

Atlantic Richfield Company

Treatment System Operation and Maintenance

Technical Advisory Committee Meeting

Leviathan Mine Site

January 9, 2014

2013 Treatment System Update

► Removal Actions

- High Density Sludge (HDS) Treatment System
- Aspen Seep Bioreactor (ASB) Treatment System



Leviathan Mine Site



Spring Access and Operations Setup

Provide safe access as soon as possible

▶ April 8, 2013

- Accessed site, evaluated road conditions, and began Nevada Access Road maintenance

▶ April 10, 2013

- Initiated site mobilization, site operations support setup, and began HDS Treatment System commissioning

▶ May 1, 2013

- Began capture at Channel Underdrain (CUD) and Delta Seep (DS)

HDS Treatment System



HDS Treatment System Operations Season Highlights

- ▶ No loss of capture of CUD or DS flows occurred during the 2013 Atlantic Richfield Work Season (ARWS) June 1 - Sept 30
- ▶ Successfully treated and discharged approximately 5.6 million gallons of acid drainage
- ▶ All discharged water to Leviathan Creek met discharge criteria



HDS Treatment System Operations

- ▶ May 10, 2013
 - Began treatment plant operations
- ▶ May 15, 2013
 - Began discharge to Leviathan Creek
- ▶ October 31, 2013
 - Capture of CUD and DS flows ended
- ▶ October 31, 2013
 - HDS Treatment Plant Discharge to Leviathan Creek ended
 - Pumped Pond 4 down to approximately 15 inches of water remaining

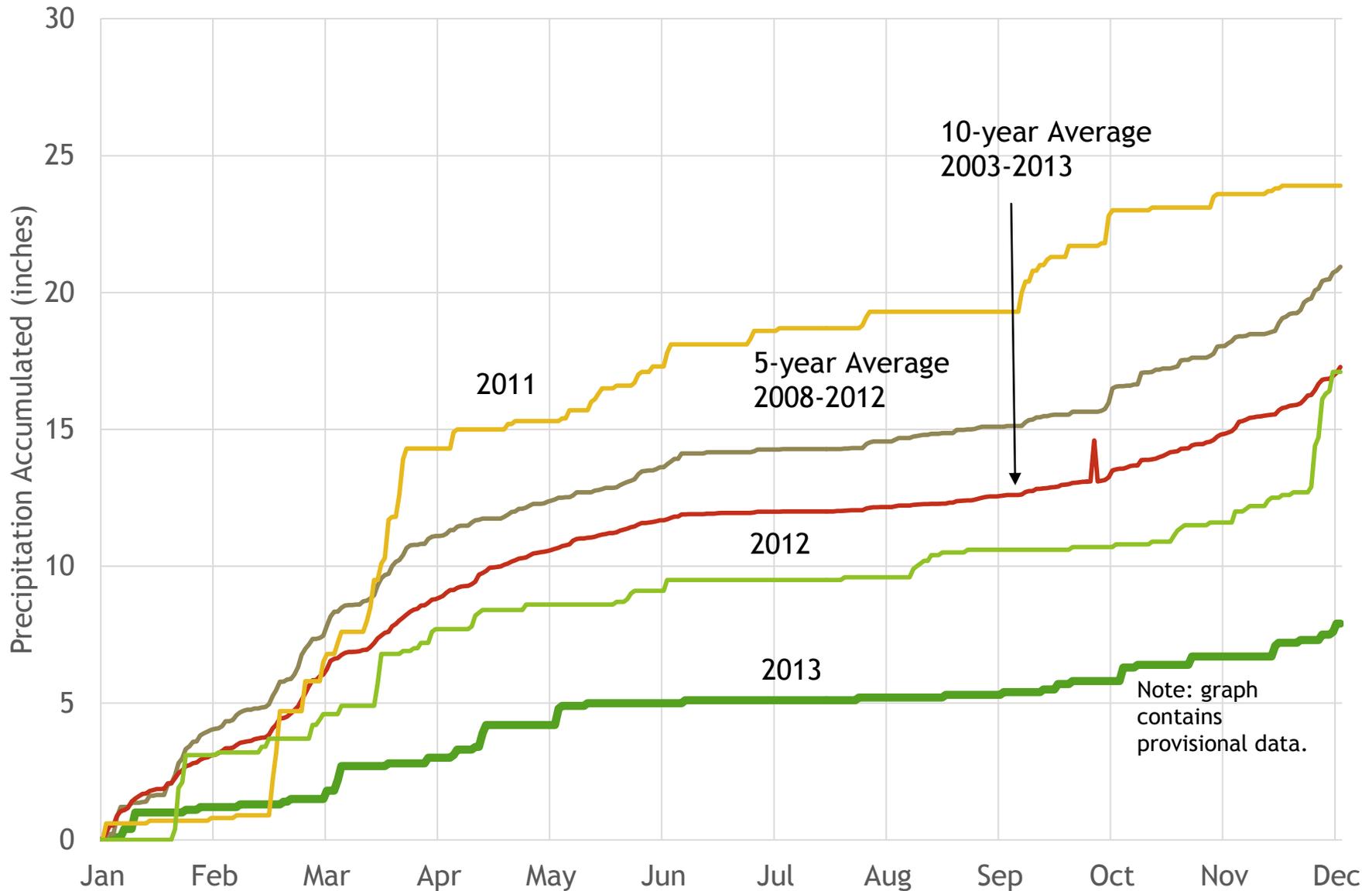


HDS Treatment System Operations- 2013 Challenges

- ▶ New low flow influent pumps
- ▶ Rim Fire
- ▶ Extended duration of intermittent flow through the plant due to low flows in CUD and DS



SNOTEL - Monitor Pass



Channel Underdrain Historic Flow



Delta Seep Historic Flow



HDS Treatment System Optimization

Continued system optimization to ensure safe and reliable operations

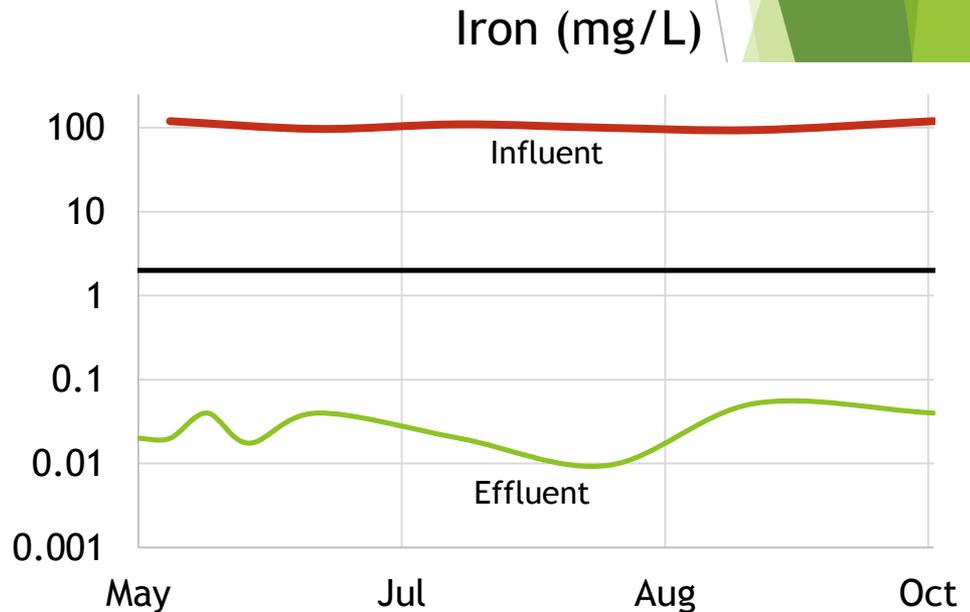
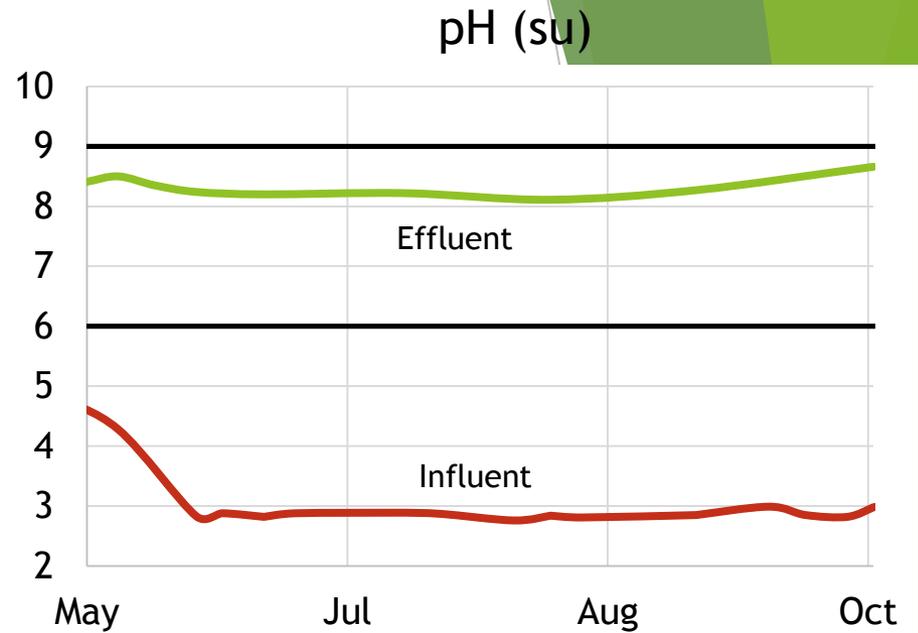
- ▶ Influent Pumps
 - Added low flow pumps
 - Moved existing pumps
 - Changed piping
- ▶ Replaced Generator Engines
- ▶ Stair maintenance



HDS Effluent

Analyte	Max	Std
Aluminum	0.480	4
Arsenic	0.0006	0.34
Cadmium	<0.001	0.009
Chromium	<0.002	0.97
Copper	0.0045	0.026
Iron	0.052	2
Lead	<0.001	0.136
Nickel	0.026	0.84
Zinc	0.010	0.21

Note: Standard is Discharge Daily Grab. All analytes are dissolved and in mg/L except pH, which is su



HDS Treatment System Winterization

- ▶ Winterization of the HDS Treatment Plant and operation support area occurred from October 31 through November 15, 2013
- ▶ November 11, 2013 site office trailers were removed
- ▶ Consumables stored on-site to facilitate spring commissioning
 - 4200 gal diesel
 - 14.5 tons lime
 - 25 kg flocculant

HDS Treatment System Consumables Information

	Lime Utilization	Polymer Utilization	Sludge Generation		Energy Usage	Fuel Consumption
Unit Rate	0.37 g/L	3.66 mg/L	2.5 ton/MG	4.5 CY/MG	LAS = 4,644 ARWS = 9,365 kWh/week	LAS = 61 ARWS = 58 Gal/Day
2013 Total	8.7 tons	78 kg	13.8 tons	25 CY	206,690 kWh	17,934 gallons

Note: Table contains provisional data.

ASB Treatment System



ASB Treatment System Operations

▶ LAS Operations

- Monthly visits for system O&M, cold weather system upsets, and compliance sampling
- Specialized training for Winter Access
- Detailed planning, preparation, and coordination
- Winter Access Team visits with scouting trips
- Team used a combination of 4x4 vehicles and snowmobiles to access the site during winter visits in 2013.

▶ ARWS Operations

- Performed system O&M and improvements
- Compliance sampling twice per month
- Solids management - Transferred solids from Pond 3 to Pond 4

ASB Treatment System Maintenance Activities

- ▶ Replacement of two recirculation pumps
- ▶ Scale cleanout in effluent piping
- ▶ Biocell flushing
- ▶ Recirculation pump faults in July-September
- ▶ Transfer of sludge from Pond 3 to Pond 4
 - No solid dewatering or off site disposal in 2013
- ▶ Installation and configuration of new satellite communication equipment
- ▶ Replacement of propane generator engines



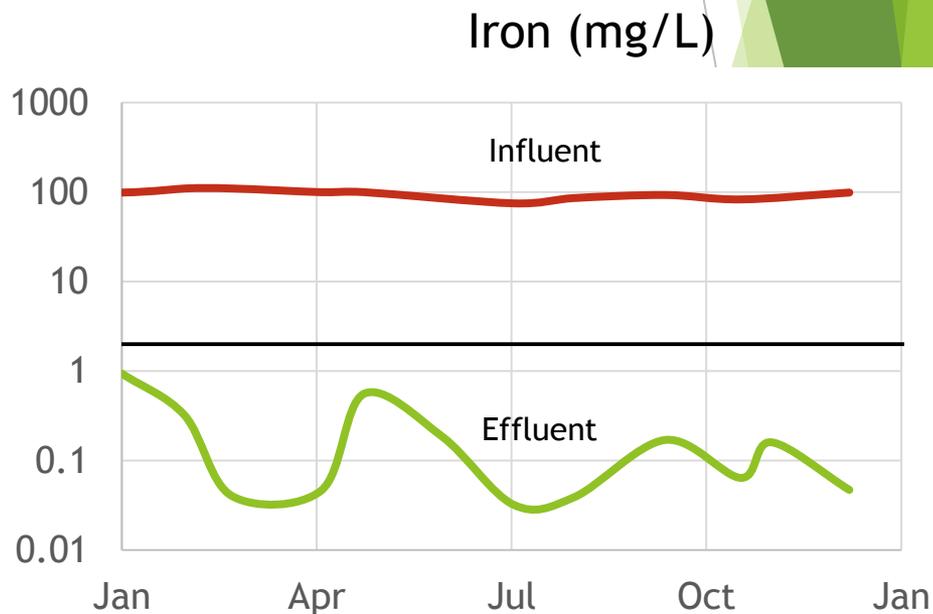
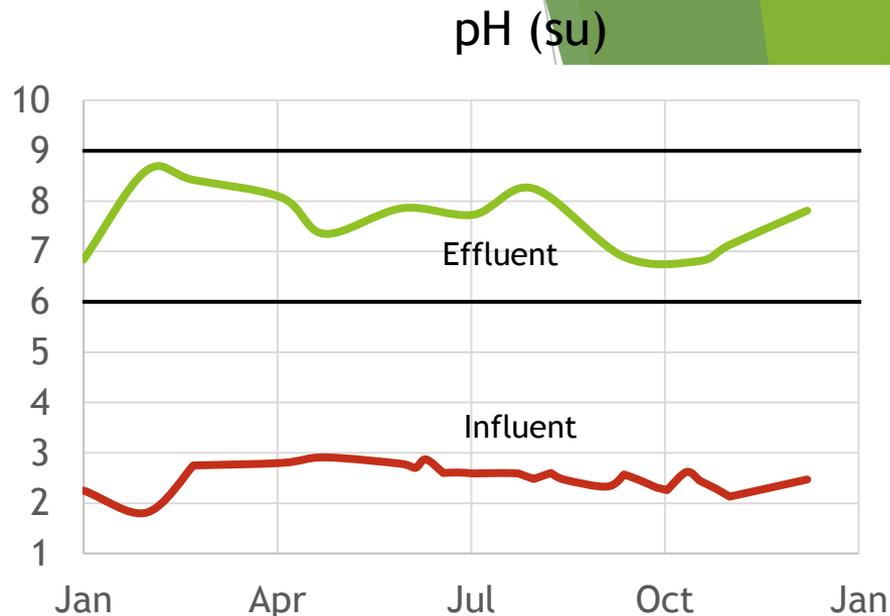
ASB Treatment System Performance

- ▶ Site improvements continue to increase system control and monitoring
- ▶ Indicator parameters demonstrate good bioreactor performance
 - Average effluent pH of 7.6
 - Average biocell ORP of -335 mV
 - Consistently high sulfate removal (300-800 mg/L)
- ▶ Consistently met discharge criteria with no exceedances

ASB Effluent

Analyte	Max	Std
Aluminum	0.580	4
Arsenic	0.0030	0.34
Cadmium	<0.002	0.009
Chromium	<0.002	0.97
Copper	0.0021	0.026
Iron	0.940	2
Lead	<0.002	0.136
Nickel	0.051	0.84
Zinc	0.029	0.21

Note: Standard is Discharge Daily Grab. All analytes are dissolved and in mg/L except pH, which is su



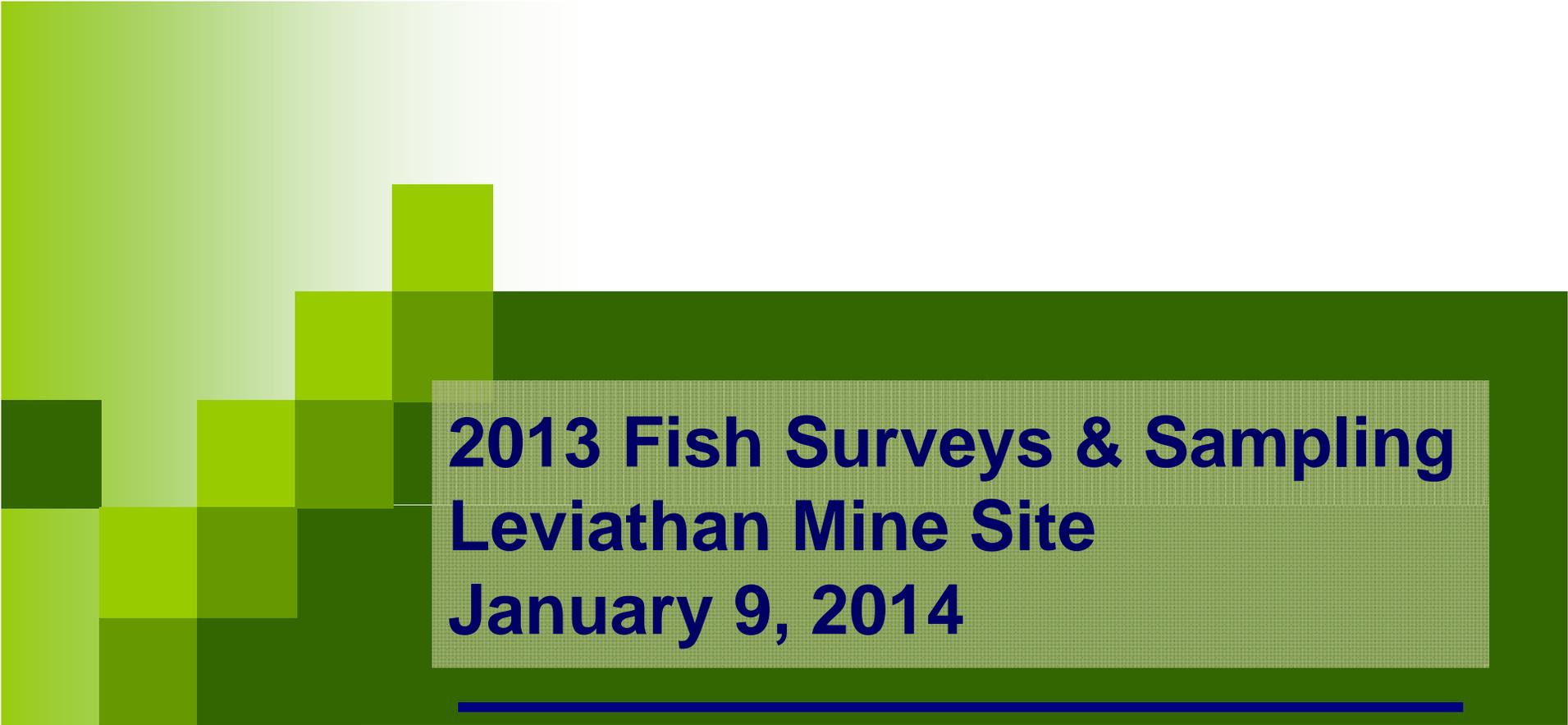
ASB Treatment System Consumables Information

	NaOH Utilization	Ethanol Utilization	Energy Usage	Propane Fuel Consumption
Unit Rate	1.53 ml/L	0.57 ml/L	ARWS = 210 LAS = 250 kWh/Week	ARWS = 9 LAS = 13 Gal/Day
Projected Totals	3,029 Gal	1,120 Gal	12,330 kWh	4,316 Gallons

Note: Table contains provisional data.



**Technical Advisory Committee Meeting
Leviathan Mine Site
January 9, 2014**



**2013 Fish Surveys & Sampling
Leviathan Mine Site
January 9, 2014**



Fish Tissue COC List (whole body/filet)

Analytes

- Aluminum
- Antimony
- Arsenic*
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Moisture content

Analytes

- Iron
- Manganese
- Mercury
- Nickel
- Lead
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc
- Lipid content



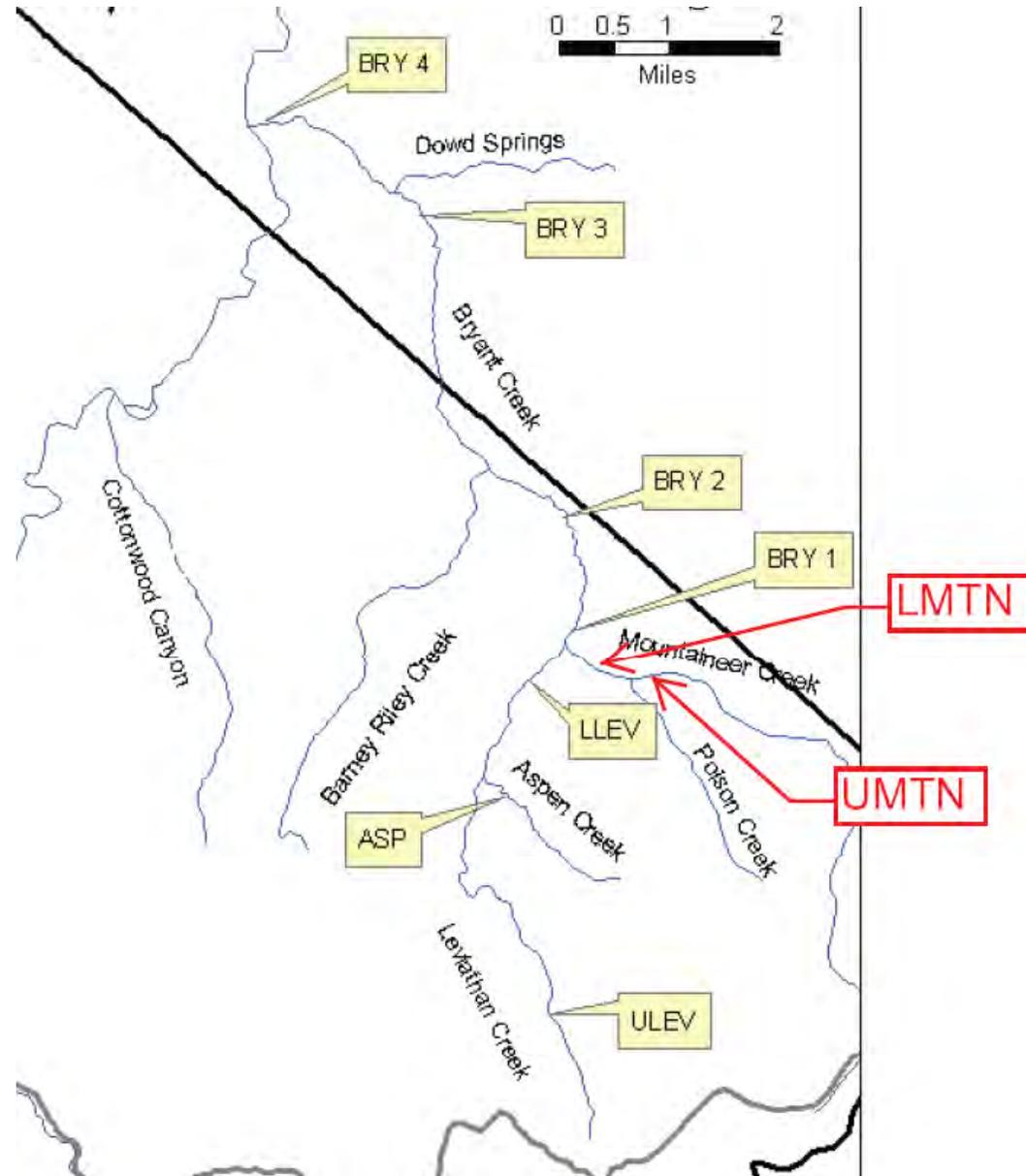
Trout Composite Samples

Sampling Reaches

- **Upper Leviathan**
None retained
 - **Aspen**
None collected
- **Lower Leviathan**
Brook trout
- **Upper Mountaineer**
Rainbow/Brook trout(2)
- **Lower Mountaineer**
Brook/Rainbow trout (2)

Sampling Reaches

- **Bryant “1”**
Brook/Rainbow trout (2)
- **Bryant “2”**
Rainbow/Brown trout (2)
- **Bryant “3”**
Brown trout (3)
- **Bryant “4”**
Brown trout (2)











**2013 RI/FS Update
Leviathan Mine Site
January 9, 2014**



Overview of Presentation

- Document Status
- Field Activities
 - On-Property Area
 - Off-Property Area
 - Reference Area
 - Cultural Survey
 - Fish Surveys & Sampling
- Moving Forward



RI/FS Document Status

On-Property FRI Work Plan

- Amendment No. 5 for Gaging Stations – June 2013
 - U.S. EPA approval – July 2013
- Amendment No. 6 for Characterization of Mine Waste Using Field-Portable X-ray Fluorescence and Incremental Sampling Methodology – June 2013
 - U.S. EPA partial approval and comment – August 2013
 - Conference call with U.S. EPA – August 2013
 - Response to Comment (RTC) – September 2013
- Amendment No. 7 for Sediment Quality Triad Sampling in Aspen and Leviathan Creeks – June 2013
 - U.S. EPA approval – June 2013



RI/FS Document Status (continued)

Off-Property FRI Work Plan

- Addendum No. 2 – February 2013
- Technical meeting with U.S. EPA – March 2013
- U.S. EPA partial approval and comment – May 2013
- Conference call with U.S. EPA – June 2013
- RTC and Revised Addendum No. 2 – June 2013
- Rationale to eliminate pore water sampling – August 2013
- U.S. EPA approval and comments on Revised Addendum No. 2 – August 2013



RI/FS Document Status (continued)

On-Property and Off-Property FRI Work Plans

- Request for Approval of Change in Surface Water Monitoring Program – April 2013
- U.S. EPA partial approval – April 2013
- Conference call with U.S. EPA to review comments in partial approval – April 2013



RI/FS Document Status (continued)

Reference FRI Work Plan

- Addendum No. 2 for Sediment Quality Triad Sampling in Mountaineer Creek – June 2013
- U.S. EPA approval – June 2013



RI/FS Document Status (continued)

Data Submittals

- 2012 RI/FS Data Summary Report – estimated
January 2014



National Historic Preservation Act (NHPA)

- Draft Programmatic Agreement submitted to U.S. EPA - February 2013
- U.S. EPA requests preparation Section 106 Consultation for 2013 field activities – late March 2013
- Project Description, APE map, and records searches submitted to U.S. EPA – May 2013
- U.S. EPA requests pedestrian surveys be conducted for submittal with Section 106 consultation letter – May 2013
- Pedestrian surveys conducted – June and August 2013



National Historic Preservation Act (NHPA) (continued)

- Began report preparation – August 2013
- Report for drill and storm water sites submitted to U.S. EPA – August 2013 (original) and September 2013 (revised)
- California State Historic Preservation Officer approves drill/storm water sites report – October 2013
- Additional pedestrian surveys conducted – October 2013
- Report submittal – estimated January 2014



2013 On-Property FRI Activities

- On-Property FRI Work Plan and Amendments
- Eight Remedial Investigation/Feasibility Study (RI/FS) Tasks
 - Hydrogeologic Investigations
 - Source Investigations - mine waste, acid drainage, floodplain soil and air
 - Water Balance Studies
 - Surface Water Investigations
 - Stream Sediment Investigations
 - Bioassessment Investigations
 - Storm Water and Snowmelt Runoff Investigations
 - Geotechnical Investigations

On-Property Study Areas

- Leviathan Creek Study Area (LCSA)
- Aspen Creek Study Area (ACSA)
- Pit Study Area (PSA)



On-Property FRI Data Collection

On-Property RI/FS Tasks		Data Collection Activity												
		Mapping/Field Verification	Geophysics	Drilling and Well Installation	Groundwater Monitoring	Mine/Site Features Evaluation	Soil Sampling	Meteorological Monitoring	Surface Water Monitoring	Stream Sediment Sampling	Storm Water and Snowmelt Monitoring	Plant Sampling	Fish/Habitat Surveys and Sampling	Slope Monument Monitoring
Hydrogeologic Investigations		X		X	X		X							
Source Investigations	Mine Waste	X					X							
	Acid Drainage		X	X	X	X	X	X	X					
	Floodplain Soil	X					X							
	Air	X					X	X						
Water Balance Studies		X						X	X					
Surface Water Investigations		X							X					
Stream Sediment Investigations		X								X				
Bioassessment Investigations		X					X		X	X		X	X	
Storm Water and Snowmelt Runoff Investigations		X						X			X			
Geotechnical Investigations		X		X			X							X

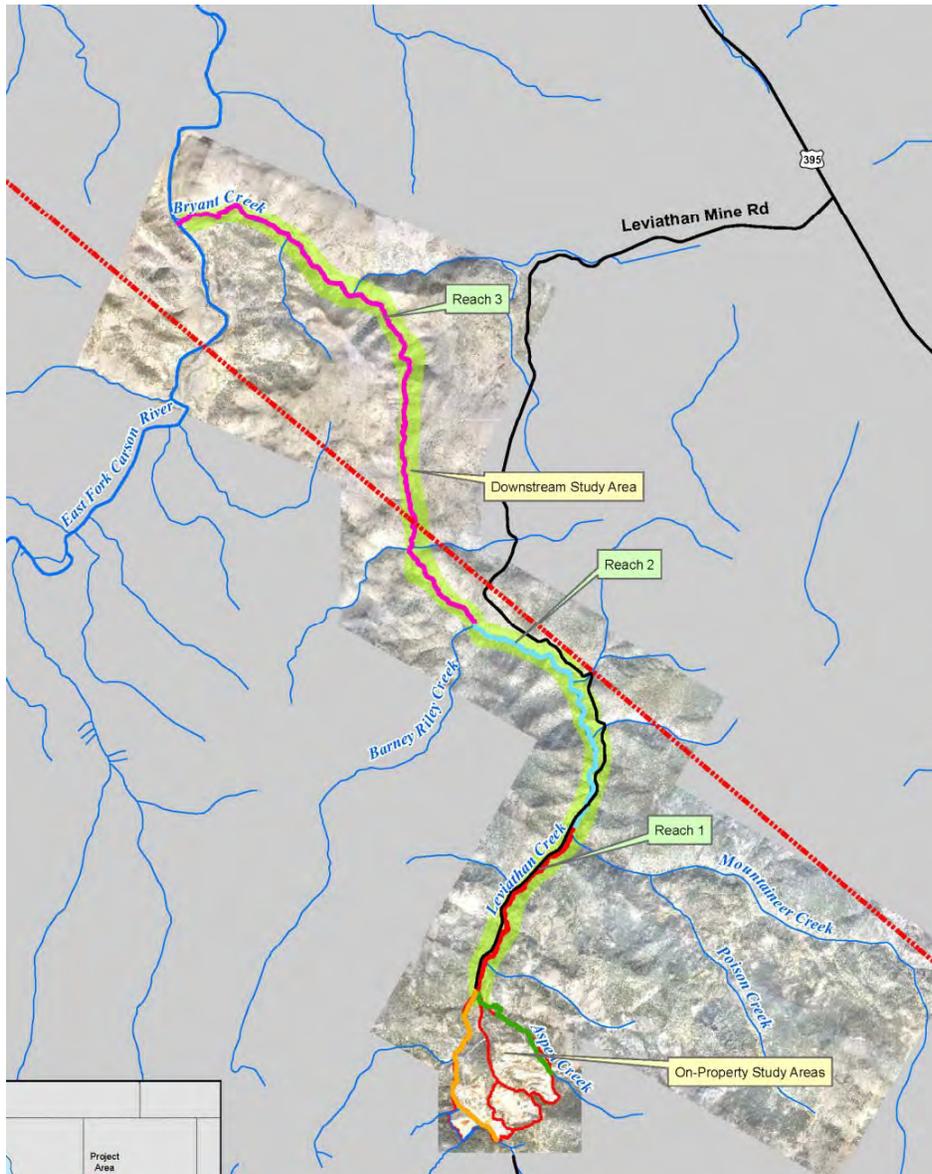
Completed (for select activities assumes 2 years sufficient)
 In Progress
 Not Started
 Completion subject to NHPA



2013 Off-Property FRI Activities

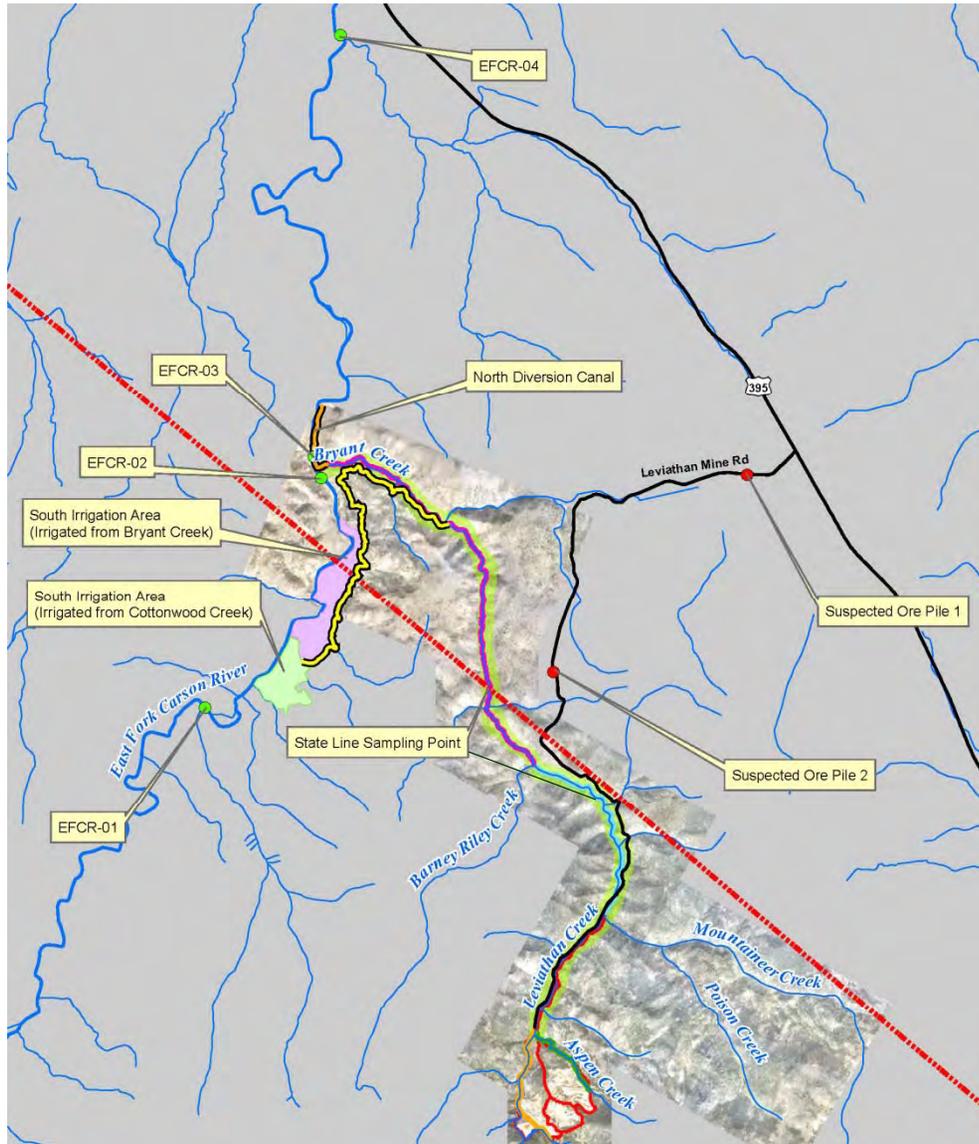
- Off-Property FRI Work Plan and Addenda
- Downstream Study Area (DSA) and Supplemental Study Areas (East Fork of Carson River, River Ranch, suspected ore piles, and Leviathan Mine Road)
- Four RI/FS Tasks
 - Floodplain Soil Investigations
 - Surface Water Investigations
 - Stream Sediment Investigations
 - Bioassessment Investigations

Downstream Study Area



- Riparian corridor along Leviathan and Bryant creeks to confluence with East Fork Carson River
- Approximately 9 miles

Supplemental Study Areas



- Supplemental Study Areas
 - East Fork Carson River
 - River Ranch
 - Suspected ore piles along Leviathan Mine Road
 - Leviathan Mine Road

Off-Property FRI Data Collection

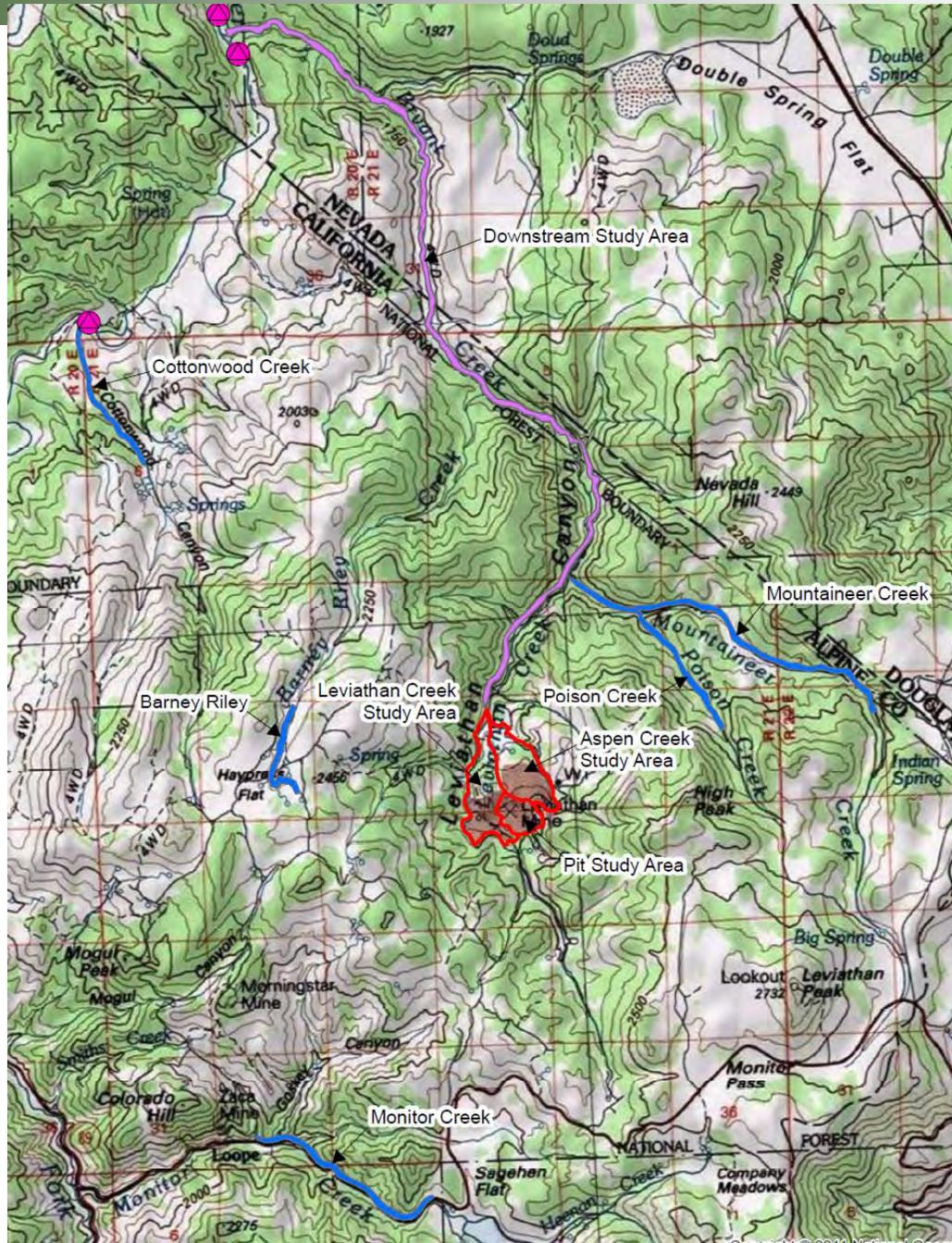
Off-Property RI/FS Tasks	Data Collection Activity					
	Mapping/Field Verification	Soil Sampling	Surface Water Monitoring	Stream Sediment Sampling	Plant Sampling	Fish/Habitat Surveys and Sampling
Downstream Study Area						
Surface Water Investigations	X		X			
Stream Sediment Investigations	X			X		
Floodplain Soil Investigations	X	X				
Bioassessment Investigations	X	X	X	X	X	X
Supplemental Study Areas						
Surface Water Investigations			X			
Stream Sediment Investigations				X		
Bioassessment Investigations		X	X	X	X	X
Soil Investigations	X	X				

- Completed (for select activities assumes 2 years sufficient)
- In Progress
- Not Started
- Completion subject to NHPA



2013 Reference FRI Activities

- Reference FRI Work Plan and Addenda
- Six RI/FS Tasks
 - Surface Water Investigations
 - Stream Sediment Investigations
 - Floodplain Soil Investigations
 - Bioassessment Investigations
 - Groundwater Investigations
 - Soil Investigations



Reference FRI Data Collection

Reference RI/FS Tasks	Data Collection Activity							
	Mapping/Field Verification	Drilling and Well Installation	Groundwater Monitoring	Soil Sampling	Surface Water Monitoring	Stream Sediment Sampling	Plant Sampling	Fish/Habitat Surveys and Sampling
Surface Water Investigations	X				X			
Stream Sediment Investigations	X					X		
Floodplain Soil Investigations	X			X				
Bioassessment Investigations	X			X		X	X	X
Groundwater Investigations	X	X	X					
Soil Investigations	X			X				

 Completed
 In Progress
 Not Started
 Completion subject to NHPA

Drilling and Monitoring Well Installation





Drilling and Monitoring Well Installation

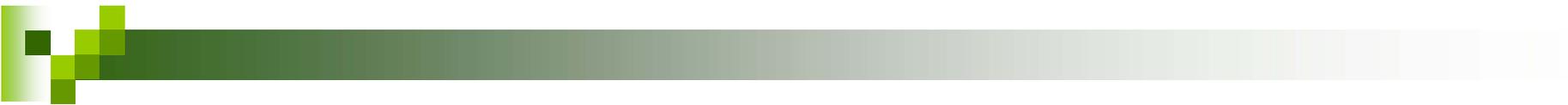
- 2013 drilling program focused on:
 - Aspen Creek Study Area
- 2013 drilling locations selected based on:
 - 2011 and 2012 field results
 - subsurface conditions (lithology, water quality, depth-to-water) during drilling
 - groundwater monitoring (water quality and water-level elevation)
 - 2011 geophysical surveys
 - Conceptual hydrogeological model developed using historical information and current RI data
 - Field data collected as drilling progressed
 - Accessibility



Drilling and Sampling

- Drilled four boreholes (~640 ft total)
- Continuously cored and lithologically logged
- Collected soil samples from select boreholes
- Monitored for presence of water entering borehole
- Collected grab-groundwater samples during drilling





Drilling and Sampling

- Soil Samples

- Laboratory analysis – RI/FS metals, acid-base account, total organic carbon, and physical analysis

- Grab Groundwater Samples

- Field water-quality parameters
 - Laboratory analysis
 - RI/FS metals and general chemistry
 - Isotopes (select samples)

Well Installation

- Three of four boreholes completed as 4-inch-diameter monitoring wells; one borehole destroyed
- Wells developed after installation



Groundwater Monitoring



Water Levels

- Manual measurements monthly (electric sounder) – April through November in 39 wells and 25 piezometers
- Automatic measurements (pressure transducers and data loggers) select wells and piezometers – March through December in 12 wells and 17 piezometers

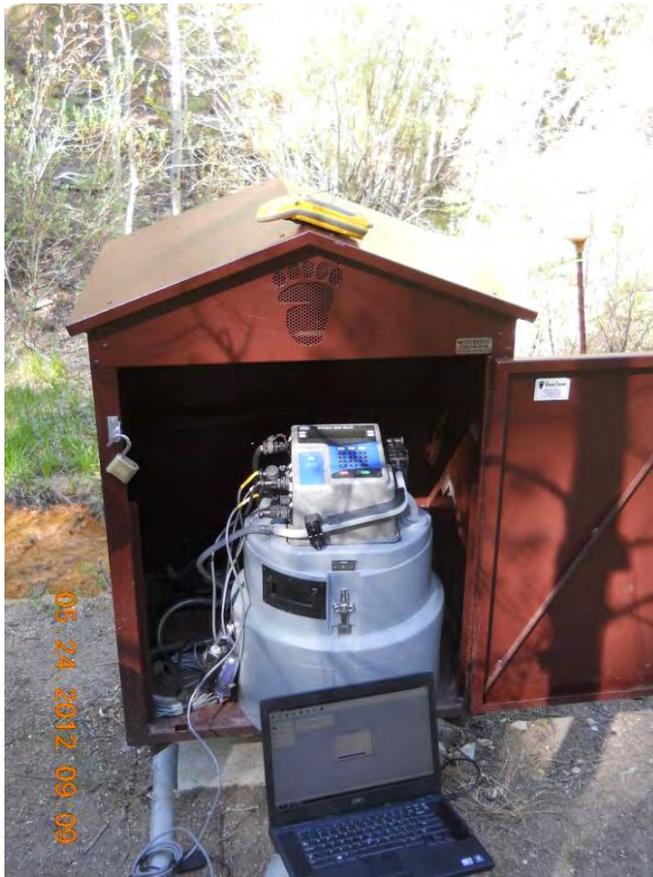
Groundwater Monitoring



Groundwater Sampling

- May/June – sampled 36 of 40 wells/piezometers (3 dry; 1 bent) samples
- September/October – sampled 35 of 40 wells/piezometers (4 dry; 1 bent)
- November – sampled 3 new wells
- Field water-quality parameters
- Laboratory analysis – RI/FS metals, general chemistry, and isotopes (new wells only)
- Used low-flow sampling procedures where feasible to reduce sample turbidity

Storm Water Monitoring



Six semi-automated storm water monitoring stations in LCSA:

- Storm Water – 3 events
- Snowmelt – 1 event



Meteorological Station and Evaporation Pan Monitoring



- Weekly inspections and data downloads
 - Three meteorological stations
 - Three evaporation pans
- Annual calibration of meteorological station



Water Balance Studies

- Upper Tributary
 - Water level monitoring - 6 drive-point piezometers in creek bed
 - Flow monitoring – 3 flow stations (weirs)
 - Automatic monitoring using pressure transducers and data loggers
- Pond Water Levels
 - Ponds 1, 2N, 2S, 3
 - Automatic monitoring using pressure transducers and data loggers



Weirs and Pond Stage Monitoring

- Weirs at CUD and Aspen Seep
- Pond 4 stage gage
- Monthly maintenance and data downloads



Synoptic Flow Measurements and Surface Water Sampling

- Flow measured approximately monthly at 23 on-property locations (24th location is a pond)
- Surface water samples collected concurrent with flow measurements 4 times per year at 24 on-property locations
- Flow measured and surface water samples collected 4 times per year at 5 downstream locations and 1 Mountaineer Creek location
- Field water-quality parameters
- Laboratory analysis – RI/FS metals and general chemistry



Synoptic Flow and Surface Water Sampling



Four sampling events:

1. Before either HDS or Pond 1 treatment systems operating – late April to early May
2. With only HDS treatment system operating – June
3. With both HDS and Pond 1 treatment systems operating – July
4. After both HDS and Pond 1 treatment systems discontinue operating – November

Source Monitoring

- Five on-property locations:
 - Aspen Seep
 - Channel Underdrain
 - Delta Seep Underdrain
 - Adit
 - Pit
- Four events per field season generally concurrent with surface water monitoring
- Field water-quality parameters
- Laboratory analysis – RI/FS metals, general chemistry



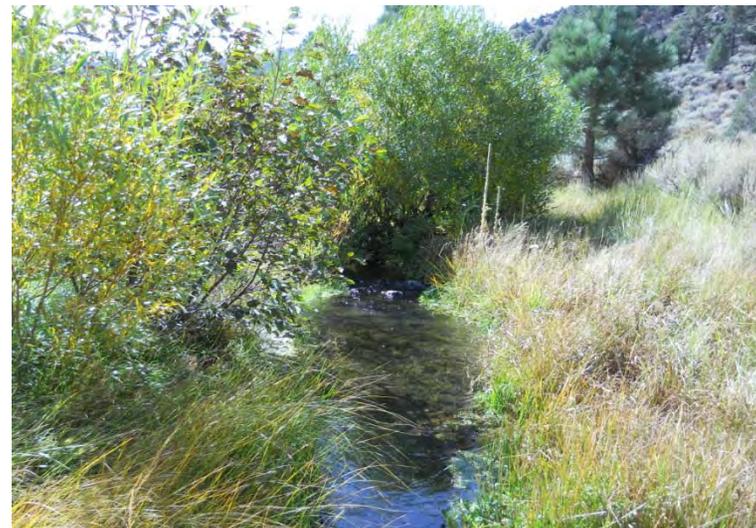
Beaver Pond Monitoring

- On property in Leviathan Creek
- Field water-quality parameters measured every other week
- 15 locations along ~1/2 mile of creek



In-Stream Sediment Sampling

- Collected sediment samples for geochemical characterization and grain-size analysis
- 84 locations in DSA



Sediment Quality Triad Sampling



- Collected sediment samples for geochemical characterization and bioassay
- Sampled 9 locations
 - 2 on property
 - 5 off property in the DSA
 - 2 in Mountaineer Creek
- Performed in June and October

Terrestrial Habitat Verification

Field-verified terrestrial habitat type:

- Reference Study Area
 - Mountaineer Creek
 - Poison Creek
 - Cottonwood Creek
- 25 transects



Aquatic Habitat Assessment

Characterized aquatic habitat:

- Reference Study Area
 - Mountaineer Creek
 - Poison Creek
 - Cottonwood Creek



East Fork Carson River

- Surface water and sediment samples collected for geochemical characterization
- Four locations





Suspected Ore Piles

- Soil samples collected from two suspected ore piles along Leviathan Mine Road





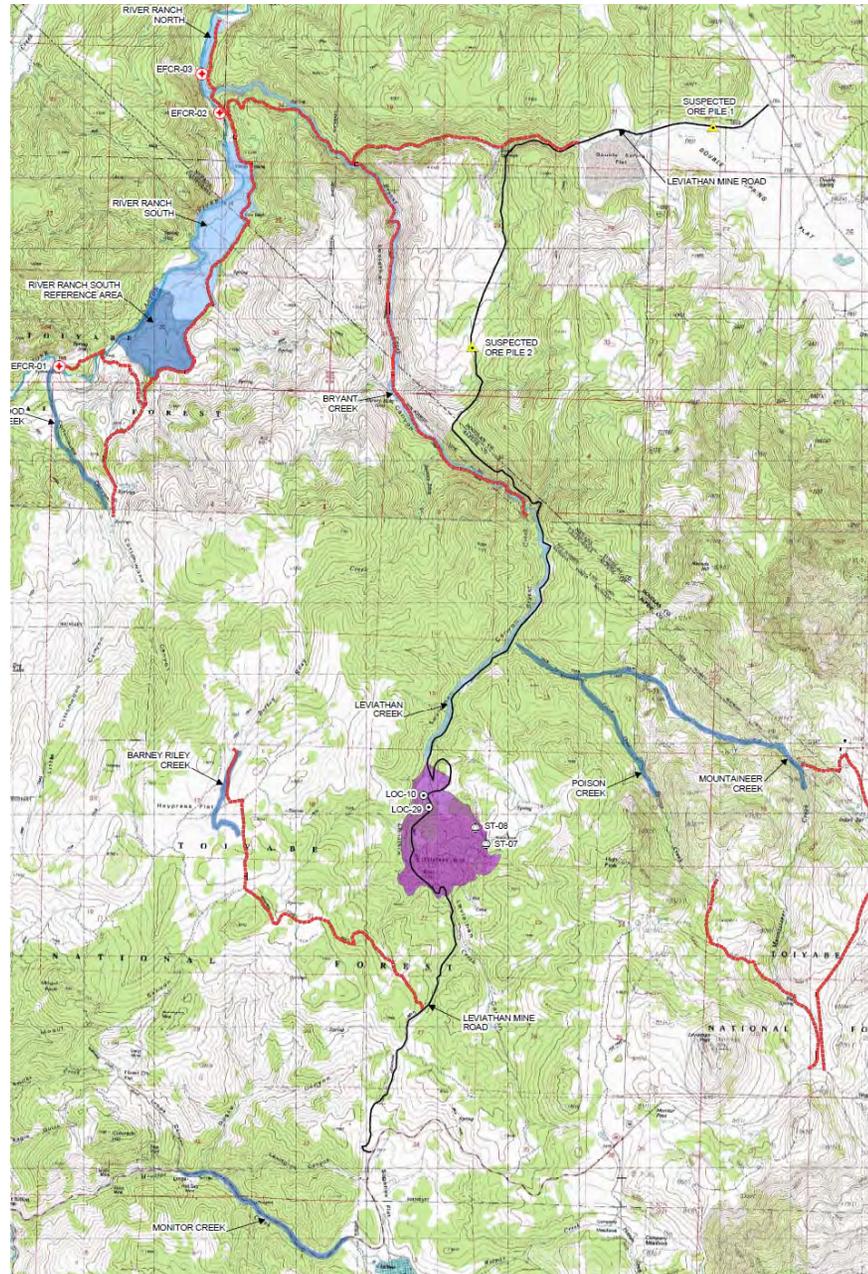
Cultural Resource Survey

■ Pedestrian surveys

- Leviathan Mine (select areas)
- Leviathan and Aspen creeks (on property)
- Leviathan and Bryant creeks (DSA)
- River Ranch
- Mountaineer, Poison, Cottonwood, Monitor, and Barney Riley creeks (potential reference creeks)
- Leviathan Mine Road and Ore Piles



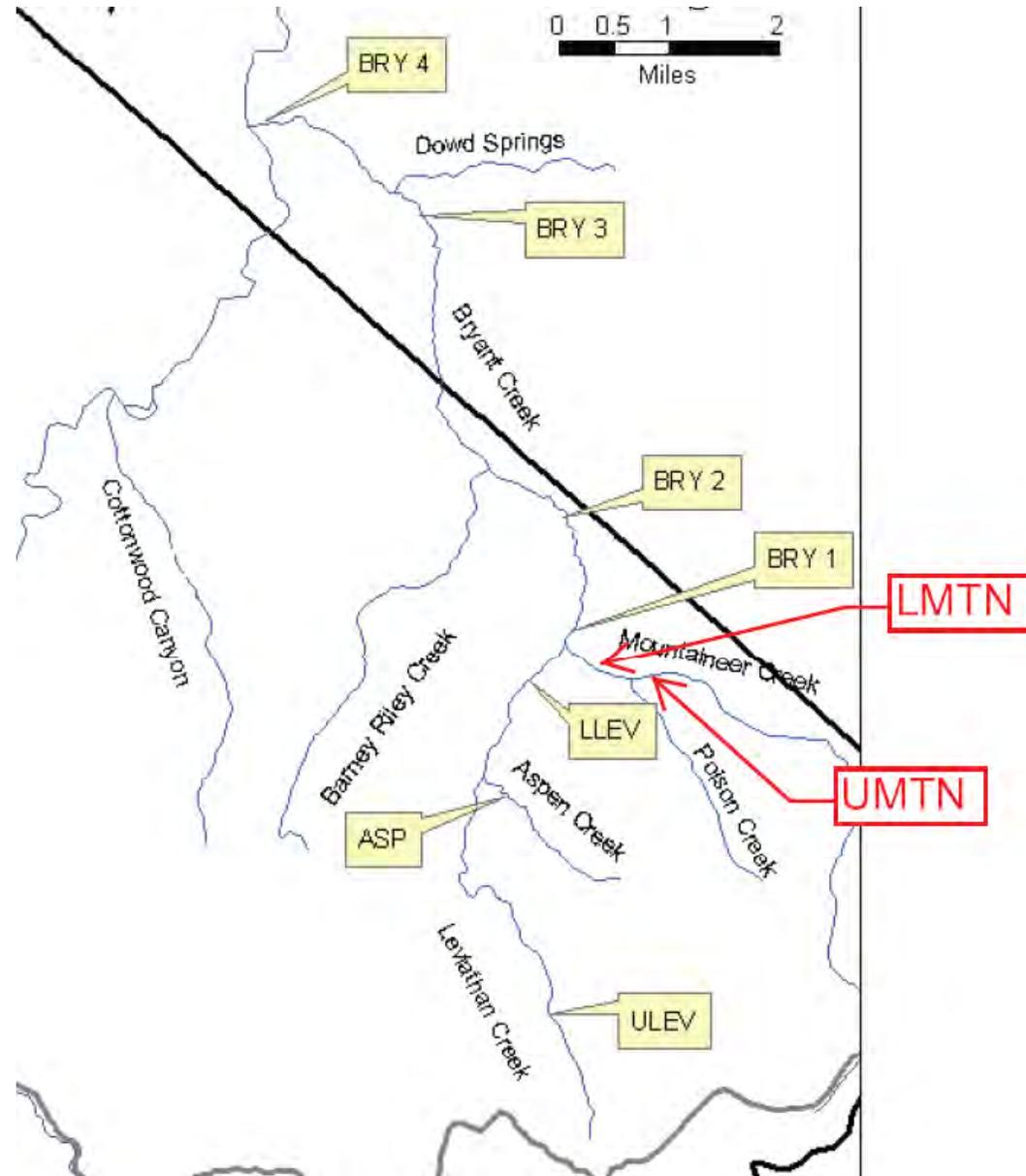
- Transects spaced no more than 15 meters apart
- Surveyed 941 acres



Fish Survey & Sampling

- Collaborative effort with USFWS
- Nine locations
 - Bryant, Leviathan, Aspen, Mountaineer creeks
- Species, count, weight, length, tissue samples
- RI/FS metals, moisture content, lipids, arsenic speciation (select samples)







Moving Forward – Documents

- Off-Property FRI Work Plan
 - Amendments as needed – detailed sampling plans for sediment, floodplain, bioassessment, and changes to on-going programs
- Reference FRI Work Plan
 - Submit Revised Work Plan – phased approach, final selection of streams, results of Phase I preliminary investigations, and proposed Phase II detailed investigations
 - Approval of Revised Work Plan
- Approval of ERA Work Plan
- 2013 RI/FS Data Summary Report
- Combined Acid Drainage Treatment Treatability Investigation Work Plan
- Feasibility Study Work Plan



Moving Forward – Field Activities

- Continue implementation of On-Property FRI Work Plan and Amendments
- Continue implementation of Revised Off-Property FRI Work Plan Addendum 2 (detailed investigations)
- Continue implementation of Reference Area FRI Work Plan Addendum No. 1 (preliminary investigations); upon approval begin implementation of revised Work Plan (detailed investigations)
- Begin field implementation of Combined Acid Drainage Treatment Treatability Investigation Work Plan