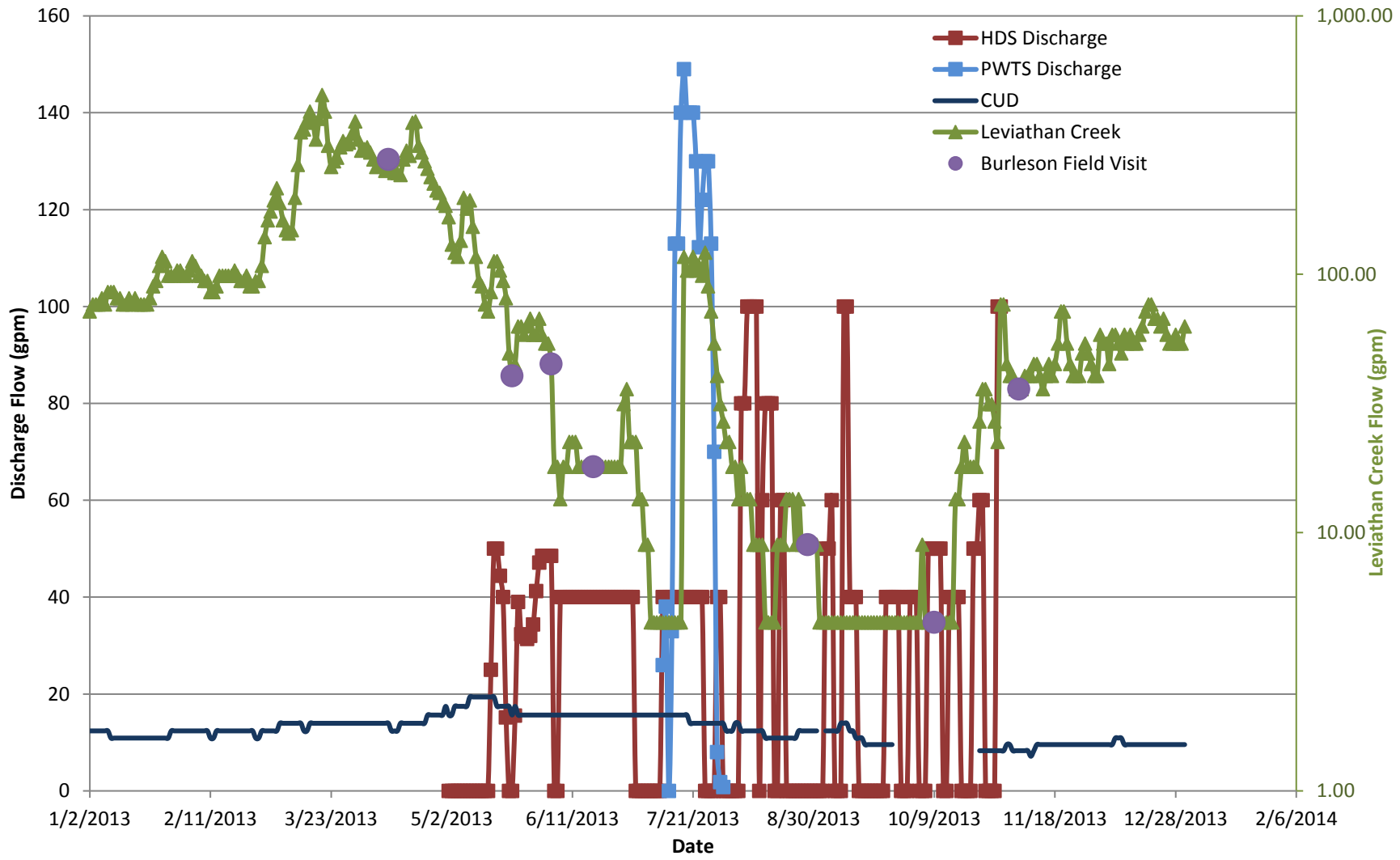


FIGURE 5

TREATMENT SYSTEM DISCHARGE AND FLOW AT STATION 15 (LEVIATHAN CREEK) LEVIATHAN MINE SUPERFUND SITE ALPINE COUNTY, CALIFORNIA

BURLESON CONSULTING, INC.

Treatment system discharges are shown diagramatically and are not accurate depictions of actual flow rate

CUD and Leviathan Creek flow rates are from the U.S. Geological Survey 2012.

Recent Daily Water for California, Accessed online at: http;//waterdata.usgs.gov/ca/nwis/current?type=flow

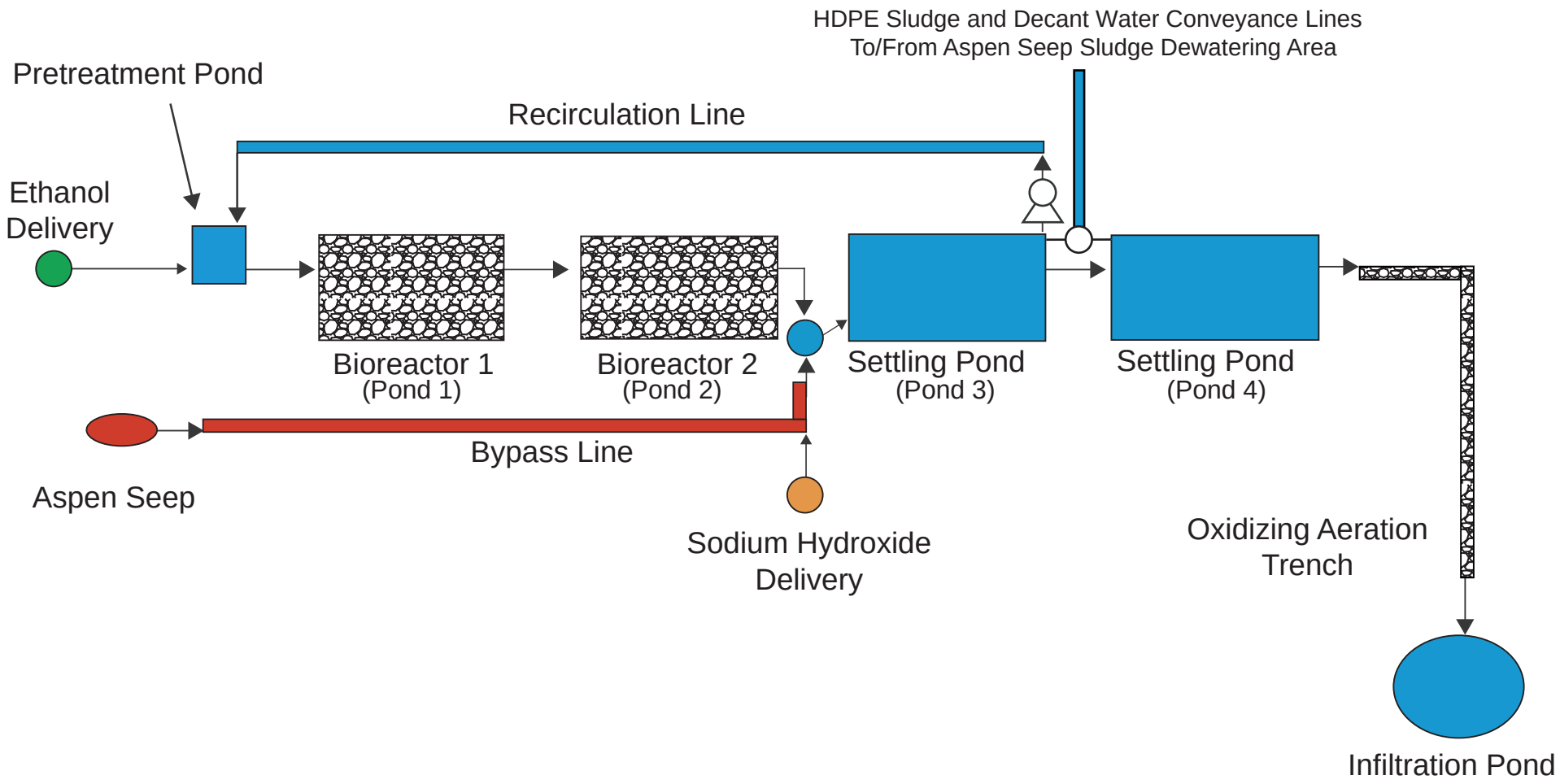


FIGURE 6

ASPEN SEEP BIOREACTOR OPERATION WITH RECIRCULATION LEVIATHAN MINE SUPERFUND SITE ALPINE COUNTY, CALIFORNIA

Burleson Consulting, Inc.

Modified from: Tsukamoto, Tim K. and Miller, Glenn C. 2005. "Draft Data Summary Report for Bioreactors at the Leviathan Mine, Aspen Seep 2004." August.

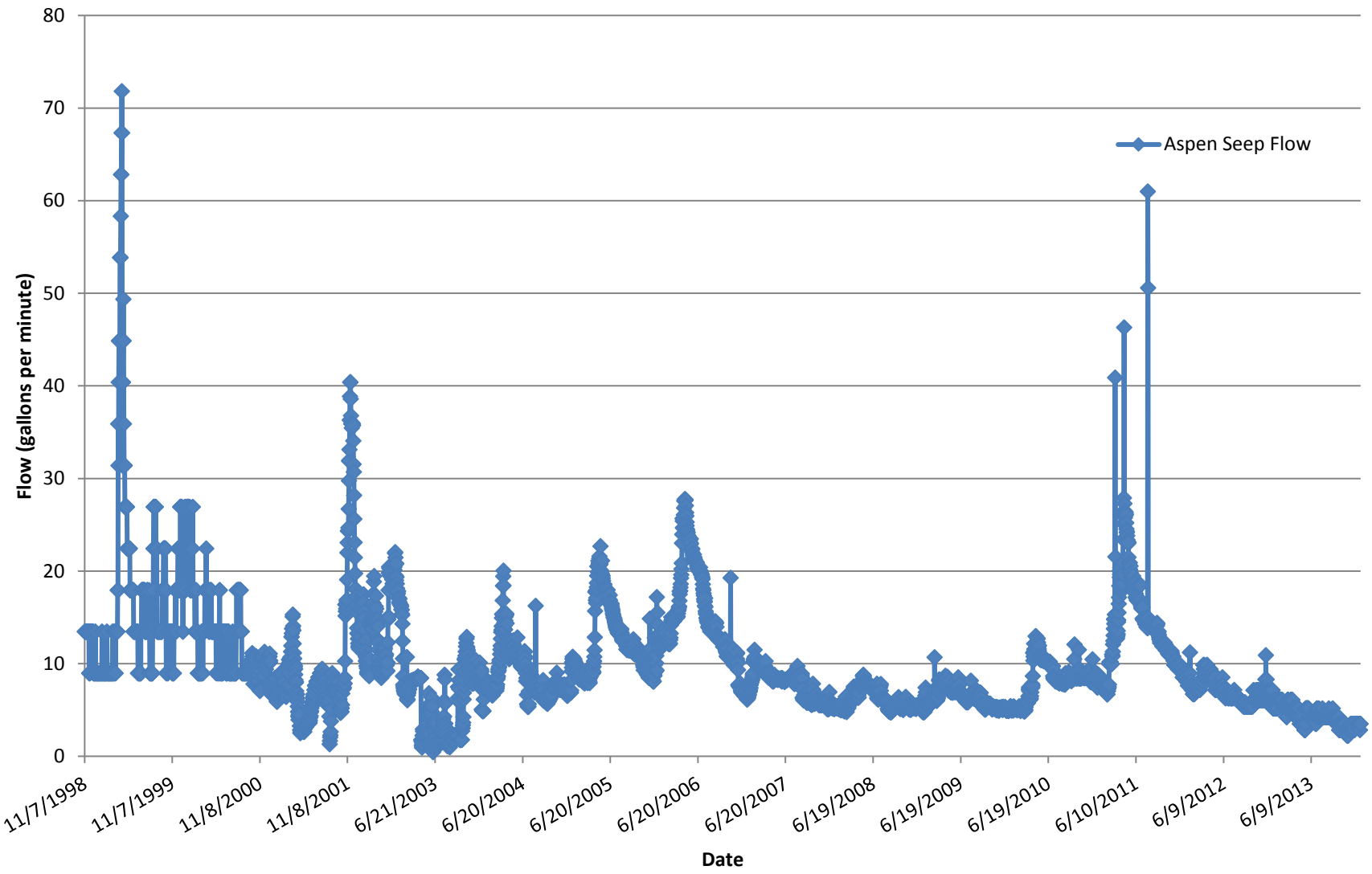
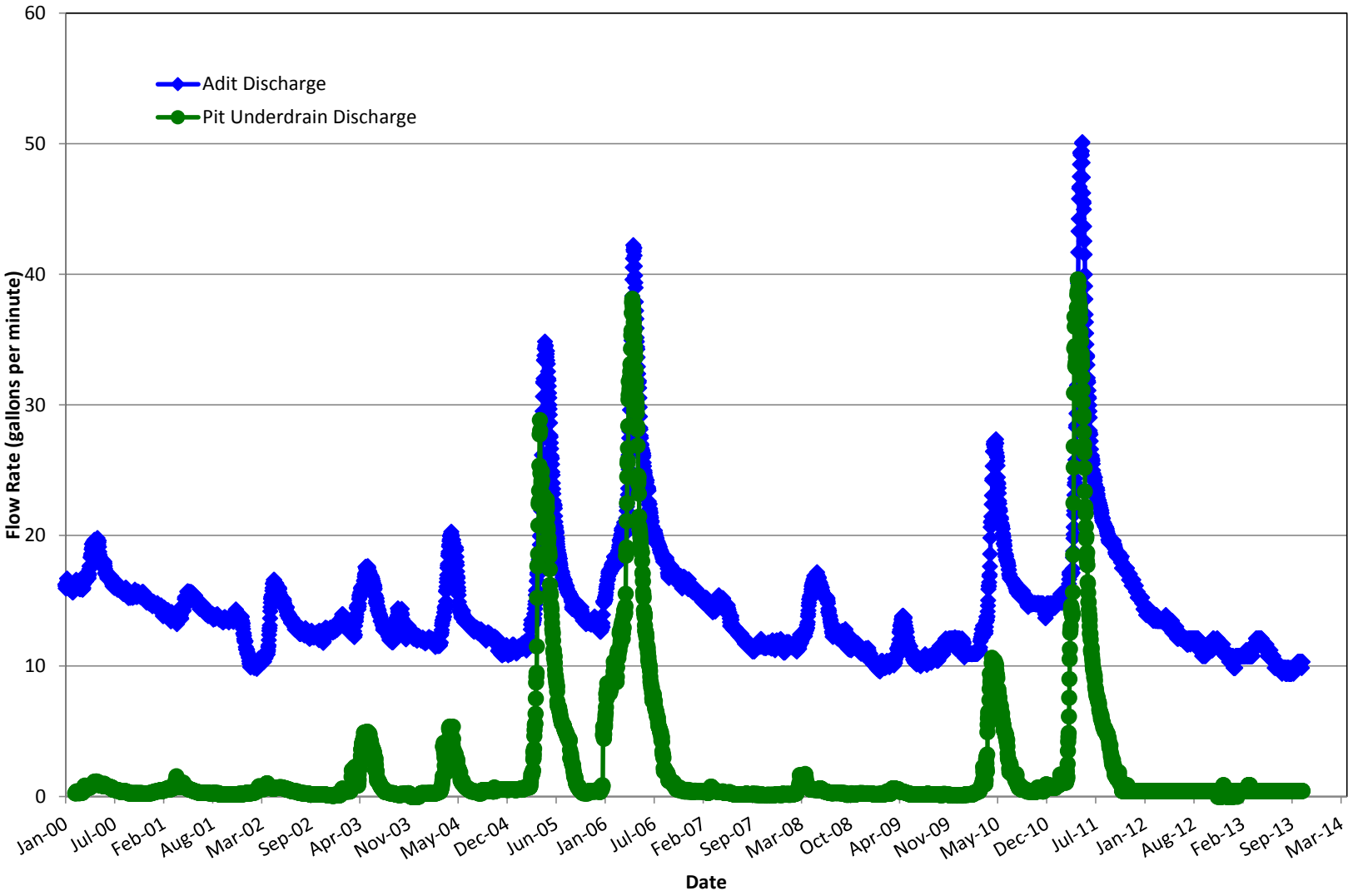


FIGURE 7

ASPEN SEEP FLOW THROUGH DECEMBER 31, 2013
LEVIATHAN MINE SUPERFUND SITE
ALPINE COUNTY, CALIFORNIA

SOURCE: LEVIATHAN MINE DATABASE, QUARTERLY REPORTS FROM USGS TO REGIONAL BOARD, & ATLANTIC RICHFIELD 2013 ANNUAL REPORT

BURLESON CONSULTING, INC.



Data Sources:

U.S. Geological Survey. 2012. Recent Daily Water Data for California, Monitoring Station 10308784
Accessed online at: http://waterdata.usgs.gov/ca/nwis/uv/?site_no=10308784&amp.

U.S. Geological Survey. 2012. Recent Daily Water Data for California, Monitoring Station 10308785
Accessed online at: http://waterdata.usgs.gov/ca/nwis/uv/?site_no=10308785&amp.

FIGURE 8

ADIT AND PUD DISCHARGE RATES THROUGH OCTOBER 8, 2012
LEVIATHAN MINE SUPERFUND SITE
ALPINE COUNTY, CALIFORNIA

BURLESON CONSULTING, INC.

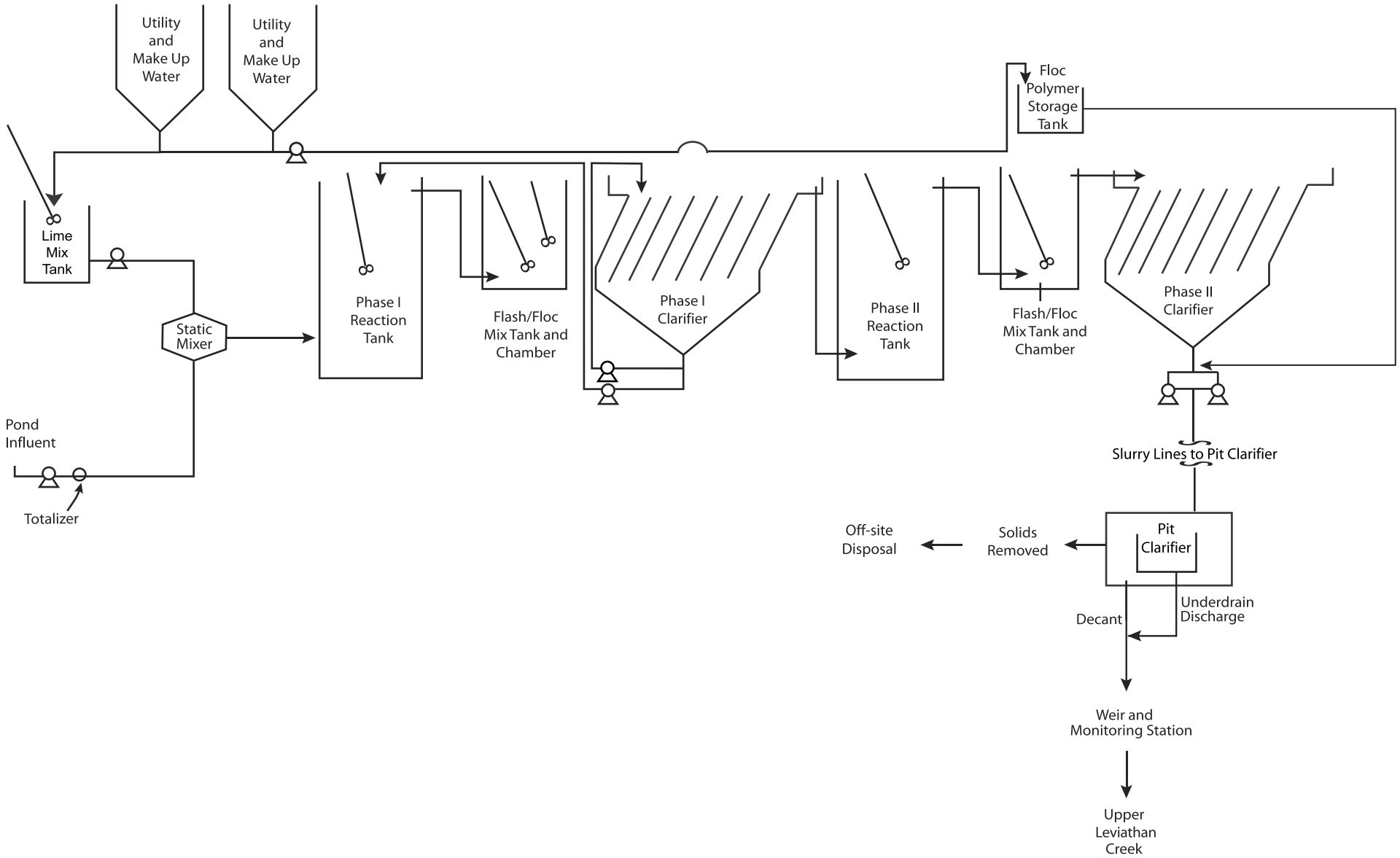


FIGURE 9

POND 1 LIME TREATMENT PLANT PROCESS FLOW DIAGRAM LEVIATHAN MINE SUPERFUND SITE ALPINE COUNTY, CALIFORNIA

Burleson Consulting, Inc.

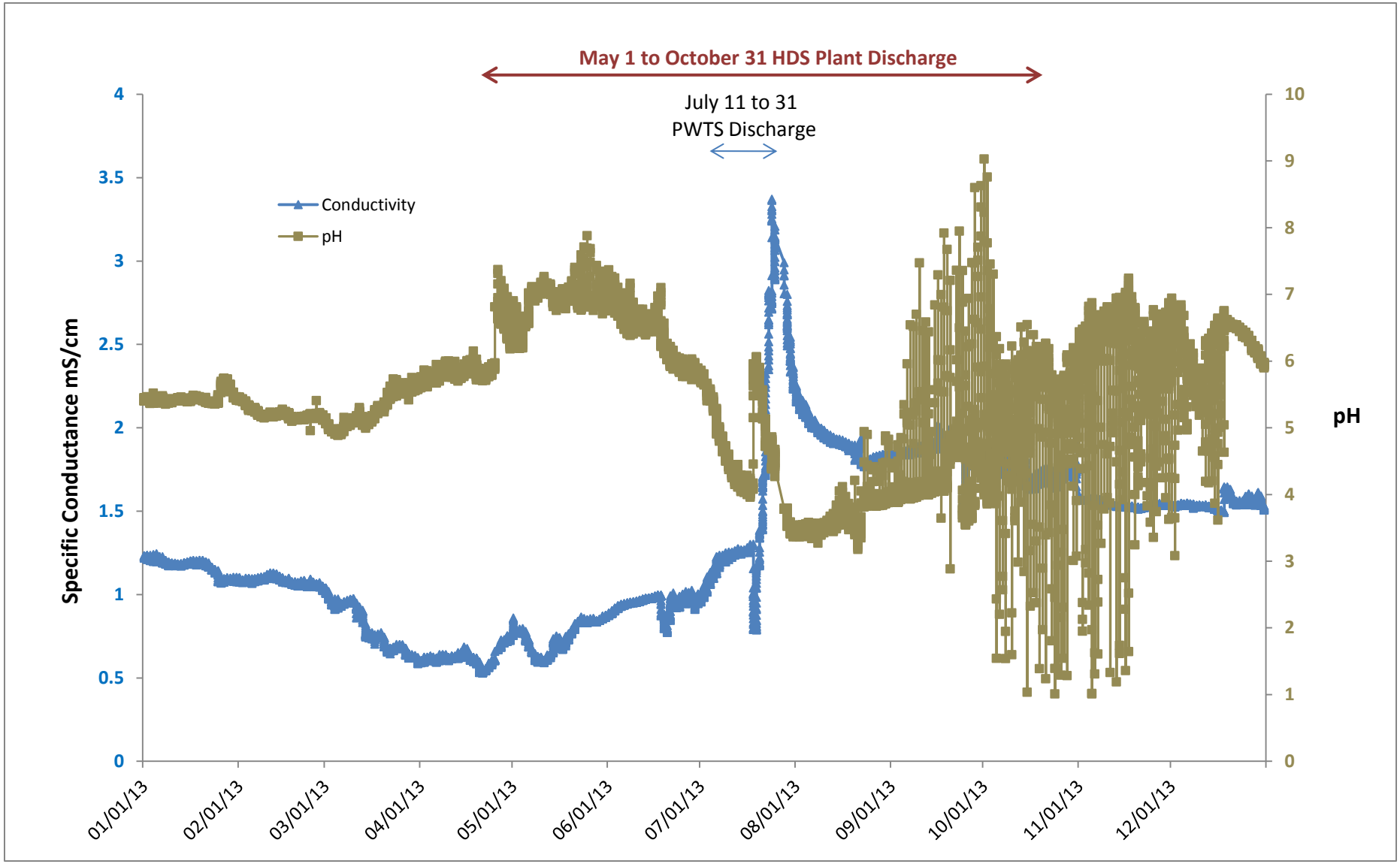


FIGURE 10

STATION 15 ENVIRONET WATER QUALITY DATA DURING 2013
LEVIATHAN MINE SUPERFUND SITE
ALPINE COUNTY, CALIFORNIA

BURLESON CONSULTING, INC.

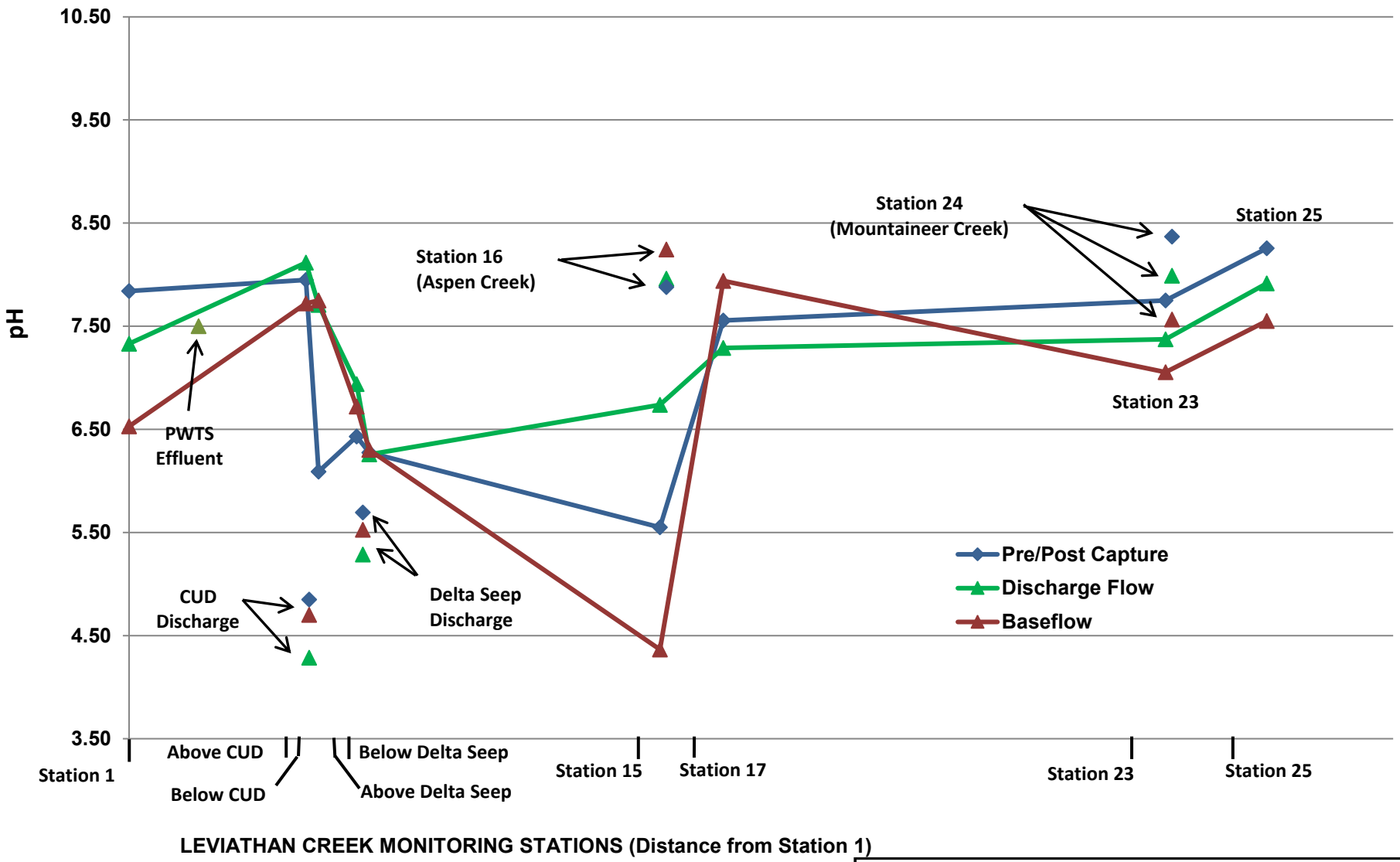
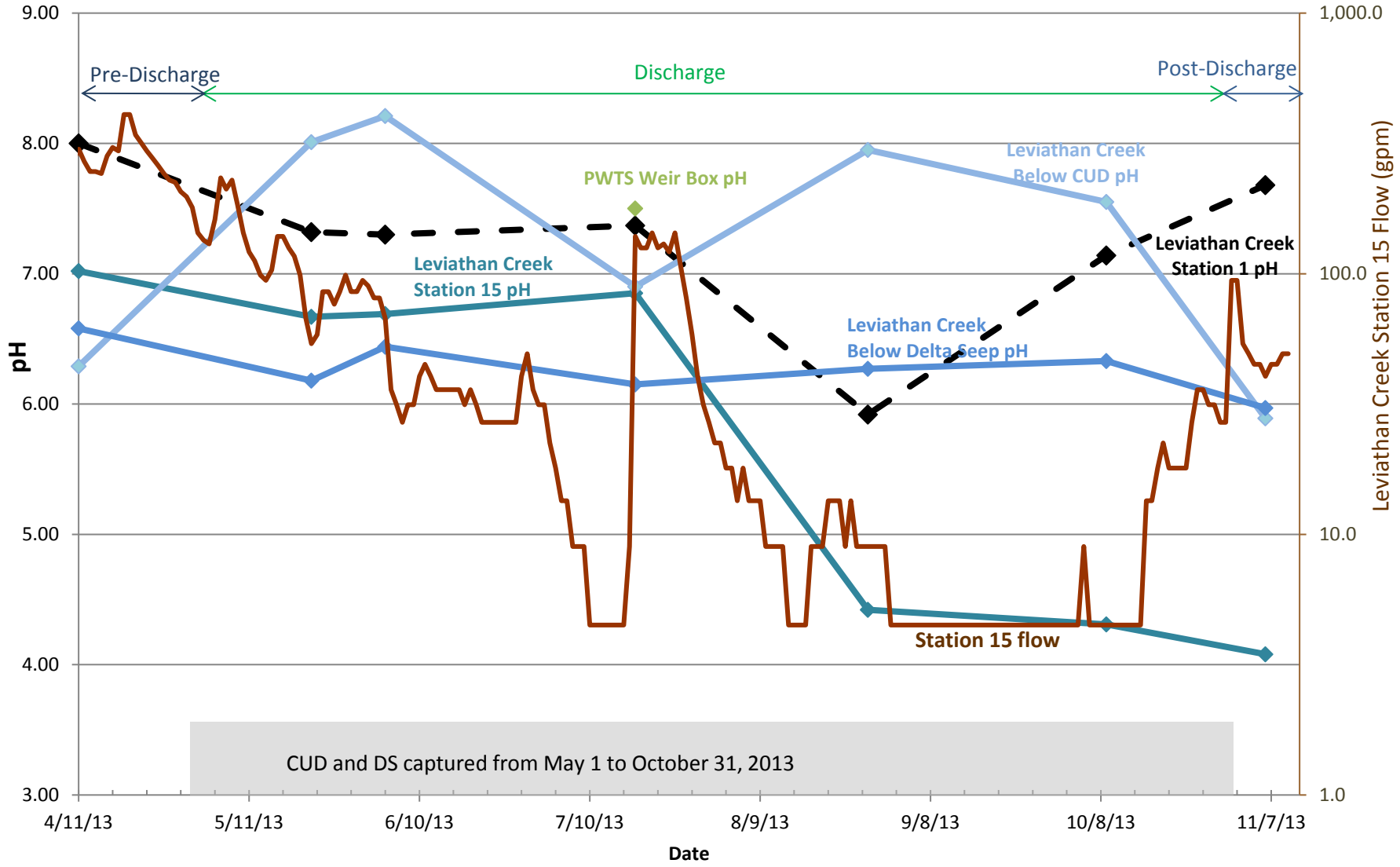


FIGURE 11

LEVIATHAN CREEK AVERAGE pH BY STAGE DURING 2013 TREATMENT
LEVIATHAN MINE SUPERFUND SITE
ALPINE COUNTY, CALIFORNIA

BURLESON CONSULTING, INC.

Notes:
CUD Channel Underdrain
PWTS Pond Water Treatment System



Notes:

CUD Channel Underdrain

DS Delta Seep

gpm Gallon per minute

Dashed line represents upstream monitoring location not affected by mine drainage

Leviathan Creek data from U.S.G.S. 2013. Recent Daily Water Data for California, Monitoring Station 10308789. Accessed online at: http://waterdata.usgs.gov/ca/nwis/uv/?site_no=10308789&amp.

FIGURE 12

LEVIATHAN CREEK pH AND FLOW DURING 2013 TREATMENT
LEVIATHAN MINE SUPERFUND SITE
ALPINE COUNTY, CALIFORNIA

BURLESON CONSULTING, INC.

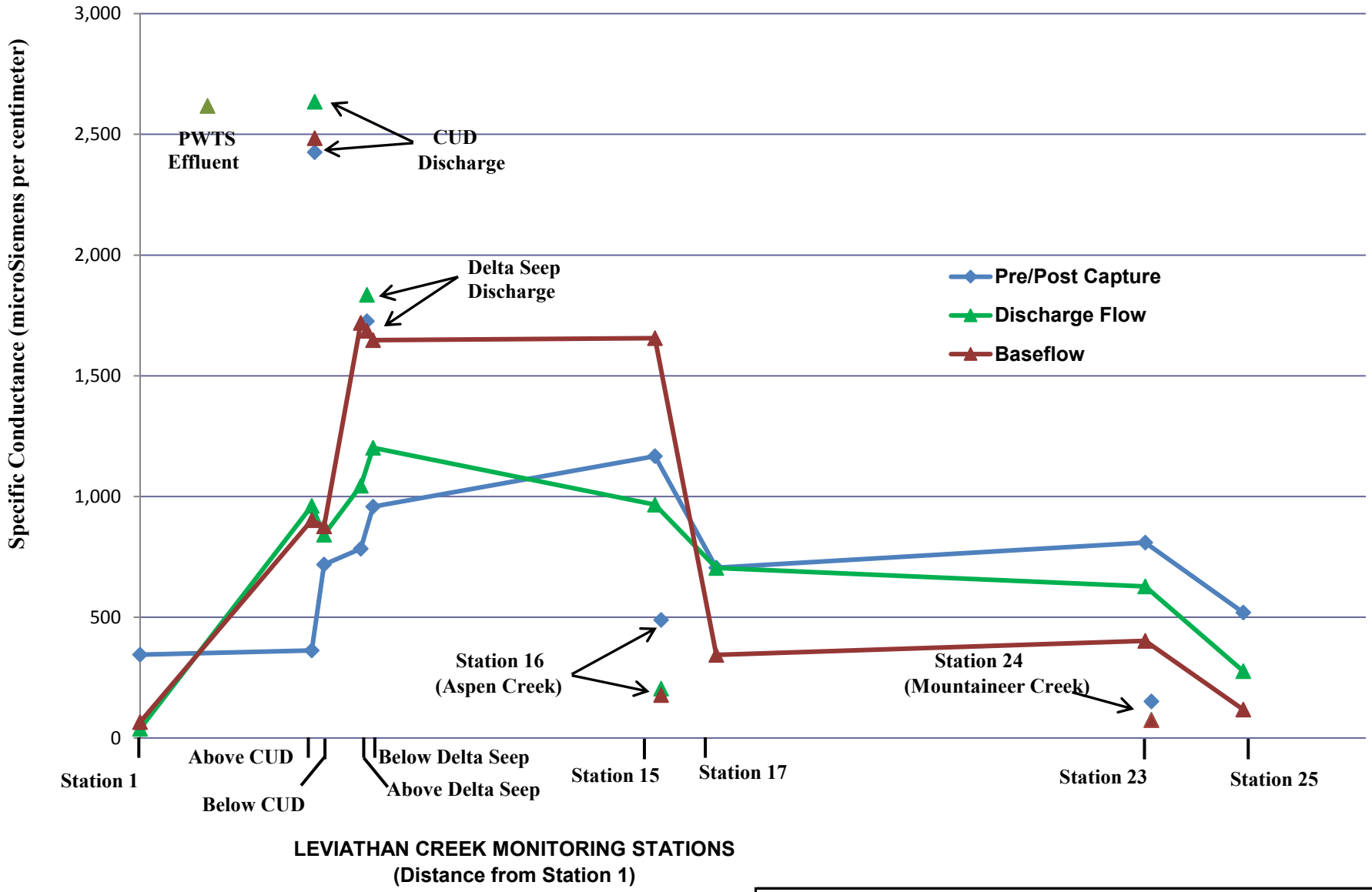
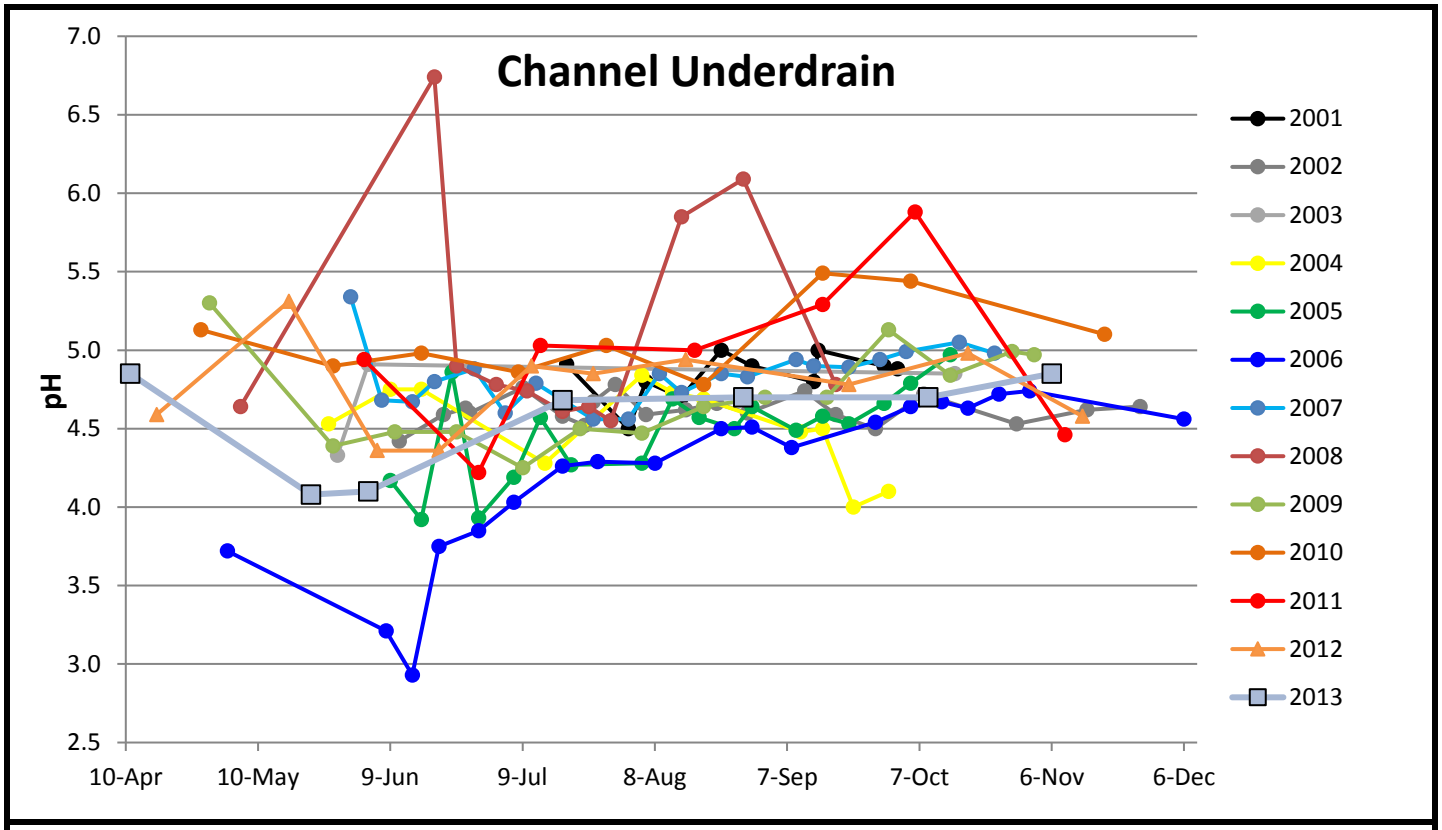


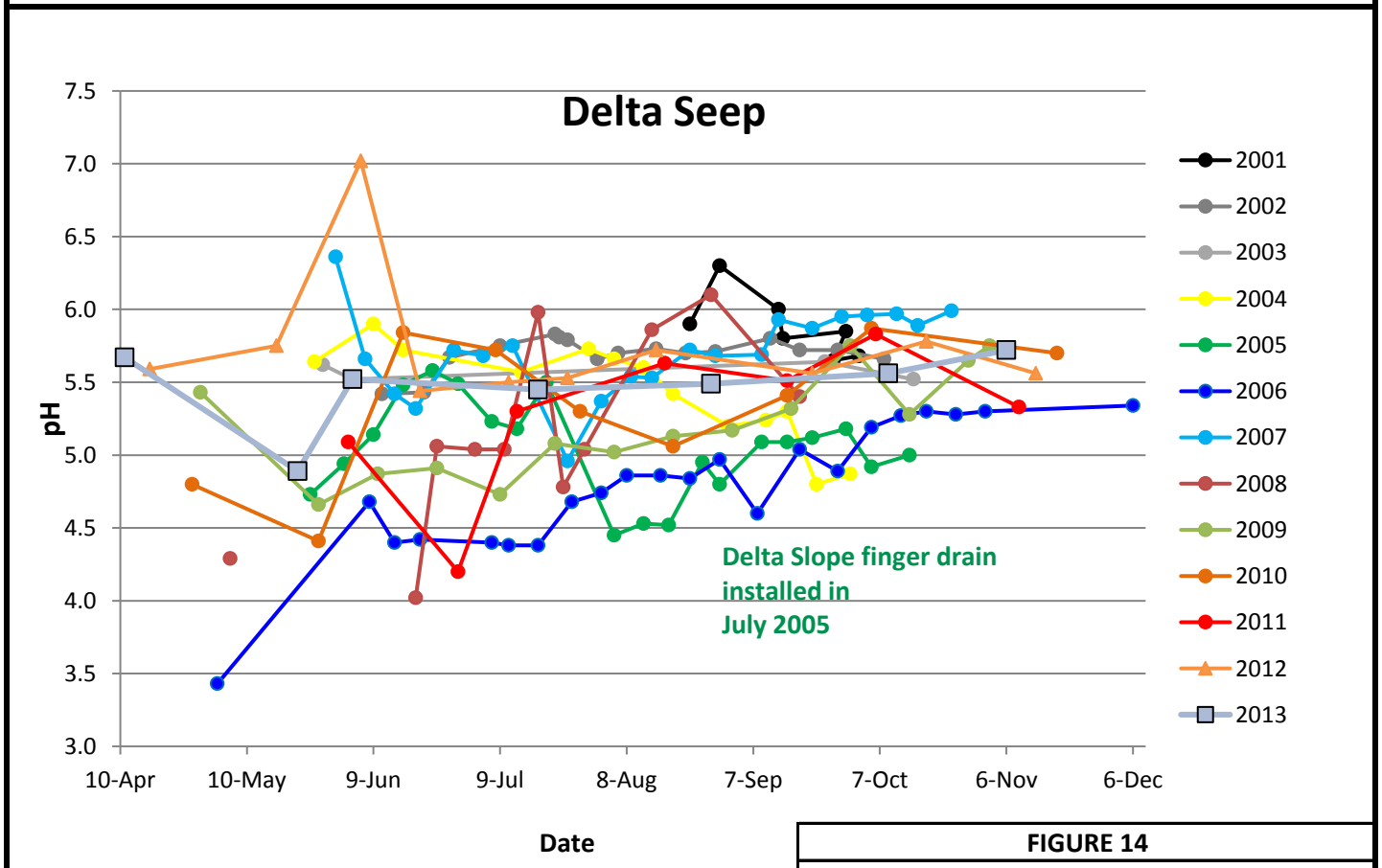
FIGURE 13

LEVIATHAN CREEK AVERAGE SPECIFIC CONDUCTANCE DURING 2013 FLOW STAGES
LEVIATHAN MINE SUPERFUND SITE
ALPINE COUNTY, CALIFORNIA

BURLESON CONSULTING, INC.

Notes:
CUD Channel Underdrain
PWTS Pond Water Treatment System





Note:
Delta Seep data since July 2005 represent the mixture of seepage and discharge from the Delta Slope finger drain.

FIGURE 14

CUD AND DELTA SEEP pH
LEVIATHAN MINE SUPERFUND SITE
ALPINE COUNTY, CALIFORNIA

BURLESON CONSULTING, INC.

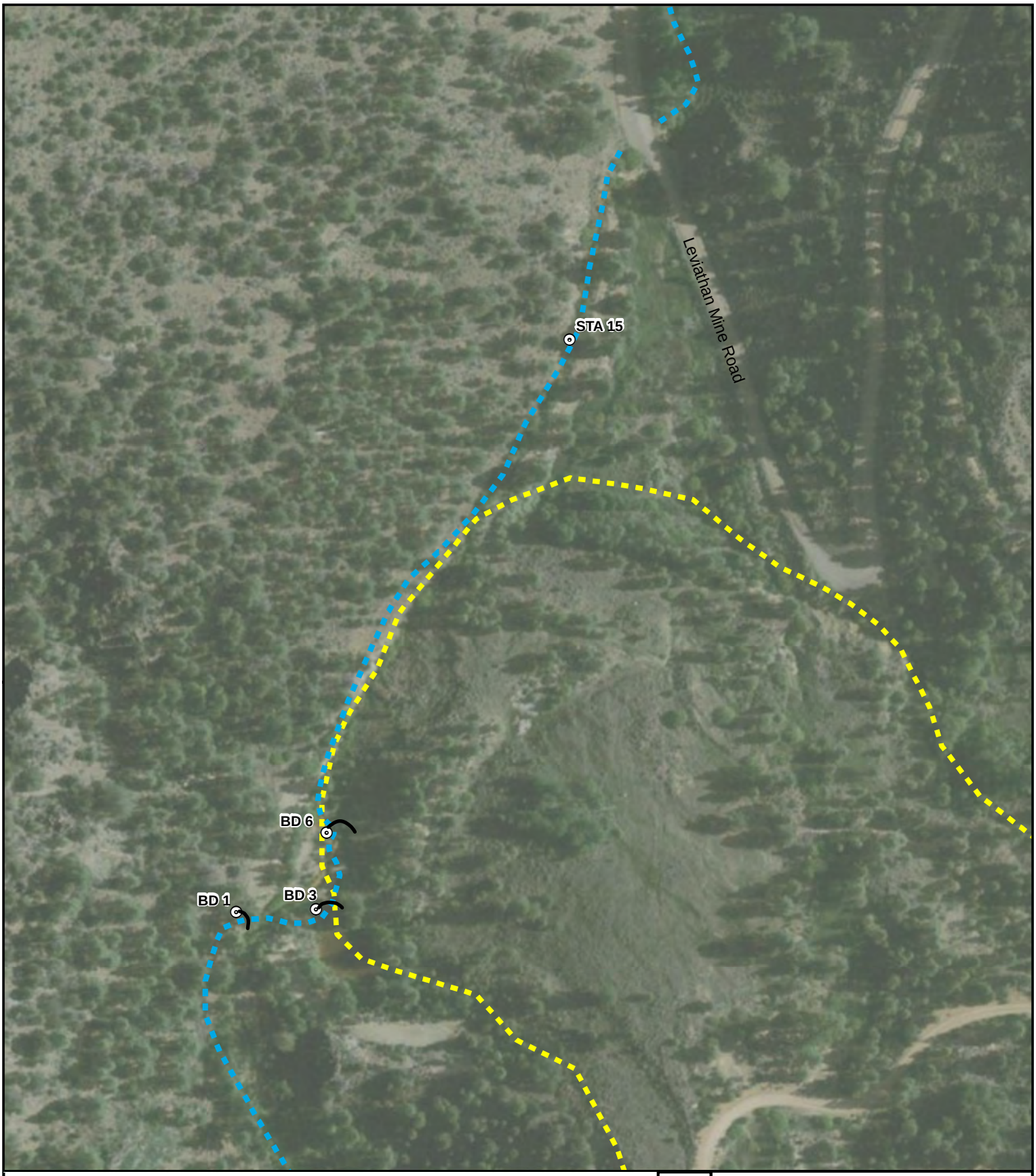
Mountaineer Creek (bottom creek) and Leviathan Creek, before capture of Channel Underdrain and Delta Seep, April 11, 2013.

Mountaineer Creek (bottom creek) and Leviathan Creek, after capture and treatment of Channel Underdrain and Delta Seep, May 22, 2013.

FIGURE 15

LEVIATHAN CREEK AT CONFLUENCE WITH MOUNTAINEER CREEK LEVIATHAN MINE SUPERFUND SITE ALPINE COUNTY, CALIFORNIA

BURLESON CONSULTING



Legend

- Approximate Location of Beaver Dam
- Water Quality Measurement Location
- Leviathan Creek
- Approximate Leviathan Creek Landslide

N

FIGURE 16

Beaver Pond
Water Quality Survey Locations
Leviathan Mine Superfund Site
Alpine County, California

0 150 300
Feet

Burleson Consulting, Inc.

Legend

Creek

Water Quality Measurement Location

N

0 220 440 880 Feet

Aerial Image Source: NAIP 2009, Alpine County

FIGURE 17

Aspen Creek Water Quality Sample Locations
Leviathan Mine Superfund Site
Alpine County, California

Document Path: S:\GIS\Projects\Leviathan Mine\GIS Data\Figures\Aspen_Creek.mxd

TABLES **5 PAGES**

REVIEW DOCUMENT

Table 1. Channel Underdrain and Delta Seep Treatment Summary by Year

Source	Number of Days Source was Captured and Treated, by Year and Method												
	2001 LNP[a]	2002 LNP[a]	2003 LNP[a]	2004 LNP[a]	2005 HDS[a]	2006 HDS/LNP[a]	2007 RCTS[d]	2008 RCTS[b]	2009 RCTS/HDS[b]	2010 HDS[b]	2011 HDS[b]	2012 HDS[b]	2013 HDS[b]
Channel Underdrain	61	128	104	122	66	36/48	117	135	182	183	166	180	183
Delta Seep	0	4	100	73	0	0	96	135	180	180	166	180	183
Volume of Water Treated (million gal)	1.4[b]	3.17[b]	4.72[b]	5.0[b]	2.9[b]	1.9/1.8[c]	3.2	6	6.9	10.6	13.8	6.6	6.2

Notes:
HDS High density sludge pilot plant
LNP Pond 4 lime neutralization plant
RCTS Rotating Cylinder Treatment System

a Values are from Tetra Tech EM Inc. oversight files, as reported in:
Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. February 2002.
2002 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. March 2003.
2003 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. June 2004.
2004 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. March 2005.
2005 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. March 2006.
2006 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. March 2007.

b Values are from Atlantic Richfield Company's annual Early Response Action completion reports:
Brown and Caldwell. 2002. *Leviathan Mine 2001 Early Response Action, Channel Underdrain Treatment Completion Report.* February.
Unipure Environmental. 2003. *Draft Leviathan Mine Site 2002 Early Response Action Completion Report.* March.
Unipure Environmental. 2004. *Draft Final Leviathan Mine Site, 2003 Early Response Action Completion Report.* April 27.
EMC^2. 2005. *Draft 2004 Early Response Action Completion Report.* May.
UniPure and EMC^2. 2006. *Draft 2005 Early Response Action Completion Report, Lime Neutralization Treatment System Using the High Density Sludge Pilot Study* . April.
Amec Geomatrix. 2009. *2008 Annual completion Report: Channel Underdrain, Delta Seep and Aspen Seep Water Treatment Activities* . April.
Amec Geomatrix. 2010. *2009 Annual completion Report: Channel Underdrain, Delta Seep and Aspen Seep Water Treatment Activities* . April.
Amec Geomatrix. 2011. 2010 *Annual completion Report: Channel Underdrain, Delta Seep and Aspen Seep Water Treatment Activities.* April.
Amec Geomatrix. 2012. 2011 *Annual completion Report: Channel Underdrain, Delta Seep and Aspen Seep Water Treatment Activities.* April.
Amec Geomatrix. 2013. 2012 *Annual completion Report: Channel Underdrain, Delta Seep and Aspen Seep Water Treatment Activities.* April.
Copper Environmental and Broadbent. 2014. 2013Annual completion Report: Channel Underdrain, Delta Seep and Aspen Seep Water Treatment Activities. April.

c Value was provided by Atlantic Richfield Company's treatment system contractor at the Leviathan Mine Technical Advisory Committee Meeting on November 2, 2006.

d Values are from USACE oversight files, as reported in:
2007 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. June 2007.

Table 2. Evaporation Pond Water Treatment System Summary by Year

Treatment System Location		Treatment Year												
		2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007[f]**	**2008[g]**	**2009[b]**	**2010[b]**	**2011[b]**	**2012[b]**	**2013[b]**
Duration of Treatment[a] (days)	Pond 1	40	79[c]	17	32	48	47	16	41[c]	33	39	43	25	18
	Pond 3	0	0	0	0	10	84	0	0	0	0	56	0	0
Volume of Treated Water Discharged[b] (million gallons)	Pond 1	4	3.8	3.5	5.9	9.9	13.2	3.12	3.1	2.9	6.7	9.8	2.8	2.7
	Pond 3	0	0	0	0	0.53[e]	7.5[d]	0	0	0	0	8.2	0	0

Notes:

a Values are from Tetra Tech EM Inc. oversight files, as reported in:
Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. February 2002.
2002 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. March 2003.
2003 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. June 2004.
2004 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. March 2005.
2005 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. March 2006.

b Values are from California Regional Water Quality Control Board, Lahontan Region annual reports:
2001 Year-end Report for Leviathan Mine, Alpine County, California. February 2002.
2002 Year-end Report for Leviathan Mine, Alpine County, California. February 2003.
2003 Year-end Report for Leviathan Mine, Alpine County, California. February 2004.
Year-end Report for the 2004 Field Season at Leviathan Mine, Alpine County, California. February 2005.
Year-end Report for the 2005 Field Season at Leviathan Mine, Alpine County, California. February 2006.
Year-end Report for the 2009 Field Season at Leviathan Mine, Alpine County, California. March 2010.
Year-end Report for the 2010 Field Season at Leviathan Mine, Alpine County, California. February 2011.
Year-end Report for the 2011 Field Season at Leviathan Mine, Alpine County, California. February 2012.
Year-end Report for the 2012 Field Season at Leviathan Mine, Alpine County, California. February 2013.
Year-end Report for the 2013 Field Season at Leviathan Mine, Alpine County, California. February 2014.

c The treatment system was not operated 24 hours per day, 7 days per week during these years.

d Values were provided by the California Regional Water Quality Control Board,

e An additional 400,000 gallons of water was treated in Pond 3 and allowed to evaporate from the pond.

f Values are from USACE oversight files, as reported in:
2007 Oversight Summary Report, Leviathan Mine Superfund Site, Alpine County, California. June 2007.

g Kao, Chein. 2008. Presentation at the Leviathan Mine Superfund Site Technical Advisory Committee Meeting. November 18.

Table 3. Leviathan Creek Flow Stages during the 2013 Treatment Season

Creek Flow Stage	Components of Leviathan Creek Flow	Monitoring Dates
Pre/Post Capture	Spring runoff flow, CUD discharge, and Delta Seep discharge	April 11, 2013
		November 6, 2013
Discharge Flow	Base flow and treatment system discharge	June 4, 2013
		July 18, 2013
Base Flow	Primarily base flow	May 22, 2013
		August 28, 2013
		October 9, 2013

Note:

CUD Channel Underdrain

Table 4. Leviathan Mine Beaver Pond Water Quality Measurements

Location	Time	pH	T (°C)	SC (µS/cm)	ORP (mV)
April 11, 2013					
BD-1	11:30	6.04	6.38	1,153	NM
BD-3	11:25	6.25	7.24	1,194	NM
BD-6	11:18	6.43	7.53	1,179	NM
May 22, 2013					
BD-1	14:02	5.8	14.72	800	NM
BD-3	13:57	5.99	14.54	712	NM
BD-6	13:53	5.99	15.81	729	NM
June 4, 2013					
BD-1	15:15	5.48	18.32	1,007	NM
BD-3	15:08	6.33	18.94	846	NM
BD-6	15:04	6.46	20.21	824	NM
July 18, 2013					
BD-1	NA	3.87	19.24	2,308	NM
BD-3	13:10	6.12	20.33	1,499	NM
BD-6	13:03	6.3	22.02	1,347	NM
August 28, 2013					
BD-1	13:28	4.29	19.93	2,259	NM
BD-3	13:25	5.58	18.07	2,209	NM
BD-6	13:22	4.49	16.23	2,071	NM
October 9, 2013					
BD-1	13:09	4.08	6.78	1,735	NM
BD-3	13:07	5.23	7.81	1,699	NM
BD-6	13:01	3.75	8.32	1,683	NM
November 6, 2013					
BD-1	14:10	5.76	5.92	1,430	NM
BD-3	14:15	5.84	5.24	1,485	NM
BD-6	14:20	5.17	4.67	1,326	NM

°C	degree Celsius	ORP	Oxidation-reduction potential
µS/cm	microSiemen per centimeter	SC	Specific conductance
gpm	gallon per minute	T	Temperature
mV	milliVolt		

Notes:

BD-1 - Upstream Beaver Dam

BD-3 - Main Beaver Dam

BD-6 - Downstream Beaver Dam

Table 5. Leviathan Mine Aspen Creek Quality Measurements

Location	Time	pH	T (°C)	SC (µS/cm)
August 28, 2013				
AC-1	14:55	7.77	15.07	216
AC-Spring	14:50	6.01	10.53	340
AC-IOP	14:42	6.97	15.23	219
AC-M3	14:36	6.9	15.77	157

°C	degree Celsius	ORP	Oxidation-reduction potential
µS/cm	microSiemen per centimeter	SC	Specific conductance
gpm	gallon per minute	T	Temperature
mV	milliVolt		

Notes:

AC-1- Aspen Creek downstream from IOP

AC-Spring - Spring near AC-1

AC-IOP - Aspen Creek at downstream end of IOP

AC-M3 - Aspen Creek in Meadow upstream from IOP

APPENDIX A: OVERSIGHT SUMMARIES **28 PAGES**
(Presented on Compact Disc)

APPENDIX B: OVERSIGHT PHOTOGRAPHS **19 PAGES**
(Presented in Hard Copy and on Compact Disc)

APPENDIX C: FIELD INSTRUMENT MEASUREMENT RECORDS **20 PAGES**
(Presented on Compact Disc)

REVIEW DOCUMENT

APPENDIX A: OVERSIGHT SUMMARIES **21 PAGES**

REVIEW DOCUMENT

Leviathan Mine Superfund Site
April 11, 2013
Burleson Consulting, Inc. Oversight

Period of Oversight: 9:30 AM to 3:30 PM

Oversight Personnel: Greg Reller of Burleson; Gary Riley and Lily Tavassoli of EPA

Summary of Site Activities:

California Regional Water Quality Control Board, Lahontan Region (Regional Board):

- No activities observed.

Atlantic Richfield Company (Atlantic Richfield):

- AMEC, under contract to Atlantic Richfield was on site preparing the High Density Sludge (HDS) system for 2013 operations.

Burleson Consulting, Inc. (Burleson)

- Burleson measured water quality along Leviathan Creek.
- Burleson inspected site access conditions.

The weather conditions varied from overcast with light rain in the morning, to sunny and warm with a gentle breeze in the afternoon. Snow patches were present on north and east facing slopes above about 7,000 feet. The Leviathan Mine Road from Highway 395 to the site was mostly dry and free of snow with the road surface slightly rutted. Monitor Pass was open, however site personnel reported that the California entrance road remained very wet on northeast facing slopes. Site personnel anticipate beginning to use the California entrance road by the end of April, provided that no more precipitation occurs.

Leviathan and Bryant Creek Flows: According to the USGS website (http://waterdata.usgs.gov/ca/nwis/current?type=flow), flow in Leviathan Creek at Station 15 has varied from about 0.4 cubic feet per second (cfs) to about 1.3 cfs since early April. Also according to USGS, flows at Station 25 in Bryant Creek varied from about 1.5 cfs to about 2.8 cfs since early April. Flows vary through each day with higher flows in the late afternoon and lower flows in the early morning. This pattern appears to reflect diurnal temperature fluctuations. These flows are among the lowest recorded for this time of year at each station during 14 years of monitoring.

Atlantic Richfield

Pond 4 Area: AMEC personnel, under contract to Atlantic Richfield, were on site preparing the HDS plant for limited access season (LAS) operations. Work was being conducted out of the HDS control trailer and the HDS plant. The generators were being started, and the heating system within the HDS building was operating. The channel underdrain (CUD) and delta seep (DS) interceptors remained winterized with no pumps installed, and controls wrapped in plastic.

The ground surface was mostly dry at the Pond 4 work area. The erosion controls installed by AMEC along the Upper and Crusher Roads at the end of the 2011 work season appear to have reduced the amount of runoff-related erosion along site roads. A straw wattle was emplaced at the top of the Delta Slope access road, apparently to direct runoff into a storm water drop-inlet along the west side of the road. Straw wattles were also emplaced along both sides of the Delta Slope access road, apparently to minimize

sediment erosion from Delta Slope runoff. Several rills are present on the Delta Slope above the access road.

Aspen Seep Bioreactor: Roads to the Aspen Seep were reported to be very wet and we elected to not visit Aspen Seep to avoid unnecessary damage to the road surface. AMEC staff were reported to be performing maintenance at the ASBR.

Regional Board

No Regional Board staff or contractors were encountered on site. Burleson inspected the Pit Clarifier and Pond 1 area. There was no visible water in the Pit Clarifier and the accumulated solids exhibited mud cracks characteristic of shrinkage due to drying. No flowing water was observed in the Pit surface water control system. The Pond Water Treatment System remained winterized. Pond 1, Pond 2N, and Pond 2S each appeared to have a couple of feet of freeboard. The bottom of Pond 3 was submerged, and the pond had a couple of feet of freeboard.

Burleson

On April 11, 2013 water in the Leviathan Creek channel at the confluence of Leviathan and Mountaineer creeks was pale orange and translucent (right center in attached photograph 177, Mountaineer Creek is on the left in the photo).

Dams at the beaver ponds appear to have been reinforced through the winter, and water was overflowing each of the dams during the site visit. Several freshly felled aspen trees were present along Leviathan Creek, upstream from the old mine road.

On April 11, 2013 Burleson measured water quality in Leviathan Creek and the beaver ponds. Water quality readings taken by Burleson are presented in Table 1.

Table 1. Leviathan Mine Surface Water Quality Measurements on April 11, 2013

Location	Time	pH	T (°C)	SC (µS/cm)
Leviathan Creek, Station 1	14:14	8.00	7.08	690
Leviathan Creek, Above CUD	12:59	7.90	8.86	726
CUD	12.54	4.85	8.61	2,792
Leviathan Creek, Below CUD	13:03	6.29	9.23	1,012
Leviathan Creek, Above Delta Seep	13:28	7.08	10.13	1,025
Delta Seep	13:21	5.67	8.42	2,178
Leviathan Creek, Below Delta Seep	13:35	6.58	10.05	1,116
Beaver Pond “Upper” Dam	11:30	6.04	6.38	1,153
Beaver Pond Main Dam	11:25	6.25	7.24	1,194
Beaver Pond “Lower” Dam	11:18	6.43	7.53	1,179
Tributary to “Lower” Pond at Dam	11:42	7.40	7.55	786
Leviathan Creek, Station 15	11:03	7.02	7.29	917
Aspen Creek, Station 16	10:54	7.55	7.48	914
Leviathan Creek, Station 17	10:50	7.55	7.41	967
Leviathan Creek, Station 23	10:22	7.38	6.06	1,055

Location	Time	pH	T (°C)	SC (µS/cm)
Mountaineer Creek, Station 24	10:26	8.29	5.84	273
Bryant Creek, Station 25	10:29	8.21	5.96	867

Notes:

°C	Degree Celsius	SC	Specific conductance
µS/cm	MicroSiemen per centimeter	T	Temperature
mV	MilliVolt		

Upcoming Events:

- Atlantic Richfield plans to start HDS operations on or before May 1.
- Burleson will coordinate additional oversight visits with EPA and USACE. Burleson currently plans to conduct water quality measurements about 2 to 3 weeks after capture of CUD and DS is achieved.

Leviathan Mine Superfund Site
May 22, 2013
Burleson Consulting, Inc. Oversight

Period of Oversight: 9:30 AM to 3:00 PM

Oversight Personnel: Greg Reller and Kevin Ghalambor of Burleson; Doug Delaney and John Erwin of USACE

Summary of Site Activities:

California Regional Water Quality Control Board, Lahontan Region (Regional Board):

- No activities observed.

Atlantic Richfield Company (Atlantic Richfield):

- AMEC, under contract to Atlantic Richfield was on site operating the High Density Sludge (HDS) system and conducting RI/FS activities.

Burleson Consulting, Inc. (Burleson)

- Burleson measured water quality along Leviathan Creek and associated creeks.
- Burleson observed site activities.

The weather conditions were sunny and cool with a gentle breeze. Monitor Pass was open and we eneterd the site through the California gate. The Leviathan Mine Road from Highway 89 to the site was dry, and the road to the east of the pit was passable.

Leviathan and Bryant Creek Flows: According to the USGS website (http://waterdata.usgs.gov/ca/nwis/current?type=flow), flow in Leviathan Creek at Station 15 has declined from about 1.3 cubic feet per second (cfs) in mid April to about 0.1 cfs on May 22. Flow at Station 15 appear to increase slightly during periods of discharge from the HDS plant at Pond 4. Also according to USGS, flows at Station 25 in Bryant Creek declined from about 3 cfs to about 1.2 cfs since mid April. These flows are among the lowest recorded for this time of year at each station during 14 years of monitoring. Flows vary through each day with higher flows in the late afternoon and lower flows in the early morning. This pattern appears to reflect diurnal temperature fluctuations.

Atlantic Richfield

Pond 4 Area: AMEC personnel, under contract to Atlantic Richfield, were on site operating the HDS plant for limited access season (LAS) operations. Flow at the CUD and Delta Seep was being captured and pumped into Pond 4. The HDS plant was operating, but discharge to Leviathan Creek did not occur during the site visit. Pond 4 stage was about one foot below the overflow inlet.

Aspen Seep Bioreactor: Roads to the Aspen Seep were dry and the ASBR was operating in recirculation mode during the site visit. Broadbent staff were performing maintenance at the ASBR. The water level in the final settling pond was very low, this is to provide for improvement of the pond outflow apparatus to prevent clogging by debris, and in preparation for transfer of solids from ASBR Pond 3 to Pond 4.

Remedial Investigation: Burleson encountered a groundwater sampling crew within the overburden area.

Regional Board

No Regional Board staff or contractors were encountered on site. Two roll-off bins were present at the Regional Board staging area near MW-1. Burleson inspected the Pit Clarifier and Pond 1 area. There was no visible water in the Pit Clarifier and the accumulated solids exhibited mud cracks characteristic of shrinkage due to drying. No flowing water was observed in the Pit surface water control system. The Pond Water Treatment System remained winterized. Plastic wrapping around one of the control panels was shredded, apparently by the wind. Pond 1, Pond 2N, and Pond 2S each appeared to have a couple of feet of freeboard. The bottom of Pond 3 was submerged, and the pond had a couple of feet of freeboard.

Burleson

On May 22, 2013 Burleson visited the site with USACE staff to familiarize the new project manager (Mr. Doug Delaney) with site features. We visited each of the ERA work areas, the Pit, the Leviathan Creek landslide, the beaver ponds, the Overburden Area, and left the site via the Nevada road to point out the Stateline area along Bryant Creek, the Double Spring area and approach to Doud Spring, and visited the Ruenstroth Dam site along the East Fork Carson River.

Water was trickling over each of the beaver dams during the site visit. Water in the Leviathan Creek channel at the confluence of Leviathan and Mountaineer creeks was transparent, and fingerling trout were present in Leviathan Creek upstream from Mountaineer Creek in the vicinity of the USGS bubbler.

On May 22, 2013 Burleson measured water quality in Leviathan Creek and the beaver ponds. Water quality readings taken by Burleson are presented in Table 1.

Table 1. Leviathan Mine Surface Water Quality Measurements on May 22, 2013

Location	Time	pH	T (°C)	SC (µS/cm)
Leviathan Creek, Station 1	10:23	7.32	6.19	7
Leviathan Creek, Above CUD	11:30	8.29	16.70	23
CUD	11:33	4.05	9.09	2,397
Leviathan Creek, Below CUD	11:39	8.01	17.94	70
Leviathan Creek, Above Delta Seep	11:52	7.21	12.21	118
Delta Seep	12:03	4.89	9.31	1,789
Leviathan Creek, Below Delta Seep	11:59	6.18	12.27	334
Beaver Pond “Upper” Dam	14:02	5.80	14.72	800
Beaver Pond Main Dam	13:57	5.99	14.54	712
Beaver Pond “Lower” Dam	13:53	5.99	15.81	729
Leviathan Creek, Station 15	13:43	6.67	17.21	749
Aspen Creek, Station 16	13:34	7.72	16.33	249
Leviathan Creek, Station 17	13:30	7.19	17.39	522
Leviathan Creek, Station 23	14:27	6.95	14.53	552
Mountaineer Creek, Station 24	14:32	7.62	12.36	89
Bryant Creek, Station 25	14:34	7.44	12.88	215

Notes:

°C	Degree Celsius	SC	Specific conductance
µS/cm	MicroSiemen per centimeter	T	Temperature

Upcoming Events:

- Atlantic Richfield plans to start re-plumbing the influent lines from Pond 4 to the HDS plant in the near future.
- Burleson will coordinate additional oversight visits with EPA and USACE. Burleson currently plans to conduct water quality measurements in early June.

Leviathan Mine Superfund Site
June 4, 2013
Burleson Consulting, Inc. Oversight

Period of Oversight: 9:30 AM to 16:00 PM

Oversight Personnel: Greg Reller and Patty Cubanski of Burleson

Summary of Site Activities:

California Regional Water Quality Control Board, Lahontan Region (Regional Board):

- No activities observed.

Atlantic Richfield Company (Atlantic Richfield):

- AMEC, under contract to Atlantic Richfield was on site operating the High Density Sludge (HDS) system, maintaining the Aspen Seep Bioreactor (ASBR) and conducting RI/FS activities.

Burleson Consulting, Inc. (Burleson)

- Burleson measured water quality along Leviathan Creek and associated creeks.
- Burleson observed site activities.

The weather conditions were sunny and warm with a gentle breeze. Monitor Pass was open and we entered the site through the California gate. The Leviathan Mine Road from Highway 89 to the site was dry, and the road to the east of the pit ('goat trail') was passable.

Leviathan and Bryant Creek Flows: According to the USGS website (http://waterdata.usgs.gov/ca/nwis/current?type=flow), flow in Leviathan Creek at Station 15 has declined from about 0.3 cubic feet per second (cfs) in mid May to about 0.15 cfs on June 4. Flow at Station 15 appears to increase slightly during periods of discharge from the HDS plant at Pond 4. Also according to USGS, flows at Station 25 in Bryant Creek declined from about 1.5 cfs to about 1 cfs since mid May. These flows are among the lowest recorded for this time of year at each station during 14 years of monitoring. Flows vary through each day with higher flows in the late afternoon and lower flows in the early morning. This pattern appears to reflect diurnal temperature fluctuations.

Atlantic Richfield

Pond 4 Area: AMEC personnel, under contract to Atlantic Richfield, were on site operating the HDS plant for Atlantic Richfield Work Season (ARWS) operations. Flow at the CUD and Delta Seep was being captured and pumped into Pond 4. The HDS plant was operating, but discharge to Leviathan Creek did not occur during the site visit. Pond 4 stage was about two feet below the overflow inlet. Modifications to the HDS influent pump system from Pond 4 were underway.

Aspen Seep Bioreactor: Roads to the Aspen Seep were dry and the ASBR was operating in recirculation mode during the site visit. Broadbent staff were performing maintenance at the ASBR. The water level in the final settling pond was very low to provide for improvement of the pond outflow apparatus to prevent clogging by debris, and in preparation for transfer of solids from ASBR Pond 3 to Pond 4.

Remedial Investigation: Burleson encountered a groundwater sampling crew at Pond 1.

Regional Board

No Regional Board staff or contractors were encountered on site. Two roll-off bins and a trailer were present at the Regional Board staging area near MW-1. Within the flow control structure, Burleson observed drops of water falling slowly from the Pit Underdrain, and a steady flow from the Adit drain. Burleson inspected the Pit Clarifier and Pond 1 area. There was no visible water in the Pit Clarifier and the accumulated solids exhibited mud cracks characteristic of shrinkage due to drying. No flowing water was observed in the Pit storm water control system. The Pond Water Treatment System remained winterized. Pond 1, Pond 2N, and Pond 2S each appeared to have a couple of feet of freeboard. Water in Pond 3 is evaporating, the pond bottom remains covered with water, and the pond had a couple of feet of freeboard.

Burleson

On June 4, 2013 Burleson visited the site each of the ERA work areas, the Pit, the Leviathan Creek landslide, the beaver ponds, and the Overburden Area, and left the site via the Nevada road.

Water was trickling over each of the beaver dams during the site visit. Burleson observed Caddis larvae in Leviathan Creek at Delta Seep. Caddis larvae at Station 15 appeared lethargic (did not move when nudged) and were coated with orange precipitate (see attached photo). Water in the Leviathan Creek channel at the confluence of Leviathan and Mountaineer creeks was transparent, and fingerling trout were present in Leviathan Creek upstream from Mountaineer Creek in the vicinity of the USGS bubbler.

On June 4, 2013 Burleson measured water quality in Leviathan Creek and the beaver ponds. Water quality readings taken by Burleson are presented in Table 1.

Table 1. Leviathan Mine Surface Water Quality Measurements on June 4, 2013

Location	Time	pH	T (°C)	SC (µS/cm)
Leviathan Creek, Station 1	10:50	7.3	9.22	52
Leviathan Creek, Above CUD	11:31	8.68	19.16	67
CUD	11:22	4.10	8.76	2,688
Leviathan Creek, Below CUD	11:37	8.21	22.53	79
Leviathan Creek, Above Delta Seep	12:00	7.12	16.14	361
Delta Seep	11:52	5.52	10.04	1,746
Leviathan Creek, Below Delta Seep	12:08	6.44	15.39	623
Beaver Pond “Upper” Dam	15:15	5.48	18.32	1,007
Beaver Pond Main Dam	15:08	6.33	18.94	846
Beaver Pond “Lower” Dam	15:04	6.46	20.21	824
Leviathan Creek, Station 15	14:56	6.69	21.52	836
Aspen Creek Upstream from Site	14:18	7.49	20.68	33
Aspen Seep	13:00	2.37	12.72	2,711
Aspen Seep Bioreactor Pond 3	13:05	8.30	24.27	2,112
Aspen Seep Bioreactor Oxidation Trench	13:11	7.95	23.48	2,204
Aspen Creek, Station 16	14:43	7.96	20.26	145
Leviathan Creek, Station 17	14:38	7.33	21.50	529

Location	Time	pH	T (°C)	SC (µS/cm)
Leviathan Creek, Station 23	15:47	7.62	18.03	538
Mountaineer Creek, Station 24	15:51	8.41	16.41	56
Bryant Creek, Station 25	15:55	8.32	16.78	197

Notes:

°C	Degree Celsius	SC	Specific conductance
µS/cm	MicroSiemen per centimeter	T	Temperature

Upcoming Events:

- Atlantic Richfield plans to complete re-plumbing the influent lines from Pond 4 to the HDS plant in the near future, and plans to begin replacing generator engines at the HDS plant later in June.
- Burleson will coordinate additional oversight visits with EPA and USACE. Burleson currently plans to conduct water quality measurements in early July.

Photo: Caddis larvae (arrows) in Leviathan Creek at Station 15

Leviathan Mine Superfund Site
July 18, 2013
Burleson Consulting, Inc. Oversight

Period of Oversight: 9:30 AM to 15:00 PM

Oversight Personnel: Jeremey Ashe of Burleson, Gary Riley of EPA

Summary of Site Activities:

California Regional Water Quality Control Board, Lahontan Region (Regional Board):

- The pond water treatment system was being operated by URS under contract to the Regional Board.
- Water from the Pit Clarifier was discharging through the weir box to Leviathan Creek.

Atlantic Richfield Company (Atlantic Richfield):

- AMEC, under contract to Atlantic Richfield was on site operating the High Density Sludge (HDS) system, and conducting RI/FS activities.
- The Aspen Seep Bioreactor (ASBR) was operating in recirculation mode.

Burleson Consulting, Inc. (Burleson)

- Burleson measured water quality along Leviathan Creek and associated creeks.
- Burleson observed site activities.

The weather conditions were sunny and warm. Monitor Pass was open and we entered the site through the California gate.

Leviathan and Bryant Creek Flows: According to the USGS website (http://waterdata.usgs.gov/ca/nwis/current?type=flow), flow in Leviathan Creek at Station 15 declined from about 0.1 cubic feet per second (cfs) on July 1 to about 0.01 cfs by July 13, and then increased to about 0.4 cfs on July 17. Since July 17, flow at Station 15 has fluctuated diurnally from about 0.2 to 0.4 cfs. Also according to USGS, maximum flows at Station 25 in Bryant Creek declined from about 0.9 cfs to about 0.8 cfs from July 1 through July12, with maximum flows increasing to about 1.1 cfs on July 18. Flows vary through each day with higher flows in the morning and lower flows in the afternoon. This pattern appears to reflect diurnal temperature fluctuations.

Atlantic Richfield

Pond 4 Area: AMEC personnel, under contract to Atlantic Richfield, were on site operating the HDS plant for Atlantic Richfield Work Season (ARWS) operations. Flow at the CUD and Delta Seep was being captured and pumped into Pond 4. The HDS plant was operating with discharge to Leviathan Creek during the site visit.

Aspen Seep Bioreactor: Roads to the Aspen Seep were dry and the ASBR was operating in recirculation mode during the site visit. The water level in the final settling pond was very low in preparation for transfer of solids from ASBR Pond 3 to Pond 4. Influent flow from Aspen Seep was at a very low rate.

Remedial Investigation: Burleson encountered a surface water sampling crew at Station 15.

Regional Board

Regional Board contractors were operating the PWTS to treat water accumulated in Pond1, Pond 2N, and Pond 2S. Burleson inspected the Pit Clarifier and observed water discharging through the weir box. No flowing water was observed in the Pit storm water control system.

Burleson

On July 18, 2013 Burleson visited the site each of the ERA work areas, the Pit, the Leviathan Creek landslide, the beaver ponds, and the Overburden Area, and left the site via the California road. A mature (estimated 12-inch long) trout was observed in Leviathan Creek at Station 1.

Water was overflowing each of the beaver dams during the site visit. Burleson observed tadpoles at the main beaver pond.

On July 18, 2013 Burleson measured water quality in Leviathan Creek and the beaver ponds. Water quality readings taken by Burleson are presented in Table 1.

Table 1. Leviathan Mine Surface Water Quality Measurements on June 4, 2013

Location	Time	pH	T (°C)	SC (µS/cm)
Leviathan Creek, Station 1	9:31	7.37	9.62	56
Pit Clarifier	10:00	8.00	18.95	2,882
PWTS Discharge Weir Box	10:15	7.50	18.81	2,618
Leviathan Creek, Above CUD	10:30	7.38	19.87	2,795
CUD	10:35	4.68	8.72	2,821
Leviathan Creek, Below CUD	10:40	6.90	20.37	2,378
Leviathan Creek, Above Delta Seep	11:00	6.49	18.59	2,657
Delta Seep	10:50	5.45	10.09	1,971
Leviathan Creek, Below Delta Seep	11:10	6.15	18.47	2,649
EPA Station Above Beaver Ponds	13:40	5.40	16.40	2,685
Beaver Pond No. 9	13:28	4.75	19.35	2,448
Beaver Pond “Upper” Dam		3.87	19.24	2,308
Beaver Pond Main Dam	13:10	6.12	20.33	1,499
Beaver Pond “Lower” Dam	13:03	6.30	22.02	1,347
Leviathan Creek, Station 15		6.85	20.94	1,313
Aspen Seep	11:40	3.13	15.00	2,102
Aspen Seep Bioreactor Pond 3	11:45	8.21	17.63	2,230
Aspen Creek, Station 16	12:40	8.20	17.27	218
Leviathan Creek, Station 17	12:30	7.35	19.85	1,062
Leviathan Creek, Station 23	14:30	7.55	18.52	793
Mountaineer Creek, Station 24	14:40	7.94	16.74	79
Bryant Creek, Station 25		7.99	17.65	418

Notes:

°C	Degree Celsius	SC	Specific conductance
µS/cm	MicroSiemen per centimeter	T	Temperature

Upcoming Events:

- Atlantic Richfield plans to resume intermittent HDS operations while maintaining CUD and DS capture for the remainder of the treatment season.
- Burleson will coordinate additional oversight visits with EPA and USACE. Burleson currently plans to conduct water quality measurements in August.

Leviathan Mine Superfund Site
August 28, 2013
Burleson Consulting, Inc. Oversight

Period of Oversight: 9:30 AM to 15:00 PM

Oversight Personnel: Greg Reller and Jeremey Ashe of Burleson

Summary of Site Activities:

California Regional Water Quality Control Board, Lahontan Region (Regional Board):

- Burleson did not encounter Regional Board staff. The pond water treatment system was winterized.

Atlantic Richfield Company (Atlantic Richfield):

- Burleson did not encounter Atlantic Richfield representatives at the Pond 4 work area. Site work was temporarily halted due to smoky conditions associated with the Rim Fire near Yosemite National Park.
- The High Density Sludge (HDS) plant was not discharging to Leviathan Creek.
- The Aspen Seep Bioreactor (ASBR) was operating in recirculation mode. Atlantic Richfield representatives were on site measuring particulates in air.

Burleson Consulting, Inc. (Burleson)

- Burleson measured water quality along Leviathan Creek and associated creeks.
- Burleson observed site activities.

The weather conditions were partly cloudy with occasional wind gusts. The air was slightly to very smoky due to the Rim Fire near Yosemite National Park. Monitor Pass was open and we entered the site through the California gate.

Leviathan and Bryant Creek Flows: According to the USGS website (http://waterdata.usgs.gov/ca/nwis/current?type=flow), flow in Leviathan Creek at Station 15 declined from about 0.05 cubic feet per second (cfs) on August 03 to about 0.01 cfs by August 17, and then increased to about 0.04 cfs by August 24. The flow at Station 15 does not appear to have fluctuated diurnally. Also according to USGS, maximum flows at Station 25 in Bryant Creek remained at or near .65 cfs from August 3 through August 28. There was an increase between August 21 and August 22 where maximum flows approached 0.8cfs. This correlates with a thunderstorm that reportedly interrupted site work on August 21.

Atlantic Richfield

Burleson encountered Mike Trynor and another person at the ASBR. Mike was measuring air quality to determine if and when site work could resume. Mike said air quality was below OSHA standards. Other site activities by Atlantic Richfield are suspended until air quality improves.

Burleson noticed that generators at the HDS plant and ASBR were running. The CUD and DS flows appeared to be captured and directed to Pond 4. The ASBR was operating in recirculation mode.

Water at the infiltration/Overflow Pond (I/OP) was translucent pale green and no longer a milky gray. Mike noted that this might be the result of adjusting the ASBR effluent to increase the iron in the water. Reportedly, oxidation and precipitation of the iron results in an improved appearance at the I/OP.

Regional Board

Burleson inspected the Pit Clarifier and observed no visible water. Additionally, no flowing water was observed in the Pit storm water control system. The PWTS was winterized, though tarps covering a couple of the electrical panels appeared to be very loose.

Burleson

On August 28, 2013 Burleson visited each of the ERA work areas, the Pit, the Leviathan Creek landslide, the beaver ponds, and the Overburden Area, and left the site via the Nevada Road. A mature (estimated 8-10-inch long) trout was observed in Leviathan Creek at Station 1. Several trout were also observed at Station 25 in Bryant Creek.

Water was not overflowing the beaver dams during the site visit. All beaver ponds monitored were full with the exception of the "upper" (orange) pond. The "upper" (orange) pond water level was about 4 feet lower than the dam crest. The main an dlower pond dam crests appeared to have been raised by as much as two feet this season. Burleson did not observe tadpoles at any of the beaver ponds during this visit.

On August 28, 2013 Burleson measured water quality in Leviathan Creek, Aspen Creek, and the beaver ponds. Water quality readings taken by Burleson are presented in Table 1.

Table 1. Leviathan Mine Surface Water Quality Measurements on August 28, 2013

Location	Time	pH	T (°C)	SC (µS/cm)
Leviathan Creek, Station 1	10:43	5.92	9.44	87
Pit Clarifier		No Water Visible		
Leviathan Creek, Above CUD	11:20	7.84	18.54	177
CUD	10:17	4.70	9.19	2,791
Leviathan Creek, Below CUD	10:22	7.95	16.39	172
Leviathan Creek, Above Delta Seep	11:34	6.57	11.37	1,888
Delta Seep	11:31	5.49	9.83	1,877
Below Delta Seep Drain Valve	11:36	6.27	12.91	1,746
Leviathan Creek, Below Delta Seep	11:41	6.78	11.61	1,889
"Upper" (Orange) Beaver Pond	13:28	4.29	19.93	2,259
Main Beaver Pond	13:25	5.58	18.07	2,209
"Lower" Beaver Pond	13:22	4.49	16.23	2,071
Leviathan Creek, Station 15	13:15	4.42	17.84	1,836
Aspen Seep	12.18	3.59	12.11	2,728
Oxidation Trench at IOP	12.25	7.87	20.18	2,198
Aspen Creek, Station 16	13:10	8.15	14.89	228
Station SW 19	14:23	7.69	15.82	132
Aspen Creek above IOP	14:36	6.90	15.77	157
Aspen Creek at IOP	14:42	6.97	15.23	219

Location	Time	pH	T (°C)	SC (µS/cm)
Spring at Aspen Creek Below IOP	14:50	6.01	10.53	340
Aspen Creek below IOP	14:55	7.77	15.07	216
Leviathan Creek, Station 17	13:05	7.77	15.36	410
Leviathan Creek, Station 23	13:49	7.47	15.10	508
Mountaineer Creek, Station 24	13:51	7.93	13.44	95
Bryant Creek, Station 25	13:54	7.90	13.64	143

Notes:

°C	Degree Celsius	SC	Specific conductance
µS/cm	MicroSiemen per centimeter	T	Temperature

Upcoming Events:

- Atlantic Richfield plans to resume work when air quality improves.
- Burleson will coordinate additional oversight visits with EPA and USACE. Burleson currently plans to conduct water quality measurements in September.

Leviathan Mine Superfund Site
October 9, 2013
Burleson Consulting, Inc. Early Response Action Oversight

Period of Oversight: 10:00 AM to 15:00 PM

Oversight Personnel: Greg Reller and Jeremey Ashe of Burleson

Summary of Site Activities:

California Regional Water Quality Control Board, Lahontan Region (Regional Board):

- Regional Board staff was on site conducting a pre-bid meeting. The meeting was to acquaint prospective bidders with site features as part of procuring a water treatment plant operator for future pond water treatment system operations.
- The pond water treatment system was winterized.

Atlantic Richfield Company (Atlantic Richfield):

- Burleson did not encounter Atlantic Richfield representatives.
- Site work was temporarily halted due to snow.
- CUD and Delta Seep capture systems appeared to be functioning.
- The High Density Sludge (HDS) plant was operating and discharging to Leviathan Creek.
- The Aspen Seep Bioreactor (ASBR) was operating in recirculation mode.

Burleson Consulting, Inc. (Burleson)

- Burleson measured water quality along Leviathan Creek and associated creeks.
- Burleson observed site activities.

The weather conditions were cloudy with light snow throughout the day. We entered the site through the California gate and exited through the Nevada gate.

Leviathan and Bryant Creek Flows: According to the USGS website (http://waterdata.usgs.gov/ca/nwis/current?type=flow), flow in Leviathan Creek at Station 15 since mid-September has been below 0.01 cubic feet per second (cfs). The flow in Leviathan Creek at Station 15 increased to about 0.04 cfs between October 04 and October 05. Flows from October 06 through October 09 have fluctuated between .01 and .02 cfs. Also according to USGS, flows at Station 25 in Bryant Creek increased slightly from about 0.7 to about .90 cfs since late September 25.

Atlantic Richfield

Burleson did not encounter any Atlantic Richfield employees during this visit. The site activities appeared to be suspended by Atlantic Richfield due to snow.

Burleson noticed that generators at the HDS plant were running. The CUD and DS flows appeared to be captured and directed to Pond 4. The HDS plant was discharging into Leviathan Creek. The ASBR was operating in recirculation mode.

Regional Board

Burleson inspected the Pit Clarifier and observed no visible water. Additionally, no flowing water was observed in the Pit storm water control system. The PWTS was winterized. Regional Board staff were

conducting a pre-bid meeting. Approximately 7 vehicles were parked at the Regional Board Office trailer near the California entrance to the site.

Burleson

On October 9, 2013 Burleson visited each of the ERA work areas, the Pit, the Leviathan Creek landslide, the beaver ponds, and the Overburden Area, and left the site via the Nevada Road. Several fingerling trout were observed at Station 23 in Leviathan Creek.

Water was not overflowing the beaver dams during the site visit. The beaver ponds were not full. The "upper" (orange) pond water level was about 2 feet lower than the dam crest. Burleson did not observe tadpoles at any of the beaver ponds during this visit.

On October 9, 2013 Burleson measured water quality in Leviathan Creek, Aspen Creek, and the beaver ponds. Water quality readings taken by Burleson are presented in Table 1.

Table 1. Leviathan Mine Surface Water Quality Measurements on October 9, 2013

Location	Time	pH	T (°C)	SC (µS/cm)
Leviathan Creek, Station 1	10:27	7.14	3.06	45
Pit Clarifier		No Water Visible		
Leviathan Creek, Above CUD	10:43	7.60	6.58	1,627
CUD	10:47	4.70	8.73	2,177
Leviathan Creek, Below CUD	10:56	7.55	6.29	1,581
Leviathan Creek, Above Delta Seep	11:20	6.87	5.75	1,550
Delta Seep	11:06	5.56	8.39	1,496
Leviathan Creek, Below Delta Seep	11:13	6.33	5.97	1,550
"Upper" (Orange) Beaver Pond	13:09	4.08	6.78	1,735
Main Beaver Pond	13:07	5.23	7.81	1,699
"Lower" Beaver Pond	13:01	3.75	8.32	1,683
Leviathan Creek, Station 15	12:55	4.31	5.24	1,475
Aspen Seep	11:49	2.76	8.36	2,044
Aspen Biorecator Settling Pond	11:58	8.31	6.59	1,923
Aspen Creek, Station 16	12:49	8.34	4.29	127
Leviathan Creek, Station 17	12:45	8.11	4.46	279
Leviathan Creek, Station 23	13:32	6.64	4.52	296
Mountaineer Creek, Station 24	13:35	7.20	4.63	52
Bryant Creek, Station 25	13:39	7.20	4.64	93

Notes:

°C	Degree Celsius	SC	Specific conductance
µS/cm	MicroSiemen per centimeter	T	Temperature

Upcoming Events:

- EPA and Regional Board plan to hold the annual end of year inspection.
- Atlantic Richfield plans to resume work when weather conditions improve.
- Atlantic Richfield will prepare to winterize the ASBR and HDS treatment areas in early November.
- Burleson will coordinate additional oversight visits with EPA and USACE. Burleson currently plans to conduct water quality measurements in November after the CUD and DS are returned to Leviathan Creek and the HDS plant is winterized.

Leviathan Mine Superfund Site
November 6, 2013
Burleson Consulting, Inc.

Period of Oversight: 10:00 AM to 15:30 PM

Oversight Personnel: Greg Reller and Jeremey Ashe of Burleson

Summary of Site Activities:

US Environmental Protection Agency (EPA):

- EPA staff was on site observing post-treatment season site conditions.

California Regional Water Quality Control Board, Lahontan Region (Regional Board):

- Regional Board staff was not on site.
- The pond water treatment system was winterized.

Atlantic Richfield Company (Atlantic Richfield):

- CUD and DS capture systems were off-line and winterized; and the CUD and DS were discharging directly into Leviathan Creek.
- The High Density Sludge (HDS) plant was being cleaned out as part of winterization.
- The Aspen Seep Bioreactor (ASBR) was operating in recirculation mode.
- AMEC crews were seen at the DS and beaver ponds conducting surface water sampling.
- AMEC personnel were overseeing demobilization of the drill rig at the Aspen Gate.

Burleson Consulting, Inc. (Burleson)

- Burleson measured water quality along Leviathan Creek and associated creeks.
- Gray precipitate was forming near the CUD discharge location.

The weather conditions were clear and patchy snow was present on north facing slopes from previous snow events. We entered and exited the site through the California gate.

Leviathan and Bryant Creek Flows: According to the USGS website (http://waterdata.usgs.gov/ca/nwis/current?type=flow), flow in Leviathan Creek at Station 15 since mid-October has averaged 0.23 cubic feet per second (cfs). The flow in Leviathan Creek at Station 15 increased to about 0.85 cfs between October 31 and November 01. This peak coincided with final treatment operations associated with maximizing the storage capacity of Pond 4 reported by Atlantic Richfield. After peak flow on November 01, flows dropped and have fluctuated between 0.08 cfs and 0.15 cfs. Also according to USGS, flows at Station 25 in Bryant Creek have been about 1.0 cfs since late October. During November flows have ranged from about 0.6 cfs to about 1.6 cfs.

Atlantic Richfield

AMEC personnel (under contract to Atlantic Richfield) were winterizing the HDS plant, collecting surface water samples along Leviathan Creek, and supervising demobilization of the drilling rig at the Aspen Gate.

The CUD and DS were discharging to Leviathan Creek. There was a gray precipitate (bacterial mat?) forming on the stream bed downstream from the CUD discharge.

The ASBR was operating in recirculation mode. The pH of water within the ASBR Settling Pond No. 3 was 9.10.

Regional Board

Burleson inspected the Pit Clarifier and weir box and observed no visible water. No flowing water was observed in the Pit storm water control system. The PWTS was winterized. Regional Board staff was not on site.

Burleson

On November 6, 2013 Burleson visited each of the ERA work areas, the Pit, the Leviathan Creek landslide, the beaver ponds, and the Overburden Area, and left the site via the California Road. Several fingerling trout were observed at Station 23 in Leviathan Creek and Station 25 in Bryant Creek. No aquatic insects were observed during our visit. Ice was present at many of the water quality measuring stations.

Water was not overflowing the beaver dams during the site visit. The beaver ponds were full. All beaver pond water surface elevations were at the dam crest. Burleson did not observe tadpoles at any of the beaver ponds during this visit.

Burleson met with EPA representatives Lilly Tavassoli, Gary Riley, and Dana Barton at the site. Burleson discussed site features, history, and current issues relating to the beaver ponds with EPA.

On November 6, 2013 Burleson measured water quality in Leviathan Creek, Aspen Creek, and the beaver ponds. Water quality readings taken by Burleson are presented in Table 1.

Table 1. Leviathan Mine Surface Water Quality Measurements on November 6, 2013

Location	Time	pH	T (°C)	SC (µS/cm)
Leviathan Creek, Station 1	10:54	7.68	0.35	0
Leviathan Creek, Above CUD	11:19	8.00	0.34	0
CUD	11:21	4.85	8.94	2,059
Leviathan Creek, Below CUD	11:25	5.89	2.29	426
Leviathan Creek, Above Delta Seep	11:40	6.41	2.34	542
Delta Seep	11:35	5.72	7.71	1,275
Leviathan Creek, Below Delta Seep	11:44	5.97	3.91	800
“Upper” (Orange) Beaver Pond	14:10	5.76	5.92	1,430
Main Beaver Pond	14:15	5.84	5.24	1,485
“Lower” Beaver Pond	14:20	5.17	4.67	1,326
Leviathan Creek, Station 15	14:06	4.08	6.61	1,417
Aspen Seep	13:25	3.70	5.60	1,803
Aspen Biorecator Settling	13:32	9.10	4.19	1,756

Location	Time	pH	T (°C)	SC (µS/cm)
Pond				
Aspen Creek, Station 16	14:00	8.21	1.63	64
Leviathan Creek, Station 17	13:56	7.98	2.38	444
Leviathan Creek, Station 23	15:17	8.12	0.58	563
Mountaineer Creek, Station 24	15:20	8:45	2.38	30
Bryant Creek, Station 25	15:22	8.30	1.98	173

Notes:

°C	Degree Celsius	SC	Specific conductance
µS/cm	MicroSiemen per centimeter	T	Temperature

Upcoming Events:

- Atlantic Richfield plans to complete winterization activities and demobilize from the site by November 15.
- Burleson will coordinate additional oversight visits with EPA and USACE. Burleson currently plans to conduct water quality measurements in April 2014 before limited access season treatment begins.

APPENDIX B: OVERSIGHT PHOTOGRAPHS **10 PAGES**

REVIEW DOCUMENT

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-1	Pond early in the ARWS. View to north. May 22, 2013	
B-2	Pond 4 with overflow inlet and road to Pond 1 in background. Insulated CUD and Delta Seep influent pipes in foreground. View to Southeast. April 11, 2013	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-3	Pond 4 after treatment activity was completed for 2013. View to north. November 06, 2013	
B-4	Aspen Seep collection area. View to southeast. August 08, 2013	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-5	Aspen Seep Bioreactor Pond 4 with low water level to provide capacity for solids transfer from Pond 3. View to west. August 28, 2013	
B-6	Aspen Seep Bioreactor Infiltration/Overflow Pond. View to Northwest. August 28, 2013	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-7	Aspen Seep Bioreactor effluent flow to Pond 3. Note black color of effluent. View to South. August 28, 2013	
B-8	Aspen Seep Bioreactor ponds 3 and 4. View to West. August 28, 2013	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-9	Early season view of Pond Water Treatment System at Pond 1. View to northeast. April 11, 2013	
B-10	Pit Clarifier and piccolo drain during PWTS operations. View to Northwest. July 18, 2013	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-11	Pit Clarifier and piccolo drain after PWTS operations were completed. View to Northwest.. August 28, 2013	
B-12	Winterized Pond Water Treatment System at Pond 1. View to North. November 11, 2013	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-13	Station 1 Leviathan Creek. Staff gauge directly across from employee, storm water sampler inlet to left of water quality probe. View to West. May 22, 2013	
B-14	Bottom of concrete channel along Leviathan Creek at Channel Underdrain (CUD). Workers repairing CUD weir cover. View to South. July 18, 2013	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-15	Delta Seep collection system at Leviathan Creek. View to Southeast. June 04, 2013	
B-16	Aspen Seep collector with water probe. White pipe delivers water to weir (not pictured). View Down. July 18, 2013	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-17	Beaver Ponds at toe of Leviathan Creek Landslide (left side of photo). View to Southwest. Haze is due to smoke from wildfires near Yosemite. August 28, 2013	
B-18	'Main Beaver Pond' with upstream toe of Leviathan Creek Landslide on far end of dam. View to East. May 22, 2014	

Appendix B
Leviathan 2013 Oversight Summary Report
Oversight Photographs

Photo Number	Photo Description	Photo
B-19	Green pond water with orange rim characteristic of beaver ponds during periods when water flows over the dam. Compare with similar view during dry conditions in photo B-20. View to Southwest May 22, 2013	
B-20	Orange sediment exposed in beaver pond upstream from 'causeway' dam (referred to as big orange pond by site personnel) during low flow conditions. View to Southwest. August 28, 2013	

APPENDIX C: FIELD INSTRUMENT MEASUREMENT RECORDS **14 PAGES**

REVIEW DOCUMENT

LEVIATHAN MINE
WATER QUALITY MONITORING

Date: 11 APRIL 13 **Weather Conditions:** OVERCAST - DRIZZLE **Personnel:** GJA, LT, GR

Location	Time	pH	Temperature (C)	Specific Cond. (µS/cm)	Eh (mV)	Comments
~~Leviathan Creek, Station 1~~	~~10:22~~	~~7.38~~	~~6.06~~	~~1,055~~	~~-331.7~~	~~Light~~
~~Pit Clarifier~~ STA 1	14:14	8.00	7.08	690	-312.0	
PWTS Discharge Weir Box						
Leviathan Creek upstream from the CUD	1259	7.90	8.86	726	-317.2	
CUD	12:54	4.85	8.61	2,792	-356.1	
Leviathan Creek downstream from the CUD	13:03	6.29	9.23	1,012	-317.0	
Leviathan Creek upstream from Delta Seep	1328	7.08	10.13	1,025	-308.9	
Delta Seep (collection tank)	13:21	5.67	8.42	2,178	-322.7	
Leviathan Creek downstream from Delta Seep		6.58	10.05	1,116	-310.7	
Aspen Seep (influent weir box)						
Aspen Bioreactor Settling Pond						
Leviathan Creek, Station 15	11:03	7.02	7.29	917	-322.1	
Aspen Creek, Station 16	10:54	8.20	7.48	914	-333.7	
Leviathan Creek, Station 17	10:50	7.55	7.41	67	-325.0	ORANGE MATERIAL IN POOL
Leviathan Creek, Station 23	10:22	7.38	6.06	1,055	-331.7	
Mountaineer Creek, Station 24	10:26	8.29	5.84	273	-337.8	
Bryant Creek, Station 25	10:29	8.21	5.96	867	-334.0	
Aspen Creek above site						
LOWER DAM	11:18	6.43	7.53	1,179	-319.7	AT INT. TRIB TO LEV. CK.
MAIN DAM	11:25	6.25	7.24	1,194	-321.6	
'UPPER' DAM	11:30	6.04	6.38	1153	-315.3	
LEV. TRIB	11:47	7.40	7.55	786	-376.7	

FIELD INSTRUMENT CALIBRATION RECORD

Leviathan Mine

Calibration Code:		Sheet 1 of 1
Employee Performing Calibration: Greg Reller		Date: 11 APRIL 13
Instruments:	**Standards:**	**Lot Number and Expiration Date:**
Hanna 9828 meter with pH-ORP probe	pH = 7.00	
	pH = 4.00	
	pH = 10.00	
	pH = 6.89	3439 / 7-2016
	_____µS/cm	
	_____µS/cm	
	_____mV	

Instrument Calibration Data

Trial No.	Time	Parameter	Response As Found	Response As Left	Solution Temp. (C)	Zero	Battery Check	Alarm Point	Notes
1	10:18	pH 6.89	6.97	6.88					
1	10:18	SC 5,000	4786	4988	16.07				
	1426	pH 6.89	6.89	4,844					

Review

On-Site Health and Safety Officer _____ Date _____

Site Manager/Project Manager _____ Date _____

Action

FIELD INSTRUMENT CALIBRATION RECORD

Leviathan Mine

Calibration Code:		Sheet 1 of 1
Employee Performing Calibration: GSR/KG		Date: 22 May 13
Instruments:	**Standards:**	**Lot Number and Expiration Date:**
Hanna 9828 meter with pH-ORP probe	pH = 7.00	
	pH = 4.00	
	pH = 10.00	
	pH = 6.89	3439 7/2016
	5,000 µS/cm	"
	_____ µS/cm	
	_____ mV	

Instrument Calibration Data

Trial No.	Time	Parameter	Response As Found	Response As Left	Solution Temp. (C)	Zero	Battery Check	Alarm Point	Notes
1	10:06	pH	7.35	6.86	14				
		SC	5275	5002	14				
2	1440	pH	6.50		21.74				
		SC	4853						

Review

On-Site Health and Safety Officer _____ Date _____

Site Manager/Project Manager _____ Date _____

Action

LEVIATHAN MINE
WATER QUALITY MONITORING

Date: 22 MAY 13 **Weather Conditions:** CLEAR, BREEZY, COOL **Personnel:** GJR, KG (w/USACE)

Location	Time	pH	Temperature (C)	Specific Cond. (µS/cm)	Eh (mV)	Comments
Leviathan Creek, Station 1	10:23	7.32	6.19	7	-368.2	EH MISSING
Pit Clarifier						NOT SAMPLED DUE TO NO FLOWS/WATER
PWTS Discharge Weir Box						
Leviathan Creek upstream from the CUD	11:30	8.29	16.70	23	-348.9	
CUD	11:33	4.05	9.09	2397	-421.8	
Leviathan Creek downstream from the CUD	11:39	8.01	17.94	70	-369.0	
Leviathan Creek upstream from Delta Seep	11:52	7.21	12.21	118	-370.5	
Delta Seep (collection tank)	12:03	4.89	9.31	1789	-385.7	
Leviathan Creek downstream from Delta Seep	11:59	6.18	12.27	334	-369.3	
Aspen Seep (influent weir box)	12:46	2.14	10.53	2527	-335.0	
Aspen Bioreactor Settling Pond	12:53	7.74	15.79	2281	-556.7	
Leviathan Creek, Station 15	13:43	6.67	17.21	749	-398.2	
Aspen Creek, Station 16	13:34	7.72	16.33	249	-403.5	
Leviathan Creek, Station 17	13:30	7.19	17.39	522	-406.8	
Leviathan Creek, Station 23	14:27	6.95	14.53	552	-410.2	
Mountaineer Creek, Station 24	14:32	7.62	12.36	89	-408.9	
Bryant Creek, Station 25	14:34	7.44	12.88	215	-413.5	
Aspen Creek above site						NOT VISITED
Lower Beaver Pond Dam	13:53	5.99	15.81	729	-418.8	
Main Beaver Pond Dam	13:57	5.99	14.54	~~712~~ 712	-421.4	
Upper Beaver Pond Dam	14:02	5.80	14.72	800	-419.9	

LEVIATHAN MINE
WATER QUALITY MONITORING

Date: 4 JUN 2012 **Weather Conditions:** CLEAR/warm **Personnel:** GSR/PJC

Location	Time	pH	Temperature (C)	Specific Cond. (µS/cm)	Eh (mV)	Comments
Leviathan Creek, Station 1	10:50	7.30	9.22	52	-278.8	
Pit Clarifier	NO FLOW/DRY					
PWTS Discharge Weir Box	NO water/DRY					
Leviathan Creek upstream from the CUD	11:31	8.68	19.16	67	-270.5	
CUD	1122	4.10	8.76	2,658	-277.1	pH jumping from 4.08 to 4.64
Leviathan Creek downstream from the CUD	11:37	8.21	22.53	79	-254.3	
Leviathan Creek upstream from Delta Seep	12:00	7.1-7.15	16.04	361	-265.0	
Delta Seep (collection tank)	11:52	5.52	10.04	1,746	-237.	pH - fluctuating ±1
Leviathan Creek downstream from Delta Seep	12:08	6.44	15.39	623	-244.2	
Aspen Seep (influent weir box)	13:00	2.37	12.72	2,711	+257.1	
Aspen Bioreactor Settling Pond 3	13:05	8.30	24.27	2,112	-591.1	
Leviathan Creek, Station 15	1456	6.69	21.52	836	-295.3	
Aspen Creek, Station 16	1443	7.96	20.26	145	-307.5	
Leviathan Creek, Station 17	14:38	7.33	21.50	528 510	-292.2	
Leviathan Creek, Station 23	15:47	7.62	18.03	538	-282.7	pH 7.48 AND 7.62 - SWITCHING
Mountaineer Creek, Station 24	1551	8.41	16.41	56	-281.1	
Bryant Creek, Station 25	1555	8.32	16.78	197	-278.8	
Aspen Creek above site	1418	7.49	20.68	28 31 32	-306.2	
Lower Beaver Pond	1504	6.46	20.21	824	-305.8	
Main Beaver Pond	1508	6.33	18.94	846	-312.6	
Upper Beaver Pond	1515	5.82	18.32	1007	-299.7	
Spring at Aspen Creek below IOP	NOT	VISITED				NOT VISITED
Aspen Creek below IOP						
Aspen Creek at IOP						
Aspen Creek above IOP						
Oxidation Trench	13:11	7.95	23.48	2204	-300.8	

FIELD INSTRUMENT CALIBRATION RECORD

Leviathan Mine

Calibration Code:		Sheet 1 of
Employee Performing Calibration:		Date: 3 JUNE / 4 JUNE
Instruments:	**Standards:**	**Lot Number and Expiration Date:**
Hanna 9828 meter with pH-ORP probe	pH = 7.00	
	pH = 4.00	
	pH = 10.00	
	pH = 6.86	5214 11/2017
	5,000 µS/cm	11
	_____ µS/cm	
	_____ mV	

Instrument Calibration Data

Trial No.	Time	Parameter	Response As Found	Response As Left	Solution Temp. (C)	Zero	Battery Check	Alarm Point	Notes
	1330	pH	6.41	6.86	24.31				3 JUNE
		SC	6,346	5029	24.32				
	10:15	pH	7.00	6.86	23.07				4 JUNE
		SC	3654	5,020	"				
	16:08	pH	6.89		24.26				4 JUNE
	16:08	SC	5375		24.26				

Review

On-Site Health and Safety Officer _____ Date _____

Site Manager/Project Manager _____ Date _____

Action

LEVIATHAN MINE
WATER QUALITY MONITORING

Date: 7-18-13 **Weather Conditions:** Sunny Clear Sky **Personnel:** Jeremy AGL

Location	Time	pH	Temperature (C)	Specific Cond. (µS/cm)	Eh (mV) ORP	Comments
Leviathan Creek, Station 1	9:31	7.37	9.62	56	-255.0	Low Flow from L. Creek, Saw Trout in Creek
Pit Clarifier	1000	8.00	18.45	3382	-255.0	Flow going into Pit Clarifier
PWTS Discharge Weir Box	1015	7.50	18.81	2618	-235.6	Flow Box Full
Leviathan Creek upstream from the CUD	1030	7.38	19.87	2795	-220.8	Crew working on CUD
CUD	1035	4.68	8.72	2821	-302.4	" "
Leviathan Creek downstream from the CUD	1040	6.90	20.37	2378	-215.4	" "
Leviathan Creek upstream from Delta Seep	1050	5.45	10.01	1971	-283.1	★ I took the tank First AGL
Delta Seep (collection tank)	1100	6.44	18.59	2657	-219.9	pH = 5.45 upstream pH = 6.44
Leviathan Creek downstream from Delta Seep	1110	6.18	18.47	2649	-224.6	Looks very Red Iron??
Aspen Seep (influent weir box)	1140	3.13	15.00	2102	274.4	Little to No water
Aspen Bioreactor Settling Pond	1145	8.21	17.63	2230	-587.9	Very Black water
Leviathan Creek, Station 15	1230	7.85	19.95	1062	-240.3	
Aspen Creek, Station 16	1240	8.20	17.27	218	-262.0	
Leviathan Creek, Station 17	1330	7.35	19.95	1062	-240.3	Cloudy water (High discharges?)
Leviathan Creek, Station 23	1330	7.55	18.52	793	-269.5	
Mountaineer Creek, Station 24	1340	7.44	16.74	79	-271.5	
Bryant Creek, Station 25		7.11	17.65	418	-268.3	Saw trout in Creek?
~~Aspen Creek above site~~						
Lower Beaver Pond	1303	6.30	22.02	1347	-228.4	
Main Beaver Pond	1310	6.12	20.33	1449	-251.9	Saw tadpole in Pond Leopard Frog? Not Free
Upper Beaver Pond		3.87	19.24	2308	-194.4	Yellow orange Water
Station 15		6.85	20.94	1313	-226.9	High Flow 4.40-4.41 Stopped going
★ BVR Dam #9 upstream	1328	4.75	19.35	2448	-232.5	Took Sample up
EPA Station Above BVR Ponds	1340	5.40	16.48	2695	-256.6	New Dam Above

FIELD INSTRUMENT CALIBRATION RECORD

Leviathan Mine

Calibration Code:	Sheet 1 of 1
Employee Performing Calibration: Jeremey Agle	Date: 7/18/13

Instruments:	Standards:	Lot Number and Expiration Date:
(1) pH meter	pH = 7.00	
(2) pH meter	pH = 4.00	
(3) pH meter	pH = 10.00	
(4) pH meter	pH = 6.86 (Blue)	5214 Exp 11/2017
(5) Specific conductance meter	5,000 µS/cm (Blue)	5214 Ex 11/2017
(6) Specific conductance meter	_____µS/cm	
(7)		
(8)		
(9)		
(10)		
(11)		

Instrument Calibration Data

Time	Standard Solution	Response As Found	Response As Left	Solution Temp. (C)	Zero	Battery Check	Alarm Point	Notes
0911	PH 6.86	6.86	6.86	22.44				Left 5515
0911	SC 5,000	4955	4955	22.44				" "
2 30 pm	PH 6.86	6.85						
2 30 pm	SC 5000	5677						

Review

On-Site Health and Safety Officer _____ Date _____

Site Manager/Project Manager _____ Date _____

Action

07/09/13 01:55 PM

LEVIATHAN MINE
WATER QUALITY MONITORING

Date: 28 AUG 13 **Weather Conditions:** PARTY CLOUDY/SMOKE HAZE **Personnel:** GSR/JBA

Location	Time	pH	Temperature (C)	Specific Cond. (µS/cm)	Eh (mV)	Comments
Leviathan Creek, Station 1	10:43	5.92	9.44	87	-216.2	
Pit Clarifier						NO WATER INSIDE
BLD DS DRAIN VALVE ~~PWTS Discharge Weir Box~~ JBA	11:36	6.27	12.91	1,746	-287.4	WATER FROM DS OUTLET VALVE
Leviathan Creek upstream from the CUD	11:20	7.84	18.54 JBA	177	-190.9 JBA	
CUD	11:17	4.70	~~27.97~~ 19.19	2,791	~~4.77~~ 2.6	
Leviathan Creek downstream from the CUD	11:22	7.95	16.39	172	-191.8	
Leviathan Creek upstream from Delta Seep	11:34	6.57	11.37	1,888	-282.5	
Delta Seep (collection tank)	11:31	5.49	9.83	1,877	-209.1	
Leviathan Creek downstream from Delta Seep	11:41	6.78	11.61	1,889	-223.7	
Aspen Seep (influent weir box)	12:18	3.59	12.11	2,728	356.0	
OX TRENCH @ TOP ~~Aspen Bioreactor Settling Pond~~	12:25	7.87	20.18	2,198	-127.8	AT BOTTOM OF OX. TRENCH
Leviathan Creek, Station 15	1315	4.42	17.84	1836	-74.0	
Aspen Creek, Station 16	1310	8.15	14.89	228	-208.0	
Leviathan Creek, Station 17	13:05	7.77	15.36	410	-198.7	FAY IN POOL
Leviathan Creek, Station 23	1349	7.47	15.10	508	-193.3	
Mountaineer Creek, Station 24	1351	7.93	13.44	95	-203.9	
Bryant Creek, Station 25	1354	7.90	13.64	143	-208.7	
Aspen ~~Creek above site~~ SPRING	14:23	7.69	16.82	132	-212.6	SPRING FROM ASPEN CREEK @ RD (SW-19)
Lower Beaver Pond	13:22	4.49	16.23	2,071	-117.5	
Main Beaver Pond	1312	5.58	18.07	2,209	-153.7	
Upper Beaver Pond	1328	4.29	19.93	2,259	71.3	
Spring at Aspen Creek below IOP	1450	6.01	10.52	340	-251.5	
Aspen Creek below IOP	14:55	7.77	15.07	216	-227.7	
Aspen Creek at IOP	14:42	6.97	15.23	219	-223.7	
Aspen Creek above IOP	14:36	6.90	15.77	157	-245.9	

FIELD INSTRUMENT CALIBRATION RECORD

Leviathan Mine

Calibration Code:		Sheet 1 of
Employee Performing Calibration:		Date: 28 AUG 12
Instruments:	**Standards:**	**Lot Number and Expiration Date:**
(1) pH meter HI 9828	pH = 7.00	UNREADABLE 19/27/13
(2) pH meter "	pH = 4.00	" /10/16/13
(3) pH meter "	pH = 10.00	" /10/16/13
(4) pH meter	pH = 6.86 (Blue)	
(5) Specific conductance meter	5,000 µS/cm (Blue)	
(6) Specific conductance meter	_____µS/cm	
(7)		
(8)		
(9)		
(10)		
(11)		

Instrument Calibration Data

Time	Standard Solution	Response As Found	Response As Left	Solution Temp. (C)	Zero	Battery Check	Alarm Point	Notes
10:27	7.00	6	6.97					
	4.00		4.00					
	10.00		9.32					
10:33 pH	6.86	6.11	6.867	20.63				
SC	5000	5197	5,006	21.03				
15:10 pH	6.86	7.47		24.69				
SC	5,000	4,909						

Review

Site Manager/Project Manager _____ Date _____

Action

LEVIATHAN MINE
WATER QUALITY MONITORING

Date: 90C7/3 **Weather Conditions:** SNOWING, COLD **Personnel:** GJL + J.A.

Location	Time	pH	Temperature (C)	Specific Cond. (µS/cm)	Eh (mV)	Comments
Leviathan Creek, Station 1	1027	7.14	3.06	45	-262.6	
Pit Clarifier						
PWTS Discharge Weir Box						
Leviathan Creek upstream from the CUD	1043	7.60	6.58	1,627	-239	
CUD		4.70	8.73	2,177	-141.0	
Leviathan Creek downstream from the CUD	10:56	7.55	6.29	1,581	-217.3	
Leviathan Creek upstream from Delta Seep	1120	6.87	5.75	1,550	-206.6	
Delta Seep (collection tank)	11:06	5.56	8.39	1,496	-180.0	
Leviathan Creek downstream from Delta Seep	11:13	6.33	5.97	1,550	-198.9	
Aspen Seep (influent weir box)	1149	2.76	8.36	2,044	11.8	
Aspen Bioreactor Settling Pond	1158	8.31	6.59	1,923	-454.4	
Leviathan Creek, Station 15	1255	4.31	5.24	1,475	-174.5	
Aspen Creek, Station 16	1249	8.34	4.29	127	-216.0	
Leviathan Creek, Station 17	1245	8.11	4.46	279	-214.1	
Leviathan Creek, Station 23	1332	6.64	4.52	286	-165.9	
Mountaineer Creek, Station 24	1335	7.20	4.63	52	-170	
Bryant Creek, Station 25	1339	7.20	4.64	93	-152	
Aspen Creek above site						
Lower Beaver Pond	1301	3.75	8.32	1,683	-135.9	
Main Beaver Pond	1307	5.23	7.81	1,629	-152.5	
Upper Beaver Pond	1309	4.08	6.78	1,735	-134.7	
Spring at Aspen Creek below IOP						
Aspen Creek below IOP						
Aspen Creek at IOP						
Aspen Creek above IOP						

FIELD INSTRUMENT CALIBRATION RECORD

Leviathan Mine

Calibration Code: MI 9828-D	Sheet 1 of 1
Employee Performing Calibration: Serena Ashe	Date: 10-9-13

Instruments:	Standards:	Lot Number and Expiration Date:
(1) pH meter	pH = 7.00	
(2) pH meter	pH = 4.00	
(3) pH meter	pH = 10.00	
(4) pH meter	pH = 6.86 (Blue)	5214 exp 11/2017
(5) Specific conductance meter	5,000 µS/cm (Blue)	5214 Exp 11/2017
(6) Specific conductance meter	_____µS/cm	
(7)		
(8)		
(9)		
(10)		
(11)		

Instrument Calibration Data

Time	Standard Solution	Response As Found	Response As Left	Solution Temp. (C)	Zero	Battery Check	Alarm Point	Notes
0955	ph 6.86	6.87	6.89					
0955	5,000 µS/cm	5781	5019					
1341	6.86	6.90		10.76				
1342	5,000	4063↑		10.46				

Review

Site Manager/Project Manager _____ Date _____

Action

LEVIATHAN MINE
WATER QUALITY MONITORING

Date: 6 NOV 13 **Weather Conditions:** PART CLOUDY, WARM **Personnel:** GJR/JBA

Location	Time	pH	Temperature (C)	Specific Cond. (µS/cm)	Eh (mV)	Comments
Leviathan Creek, Station 1	10:54	7.68	0.35	0	-196.3	BROKE ICE TO TAKE MEASUREMENT
Pit Clarifier						NO WATER PRESENT
PWTS Discharge Weir Box						NO WATER PRESENT
Leviathan Creek upstream from the CUD	11:19	8.00	0.34	0	-198.3	SC PROBE MALFUNCTION?
CUD	11:21	4.85	8.94	2,059	-116.9	
Leviathan Creek downstream from the CUD	11:25	5.89	2.29	462	-139.9	
Leviathan Creek upstream from Delta Seep	11:40	6.41	2.34	542	-152.9	
Delta Seep (collection tank)	11:35	5.72	7.71	1,275	-143.2	SCALE ± 1/3 OF COLLECTION INFLOW PIPE
Leviathan Creek downstream from Delta Seep	11:44	5.97	3.91	800	-147.8	
Aspen Seep (influent weir box)	13:25	3.70	5.60	1,803	102.8	
Aspen Bioreactor Settling Pond	13:32	9.10	4.19	1,756	-292.5	PUMP 3
Leviathan Creek, Station 15	1406	4.08	6.61	1,417	-129.9	
Aspen Creek, Station 16	1400	8.21	1.63	64	-219.9	
Leviathan Creek, Station 17	1356	7.98	2.38	444	-211.2	ICE ON MICCOUS
Leviathan Creek, Station 23	1517	8.12	0.58	563	-205.6	ICE ON WATER
Mountaineer Creek, Station 24	1520	8.45	2.38	30	-216.4	
Bryant Creek, Station 25	1522	8.30	1.98	173	-213.0	
Aspen Creek above site						
Lower Beaver Pond	1410	5.76	5.92	1430	-171.0	NO BUGS
Main Beaver Pond	1415	5.84	5.24	1485	-171.1	NO BUGS
Upper Beaver Pond	1420	5.17	4.67	1326	-162.6	NO BUGS
Spring at Aspen Creek below IOP						NOT VISITED
Aspen Creek below IOP						
Aspen Creek at IOP						
Aspen Creek above IOP						

FIELD INSTRUMENT CALIBRATION RECORD

Leviathan Mine

Calibration Code: HI 9828-25		Sheet 1 of 1
Employee Performing Calibration: [illegible]		Date: 11/4/13
Instruments:	**Standards:**	**Lot Number and Expiration Date:**
(1) pH meter	pH = 7.00	
(2) pH meter	pH = 4.00	
(3) pH meter	pH = 10.00	
(4) pH meter	pH = 6.86 (Blue)	5214 ex 11/2017
(5) Specific conductance meter	5,000 µS/cm (Blue)	5214 ex 11/2017
(6) Specific conductance meter	_____ µS/cm	
(7)		
(8)		
(9)		
(10)		
(11)		

Instrument Calibration Data

Time	Standard Solution	Response As Found	Response As Left	Solution Temp. (C)	Zero	Battery Check	Alarm Point	Notes
[illegible]00	Ph 6.86	6.6[illegible]	[illegible]6	22.07				
	µ5000	497[illegible]	[illegible]	22.07				
1030 Nov 6,13	Ph 6.86	7.05	6.81	18.05				
	µ5000	5153	5014	18.05				
1530 Nov 6,13	Ph 6.86	6.93		17.46				
	µ5000	[illegible]	3880	17.46				

Review

Site Manager/Project Manager

Date

Action

11/04/13 01:58 PM