TABLES

TABLE 1
Historical and Ongoing Data Sources - Updated September 2008
Leviathan Mine Site

Source Codes	Date	Author(s)	Title	AVAILABLE DATA						
				SW	FLOW	BIO	SED	SOIL	SLDG	GW
ONGOING DATA SOURCES										
ARC-EDT	ONGOING	Atlantic Richfield	Electronic Data Transfer (EDT)-CUD/DS Treatment Data	X	X				X	
EPA-EDT	ONGOING	EPA	Technology Evaluation Treatment Data	X					X	
EPA-EDT-Ned Black	ONGOING	Ned Black	EDT - Stream Sediment and Water Quality Data			X	X			
HER-EDR	ONGOING	HERBST	Electronic Data Report (EDR) - Aquatic Biological Data			X				
NDE-EDT	ONGOING	NDEP	EDT - Surface Water Quality Data	X	X					
RWQ-EDT	ONGOING	RWQCB	EDT - Surface Water Quality Data, Adit/PUD Biphasic Treatment Data, Climate Data, Monitoring Well #3 Data, and Bioassessment Data	X	X	X	X		X	X
UNR-EDT	ONGOING	UNR	EDT - Aspen Seep Bioreactor Treatment Data	X	X				X	
USG-EDR	ONGOING	USGS	EDR - Periodic Field Flow Measurements, Provisional (CA & NV Offices)		X					
USG-EDT	ONGOING	USGS	EDT - USGS Provisional Flow Data		X					
USG-PUB	ONGOING	USGS	Published Flow Data (CA & NV Offices)		X					

TABLE 1
Historical and Ongoing Data Sources - Updated September 2008
Leviathan Mine Site

Source Codes	Date	Author(s)	Title	AVAILABLE DATA						
				SW	FLOW	BIO	SED	SOIL	SLDG	GW
HISTORICAL DATA SOURCES										
BAL-001	1989	James W. Ball D. Kirk Nordstrom USGS	Final Revised Analyses of Major and Trace Elements from Acid Mine Waters in the Leviathan Mine Drainage Basin, California and Nevada, October 1981 to Oct 1982	X	X					
BRO-004	2002	Brown & Caldwell Consultants	Leviathan Mine 2001 Early Response Action, Channel Underdrain Treatment Completion Report (with Appendices A through F)	X						
BUT-001	1977	Richard Butterfield, UNR	The Revegetation Potential of the Leviathan Mine Soils, MS Thesis University Nevada Reno					X		
CLA-002	1977	Vic Claassen and Michael Hogan-Univ CA, Davis	Partial Soil Remediation and Revegetation of the Leviathan Mine					X		
COL-001	1958	S.J. Coli	Report Leviathan Creek Bioassay			X				
ENS-001	1998	ENSR Environmental Toxicology Services for ARCO Environmental Remediation, LLC	Data Report for the Leviathan Mine Study Area Water and Sediment Toxicity Testing and Benthic Community Data September 1998 Assessment	X		X	X			

TABLE 1
Historical and Ongoing Data Sources - Updated September 2008
Leviathan Mine Site

Source Codes	Date	Author(s)	Title	AVAILABLE DATA						
				SW	FLOW	BIO	SED	SOIL	SLDG	GW
HISTORICAL DATA SOURCES										
HAM-001	1985	D. P. Hammermeister S.J. Walmsley USGS	Hydrologic Data for Leviathan Mine and Vicinity Alpine County, California, 1981-83	X		X	X			X
HOF-001	2000	Ray J. Hoffman Karen A. Thomas USGS	Methylmercury in Water and Bottom Sediment Along the Carson River System, Nevada and California, September 1998	X	X		X			
KLE-002	2002	Kleinfelder, Inc. Reno, NV	Geotechnical Investigation Report: Phase II Slope Stability Investigation, Leviathan Mine Delta Area Waste Pile, Alpine County, California							X
LAW-001	1992	Stephen J. Lawrence USGS	0			X	X			
LEG-004	1968	John Leggett RWQCB	Letter: Transmit RWQCB meeting minutes; Fish and Game Report (Sterling P. Davis, 1969)	X		X				
LEH-001	1998	Stafford K. Lehr CDFG	Leviathan Mine Natural Resources Damage Assessment Phase I Fisheries Assessment			X				
MIL-001	2001	Glenn C Miller Timothy K Tsukamoto UNR	Operation and Monitoring of Bioreactors at the Leviathan Mine	X						

TABLE 1
Historical and Ongoing Data Sources - Updated September 2008
Leviathan Mine Site

Source Codes	Date	Author(s)	Title	AVAILABLE DATA						
				SW	FLOW	BIO	SED	SOIL	SLDG	GW
HISTORICAL DATA SOURCES										
NCR-002	1955	Nevada Dept of Conservation and Natural Resources, Division of Wildlife	Stream and lake survey, biological and physical data - Bryant Creek			X				
NEL-002	1969	Nelson Laboratories for RWQCB	Investigation of Soil and Irrigation Water Conditions on the Brooks Park-River Ranch	X				X		
REI-001	1657	E Reinke CDPH	Transmittal to RWQCB: Leviathan Creek water quality sample results	X						
RWQ-001	1963	RWQCB	Report on Pollution of Leviathan Creek Caused by Leviathan Mine	X						
RWQ-002	1974	RWQCB	Report on Pollution of Leviathan Creek, Bryant Creek and the East Fork Carson River caused by the Leviathan Sulfur Mine	X						
SRK-002	1998	SRK Consulting	Leviathan Mine Spring 1998 Stream Monitoring Program	X	X					
SRK-003	1999	SRK Consulting	1998-1999 Data Summary Report Administrative Order on Consent Leviathan Mine, Alpine County, California	X	X			X		X

TABLE 1
Historical and Ongoing Data Sources - Updated September 2008
Leviathan Mine Site

Source Codes	Date	Author(s)	Title	AVAILABLE DATA						
				SW	FLOW	BIO	SED	SOIL	SLDG	GW
HISTORICAL DATA SOURCES										
THO-001	1998	Karen A. Thomas Michael S. Lico USGS	Data on Stream-Water and Bed-Sediment Quality in the Vicinity of Leviathan Mine, Alpine County, California, and Douglas County, Nevada; September 1998	X	X		X			
THO-002	1999	Larry Thompson Dan Welsh USFW for Atlantic Richfield and LMC	Assessments of Injuries to Aquatic Natural Resources near the Leviathan Mine, Alpine County, California. Phase 1 Data Report: Concentrations of Metals and Trace Elements in Aquatic Insects and Fish			X				
WHI-001	1952	W.White NV Dept. of Health	Letter: Regarding water samples collected from Aspen and Leviathan Creeks, pre-mine.	X	X					
YOU-001	1970	Ralph Young, Agricultural Consultant	An Appraisal of the Effects of Contaminants in Irrigation Water Derived from Bryant Creek on Agriculture	X			X	X		

TABLE 2
PRISM Estimated Precipitation
Leviathan Mine Site

Month	Mean Precipitation 1971 – 2000 (inches)	Minimum Precipitation 1971 - 2000 (inches)	Maximum Precipitation 1971 - 2000 (inches)
January	5.21	0.39	13.31
February	5.18	0.34	20.6
March	4.52	0.32	16.96
April	1.83	0.19	5.42
May	1.57	0.06	5.13
June	0.81	0.02	2.76
July	0.56	0	2.05
August	0.67	0	4.16
September	1.04	0	3.83
October	1.99	0.04	7.17
November	3.89	0.22	14.01
December	4.22	0.12	15.63
Annual Total	31.48	12.61	58.12

TABLE 3
Comparison Between Site Measured Estimates and PRISM Estimates
Leviathan Mine Site

Year	Month	Site Measured Precipitation (inches)	PRISM Estimated Precipitation (inches)
2003	March	0.89	1.99
2003	April	1.49	5.02
2003	May	0.15	0.98
2003	June	0.11	0.14
2003	July	0.03	0.46
2003	August	1.5	0.83
2003	September	0.61	0.4
2003	October	0.01	0.34
2004	March	0.36	0.97
2004	April	0.63	0.74
2004	September	0.01	0.21
2004	October	1.84	4.39
2005	February	2.03	3.22
2005	March	1.35	4.35
2005	October	0.16	0.51
2005	November	0.29	2.28
2005	December	5.87	14.53
2006	March	1.73	4.9
2006	April	3.02	3.81
2006	May	0.22	0.7

TABLE 4
24-Hour Precipitation Return Periods Estimated from NOAA Atlas No. 2
Leviathan Mine Site

Return Period	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Contour crossing the Site	3	3.25	4.5	5.5	7	7.5
Area-weighted average within the Station 23 watershed	3.14	4.22	4.71	5.54	6.84	7

TABLE 5
Estimates of Probable Maximum Precipitation
Leviathan Mine Site

Duration (hours)	1	6	12	24	48	72
PMP Estimates (inches)	1.77	5.3	8.2	12.62	17.67	19.56

TABLE 6
Monthly Average Stream Flow for Gauged Stations Near Leviathan Mine
Leviathan Mine Site

Month	1999 – 2005 (cfs)			2004 -2005 (cfs)	
	Station 1	Station 15	Station 23	4L Creek	Station 22
January	0.15	0.3	2.5	0.05	0.16
February	0.17	0.46	2.77	0.05	0.16
March	0.58	1.37	5.74	0.52	0.25
April	1.73	2.79	7.65	0.68	0.28
May	2.08	3.27	7.63	0.9	0.24
June	0.34	0.74	2.55	0.18	0.18
July	0.1	0.23	1.37	0.02	0.19
August	0.06	0.17	1.32	0.01	0.18
September	0.06	0.19	1.44	0	0.15
October	0.08	0.16	1.45	0.01	0.13
November	0.11	0.21	1.76	0.03	0.16
December	0.15	0.43	2.04	0.15	0.15
Annual	0.47	0.86	3.19	0.22	0.19
Peak Daily	17	27	37	9.2	0.77

TABLE 7
Summary of Estimated Peak Discharge Return Flows
Leviathan Mine Site

Estimated Return Flows based on Regressions for Rural California (cfs)						
Station	**2 Year**	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
1	26.4	84.5	137	247.2	344.5	497.7
15	44.2	137.5	221.9	401.8	558.5	802.8
23	62.2	189.7	304.3	549.9	762.3	1093.4
4L	8.7	30.2	50.7	93.7	132.9	194.9
22	4.5	16.5	28.1	52.3	74.7	110.4

Estimated Return Flows based on Regressions for Southwestern US (cfs)						
Station	**2 Year**	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
1	25.6	61.9	94.9	154.8	213.1	282.2
15	44.4	110.1	173.7	288.9	400.2	530.6
23	71	162.5	246.5	389.9	523.9	676.9
4L	10.5	25.7	38.8	63.3	87.7	117.5
22	5.6	14	21.1	34.8	48.7	66

TABLE 8
Peak Measured Discharges
Leviathan Mine Site

Peak Discharges (cfs)			
Water Year	**Station 1**	**Station 15**	**Station 23**
1999	21	24	
2000	2.4	7.2	
2001	1.9	9.8	14
2002	6	7.5	10
2003	6	13	11
2004	7	13	13
2005	16	17	52
2006	40	68	250

TABLE 9
Estimated Probable Maximum 24-Hour Flood Flows (cfs)
Leviathan Mine Site

Station	24-hour PMF
1	1169.2
15	2399.1
23	3664.8
4L	386.8
22	186.6

TABLE 10
Average Monthly Groundwater Discharges
Leviathan Mine Site

Average Monthly Groundwater Discharge in cfs (1999 - 2005)				
Month	**Mine Adit**	**Channel Underdrain**	**Aspen Seep**	**Pit Underdrain**
January	0.031	0.042	0.026	0.001
February	0.03	0.047	0.022	0.001
March	0.031	0.054	0.028	0.003
April	0.038	0.069	0.033	0.011
May	0.049	0.071	0.028	0.011
June	0.041	0.049	0.024	0.006
July	0.036	0.032	0.021	0.003
August	0.034	0.022	0.021	0.002
September	0.033	0.014	0.02	0.001
October	0.032	0.032	0.021	0.001
November	0.03	0.033	0.03	0.001
December	0.03	0.037	0.029	0
Annual	0.034	0.042	0.025	0.003
Peak Daily Flow	0.094	0.351	0.318	

TABLE 11
Summary Statistics for Groundwater Analytical Results Obtained During the 1982 and 1998 Sampling Events
Leviathan Mine Site

Statistic	pH (s.u.)	Al (mg/L)	As (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)
USGS Sampling 1982								
Max	7.80	1,100	35.0	700	0.310	10.0	3.20	6.80
Min	1.80	0.100	0.001	11	0.001	0.005	0.003	0.010
Mediam	4.90	32	0.031	250	0.009	0.280	0.030	0.050
SRK Sampling 1998								
Max	7.11	319	6.68	487	0.169	7.19	1.41	9.30
Min	1.88	0.017	0.001	5	0.002	0.004	0.004	0.001
Mediam	4.35	26	0.061	246	0.013	0.484	0.055	0.014

Statistic	Fe (mg/L)	Mg (mg/L)	Mn (mg/L)	Ni (mg/L)	Se (mg/L)	Sulphate (mg/L)	TDS (mg/L)	Zn (mg/L)
USGS Sampling 1982								
Max		400	68.0	24.0		14000		45.0
Min		2.90	0.031	0.100		22		0.012
Mediam		58.0	6.10	1.40		1500		0.28
SRK Sampling 1998								
Max	936	178	79.2	10.5	0.178	9900	7560	2.19
Min	0.026	1.35	0.008	0.020	0.001	22	107	0.004
Mediam	227	65.9	6.78	1.35	0.004	2355	2520	0.298

TABLE 12

Chemical Attenuation Rates Calculated for Trace Metals in the Leviathan and Bryant Creeks Drainage System

Leviathan Mine Site

	Length	As	Cu		Zn		Fe	
Site Interval	km	June	June	October	June	October	June	October
10.5 to 23.5	3.78	116	+	+	+	1.5	12900	7750
23.5 to 28	8.85	0.8	12.3	4	+	5	95	1720

1 '+' indicates a net increase in max flux of metal between sites

TABLE 13

Median Values for Stream Flows and Mass Loading of Dissolved Metals Calculated from 1998 to 2006

Leviathan Mine Site

Monitoring Station	Flow	Al	As	Ca	Cu	Fe	Ni	SO4	Zn
Sta 1	3.4	29	1.1	3,548	0.9	41	0.96	2,687	0.86
Sta 15	8.6	660	10.9	106,560	6.21	16357	206	448,507	43.7
Sta 23	18	88	5.02	164,428	3.98	1918	171	540,753	35
Sta 25	58	197	16.5	202,232	17.1	658	145	573,052	27.2
Sta 26	102	186	27.5	286,281	57.5	1593	57.4	803,790	188

Flow measured in liters per second

Metal mass measured in grams per day

TABLE 14

Mass Loading Comparison for Select Constituents to Leviathan and Bryant Creeks on Specific Days

Leviathan Mine Site

Flows are in liters/second and Mass is shown in grams/day

Monitoring Station	Flow	Al	As	Ca	Cr	Cu	Fe	Ni	SO_4	Zn
Sample Date	4/26/2005									
Sta 1	125	3,015	15.1	88,282	3.23	17	2,046	17	64,597	22
Sta 15	221	7,634	133.6	591,648	1.91	145	56,302	1,052	2,099,396	515
Sta 23	340	6,166	94.0	1,010,059	5.87	264	13,507	1,125	3,229,838	352
Sta 25	538	6,509	134.8	1,297,074	9.30	251	14,412	1,158	3,612,282	372
Sample Date	5/24/2005									
Sta 1	99	1,627	14	66,799	2.57	7.71	1,113	7.71	29,117	4.28
Sta 15	167	3,176	147	313,270	4.33	46	43,309	595	866,184	115
Sta 23	241	3,744	106	623,946	6.24	67	14,559	715	1,455,875	104
Sta 25	425	5,505	128	829,481	11.01	70	13,580	716	2,172,801	110
Sample Date	4/25/2006									
Sta 1	249	4,522	26	202,403	7.75	30	3,230	41	99,048	207
Sta 15	396	4,796	158	993,420	6.85	350	51,384	1,404	3,083,028	480
Sta 23	623	9,151	210	1,722,581	14.53	323	17,226	1,615	5,060,082	425
Sta 25	878	12,136	296	1,972,159	20.48	379	19,722	1,441	4,702,842	190
Sample Date	5/30/2005									
Sta 1	68	1,409	7.05	52,852	1.35	3.05	1,233	4.70	21,141	16
Sta 15	105	643	96.01	334,973	1.63	10.86	82,385	996	1,539,067	163
Sta 23	127	418	35.23	550,541	1.54	6.50	5,065	881	2,312,271	79
Sta 25	221	611	40.08	591,648	2.67	11.07	1,145	668	1,889,456	50

TABLE 15
Initial Remedial Action Technology Descriptions
Leviathan Mine Site

General Remedial Actions	Remediation Technology/ Process Type	Description
No Action Alternative	None	It is a requirement of CERCLA and the NCP to evaluate the "No Action" alternative against other alternatives.
Institutional Controls	Administrative Controls	These are non-engineering site management techniques to protect human health and the environment. Examples of institutional controls include fencing, easements, deed restrictions, signage and monitoring.
Engineering Controls	Capping	Examples of capping include surface armoring, soil enhancement, geosynthetic or asphalt cover systems.
	Hydraulic Control	Controlling groundwater can be accomplished by. French drains, automated well fields; slurry wells or cutoff walls, etc.
	Storm Water Control	Storm water controls include waddles, bales of straw, and diversion ditches used to redirect the water. Materials such as straw and geo-textile matting are spread over large sloped areas to aid erosion control. Re-seeding an exposed area is another way to control erosion. Generally, these practices are used in conjunction with each other.
	Erosion Controls/ Diversion	Erosion control and diversion measures generally involve more construction equipment to implement and possibly the placement of armoring in the diversion ditch bottoms to control erosion. This is usually used at the perimeter of large sites in an attempt to divert flow.
	Grading/ Surface Water Diversion	Grading and surface water diversion generally describes on-site surface water control, collection and containment.
	Containment	Containment is used to prevent one media from contacting another. The use of cut off walls, ponds, and retention basins are examples of containment.
	Interceptor Trenches	Interceptor trenches are engineered subsurface structures that provide preferential pathways for groundwater to flow. They capture and divert the water prior to reaching another point.
	Reinjection/ Infiltration	Reinjection and infiltration are means of reintroducing water to the subsurface. Reinjection uses mechanical means to pump the water into the ground and infiltration relies on gravity.
Removal Actions	Excavation	Excavation is the process of physically removing a media and moving or disposing of it in a different location.
	Groundwater Extraction	Groundwater extraction is the process of removing groundwater from the subsurface usually through pumping and treating or discharging the water after extraction.

TABLE 15
Initial Remedial Action Technology Descriptions
Leviathan Mine Site

General Remedial Actions	Remediation Technology/ Process Type	Description
Physical/ Chemical Treatment	Chemical Treatment	Primarily lime treatment and variations on this technology. Lime treatment of ARD is a relatively simple chemical process where low pH ARD is neutralized using lime to precipitate dissolved metals. Chemical precipitation and other metals treatment options can also be used.
	Bioreactor	A treatment technology that uses large quantities of biologic cultures to reduce the toxic effects of waste stream being treated.
	Insitu Treatment	Insitu treatment can include insitu chemical reduction of metals or stimulating biological reduction.
Biological Treatment	Revegetation	Revegetation uses grass and plants to take up rainwater with their roots and help prevent it from soaking into the soil below. Revegetation also mitigates erosion.
	Biological Treatment	Biological treatment utilizes organic carbon and crushed limestone to enhance the conditions for sulfur reducing bacteria. These bacteria along with the limestone neutralize the pH and reduce the dissolved metal concentrations in ARD.
	Wetland Treatment	Wetlands have been demonstrated to be a technologically feasible method of treating dissolved metal laden water. Wetlands provide an organic rich environment that is typically anaerobic. The two mechanisms that remove metals are absorption by the organic rich substrate and sulfate reduction.
	Phytoremediation	Phytoremediation includes the use of plants and their associated microbiota, soil amendments and agronomic techniques to remove, contain, or render harmless environmental contaminates.

TABLE 16
Initial Remedial Actions Identified for the Aspen Creek Study Area
Leviathan Mine Site

Media	Removal Action	Description
Soil	No Action	Required by CERLCA / NCP
	Administrative Controls	Including but not limited to additional fencing, signs, land use controls
	Removal	Focused removal actions in areas identified during the RI to contain elevated concentrations of pyrite and other sulfide minerals
	Capping	Capping of selected areas to prevent contact or infiltration
	Containment	The installation of structures (diversion or otherwise) to restrict surface water and shallow groundwater from contacting certain soils
	Revegetation	Using vegetation to limit infiltration of surface water and reduce shallow groundwater
	Grading/ Surface Water Diversion	Recontouring or benching and construction diversion structures for portions of the overburden piles
	Insitu	Treatment in place for soils using chemical or biological methods
Surface Water/ Shallow Groundwater	No Action	Required by CERLCA / NCP
	Chemical Treatment	Including lime treatment, HDS, RCTS
	Biologic Treatment	Continued use of a bioreactor or similar treatment technology
	Erosion Control/ Diversion	To keep groundwater or surface water from contacting high sulfide material (source control)
	Wetland Treatment	Construction of an engineered wetland designed to support species of organisms that consume the contaminates found in ARD
	Phytoremediation	Selection and cultivation of plant species that hyperaccumulate metal into their tissue
	Reinjection/ Infiltration	Reinjection/ infiltration of diverted surface water before it contacts the overburden piles
Sediment	No Action	Required by CERLCA / NCP
	Removal	Targeted removal actions in areas identified during the RI/FS
	Storm Water Measures	Storm water control measures to prevent additional sediment from entering Aspen Creek
	Erosion Control	Erosion control measures to prevent additional sediment from entering Aspen Creek

TABLE 17
Initial Remedial Actions Identified for the Pit Study Area
Leviathan Mine Site

Area	Media	Removal Action	Description
Pit	Soil	No Action	Required by CERLCA / NCP
		Removal	Targeted removal actions in areas identified during the RI/FS Administrative Controls (see Aspen)
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Capping	The installation of an engineered cap to restrict the infiltration of surface water from contacting the areas with ARD producing mineralization
		Regrading	The expanded grading to redirect and control surface waters to reduce infiltration and erosion
		Insitu Treatment	Insitu soil treatment in order to neutralize source rock
		Revegetation	Vegetation to increase the stability of the slope, protect a cover, reduce infiltration
	Surface Water/Shallow Groundwater	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Chemical Treatment	Continued use of a lime treatment system or HDS to treat AMD
		Grading/ Diversion	Additional regrading and surface water diversion in collection areas
		Bioreactor	Using a bioreactor to treat collected AMD
		Wetland	Construct an engineered wetland to treat AMD
Adit	Soil	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Capping / Containment	Capping or controlling the adit area
		Insitu Treatment	Using the adit as a treatment cell
	Surface Water/Shallow Groundwater	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Chemical Treatment	Use of one of the chemical treatment technologies available
		Erosion Control/ Diversion	To keep groundwater from contacting high sulfide material (source control)
		Capping	The installation of an engineered cap to restrict infiltration of surface water from contacting the areas with mineralization
		Regrading	The affects of additional grading in an effort to divert water from the area
		Hydraulic Control	Extracting groundwater before it contacts mineralized material
		Insitu Treatment	The feasibility of insitu soil treatment

TABLE 17
Initial Remedial Actions Identified for the Pit Study Area
Leviathan Mine Site

Area	Media	Removal Action	Description
PUD	Soil	No Action	Required by CERLCA / NCP
		Capping	Evaluate the installation of a engineered cap
		Insitu Treatment	Insitu soil treatment
		Regrading	Additional grading
	Surface and Shallow Groundwater	No Action	Required by CERLCA / NCP
		Chemical Treatment	Continue to evaluate the most effective means of treating collected ARD
		Wetlands Treatment	Constructed wetland for treatment of ARD
		Bioremediation	Bioremediation
		Diversion	Of source water
Clarifier	Soil	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Stability of Berms	Geotechnical soil stability of the material used to construct the pond
	Surface Water and Shallow Groundwater	No Action	Required by CERLCA / NCP
		Extraction and Treatment	Evaluate the need for extraction and treatment depending upon the finding of the integrity of the liner

TABLE 18
Initial Remedial Actions Identified for the Leviathan Creek Study Area
Leviathan Mine Site

Area	Media	Removal Action	Description
Ponds	Soil	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Storm Water Controls	Existing storm water controls and make adjustments/repairs as necessary
		Revegetation	Installing plants that will thrive in the soils present in order to enhance slope stability and control erosion
		Insitu Treatment	In place soil treatment
		Liner Repair	Make necessary repairs to the liner
		Soil Stability	Evaluate stability of ponds for long-term use
	Surface Water and Shallow Groundwater	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Storm Water Controls	Existing storm water controls and make adjustments/repairs as necessary
		Liner Integrity/ Repair	Repair failed liners
		Hydraulic Controls	Hydraulic controls being used to manage surface and shallow groundwater
		Insitu Treatment	In place soil treatment
		Extraction and Treatment	The need for extraction and treatment of shallow groundwater beneath the ponds
		Expansion	Expanding existing ponds or assessing a location(s) for new pond(s)
Leviathan Creek	Surface Water	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc
		Source Controls (Upstream)	Source control measures as necessary
	Sediment	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Selected Removal	Selected removal actions downstream of the channelized portion of the creek
Channel Underdrain (CUD)	Soil	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Capping	Evaluate the installation of a engineered cap in soil areas affecting the CUD
		Revegetation	Revegetation of areas subject to erosion
		Erosion/ Diversion	Diversion of flows around the CUD
		Insitu Treatment	Insitu soil treatment
		Pond Repair	Repairing the liners in the pond as source to CUD

TABLE 18
Initial Remedial Actions Identified for the Leviathan Creek Study Area
Leviathan Mine Site

Area	Media	Removal Action	Description
Channel Underdrain (CUD)	Surface water and Shallow groundwater	No Action	Required by CERLCA / NCP
		Chemical Treatment	Continue collection and treatment of flows through the on-site chemical treatment plant(s)
		Hydraulic Control	Extraction or infiltration of flows before entering the CUD
		Wetlands	The feasibility of constructing an engineered wetlands to treat the flow
		Source Control	Eliminate sources of water
Delta Seep	Soil	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Capping	The installation of a engineered cap
		Insitu Treatment	Insitu soil treatment to eliminate source rock
		Containment	Containment of soil impacts
		Storm Water Controls	Existing storm water controls and make adjustments/repairs as necessary
		Revegetation	Revegetation of the area
		Soil Stability	Evaluate slope stability
	Surface water and Shallow groundwater	No Action	Required by CERLCA / NCP
		Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
		Erosion Control/ Diversion	To avoid contact with source materials or redirect flows
		Chemical Treatment	Treat the discharge with the on-site chemical treatment system
		Wetlands	Constructing an engineered wetlands to treat the flow
		Source Control	Eliminate sources of water

TABLE 19
Initial Remedial Actions Identified for the Offsite Study Area
Leviathan Mine Site

Media	Removal Action	Description
Surface Water and Shallow Groundwater	No Action	Required by CERLCA / NCP
	Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
Sediments	No Action	Required by CERLCA / NCP
	Administrative Controls	Including but not limited to additional fencing, signs, land use controls, etc.
	Source Treatment (Upstream)	Continued source control and treatment options
	Selected Removal	Selected sediment removal

TABLE 20
Initial Chemical-Specific ARARs and TBCs
Leviathan Mine Site

Chemical Specific ARAR	Agency	Reference	Description
Federal Drinking Water Standards	US EPA	Safe Drinking Water Act (SDWA) (42 U.S.C.) §6901 through 6992 40 CFR Part 141 et seq.	The federal Safe Drinking Water Act (SDWA) (42 U.S.C.) §6901 through 6992 40 CFR Part 141 et seq.) establishes national primary drinking water standards, as set forth in chemical-specific MCLs, to protect the quality of water distributed through public water systems.
Federal Health Advisories	US EPA	U.S. EPA's Office of Drinking Water	Federal health advisories are criteria published by U.S. EPA's Office of Drinking Water, founded on the National Academy of Science's Suggested Non-Adverse Response Levels (SNARLS) at which no known or anticipated adverse human health effects would occur, given an adequate margin of safety.
Clean Water Act (CWA)	US EPA / RWQCB	CWA, as set forth at 33 U.S.C.	The Clean Water Act is a federal act that establishes a system of minimum effluent discharge and pretreatment standards and water quality criteria. If discharges to surface waters are part of any final or interim remedial action, the CWA, as set forth at 33 U.S.C.
Resource Conservation and Recovery Act (RCRA) as Amended by the Hazardous and Solid Waste Amendments	US EPA / DTSC	42 U.S.C. §§6901-6992 40 CFR Part 264.90	RCRA establishes standards for management of hazardous wastes, and corrective actions associated therewith (42 U.S.C. §§6901-6992). RCRA also provides for groundwater protection standards for land-based permitted hazardous waste management units (40 CFR Part 264.90). Such standards are not likely to be ARARs at the site, RCRA was amended in 1980, by adding section 3001(b)(3)(A)(ii), known as the Bevill Exclusion, to exclude "solid waste from the extraction, beneficiation, and processing of ores and minerals" from regulation as hazardous waste under Subtitle C of RCRA. This exclusion would be "applicable" to operations at the site.
National Oil and Hazardous Substances Pollution Contingency Plan (NCP)	US EPA	NCP	The NCP establishes MCLGs for potential sources of drinking water and procedures for implementing cleanup of specific wastes. Only non-zero MCLGs are relevant and appropriate.
Natural Resource Damage Assessment (NRDA)	US EPA	43 CFR Part 11	The Department of Interior NRDA regulations as presented in [43 CFR Part 11]. The purpose of this part is to provide standardized and cost-effective procedures for assessing natural resource damages.
Department of Interior, Departmental Manual (DM)	US EPA	207 DM 6, paragraph 6.3B	Delegation of authority to act on the behalf of the Secretary of Interior to bureau director in conducting NRDA activities is [207 DM 6, paragraph 6.3B]

TABLE 20
Initial Chemical-Specific ARARs and TBCs
Leviathan Mine Site

Chemical Specific ARAR	Agency	Reference	Description
California Water Quality Standards	RWQCB	RWQCB (the site is within the Lahontan [Region 6] RWQCB jurisdiction)	The Porter-Cologne Water Quality Control Act provides the California State Water Resources Control Board (SWRCB) and the RWQCB (the site is within the Lahontan [Region 6] RWQCB jurisdiction) with the authority and responsibility to develop laws and regulations to protect the beneficial uses of water in the region.
Drinking Water Standards	DHS / RWQCB	California Health and Safety Code Division 5, Part 1, Chapter 7, Section 4010 et seq.	The California SDWA (California Health and Safety Code Division 5, Part 1, Chapter 7, Section 4010 et seq.) regulates drinking water standards. Like the federal SDWA, the California SDWA establishes primary and secondary MCLs.
SDWA Groundwater Protection Standard	RWQCB	Title 22, and Section 66264.94	California Code of Regulations, Title 22, and Section 66264.94 establish groundwater protection standards for RCRA regulated units. These regulations state that a given constituent in groundwater must not exceed the background level of that constituent or some higher concentration limit that is set as part of the corrective action program.
Surface Water Quality Standards	RWQCB	California Water Code § 13000 et seq. and CWA Section 303(C)(2)(B)	The State of California has also developed water quality standards for the protection of surface waters (see California Water Code § 13000 et seq. and CWA Section 303(C)(2)(B)). The Lahontan region's promulgated surface water quality standards, established by the California Inland Surface Waters Plan and specified in the Region 6 Basin Plan for COPCs at the site.
Additional Water Quality ARARs and TBCs	RWQCB	State Water Resources Control Board Resolution No. 68-16; 88-63; 92-49	State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California (Anti-degradation Policy). This resolution requires the maintenance of high quality water in California.
Federal Hazardous Waste Management Regulations	US EPA / DTSC	Bevill Exclusion discussion in Section 7.3.2.1	The RCRA regulates the handling, treatment, storage, transportation, and disposal of hazardous and solid wastes. The act contains nine sections (subtitles) that deal with waste management activities. See Bevill Exclusion discussion in Section 7.3.2.1.
U.S. EPA Region IX Preliminary Remediation Goals	US EPA	U.S. EPA, 2008	U.S. EPA Region IX has drafted PRGs for soil, air, and tap water, which were issued in April 1993 and most recently updated on September 12, 2008 (U.S. EPA, 2008). Soil PRGs are established for both residential and industrial scenarios.
Occupational Safety and Health Administration (OSHA)	OSHA	29 CFR 1910.120	A hazardous materials incident contingency plan is required for all staff per the requirements of 29 CFR 1910.120. Personnel safety is a primary focus, proper documentation, training and equipment are necessary to perform activities at the site.

TABLE 20
Initial Chemical-Specific ARARs and TBCs
Leviathan Mine Site

Chemical Specific ARAR	Agency	Reference	Description
California Hazardous Waste Management Regulations	DTSC	California Health and Safety Code Section 25100 et seq., 22 CCR 66261 through 22 CCR 66270, and 23 CCR, Division 3, Chapter 15	State hazardous waste handling, treatment, storage, transport and disposal requirements (California Health and Safety Code Section 25100 et seq., 22 CCR 66261 through 22 CCR 66270, and 23 CCR, Division 3, Chapter 15) apply to wastes that are defined as hazardous under state regulations. The state definition of hazardous waste is more expansive than the federal definition under RCRA.

TABLE 21
Potential Action-Specific ARARs and TBCs for the Leviathan Mine Site

Chemical Specific ARAR	Agency	Reference	Description
RCRA Requirements	US EPA	RCRA Subtitle C, 40 CFR 264 and 265	The U.S. EPA has authorized the State of California to run its hazardous waste and corrective action programs in-lieu of RCRA. To operate in-lieu of the federal program, state requirements must be at least as stringent as federal requirements.
Hazardous Waste Storage	US EPA	22 CCR 66264.171 through §175 (RCRA)	The substantive storage requirements are found in 22 CCR 66264.171 through §175 (RCRA) and are applicable to the storage of hazardous wastes generated on site, such as contaminated groundwater, soil cuttings, and treatment plant residuals.
The Hazardous Waste Identification Rule	US EPA	40 CFR Part 270	Recent RCRA amendments (the "Hazardous Waste Identification Rule" or the HWIR Media Rule) established a streamlined permitting process known as the Hazardous Waste Permit Program, 40 CFR Part 270.
Treatment or Storage in Staging Piles	US EPA	40 CFR Part 264.554	Staging piles are sometimes used in a remediation activity (40 CFR Part 264.554). A "staging pile" is defined as an accumulation of solid, non-flowing remediation waste that is used only during remedial operations for temporary storage at a facility.
Area of Contamination Policy	US EPA	55 Fed Reg. 8758-8760; OSWER Directive 9502.1996	U.S. EPA's area of contamination (AOC) policy allows certain discrete areas of generally dispersed contamination to be treated as it would within RCRA landfills (55 Fed Reg. 8758-8760; OSWER Directive 9502.1996). Its application does not require federal oversight.
Corrective Action Waste Management Units	US EPA	40 CFR Part 264.101 40 CFR 260.10 and 40 CFR 264.552 and 264.553	The revised RCRA (HWIR Media Rule) regulations also allow for managing hazardous remediation wastes (as defined at 40 CFR Part 264.101) in CAMU. Such CAMU requirements constitute an action-specific ARAR for the site (see 40 CFR 260.10 and 40 CFR 264.552 and 264.553).
Waste Discharge to Land	RWQCB	Title 23 of the CCR, Division 3, Chapter 15	The requirements set forth at Title 23 of the CCR, Division 3, Chapter 15 regulate the substantive discharge of waste to land and may be "applicable" if wastes will be left in place. These requirements provide standards for design, construction, monitoring, closure, and post-closure maintenance for waste management units that accept wastes.
Soil and Groundwater Remediation	US EPA	OSWER Directive 9200.4-17	The U.S. EPA has issued OSWER Directive 9200.4-17, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, that addresses the use of monitored natural attenuation for the remediation of contaminated soil and groundwater at sites governed by CERCLA or RCRA regulations.

TABLE 21
Potential Action-Specific ARARs and TBCs for the Leviathan Mine Site

Chemical Specific ARAR	Agency	Reference	Description
California Air Resources Act	CARB	HSC Division 26, Section 39000 and CCR 17, Part III, Chapter 1, Section 6000	The California Air Resources Act in implemented by the California Environmental Protection Agency's Air Resouces Board. Cal. Health & Safety Code, Division 26, Section 39000, 17 Cal. Code Reg., Part III, Chapter 1, Section 60000. The Act and it's attendant regualtions regulate vehicular and non-vehicular sources of certain air contaminants. They also provide the basis for establishing state Ambient Air Quality Standards. Primary responsibility for regualtion of stationary source emissions is delegated to local air quality management districts.
Public Nuisance	AQMD	AQMD Rule 400 and HSC 41700	Activities which cause injury, detriment, nuisance or annoyance to an considerable number of persons or to the public or which endanger the confort, repose, health or safety of any such persons of the public or which cause or have a natural tendency to cause injury or damage to business or property are prohibited under Great Basin Unified, Air Quality Management District (AQMD) Regulations, Rule 400. See, also, Health and Safety Code 41700. This rule would be "applicable" to operations at the site which emit, or may emit, ait contaminants, odors or other materials.