Interim Monitoring Report – May 2014 Monitoring Results

Union Pacific Railroad Great Salt Lake Causeway Culvert Closure and Bridge Construction Project

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Acronyms

°C	degrees Celsius
µg/L	micrograms per liter
µm	micrometers
µm/cm	micrometers per centimeter
µmhos	micromhos
µS/cm	microsiemens per centimeter
$CaCO_3$	calcium carbonate
cm	centimeters
EPA	U.S. Environmental Protection Agency
g/mL	grams per milliliter
GIS	geographic information systems
IMP	Interim Monitoring Plan
km	kilometers
m	meters
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NA	not applicable
NELAP	National Environmental Laboratory Accreditation Program
ng/g	nanograms per gram
ng/L	nanograms per liter
NGVD	National Geodetic Vertical Datum
NWP	Nationwide Permit
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
SM	Standard Methods for the Examination of Water and Wastewater
SOP	standard operating procedure
su	standard units
TDS	total dissolved solids
UDWQ	Utah Division of Water Quality
UGS	Utah Geological Survey
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

1.0 Interim Monitoring Goals and Objectives

1.1 Background

Union Pacific Railroad (UPRR) conducted interim monitoring in the Great Salt Lake pursuant to meeting the requirements of the U.S. Army Corps of Engineers (USACE) Nationwide Permit (NWP) 14 authorization and the Utah Division of Water Quality (UDWQ) 401 Water Quality Certification for temporary closure of the east culvert which is located in the UPRR causeway that extends across the Great Salt Lake (USACE 2013, 2014; UDWQ 2013).

The interim monitoring plan (IMP) consisted of four elements: (1) compiling surface water elevation data for the concurrent monitoring period, (2) collecting in-situ water profiles for temperature and other parameters, (3) collecting water quality samples for metals and other analyses at an off-site laboratory, and (4) collecting brine shrimp samples for metals analyses at an off-site laboratory and counts and taxonomic identification (Table 1; UPRR 2014).

Compiling surface water elevation and collecting salinity gradient data meets the USACE NWP 14 interim monitoring requirements (USACE 2013). Interim monitoring is focused on characterizing the open waters of Gilbert Bay and Gunnison Bay near the project site (Figure 1).

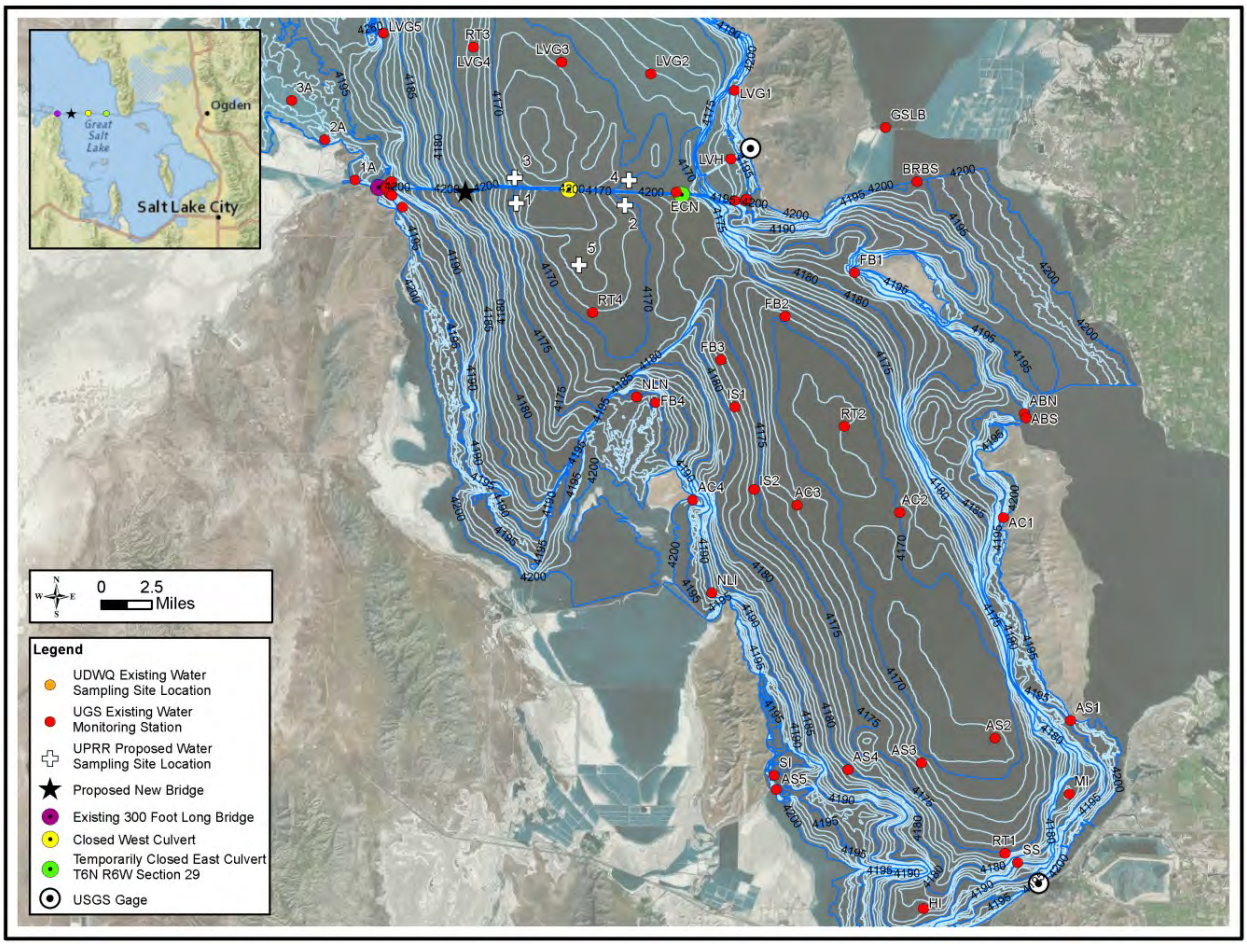
Table 1. Interim Monitoring Goals and Objectives

Element	Goals	Objectives
Surface water elevations	Capture temporary hydrologic impacts resulting from closure of the east culvert.	Obtain surface water elevations for the North Arm and South Arm of the Great Salt Lake from USGS reporting stations located at Saline and Saltair.
Surface water profiles and conventional water quality	Collect Great Salt Lake total water depth, depth to the deep brine layer[a] (if present), ambient Secchi depth, pH, temperature, and salinity data set.	Collect salinity data consistent with UDWQ and USGS methods and reporting limits.
Surface and bottom water metals, sulfate sampling and dissolved oxygen	Collect Great Salt Lake ambient metals, sulfate, hardness, and dissolved oxygen data set in surface water.	Collect metals, sulfate, and dissolved oxygen water samples at specified locations consistent with UDWQ reporting limits.
Brine shrimp counts and tissue sampling	Collect Great Salt Lake ambient brine shrimp population data and tissue metals and percent moisture data set at co-located South Arm water quality stations.	Collect brine shrimp for taxonomic identification, counts, and tissue analysis at specified locations in accordance with UDWQ-approved reporting limits.

UDWQ = Utah Division of Water Quality; USGS = U.S. Geological Survey

[a] Deep brine layer depth refers to the vertical zone in a water column in which salinity changes rapidly with depth. For the purpose of this interim monitoring plan, deep brine layer depth, halocline, and chemocline are synonymous.

Figure 1. Interim Monitoring Sampling Site Locations



Source: UPRR 2011

1.2 May 2014 Monitoring Event

HDR conducted the monitoring event on behalf of UPRR. This was the first monitoring event conducted.

The ambient lake sampling event occurred during the week of May 18, 2014. This report is provided as a data report to document the collection of samples during and laboratory analysis of samples from the open-water sampling event in accordance with permit conditions and the IMP. No interpretation of the data is provided in this report; interpretation will be provided in the annual interim monitoring report in accordance with the IMP (UPRR 2014).

2.0 Methods

Sample site locations are shown in Figure 1 above and are listed in Table 2 below. In accordance with the UDWQ- and USACE-approved IMP, monitoring occurred at three locations in Gilbert Bay and two locations in Gunnison Bay: locations to the south and north of the UPRR Great Salt Lake causeway in the vicinity of the east and west culverts and a location in Gilbert Bay between the causeway and the rest of Gilbert Bay. These sampling sites were located in the open waters of Gunnison and Gilbert Bays at locations specified in the Utah 401 Water Quality Certification and USACE NWP 14. Photographs were collected during the monitoring event at each site and are presented in Appendix B, Site Photographs, of this report.

Table 2. Interim Monitoring Sampling Site Coordinates and Descriptions

Site Name	Latitude	Longitude	Description
Gilbert Bay			
Sampling site 1	41° 12' 49.65" N	112° 43' 4.82" W	Halfway between the proposed bridge and the west culvert; 1 km south of the UPRR causeway
Sampling site 2	41° 12' 47.86" N	112° 36' 52.62" W	Halfway between the west and east culverts; 1 km south of the UPRR causeway
Sampling site 5	41° 10' 9.65" N	112° 39' 25.81" W	6 km south of the west culvert
Gunnison Bay			
Sampling site 3	41° 13' 54.62" N	112° 43' 11.77" W	Halfway between the proposed bridge and the west culvert; 1 km north of the UPRR causeway
Sampling site 4	41° 13' 34.84" N	112° 36' 40.64" W	Halfway between the west and east culverts; 0.5 km north of the UPRR causeway

N = north; W = west; km = kilometers, UPRR = Union Pacific Railroad

Table 3 below lists the samples collected and parameters measured at each site as well as the frequency of collection.

2.1 Surface Water Elevation

The U.S. Geological Survey (USGS) records surface water elevations at Saltair (USGS Station 10010000) and Saline, Utah (USGS Station 10010100) (see Figure 1 above). Elevations are in the National Geodetic Vertical Datum of 1929 (NGVD 29) datum. Data were downloaded from ut.water.usgs.gov/greatsaltlake/elevations for the week of sample collection.

Table 3. Interim Monitoring Parameters, Locations and Frequency

Parameter	Number and Sample Depth	Frequency	Field Duplicate	Field Blank	Equipment Blank	Sampling Site				
						1	2	3	4	5
Total water depth	One measurement taken from water surface to bottom of lake.	Four times per year	NA	NA	NA	X	X	X	X	X
Depth from water surface to deep brine layer	One location inferred from conductivity profile	Four times per year	NA	NA	NA	X	X	X	X	X
Secchi depth	Measurements taken from water surface and averaged.	Four times per year	NA	NA	NA	X	X	X	X	X
Conductivity, temperature, pH	Vertical profile; measurements taken in situ every 0.5 m. The field conductivity measurements will establish whether there is a deep brine layer present.	Four times per year	NA	NA	NA	X	X	X	X	X
Total dissolved solids, density	Vertical profile; grab samples taken every 1.5 m in upper brine layer; samples taken every 0.5 m in the deep brine layer.	Four times per year	10% of samples	10% of samples	10% of samples	X	X	X	X	X
Total metals (As, Cu, Pb, Se, Hg, Zn), SO_4, hardness, and DO	Grab samples taken 0.2 m from the water surface and 0.5 m from the bottom.	Four times per year	10% of samples	10% of samples	10% of samples	X	X	X	X	X
Brine shrimp count	One sample from one vertical tow.	Tri-annually (May, July, and September)	1 per event	NA	NA	X	X	NA	NA	X
Brine shrimp tissue, percent moisture	Composite sample from three vertical tows.	Tri-annually (May, July, and September)	1 per event	NA	NA	X	X	NA	NA	X

m = meters
NA = not applicable
X = parameter measured at this site
As = arsenic
Cu = copper
DO = dissolved oxygen
Hg = mercury
Pb = lead
Se = selenium
SO_4 = sulfate
Zn = zinc

[a] See Section 2.4, Brine Shrimp, and Appendix F, Data Quality Assurance Documentation. Field duplicate, field blank, and equipment blank samples were collected as part of the field quality assurance program.

2.2 In-situ Measurements

UPRR noted relevant conditions (air temperature and a description of the location) on the field data sheet during each sampling event. Field data sheets are provided in Appendix G, Field and Analytical Laboratory Data Reports. Shared sampling equipment was thoroughly cleaned between sampling sites.

In-situ water quality measurements included total water depth, depth to the deep brine layer (if present), Secchi depth, and vertical profiles of water temperature, conductivity, dissolved oxygen, and pH. Secchi depth was measured first. Then, water temperature, conductivity, dissolved oxygen, and pH were measured every 0.5 meter (m) with a multiprobe water quality meter. These water quality measurements were used to determine the depth to the deep brine layer, if present. The depth to the deep brine layer was used to determine the frequency of the grab samples for dissolved oxygen, total dissolved solids (TDS) concentrations, and density samples according to the following rules:

- If a deep brine layer is present:
  - Collect samples above the deep brine layer every 1.5 m.
  - Collect samples below the deep brine layer every 0.5 m.
- If a deep brine layer is not present:
  - Collect samples every 1.5 m.

A Troll 9500, rented from In-Situ, Inc., was used for data collection. Calibration of each probe was performed by In-Situ, Inc., prior to deployment (Appendix F, Data Quality Assurance Documentation). Calibration was also verified in the field using the manufacturer's recommended calibration methods.

2.3 Surface Water Sample Analyses

As described in the USACE- and UDWQ-approved IMP, each analytical sample was collected into laboratory-supplied clean containers. Water samples were collected at depth with a Kemmerer sampler, which was thoroughly cleaned between sites.

Water samples to be analyzed for metals were collected using "clean hands" methods consistent with the U.S. Environmental Protection Agency's (EPA) Method 1669 (EPA 1996) and the UDWQ Standard Operating Procedure (SOP) for "Trace Metals Sample Collection (Clean Hands/Dirty Hands), Decontamination, and Multiprobe In-situ Monitoring Procedures."

The samples were preserved (as appropriate), stored, and delivered to a National Environmental Laboratory Accreditation Program (NELAP)–certified laboratory for analyzing the laboratory parameters listed in the IMP (Table 4 below; UPRR 2014). May 2014 metals samples were analyzed by Brooks Rand Laboratory in Seattle, Washington. Density, dissolved oxygen, hardness, sulfate, TDS analyses were performed by American West Analytical Laboratory in Salt Lake City, Utah. A chain-of-custody record was maintained with the samples at all times.

Table 4. Water Quality Parameters and Constituents To Be Measured and Methods, with Detection Limits, Reporting Limits, and Laboratory Hold Time

Parameter		Method [a]	Method Detection Limit	Method Reporting Limit	Hold Time
Field Measurements – Surface Water					
Lake elevation [b]	—	USGS automated gage	—	—	—
Total water depth	—	Troll 9500 field measurement	—	0.1 m	Field
Depth to deep brine layer [c]	—	Troll 9500 field measurement	—	0.1 m	Field
Secchi depth	—	—	—	0.1 m	Field
pH	—	SM 4500-H	0.1 su	0.1 su	Field profile
Specific conductivity	—	SM 2510A	0.001 µmhos	0.001 µmhos	Field profile
Temperature	—	SM 2520	0.1 ºC	0.1 ºC	Field profile
Laboratory Analyses – Surface Water [d,e]					
Density	—	SM 2710F	—	0.001 g/mL	7 days
Dissolved oxygen	DO	SM 4500-OC	—	0.1 mg/L	8 hours
Hardness	—	SM 2340 C	—	1 mg/L as $CaCO_3$	14 days
Sulfate (total)	SO_4^{2-}	EPA 300.0	—	1 mg/L	28 days
Total dissolved solids [f]	Salinity [f]	SM 2540C	—	5 mg/L	7 days
Arsenic (total)	As	EPA 1640	0.05 µg/L	0.15 µg/L	180 days
Copper (total)	Cu	EPA 1640	0.04 µg/L	0.12 µg/L	180 days
Lead (total)	Pb	EPA 1640	0.003 µg/L	0.013 µg/L	180 days
Mercury (total)	Hg	EPA 1631E	0.15 ng/L	0.40 ng/L	28 days
Selenium (total)	Se	EPA 1640	0.070 µg/L	0.210 µg/L	180 days
Zinc (total)	Zn	EPA 1640	0.26 µg/L	0.75 µg/L	180 days
Laboratory Analyses – Gilbert Bay Brine Shrimp [e]					
Percent moisture	—	SM 2540G	—	1.0%	—
Arsenic (total)	As	EPA 1638	0.014 mg/kg	0.040 mg/kg	180 days
Copper (total)	Cu	EPA 1638	0.03 mg/kg	0.16 mg/kg	180 days
Lead (total)	Pb	EPA 1638	0.004 mg/kg	0.040 mg/kg	180 days
Mercury (total)	Hg	EPA 1631	0.12 ng/g	0.4 ng/g	28 days
Selenium (total)	Se	EPA 1638	0.06 mg/kg	0.15 mg/kg	180 days
Zinc (total)	Zn	EPA 1638	0.20 mg/kg	1.00 mg/kg	180 days

Table 4. Water Quality Parameters and Constituents To Be Measured and Methods, with Detection Limits, Reporting Limits, and Laboratory Hold Time

Parameter	Method [a]	Method Detection Limit	Method Reporting Limit	Hold Time
Laboratory Counts – Gilbert Bay Brine Shrimp				
Brine shrimp (*Artemia franciscana*)	Dissection microscope	Not applicable	Not applicable	Not applicable

°C = degrees Celsius
$CaCO_3$ = calcium carbonate
EPA = sampling method from EPA
µmhos = micromhos
m = meters
SM = Standard Methods for the Examination of Water and Wastewater
g/mL = grams per milliliter
mg/L = milligrams per liter
µg/L = micrograms per liter
ng/L = nanograms per liter
mg/kg = milligrams per kilogram
ng/g = nanograms per gram
su = standard units

[a] Laboratory Analytical Method or field equipment
[b] See Section 2.1, Surface Water Elevation.
[c] Deep brine layer depth refers to the vertical zone in a water column in which salinity changes rapidly with depth. The location of the deep brine layer is determined from abrupt changes in conductivity, temperature and dissolved oxygen.
[d] Estimated by American West Analytical Laboratories and Brooks Rand Laboratories (metals). Due to the nature of Great Salt Lake water, reporting limits might be elevated for some analyses.
[e] Estimated by Brooks Rand Laboratories. Due to the nature of brine shrimp tissue, reporting limits might be elevated for some analyses.
[f] Total dissolved solids will be measured to estimate salinity.

2.4 Brine Shrimp

Brine shrimp samples were collected for both metals analyses and taxonomic identification. Brine shrimp were collected via vertical tow within Gilbert Bay at stations 1, 2, and 5. Up to three vertical plankton tows were performed at stations 1, 2, and 5 to obtain brine shrimp for analytical laboratory analysis. One plankton tow was performed at these stations for brine shrimp taxonomic life stage identification and counts.

Each tow was from the bottom of the water column to the water surface, using a 165-micrometer (µm) net with a 50-centimeter (cm)-diameter opening and a screened sample bucket attached at the bottom. The net was lowered to the desired depth and raised at an approximate rate of 0.5 m per second to collect brine shrimp from the water column.

The analytical sample was concentrated into the sample bucket and transferred to a labeled and NELAP-certified laboratory-supplied sample jar. The procedure was repeated in order to collect a sample for brine shrimp taxonomic analysis by EcoAnalysts, Inc., a laboratory certified by the Society for Freshwater Sciences. The samples were stored and recorded on separate chain-of-custody forms (one for the analytical laboratory and one for the taxonomic laboratory).

2.5 Quality Assurance

All data were collected in accordance with the IMP's Quality Assurance Project Plan (QAPP) (UPRR 2014). After each event, UPRR subjected all data to quality assurance/quality control (QA/QC) procedures including but not limited to spot checks of transcription, review of electronic data submissions for completeness, comparison of geographic information systems (GIS) maps with field notes on locations, and identification of any inconsistent data. Documentation of this process is provided in Appendix F, Data Quality Assurance Documentation.

In addition, UPRR evaluated the resulting data for their consistency with the data quality objectives in the QAPP. As a result of this process, UPRR determined that the laboratory's density and dissolved oxygen data were not usable and qualified these data as "R" (rejected). Quality assurance documentation is provided in Appendix F, Data Quality Assurance Documentation. UPRR compensated for the rejected data as described in Section 2.6 below.

2.6 Study Variances and Corrective Action

The May 2014 study was conducted in conformance with the IMP, with four noted variances.

- Brine shrimp sample collection for metals analysis was limited to one vertical plankton tow per site instead of three tows as specified in the IMP. It was determined in the field that one tow would provide an adequate quantity of sample because of the abundance of shrimp observed on the first tow at each site. Data quality was not reduced due to this variance. No corrective action will be required.
- The brine layer's location was not determined via conductivity readings. In-situ conductivity measurements could not be collected because the incorrect (low-range) probe was deployed on the Troll 9500 sensor packet. The probe did not provide results at the range of conditions in the Great Salt Lake. For May 2014, the depth to the deep brine layer was determined by the Troll 9500's temperature and dissolved oxygen probes, which were calibrated and functional. UPRR consulted with USGS (Rowland 2014) to identify a high-range probe for the July 2014 sampling event. The high-range probe will be used and calibrated to a commercially available 100,000-microsiemens-per-centimeter (µS/cm) calibration solution. In July 2014, the depth to the deep brine layer (if present) will be determined using the Troll 9500 with the high-range conductivity probe and will be confirmed with temperature and dissolved oxygen measurements.
- Laboratory measurements of density did not differentiate conditions among samples. Dilutions performed when implementing Standard Methods for the Examination of Water and Wastewater (SM) 2710F reduced sample precision such that differences among the samples were not observable. Hence, the density and salinity values reported in this report were calculated from TDS concentration analytical results according to Waddell and Bolke (USGS 1973). UPRR consulted with the Utah Geological Survey (UGS) (Rupke 2014) to identify an alternate approach to determine density for the July 2014 effort. In addition to laboratory measurements, specific gravity measurements of the samples will be made with a hydrometer in July 2014 to calculate density and salinity. The hydrometer SOP is provided in Appendix H, Standard Operating Procedure for Specific Gravity Determinations Using a Hydrometer (ASTM D1429 – 13).
- Dissolved oxygen was measured two ways: via a probe on the Troll 9500 and via the Winkler method (SM 4500-OC). Dissolved oxygen determinations using the Winkler method did not

produce plausible results (that is, anoxic concentrations in the upper water column with observable and abundant aquatic life). The reason for the apparent interference could not be identified by the laboratory. UPRR concluded that the Winkler method might not be appropriate for use in Great Salt Lake brine; therefore, it will not be used further in the study's laboratory program. Dissolved oxygen will continue to be measured in situ with the Troll 9500.

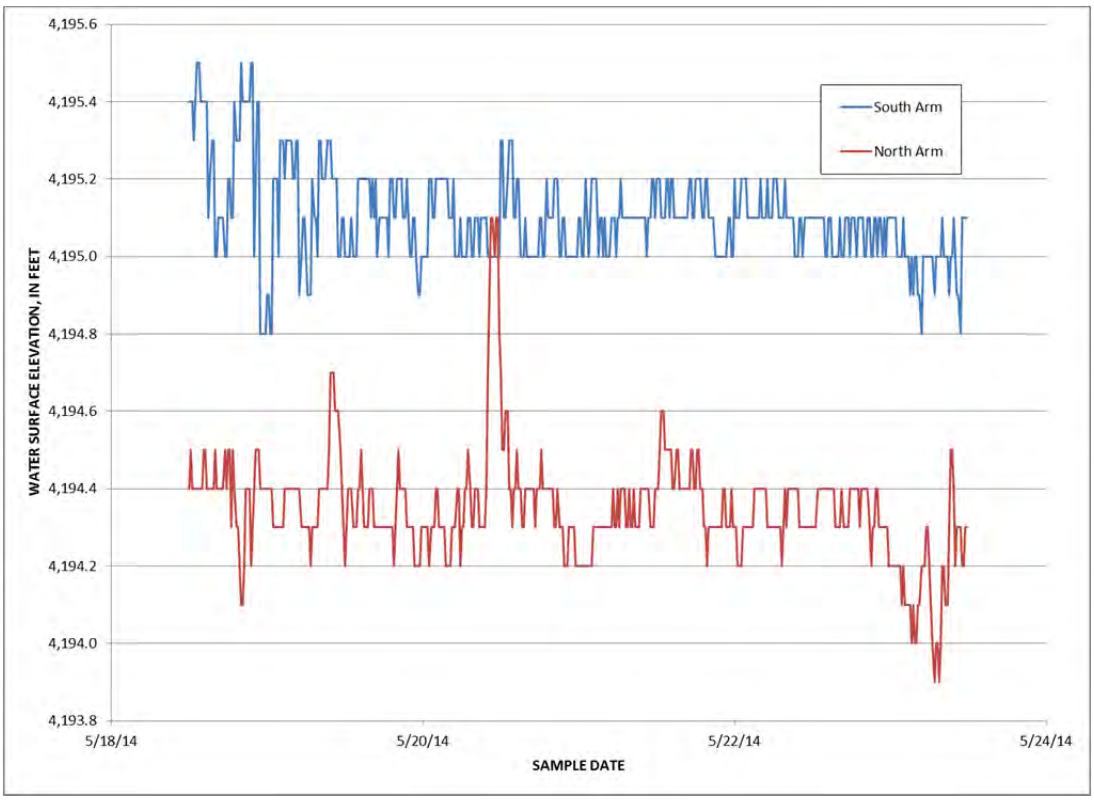
3.0 Results

The May 2014 monitoring event occurred on May 22 in Gunnison Bay (sites 3 and 4) during a period of clear and calm weather with calm seas. The Gilbert Bay sites (sites 1, 2, and 5) were sampled on May 23. On this day, the weather was clear with a light wind and variable surface conditions. Sites 1 and 2 were sampled during calm seas (see the photos in Appendix B, Site Photographs). Site 5 was sampled in approximately 1- to 2-foot seas.

3.1 Surface Water Elevation

UPRR acquired surface water elevation data in 15-minute increments for Gunnison and Gilbert Bay from the USGS website (USGS 2014; see Appendix A, Surface Water Elevation Data). During the monitoring period, the surface water elevation recorded at the South Arm gage was about 4,195.1 feet, and the North Arm gage was between 0.6 foot and 0.8 foot lower in elevation (Figure 2).

Figure 2. South and North Arm Surface Water Elevations (USGS Stations 10010000 and 10010100) during the May 2014 Monitoring Period



Elevations are in the NGVD 29 datum.

3.2 In-situ Measurements

Synoptic in-situ measurements are provided in Table 4. Temperature, pH, and dissolved oxygen profiles are provided in Figure 3, Figure 4, and Figure 5, respectively. The total water depths of sampling sites ranged from 7.2 m to 8.5 m (Table 5). Sites 1 and 5 had a deep brine layer at 6.5-m depth that ranged in thickness between 1.5 m and 2.0 m. Gilbert Bay sites (1, 2, and 5) had Secchi depths between 2.0 m and 2.3 m, while the Gunnison Bay sites (2 and 3) both had much lower water transparency.

Table 5. Water Level, Total Depth, Secchi Depth, and Brine Layer Depth

Parameter	Units	Gilbert Bay			Gunnison Bay	
		Site 1	Site 2	Site 5	Site 3	Site 4
Average water surface elevation of sampling day	feet NGVD 29	4,195.1			4,194.3	
Secchi depth	meters	2.3	2.0	2.0	0.7	0.7
Total water depth	meters	8.5	7.2	8.0	7.5	7.7
Depth from water surface to deep brine layer	meters	6.5	Not found	6.5	Not found	Not found
Deep brine layer thickness	meters	2.0	Not found	1.5	Not found	Not found

NGVD 29 = National Geodetic Vertical Datum of 1929

Water temperatures in Gilbert Bay (sites 1, 2, and 5) were similar, with decreasing temperatures in the deep brine layer (Figure 3). Water temperatures in Gunnison Bay (sites 3 and 4) were similar and warmer than in Gilbert Bay. Gilbert Bay (sites 1, 2, and 5) had similar pH profiles, with slightly reduced pH in the deep brine layer at sites 1 and 5 (Figure 4). The Gunnison Bay sites (3 and 4) were similar, with slightly acidic pH near the surface. Gilbert Bay (sites 1, 2, and 5) had lower dissolved oxygen concentrations than Gunnison Bay (sites 2 and 3; Figure 5). Sites 1 and 5 had anoxic conditions in the deep brine layer.

Figure 3. Temperature Profiles

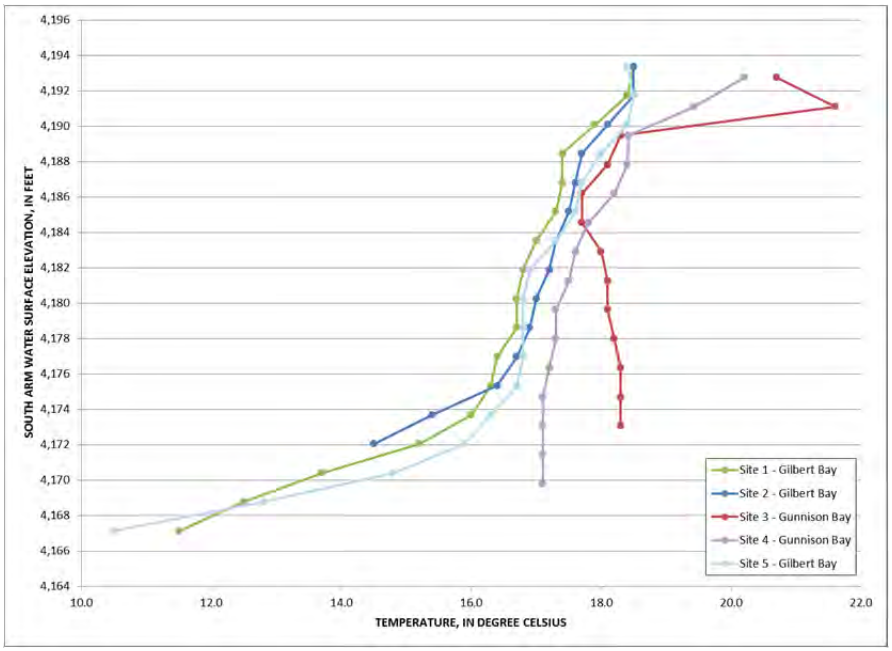


Figure 4. pH Profiles

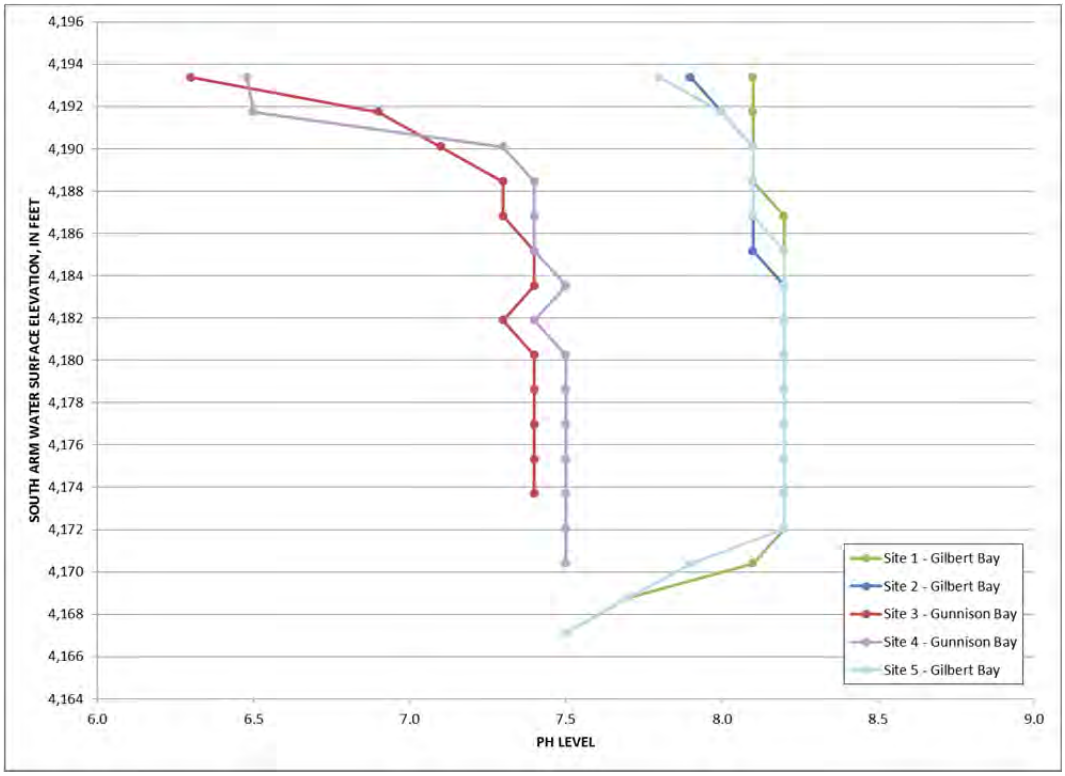
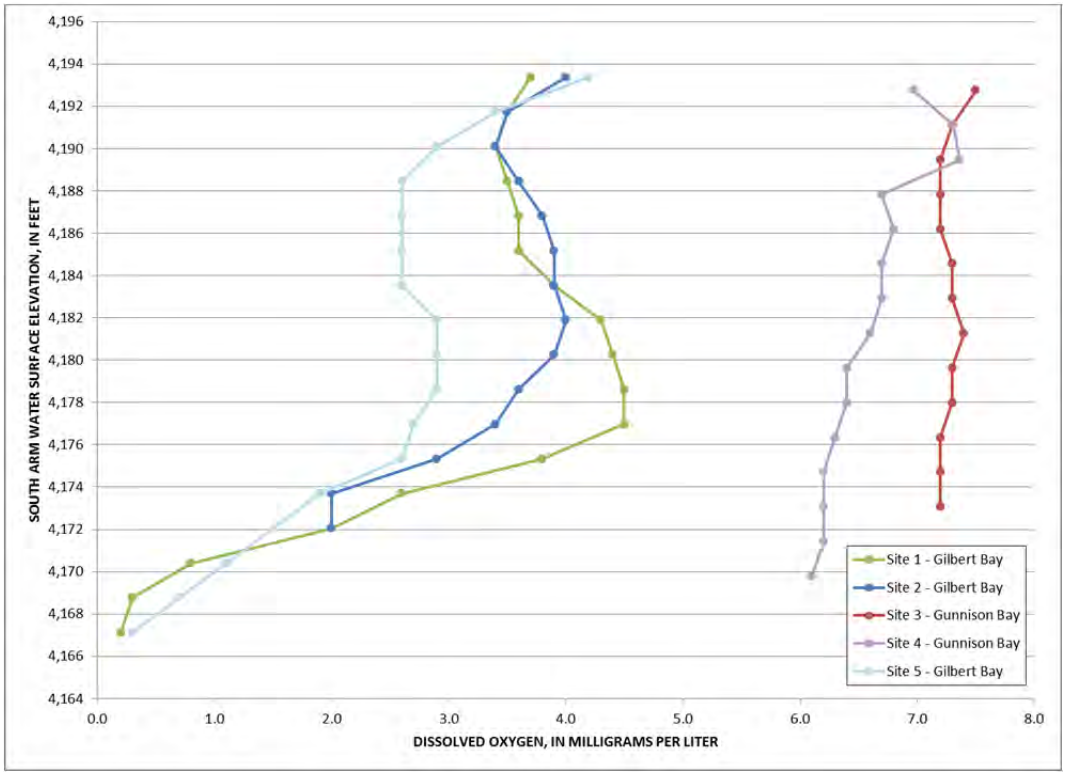


Figure 5. Dissolved Oxygen Profiles



3.3 Surface Water Samples

Results of surface water analyses are provided in Table 6 with greater detail available in Appendix C, Surface Water Analytical Results (data tables), and Appendix G, Field and Analytical Laboratory Data Reports (field data sheets and laboratory data packages). TDS concentrations in Gilbert Bay (sites 1, 2, and 5) ranged between 147 and 167 grams per liter (g/L) in the upper water column (Figure 6). TDS concentrations indicated that a deep brine layer was present at sites 1 and 5, since the lower water column TDS concentration values were elevated relative to the upper water column TDS concentration values. Dissolved oxygen data supported this observation. TDS concentrations in Gunnison Bay (sites 3 and 4) were similar, both spatially and vertically. Gunnison Bay TDS values were much greater than those at the Gilbert Bay sites.

TDS and salinity profiles are provided in Figure 6 and Figure 7, respectively. Salinity was estimated from the measured TDS concentrations per the USGS-defined relationships shown in Equations 1 and 2 below (USGS 1973).

Equation 1	$\text{Density}_{\text{estimated}}(\text{g/mL}) = C \times 0.63 + 1.000$ *where:* C = measured TDS concentration (g/mL)
Equation 2	$\text{Salinity (\%)} = \frac{\text{TDS}}{\text{Density}} \times 100$ *where:* TDS = measured TDS (g/mL) Density = $\text{Density}_{\text{estimated}}$ from Equation 1 (g/mL)

Figure 6. TDS Profiles

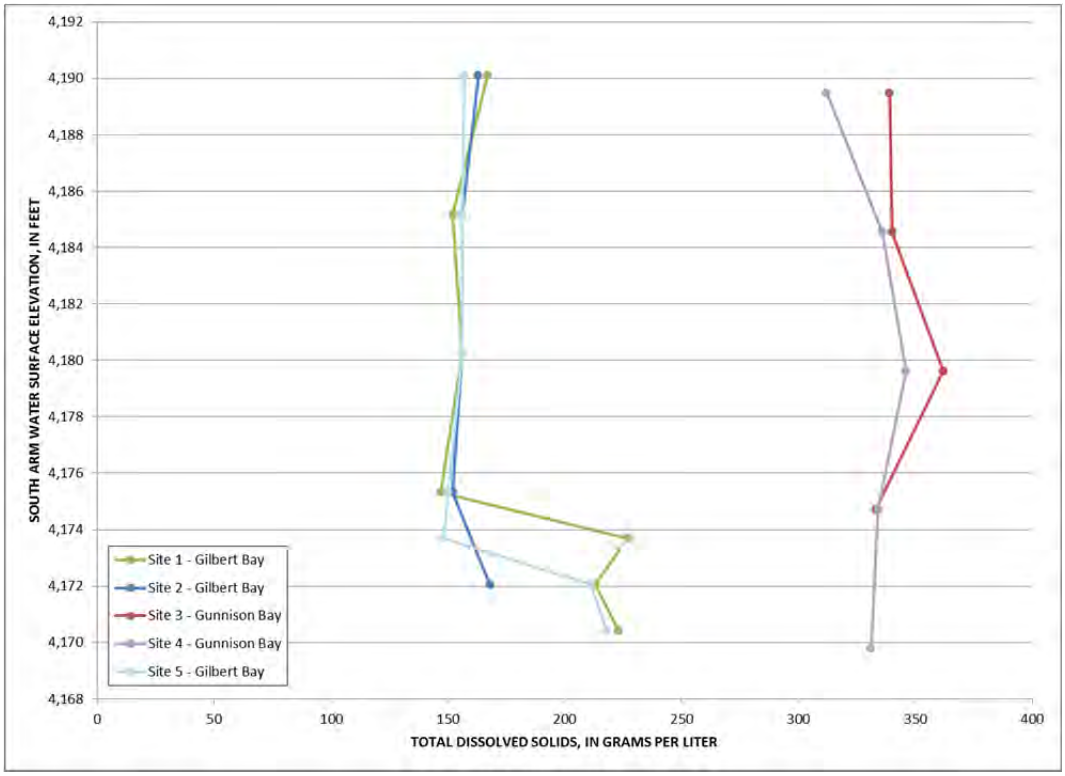


Figure 7. Salinity Profiles

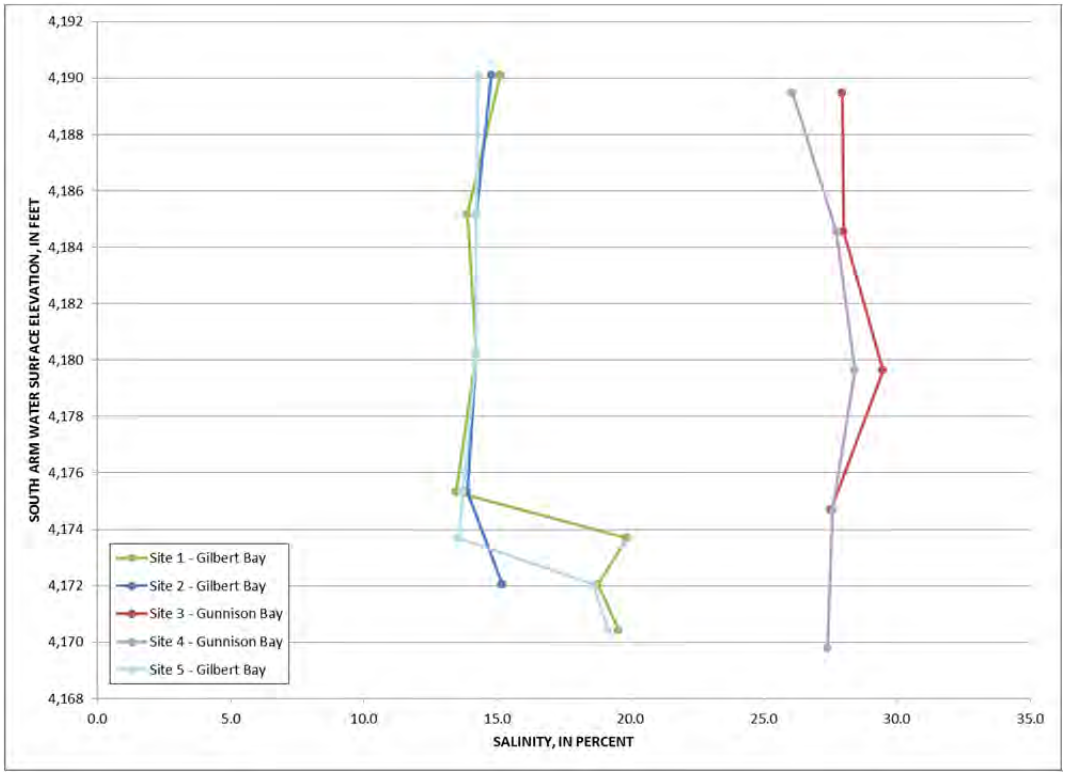


Table 6. Metals Concentrations in Surface and Deep Water Samples

Parameter	Units	Gilbert Bay		Gunnison Bay		
		Site 1	Site 2	Site 5	Site 3	Site 4
Upper Water Column						
Hardness, total	mg/L	20,500	20,100	20,200	48,700	50,400
Sulfate [a]	mg/L	10,900	9,780	9,560	20,700	23,100
Arsenic	µg/L	109	104	113	166	176
Copper	µg/L	2.73	2.56	2.68	1.11	1.13
Lead	µg/L	1.22	1.21	1.43	0.428	0.640
Mercury	ng/L	4.83	9.67	5.04	3.73	2.89
Selenium	µg/L	<1.05	<1.05	<1.05	<1.05	<1.05
Zinc	µg/L	<3.75	<3.75	<3.75	<3.75	<3.75
Lower Water Column						
Hardness, total	mg/L	22,600	20,300	20,800	52,200	49,200
Sulfate [a]	mg/L	10,600	12,800	10,600	24,800	20,400
Arsenic	µg/L	111	123	111	168	162
Copper	µg/L	2.9	14.4	2.85	1.24	1.1
Lead	µg/L	1.17	5.33	1.25	0.284	0.492
Mercury	ng/L	22.6	23**N**	15.3	2.87	2.26
Selenium	µg/L	<1.05	<1.05	<1.05	<1.05	<1.05
Zinc	µg/L	<3.75	11.5	<3.75	<3.75	<3.75

N = laboratory reports that quantity reported is estimated.

< = Not detected.

mg/L = milligrams per liter; µg/L = micrograms per liter; ng/L = nanograms per liter

[a] Data quality objectives for sulfate met quality assurance objectives (UPRR 2014); UPRR notes that historical UGS data were analyzed to a greater level of resolution.

3.4 Brine Shrimp Samples

Metals concentrations in brine shrimp tissue are provided in Table 7 with greater detail available in Appendix D, Brine Shrimp Analytical Results (data tables), and Appendix G, Field and Analytical Laboratory Data Reports (field data sheets and laboratory data packages).

In May 2014, shrimp were abundant with densities between 14,679 and 42,213 individuals per cubic meter (Table 8). Most of the brine shrimp were in the egg and early metanauplius life stages. Life stage definitions, subsample counts, and subsample quantities are provided in Appendix E, Brine Shrimp Taxonomic Results.

Table 7. Brine Shrimp Metals Tissue Concentrations

Parameter	Units	Gilbert Bay		
		Site 1	Site 2	Site 5
Total solids	%	20.84	16.75	21.73
Wet-weight				
Arsenic	mg/kg	2.73	2.65	3.07
Copper	mg/kg	2.31	2.28	2.86
Lead	mg/kg	0.163	0.353**M**	0.214
Mercury	ng/g	29.1	32.5	40.3
Selenium	mg/kg	0.41	0.34	0.47
Zinc	mg/kg	12.5	15.1	16.8
Dry-weight				
Arsenic	mg/kg	13.1	15.8	14.1
Copper	mg/kg	11.1	13.6	13.2
Lead	mg/kg	0.781	2.11**M**	0.983
Mercury	ng/g	140	194	182
Selenium	mg/kg	1.98	2.04	2.15
Zinc	mg/kg	59.8	90.3	77.4

M = laboratory reports that quantity reported is estimated.
mg/kg = milligrams per kilogram; ng/g = nanograms per gram

Table 8. Brine Shrimp Density (Individuals per Liter) and Percent Composition of Life Stages

Brine Shrimp Life Stage	Gilbert Bay		
	Site 1	Site 2	Site 5
Egg	6,846 (46%)	22,176 (53%)	16,394 (58%)
Nauplius	402 (3%)	783 (2%)	1,423 (5%)
Early metanauplius	5,449 (36%)	15,578 (37%)	8,816 (31%)
Mid metanauplius	1,292 (9%)	3,465 (8%)	1,114 (4%)
Late metanauplius	559 (4%)	30 (<1%)	278 (1%)
Subadult	279 (2%)	60 (<1%)	247 (1%)
Adult	122 (1%)	121 (<1%)	217 (1%)
Total	**14,949**	**42,213**	**28,488**

Life stage definitions, subsample counts, and subsample quantities are provided in Appendix E, Brine Shrimp Taxonomic Results.

4.0 References

[EPA] United States Environmental Protection Agency

1996 Method 1669. Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. July.

Rowland, Ryan

2014 Personal communication between Ryan Rowland, USGS, and Chuck Vertucci, HDR, regarding conductivity probe usage during sampling. July 16.

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[UDWQ] Utah Division of Water Quality

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[UPRR] Union Pacific Railroad

2011 Nationwide Permit Pre-construction Notification Form. Great Salt Lake Northern Railroad Causeway – Culvert Closure and Bridge Construction. July.

2014 Interim Monitoring Plan. Temporary Closure of the East Culvert, Great Salt Lake Causeway. Revised March 10.

[USACE] United States Army Corps of Engineers

2013 Nationwide Permit 14, Linear Transportation Projects, No. SPK 2011-00755. December 6.

2014 Approval of Interim Monitoring Plan, Modification of Special Condition 2b, and Time Extension of May 2014 Monitoring Report. April 18.

[USGS] United States Geological Survey

1973 The Effects of Restricted Circulation on the Salt Balance of Great Salt Lake, Utah. Utah Geological and Mineral Survey. Water-Resources Bulletin 18.

2014 Great Salt Lake – Lake Elevations. ut.water.usgs.gov/greatsaltlake/elevations. Accessed August 4, 2014.

APPENDIX A

Surface Water Elevation Data

Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
USGS	10010000	5/19/2014	0:00	MDT	4195.4	P	USGS	10010100	5/19/2014	0:00	MDT	4194.4	P
USGS	10010000	5/19/2014	0:15	MDT	4195.4	P	USGS	10010100	5/19/2014	0:15	MDT	4194.5	P
USGS	10010000	5/19/2014	0:30	MDT	4195.4	P	USGS	10010100	5/19/2014	0:30	MDT	4194.4	P
USGS	10010000	5/19/2014	0:45	MDT	4195.3	P	USGS	10010100	5/19/2014	0:45	MDT	4194.4	P
USGS	10010000	5/19/2014	1:00	MDT	4195.4	P	USGS	10010100	5/19/2014	1:00	MDT	4194.4	P
USGS	10010000	5/19/2014	1:15	MDT	4195.5	P	USGS	10010100	5/19/2014	1:15	MDT	4194.4	P
USGS	10010000	5/19/2014	1:30	MDT	4195.5	P	USGS	10010100	5/19/2014	1:30	MDT	4194.4	P
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Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
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USGS	10010000	5/19/2014	14:15	MDT	4195.3	P	USGS	10010100	5/19/2014	14:15	MDT	4194.3	P
USGS	10010000	5/19/2014	14:30	MDT	4195.3	P	USGS	10010100	5/19/2014	14:30	MDT	4194.3	P
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USGS	10010000	5/20/2014	2:00	MDT	4195.2	P	USGS	10010100	5/20/2014	2:00	MDT	4194.4	P
USGS	10010000	5/20/2014	2:15	MDT	4195.2	P	USGS	10010100	5/20/2014	2:15	MDT	4194.4	P
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Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
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USGS	10010000	5/20/2014	3:30	MDT	4195.2	P	USGS	10010100	5/20/2014	3:30	MDT	4194.3	P
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USGS	10010000	5/20/2014	6:15	MDT	4195.1	P	USGS	10010100	5/20/2014	6:15	MDT	4194.3	P
USGS	10010000	5/20/2014	6:30	MDT	4195.1	P	USGS	10010100	5/20/2014	6:30	MDT	4194.3	P
USGS	10010000	5/20/2014	6:45	MDT	4195	P	USGS	10010100	5/20/2014	6:45	MDT	4194.3	P
USGS	10010000	5/20/2014	7:00	MDT	4195.2	P	USGS	10010100	5/20/2014	7:00	MDT	4194.3	P
USGS	10010000	5/20/2014	7:15	MDT	4195.2	P	USGS	10010100	5/20/2014	7:15	MDT	4194.3	P
USGS	10010000	5/20/2014	7:30	MDT	4195.1	P	USGS	10010100	5/20/2014	7:30	MDT	4194.2	P
USGS	10010000	5/20/2014	7:45	MDT	4195.1	P	USGS	10010100	5/20/2014	7:45	MDT	4194.3	P
USGS	10010000	5/20/2014	8:00	MDT	4195.2	P	USGS	10010100	5/20/2014	8:00	MDT	4194.4	P
USGS	10010000	5/20/2014	8:15	MDT	4195.2	P	USGS	10010100	5/20/2014	8:15	MDT	4194.5	P
USGS	10010000	5/20/2014	8:30	MDT	4195.2	P	USGS	10010100	5/20/2014	8:30	MDT	4194.4	P
USGS	10010000	5/20/2014	8:45	MDT	4195.2	P	USGS	10010100	5/20/2014	8:45	MDT	4194.4	P
USGS	10010000	5/20/2014	9:00	MDT	4195.1	P	USGS	10010100	5/20/2014	9:00	MDT	4194.4	P
USGS	10010000	5/20/2014	9:15	MDT	4195.1	P	USGS	10010100	5/20/2014	9:15	MDT	4194.4	P
USGS	10010000	5/20/2014	9:30	MDT	4195.2	P	USGS	10010100	5/20/2014	9:30	MDT	4194.3	P
USGS	10010000	5/20/2014	9:45	MDT	4195.1	P	USGS	10010100	5/20/2014	9:45	MDT	4194.3	P
USGS	10010000	5/20/2014	10:00	MDT	4195	P	USGS	10010100	5/20/2014	10:00	MDT	4194.3	P
USGS	10010000	5/20/2014	10:15	MDT	4195	P	USGS	10010100	5/20/2014	10:15	MDT	4194.3	P
USGS	10010000	5/20/2014	10:30	MDT	4195.1	P	USGS	10010100	5/20/2014	10:30	MDT	4194.3	P
USGS	10010000	5/20/2014	10:45	MDT	4195.1	P	USGS	10010100	5/20/2014	10:45	MDT	4194.2	P
USGS	10010000	5/20/2014	11:00	MDT	4195	P	USGS	10010100	5/20/2014	11:00	MDT	4194.2	P
USGS	10010000	5/20/2014	11:15	MDT	4194.9	P	USGS	10010100	5/20/2014	11:15	MDT	4194.2	P
USGS	10010000	5/20/2014	11:30	MDT	4194.9	P	USGS	10010100	5/20/2014	11:30	MDT	4194.2	P
USGS	10010000	5/20/2014	11:45	MDT	4195	P	USGS	10010100	5/20/2014	11:45	MDT	4194.3	P
USGS	10010000	5/20/2014	12:00	MDT	4195	P	USGS	10010100	5/20/2014	12:00	MDT	4194.3	P
USGS	10010000	5/20/2014	12:15	MDT	4195	P	USGS	10010100	5/20/2014	12:15	MDT	4194.3	P
USGS	10010000	5/20/2014	12:30	MDT	4195	P	USGS	10010100	5/20/2014	12:30	MDT	4194.3	P
USGS	10010000	5/20/2014	12:45	MDT	4195	P	USGS	10010100	5/20/2014	12:45	MDT	4194.3	P
USGS	10010000	5/20/2014	13:00	MDT	4195.2	P	USGS	10010100	5/20/2014	13:00	MDT	4194.2	P
USGS	10010000	5/20/2014	13:15	MDT	4195.2	P	USGS	10010100	5/20/2014	13:15	MDT	4194.3	P
USGS	10010000	5/20/2014	13:30	MDT	4195.1	P	USGS	10010100	5/20/2014	13:30	MDT	4194.3	P
USGS	10010000	5/20/2014	13:45	MDT	4195.1	P	USGS	10010100	5/20/2014	13:45	MDT	4194.3	P
USGS	10010000	5/20/2014	14:00	MDT	4195.2	P	USGS	10010100	5/20/2014	14:00	MDT	4194.4	P
USGS	10010000	5/20/2014	14:15	MDT	4195.2	P	USGS	10010100	5/20/2014	14:15	MDT	4194.4	P
USGS	10010000	5/20/2014	14:30	MDT	4195.2	P	USGS	10010100	5/20/2014	14:30	MDT	4194.3	P
USGS	10010000	5/20/2014	14:45	MDT	4195.2	P	USGS	10010100	5/20/2014	14:45	MDT	4194.3	P
USGS	10010000	5/20/2014	15:00	MDT	4195.2	P	USGS	10010100	5/20/2014	15:00	MDT	4194.3	P
USGS	10010000	5/20/2014	15:15	MDT	4195.2	P	USGS	10010100	5/20/2014	15:15	MDT	4194.3	P
USGS	10010000	5/20/2014	15:30	MDT	4195.2	P	USGS	10010100	5/20/2014	15:30	MDT	4194.2	P
USGS	10010000	5/20/2014	15:45	MDT	4195.2	P	USGS	10010100	5/20/2014	15:45	MDT	4194.2	P
USGS	10010000	5/20/2014	16:00	MDT	4195.1	P	USGS	10010100	5/20/2014	16:00	MDT	4194.2	P
USGS	10010000	5/20/2014	16:15	MDT	4195.1	P	USGS	10010100	5/20/2014	16:15	MDT	4194.2	P

Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
USGS	10010000	5/20/2014	16:30	MDT	4195.1	P	USGS	10010100	5/20/2014	16:30	MDT	4194.3	P
USGS	10010000	5/20/2014	16:45	MDT	4195.2	P	USGS	10010100	5/20/2014	16:45	MDT	4194.3	P
USGS	10010000	5/20/2014	17:00	MDT	4195	P	USGS	10010100	5/20/2014	17:00	MDT	4194.3	P
USGS	10010000	5/20/2014	17:15	MDT	4195	P	USGS	10010100	5/20/2014	17:15	MDT	4194.4	P
USGS	10010000	5/20/2014	17:30	MDT	4195	P	USGS	10010100	5/20/2014	17:30	MDT	4194.4	P
USGS	10010000	5/20/2014	17:45	MDT	4195.1	P	USGS	10010100	5/20/2014	17:45	MDT	4194.2	P
USGS	10010000	5/20/2014	18:00	MDT	4195	P	USGS	10010100	5/20/2014	18:00	MDT	4194.3	P
USGS	10010000	5/20/2014	18:15	MDT	4195	P	USGS	10010100	5/20/2014	18:15	MDT	4194.3	P
USGS	10010000	5/20/2014	18:30	MDT	4195	P	USGS	10010100	5/20/2014	18:30	MDT	4194.4	P
USGS	10010000	5/20/2014	18:45	MDT	4195	P	USGS	10010100	5/20/2014	18:45	MDT	4194.4	P
USGS	10010000	5/20/2014	19:00	MDT	4195.1	P	USGS	10010100	5/20/2014	19:00	MDT	4194.5	P
USGS	10010000	5/20/2014	19:15	MDT	4195.1	P	USGS	10010100	5/20/2014	19:15	MDT	4194.4	P
USGS	10010000	5/20/2014	19:30	MDT	4195	P	USGS	10010100	5/20/2014	19:30	MDT	4194.3	P
USGS	10010000	5/20/2014	19:45	MDT	4195	P	USGS	10010100	5/20/2014	19:45	MDT	4194.3	P
USGS	10010000	5/20/2014	20:00	MDT	4195.1	P	USGS	10010100	5/20/2014	20:00	MDT	4194.4	P
USGS	10010000	5/20/2014	20:15	MDT	4195.1	P	USGS	10010100	5/20/2014	20:15	MDT	4194.4	P
USGS	10010000	5/20/2014	20:30	MDT	4195.1	P	USGS	10010100	5/20/2014	20:30	MDT	4194.4	P
USGS	10010000	5/20/2014	20:45	MDT	4195	P	USGS	10010100	5/20/2014	20:45	MDT	4194.3	P
USGS	10010000	5/20/2014	21:00	MDT	4195.1	P	USGS	10010100	5/20/2014	21:00	MDT	4194.3	P
USGS	10010000	5/20/2014	21:15	MDT	4195.1	P	USGS	10010100	5/20/2014	21:15	MDT	4194.3	P
USGS	10010000	5/20/2014	21:30	MDT	4195.1	P	USGS	10010100	5/20/2014	21:30	MDT	4194.3	P
USGS	10010000	5/20/2014	21:45	MDT	4195.1	P	USGS	10010100	5/20/2014	21:45	MDT	4194.4	P
USGS	10010000	5/20/2014	22:00	MDT	4195	P	USGS	10010100	5/20/2014	22:00	MDT	4194.7	P
USGS	10010000	5/20/2014	22:15	MDT	4195	P	USGS	10010100	5/20/2014	22:15	MDT	4194.9	P
USGS	10010000	5/20/2014	22:30	MDT	4195	P	USGS	10010100	5/20/2014	22:30	MDT	4195.1	P
USGS	10010000	5/20/2014	22:45	MDT	4195	P	USGS	10010100	5/20/2014	22:45	MDT	4195.1	P
USGS	10010000	5/20/2014	23:00	MDT	4195	P	USGS	10010100	5/20/2014	23:00	MDT	4195	P
USGS	10010000	5/20/2014	23:15	MDT	4195	P	USGS	10010100	5/20/2014	23:15	MDT	4195.1	P
USGS	10010000	5/20/2014	23:30	MDT	4195	P	USGS	10010100	5/20/2014	23:30	MDT	4195.1	P
USGS	10010000	5/20/2014	23:45	MDT	4195	P	USGS	10010100	5/20/2014	23:45	MDT	4194.8	P
USGS	10010000	5/21/2014	0:00	MDT	4195.3	P	USGS	10010100	5/21/2014	0:00	MDT	4194.7	P
USGS	10010000	5/21/2014	0:15	MDT	4195.3	P	USGS	10010100	5/21/2014	0:15	MDT	4194.5	P
USGS	10010000	5/21/2014	0:30	MDT	4195.1	P	USGS	10010100	5/21/2014	0:30	MDT	4194.5	P
USGS	10010000	5/21/2014	0:45	MDT	4195.1	P	USGS	10010100	5/21/2014	0:45	MDT	4194.6	P
USGS	10010000	5/21/2014	1:00	MDT	4195.2	P	USGS	10010100	5/21/2014	1:00	MDT	4194.6	P
USGS	10010000	5/21/2014	1:15	MDT	4195.3	P	USGS	10010100	5/21/2014	1:15	MDT	4194.4	P
USGS	10010000	5/21/2014	1:30	MDT	4195.3	P	USGS	10010100	5/21/2014	1:30	MDT	4194.4	P
USGS	10010000	5/21/2014	1:45	MDT	4195.3	P	USGS	10010100	5/21/2014	1:45	MDT	4194.3	P
USGS	10010000	5/21/2014	2:00	MDT	4195.1	P	USGS	10010100	5/21/2014	2:00	MDT	4194.4	P
USGS	10010000	5/21/2014	2:15	MDT	4195.1	P	USGS	10010100	5/21/2014	2:15	MDT	4194.4	P
USGS	10010000	5/21/2014	2:30	MDT	4195.2	P	USGS	10010100	5/21/2014	2:30	MDT	4194.5	P
USGS	10010000	5/21/2014	2:45	MDT	4195.2	P	USGS	10010100	5/21/2014	2:45	MDT	4194.4	P
USGS	10010000	5/21/2014	3:00	MDT	4195	P	USGS	10010100	5/21/2014	3:00	MDT	4194.4	P
USGS	10010000	5/21/2014	3:15	MDT	4195	P	USGS	10010100	5/21/2014	3:15	MDT	4194.3	P
USGS	10010000	5/21/2014	3:30	MDT	4195	P	USGS	10010100	5/21/2014	3:30	MDT	4194.3	P
USGS	10010000	5/21/2014	3:45	MDT	4195.1	P	USGS	10010100	5/21/2014	3:45	MDT	4194.4	P
USGS	10010000	5/21/2014	4:00	MDT	4195	P	USGS	10010100	5/21/2014	4:00	MDT	4194.4	P
USGS	10010000	5/21/2014	4:15	MDT	4195	P	USGS	10010100	5/21/2014	4:15	MDT	4194.4	P
USGS	10010000	5/21/2014	4:30	MDT	4195	P	USGS	10010100	5/21/2014	4:30	MDT	4194.4	P
USGS	10010000	5/21/2014	4:45	MDT	4195	P	USGS	10010100	5/21/2014	4:45	MDT	4194.4	P
USGS	10010000	5/21/2014	5:00	MDT	4195	P	USGS	10010100	5/21/2014	5:00	MDT	4194.4	P
USGS	10010000	5/21/2014	5:15	MDT	4195	P	USGS	10010100	5/21/2014	5:15	MDT	4194.3	P
USGS	10010000	5/21/2014	5:30	MDT	4195	P	USGS	10010100	5/21/2014	5:30	MDT	4194.4	P
USGS	10010000	5/21/2014	5:45	MDT	4195	P	USGS	10010100	5/21/2014	5:45	MDT	4194.4	P

Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
USGS	10010000	5/21/2014	6:00	MDT	4195.1	P	USGS	10010100	5/21/2014	6:00	MDT	4194.4	P
USGS	10010000	5/21/2014	6:15	MDT	4195.1	P	USGS	10010100	5/21/2014	6:15	MDT	4194.5	P
USGS	10010000	5/21/2014	6:30	MDT	4195	P	USGS	10010100	5/21/2014	6:30	MDT	4194.4	P
USGS	10010000	5/21/2014	6:45	MDT	4195	P	USGS	10010100	5/21/2014	6:45	MDT	4194.4	P
USGS	10010000	5/21/2014	7:00	MDT	4195.2	P	USGS	10010100	5/21/2014	7:00	MDT	4194.4	P
USGS	10010000	5/21/2014	7:15	MDT	4195.1	P	USGS	10010100	5/21/2014	7:15	MDT	4194.4	P
USGS	10010000	5/21/2014	7:30	MDT	4195.1	P	USGS	10010100	5/21/2014	7:30	MDT	4194.4	P
USGS	10010000	5/21/2014	7:45	MDT	4195.1	P	USGS	10010100	5/21/2014	7:45	MDT	4194.4	P
USGS	10010000	5/21/2014	8:00	MDT	4195.1	P	USGS	10010100	5/21/2014	8:00	MDT	4194.4	P
USGS	10010000	5/21/2014	8:15	MDT	4195.2	P	USGS	10010100	5/21/2014	8:15	MDT	4194.3	P
USGS	10010000	5/21/2014	8:30	MDT	4195.2	P	USGS	10010100	5/21/2014	8:30	MDT	4194.3	P
USGS	10010000	5/21/2014	8:45	MDT	4195.2	P	USGS	10010100	5/21/2014	8:45	MDT	4194.4	P
USGS	10010000	5/21/2014	9:00	MDT	4195	P	USGS	10010100	5/21/2014	9:00	MDT	4194.3	P
USGS	10010000	5/21/2014	9:15	MDT	4195	P	USGS	10010100	5/21/2014	9:15	MDT	4194.3	P
USGS	10010000	5/21/2014	9:30	MDT	4195.1	P	USGS	10010100	5/21/2014	9:30	MDT	4194.3	P
USGS	10010000	5/21/2014	9:45	MDT	4195.1	P	USGS	10010100	5/21/2014	9:45	MDT	4194.2	P
USGS	10010000	5/21/2014	10:00	MDT	4195	P	USGS	10010100	5/21/2014	10:00	MDT	4194.2	P
USGS	10010000	5/21/2014	10:15	MDT	4195	P	USGS	10010100	5/21/2014	10:15	MDT	4194.2	P
USGS	10010000	5/21/2014	10:30	MDT	4195	P	USGS	10010100	5/21/2014	10:30	MDT	4194.3	P
USGS	10010000	5/21/2014	10:45	MDT	4195	P	USGS	10010100	5/21/2014	10:45	MDT	4194.3	P
USGS	10010000	5/21/2014	11:00	MDT	4195	P	USGS	10010100	5/21/2014	11:00	MDT	4194.3	P
USGS	10010000	5/21/2014	11:15	MDT	4195	P	USGS	10010100	5/21/2014	11:15	MDT	4194.3	P
USGS	10010000	5/21/2014	11:30	MDT	4195	P	USGS	10010100	5/21/2014	11:30	MDT	4194.2	P
USGS	10010000	5/21/2014	11:45	MDT	4195	P	USGS	10010100	5/21/2014	11:45	MDT	4194.2	P
USGS	10010000	5/21/2014	12:00	MDT	4195.1	P	USGS	10010100	5/21/2014	12:00	MDT	4194.2	P
USGS	10010000	5/21/2014	12:15	MDT	4195.1	P	USGS	10010100	5/21/2014	12:15	MDT	4194.2	P
USGS	10010000	5/21/2014	12:30	MDT	4195	P	USGS	10010100	5/21/2014	12:30	MDT	4194.2	P
USGS	10010000	5/21/2014	12:45	MDT	4195	P	USGS	10010100	5/21/2014	12:45	MDT	4194.2	P
USGS	10010000	5/21/2014	13:00	MDT	4195.2	P	USGS	10010100	5/21/2014	13:00	MDT	4194.2	P
USGS	10010000	5/21/2014	13:15	MDT	4195.1	P	USGS	10010100	5/21/2014	13:15	MDT	4194.2	P
USGS	10010000	5/21/2014	13:30	MDT	4195	P	USGS	10010100	5/21/2014	13:30	MDT	4194.2	P
USGS	10010000	5/21/2014	13:45	MDT	4195.1	P	USGS	10010100	5/21/2014	13:45	MDT	4194.2	P
USGS	10010000	5/21/2014	14:00	MDT	4195.2	P	USGS	10010100	5/21/2014	14:00	MDT	4194.2	P
USGS	10010000	5/21/2014	14:15	MDT	4195.2	P	USGS	10010100	5/21/2014	14:15	MDT	4194.3	P
USGS	10010000	5/21/2014	14:30	MDT	4195.2	P	USGS	10010100	5/21/2014	14:30	MDT	4194.3	P
USGS	10010000	5/21/2014	14:45	MDT	4195.2	P	USGS	10010100	5/21/2014	14:45	MDT	4194.3	P
USGS	10010000	5/21/2014	15:00	MDT	4195	P	USGS	10010100	5/21/2014	15:00	MDT	4194.3	P
USGS	10010000	5/21/2014	15:15	MDT	4195.1	P	USGS	10010100	5/21/2014	15:15	MDT	4194.3	P
USGS	10010000	5/21/2014	15:30	MDT	4195.1	P	USGS	10010100	5/21/2014	15:30	MDT	4194.3	P
USGS	10010000	5/21/2014	15:45	MDT	4195	P	USGS	10010100	5/21/2014	15:45	MDT	4194.3	P
USGS	10010000	5/21/2014	16:00	MDT	4195.1	P	USGS	10010100	5/21/2014	16:00	MDT	4194.3	P
USGS	10010000	5/21/2014	16:15	MDT	4195	P	USGS	10010100	5/21/2014	16:15	MDT	4194.3	P
USGS	10010000	5/21/2014	16:30	MDT	4195	P	USGS	10010100	5/21/2014	16:30	MDT	4194.3	P
USGS	10010000	5/21/2014	16:45	MDT	4195	P	USGS	10010100	5/21/2014	16:45	MDT	4194.3	P
USGS	10010000	5/21/2014	17:00	MDT	4195.1	P	USGS	10010100	5/21/2014	17:00	MDT	4194.3	P
USGS	10010000	5/21/2014	17:15	MDT	4195.1	P	USGS	10010100	5/21/2014	17:15	MDT	4194.4	P
USGS	10010000	5/21/2014	17:30	MDT	4195.1	P	USGS	10010100	5/21/2014	17:30	MDT	4194.3	P
USGS	10010000	5/21/2014	17:45	MDT	4195	P	USGS	10010100	5/21/2014	17:45	MDT	4194.3	P
USGS	10010000	5/21/2014	18:00	MDT	4195.1	P	USGS	10010100	5/21/2014	18:00	MDT	4194.4	P
USGS	10010000	5/21/2014	18:15	MDT	4195.1	P	USGS	10010100	5/21/2014	18:15	MDT	4194.3	P
USGS	10010000	5/21/2014	18:30	MDT	4195.2	P	USGS	10010100	5/21/2014	18:30	MDT	4194.4	P
USGS	10010000	5/21/2014	18:45	MDT	4195.1	P	USGS	10010100	5/21/2014	18:45	MDT	4194.4	P
USGS	10010000	5/21/2014	19:00	MDT	4195.1	P	USGS	10010100	5/21/2014	19:00	MDT	4194.4	P
USGS	10010000	5/21/2014	19:15	MDT	4195.1	P	USGS	10010100	5/21/2014	19:15	MDT	4194.3	P

Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
USGS	10010000	5/21/2014	19:30	MDT	4195.1	P	USGS	10010100	5/21/2014	19:30	MDT	4194.3	P
USGS	10010000	5/21/2014	19:45	MDT	4195.1	P	USGS	10010100	5/21/2014	19:45	MDT	4194.4	P
USGS	10010000	5/21/2014	20:00	MDT	4195.1	P	USGS	10010100	5/21/2014	20:00	MDT	4194.3	P
USGS	10010000	5/21/2014	20:15	MDT	4195.1	P	USGS	10010100	5/21/2014	20:15	MDT	4194.3	P
USGS	10010000	5/21/2014	20:30	MDT	4195.1	P	USGS	10010100	5/21/2014	20:30	MDT	4194.4	P
USGS	10010000	5/21/2014	20:45	MDT	4195.1	P	USGS	10010100	5/21/2014	20:45	MDT	4194.3	P
USGS	10010000	5/21/2014	21:00	MDT	4195.1	P	USGS	10010100	5/21/2014	21:00	MDT	4194.3	P
USGS	10010000	5/21/2014	21:15	MDT	4195.1	P	USGS	10010100	5/21/2014	21:15	MDT	4194.3	P
USGS	10010000	5/21/2014	21:30	MDT	4195.1	P	USGS	10010100	5/21/2014	21:30	MDT	4194.4	P
USGS	10010000	5/21/2014	21:45	MDT	4195.1	P	USGS	10010100	5/21/2014	21:45	MDT	4194.4	P
USGS	10010000	5/21/2014	22:00	MDT	4195.1	P	USGS	10010100	5/21/2014	22:00	MDT	4194.4	P
USGS	10010000	5/21/2014	22:15	MDT	4195.1	P	USGS	10010100	5/21/2014	22:15	MDT	4194.4	P
USGS	10010000	5/21/2014	22:30	MDT	4195	P	USGS	10010100	5/21/2014	22:30	MDT	4194.4	P
USGS	10010000	5/21/2014	22:45	MDT	4195.1	P	USGS	10010100	5/21/2014	22:45	MDT	4194.4	P
USGS	10010000	5/21/2014	23:00	MDT	4195.1	P	USGS	10010100	5/21/2014	23:00	MDT	4194.3	P
USGS	10010000	5/21/2014	23:15	MDT	4195.2	P	USGS	10010100	5/21/2014	23:15	MDT	4194.3	P
USGS	10010000	5/21/2014	23:30	MDT	4195.2	P	USGS	10010100	5/21/2014	23:30	MDT	4194.3	P
USGS	10010000	5/21/2014	23:45	MDT	4195.1	P	USGS	10010100	5/21/2014	23:45	MDT	4194.4	P
USGS	10010000	5/22/2014	0:00	MDT	4195.2	P	USGS	10010100	5/22/2014	0:00	MDT	4194.4	P
USGS	10010000	5/22/2014	0:15	MDT	4195.2	P	USGS	10010100	5/22/2014	0:15	MDT	4194.4	P
USGS	10010000	5/22/2014	0:30	MDT	4195.2	P	USGS	10010100	5/22/2014	0:30	MDT	4194.5	P
USGS	10010000	5/22/2014	0:45	MDT	4195.1	P	USGS	10010100	5/22/2014	0:45	MDT	4194.6	P
USGS	10010000	5/22/2014	1:00	MDT	4195.1	P	USGS	10010100	5/22/2014	1:00	MDT	4194.6	P
USGS	10010000	5/22/2014	1:15	MDT	4195.1	P	USGS	10010100	5/22/2014	1:15	MDT	4194.5	P
USGS	10010000	5/22/2014	1:30	MDT	4195.2	P	USGS	10010100	5/22/2014	1:30	MDT	4194.5	P
USGS	10010000	5/22/2014	1:45	MDT	4195.2	P	USGS	10010100	5/22/2014	1:45	MDT	4194.5	P
USGS	10010000	5/22/2014	2:00	MDT	4195.1	P	USGS	10010100	5/22/2014	2:00	MDT	4194.5	P
USGS	10010000	5/22/2014	2:15	MDT	4195.2	P	USGS	10010100	5/22/2014	2:15	MDT	4194.5	P
USGS	10010000	5/22/2014	2:30	MDT	4195.2	P	USGS	10010100	5/22/2014	2:30	MDT	4194.4	P
USGS	10010000	5/22/2014	2:45	MDT	4195.1	P	USGS	10010100	5/22/2014	2:45	MDT	4194.4	P
USGS	10010000	5/22/2014	3:00	MDT	4195.1	P	USGS	10010100	5/22/2014	3:00	MDT	4194.5	P
USGS	10010000	5/22/2014	3:15	MDT	4195.1	P	USGS	10010100	5/22/2014	3:15	MDT	4194.5	P
USGS	10010000	5/22/2014	3:30	MDT	4195.1	P	USGS	10010100	5/22/2014	3:30	MDT	4194.4	P
USGS	10010000	5/22/2014	3:45	MDT	4195.1	P	USGS	10010100	5/22/2014	3:45	MDT	4194.4	P
USGS	10010000	5/22/2014	4:00	MDT	4195.1	P	USGS	10010100	5/22/2014	4:00	MDT	4194.4	P
USGS	10010000	5/22/2014	4:15	MDT	4195.1	P	USGS	10010100	5/22/2014	4:15	MDT	4194.4	P
USGS	10010000	5/22/2014	4:30	MDT	4195.1	P	USGS	10010100	5/22/2014	4:30	MDT	4194.4	P
USGS	10010000	5/22/2014	4:45	MDT	4195.1	P	USGS	10010100	5/22/2014	4:45	MDT	4194.4	P
USGS	10010000	5/22/2014	5:00	MDT	4195.2	P	USGS	10010100	5/22/2014	5:00	MDT	4194.4	P
USGS	10010000	5/22/2014	5:15	MDT	4195.2	P	USGS	10010100	5/22/2014	5:15	MDT	4194.5	P
USGS	10010000	5/22/2014	5:30	MDT	4195.1	P	USGS	10010100	5/22/2014	5:30	MDT	4194.5	P
USGS	10010000	5/22/2014	5:45	MDT	4195.1	P	USGS	10010100	5/22/2014	5:45	MDT	4194.4	P
USGS	10010000	5/22/2014	6:00	MDT	4195.2	P	USGS	10010100	5/22/2014	6:00	MDT	4194.4	P
USGS	10010000	5/22/2014	6:15	MDT	4195.2	P	USGS	10010100	5/22/2014	6:15	MDT	4194.5	P
USGS	10010000	5/22/2014	6:30	MDT	4195.2	P	USGS	10010100	5/22/2014	6:30	MDT	4194.5	P
USGS	10010000	5/22/2014	6:45	MDT	4195.2	P	USGS	10010100	5/22/2014	6:45	MDT	4194.4	P
USGS	10010000	5/22/2014	7:00	MDT	4195.1	P	USGS	10010100	5/22/2014	7:00	MDT	4194.4	P
USGS	10010000	5/22/2014	7:15	MDT	4195.1	P	USGS	10010100	5/22/2014	7:15	MDT	4194.3	P
USGS	10010000	5/22/2014	7:30	MDT	4195.2	P	USGS	10010100	5/22/2014	7:30	MDT	4194.3	P
USGS	10010000	5/22/2014	7:45	MDT	4195.2	P	USGS	10010100	5/22/2014	7:45	MDT	4194.2	P
USGS	10010000	5/22/2014	8:00	MDT	4195.1	P	USGS	10010100	5/22/2014	8:00	MDT	4194.3	P
USGS	10010000	5/22/2014	8:15	MDT	4195.1	P	USGS	10010100	5/22/2014	8:15	MDT	4194.3	P
USGS	10010000	5/22/2014	8:30	MDT	4195.1	P	USGS	10010100	5/22/2014	8:30	MDT	4194.3	P
USGS	10010000	5/22/2014	8:45	MDT	4195.1	P	USGS	10010100	5/22/2014	8:45	MDT	4194.3	P

Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
USGS	10010000	5/22/2014	9:00	MDT	4195	P	USGS	10010100	5/22/2014	9:00	MDT	4194.3	P
USGS	10010000	5/22/2014	9:15	MDT	4195	P	USGS	10010100	5/22/2014	9:15	MDT	4194.3	P
USGS	10010000	5/22/2014	9:30	MDT	4195	P	USGS	10010100	5/22/2014	9:30	MDT	4194.3	P
USGS	10010000	5/22/2014	9:45	MDT	4195	P	USGS	10010100	5/22/2014	9:45	MDT	4194.3	P
USGS	10010000	5/22/2014	10:00	MDT	4195	P	USGS	10010100	5/22/2014	10:00	MDT	4194.3	P
USGS	10010000	5/22/2014	10:15	MDT	4195	P	USGS	10010100	5/22/2014	10:15	MDT	4194.4	P
USGS	10010000	5/22/2014	10:30	MDT	4195	P	USGS	10010100	5/22/2014	10:30	MDT	4194.4	P
USGS	10010000	5/22/2014	10:45	MDT	4195	P	USGS	10010100	5/22/2014	10:45	MDT	4194.3	P
USGS	10010000	5/22/2014	11:00	MDT	4195.1	P	USGS	10010100	5/22/2014	11:00	MDT	4194.3	P
USGS	10010000	5/22/2014	11:15	MDT	4195.1	P	USGS	10010100	5/22/2014	11:15	MDT	4194.3	P
USGS	10010000	5/22/2014	11:30	MDT	4195	P	USGS	10010100	5/22/2014	11:30	MDT	4194.4	P
USGS	10010000	5/22/2014	11:45	MDT	4195	P	USGS	10010100	5/22/2014	11:45	MDT	4194.3	P
USGS	10010000	5/22/2014	12:00	MDT	4195.2	P	USGS	10010100	5/22/2014	12:00	MDT	4194.3	P
USGS	10010000	5/22/2014	12:15	MDT	4195.1	P	USGS	10010100	5/22/2014	12:15	MDT	4194.3	P
USGS	10010000	5/22/2014	12:30	MDT	4195.1	P	USGS	10010100	5/22/2014	12:30	MDT	4194.2	P
USGS	10010000	5/22/2014	12:45	MDT	4195.1	P	USGS	10010100	5/22/2014	12:45	MDT	4194.2	P
USGS	10010000	5/22/2014	13:00	MDT	4195.2	P	USGS	10010100	5/22/2014	13:00	MDT	4194.2	P
USGS	10010000	5/22/2014	13:15	MDT	4195.2	P	USGS	10010100	5/22/2014	13:15	MDT	4194.3	P
USGS	10010000	5/22/2014	13:30	MDT	4195.2	P	USGS	10010100	5/22/2014	13:30	MDT	4194.3	P
USGS	10010000	5/22/2014	13:45	MDT	4195.2	P	USGS	10010100	5/22/2014	13:45	MDT	4194.3	P
USGS	10010000	5/22/2014	14:00	MDT	4195.1	P	USGS	10010100	5/22/2014	14:00	MDT	4194.3	P
USGS	10010000	5/22/2014	14:15	MDT	4195.1	P	USGS	10010100	5/22/2014	14:15	MDT	4194.3	P
USGS	10010000	5/22/2014	14:30	MDT	4195.1	P	USGS	10010100	5/22/2014	14:30	MDT	4194.3	P
USGS	10010000	5/22/2014	14:45	MDT	4195.1	P	USGS	10010100	5/22/2014	14:45	MDT	4194.3	P
USGS	10010000	5/22/2014	15:00	MDT	4195.1	P	USGS	10010100	5/22/2014	15:00	MDT	4194.4	P
USGS	10010000	5/22/2014	15:15	MDT	4195.1	P	USGS	10010100	5/22/2014	15:15	MDT	4194.4	P
USGS	10010000	5/22/2014	15:30	MDT	4195.1	P	USGS	10010100	5/22/2014	15:30	MDT	4194.4	P
USGS	10010000	5/22/2014	15:45	MDT	4195.1	P	USGS	10010100	5/22/2014	15:45	MDT	4194.4	P
USGS	10010000	5/22/2014	16:00	MDT	4195.2	P	USGS	10010100	5/22/2014	16:00	MDT	4194.4	P
USGS	10010000	5/22/2014	16:15	MDT	4195.1	P	USGS	10010100	5/22/2014	16:15	MDT	4194.4	P
USGS	10010000	5/22/2014	16:30	MDT	4195.1	P	USGS	10010100	5/22/2014	16:30	MDT	4194.4	P
USGS	10010000	5/22/2014	16:45	MDT	4195.1	P	USGS	10010100	5/22/2014	16:45	MDT	4194.4	P
USGS	10010000	5/22/2014	17:00	MDT	4195.2	P	USGS	10010100	5/22/2014	17:00	MDT	4194.3	P
USGS	10010000	5/22/2014	17:15	MDT	4195.1	P	USGS	10010100	5/22/2014	17:15	MDT	4194.3	P
USGS	10010000	5/22/2014	17:30	MDT	4195.1	P	USGS	10010100	5/22/2014	17:30	MDT	4194.3	P
USGS	10010000	5/22/2014	17:45	MDT	4195.1	P	USGS	10010100	5/22/2014	17:45	MDT	4194.3	P
USGS	10010000	5/22/2014	18:00	MDT	4195.2	P	USGS	10010100	5/22/2014	18:00	MDT	4194.3	P
USGS	10010000	5/22/2014	18:15	MDT	4195.2	P	USGS	10010100	5/22/2014	18:15	MDT	4194.3	P
USGS	10010000	5/22/2014	18:30	MDT	4195.2	P	USGS	10010100	5/22/2014	18:30	MDT	4194.3	P
USGS	10010000	5/22/2014	18:45	MDT	4195.1	P	USGS	10010100	5/22/2014	18:45	MDT	4194.3	P
USGS	10010000	5/22/2014	19:00	MDT	4195.1	P	USGS	10010100	5/22/2014	19:00	MDT	4194.3	P
USGS	10010000	5/22/2014	19:15	MDT	4195.1	P	USGS	10010100	5/22/2014	19:15	MDT	4194.2	P
USGS	10010000	5/22/2014	19:30	MDT	4195.1	P	USGS	10010100	5/22/2014	19:30	MDT	4194.3	P
USGS	10010000	5/22/2014	19:45	MDT	4195.2	P	USGS	10010100	5/22/2014	19:45	MDT	4194.4	P
USGS	10010000	5/22/2014	20:00	MDT	4195.1	P	USGS	10010100	5/22/2014	20:00	MDT	4194.3	P
USGS	10010000	5/22/2014	20:15	MDT	4195.1	P	USGS	10010100	5/22/2014	20:15	MDT	4194.4	P
USGS	10010000	5/22/2014	20:30	MDT	4195.1	P	USGS	10010100	5/22/2014	20:30	MDT	4194.4	P
USGS	10010000	5/22/2014	20:45	MDT	4195.1	P	USGS	10010100	5/22/2014	20:45	MDT	4194.4	P
USGS	10010000	5/22/2014	21:00	MDT	4195.1	P	USGS	10010100	5/22/2014	21:00	MDT	4194.4	P
USGS	10010000	5/22/2014	21:15	MDT	4195	P	USGS	10010100	5/22/2014	21:15	MDT	4194.4	P
USGS	10010000	5/22/2014	21:30	MDT	4195	P	USGS	10010100	5/22/2014	21:30	MDT	4194.4	P
USGS	10010000	5/22/2014	21:45	MDT	4195	P	USGS	10010100	5/22/2014	21:45	MDT	4194.4	P
USGS	10010000	5/22/2014	22:00	MDT	4195.1	P	USGS	10010100	5/22/2014	22:00	MDT	4194.3	P
USGS	10010000	5/22/2014	22:15	MDT	4195.1	P	USGS	10010100	5/22/2014	22:15	MDT	4194.3	P

Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
USGS	10010000	5/22/2014	22:30	MDT	4195	P	USGS	10010100	5/22/2014	22:30	MDT	4194.3	P
USGS	10010000	5/22/2014	22:45	MDT	4195.1	P	USGS	10010100	5/22/2014	22:45	MDT	4194.3	P
USGS	10010000	5/22/2014	23:00	MDT	4195.1	P	USGS	10010100	5/22/2014	23:00	MDT	4194.3	P
USGS	10010000	5/22/2014	23:15	MDT	4195.1	P	USGS	10010100	5/22/2014	23:15	MDT	4194.3	P
USGS	10010000	5/22/2014	23:30	MDT	4195.1	P	USGS	10010100	5/22/2014	23:30	MDT	4194.3	P
USGS	10010000	5/22/2014	23:45	MDT	4195.1	P	USGS	10010100	5/22/2014	23:45	MDT	4194.3	P
USGS	10010000	5/23/2014	0:00	MDT	4195.1	P	USGS	10010100	5/23/2014	0:00	MDT	4194.3	P
USGS	10010000	5/23/2014	0:15	MDT	4195.1	P	USGS	10010100	5/23/2014	0:15	MDT	4194.3	P
USGS	10010000	5/23/2014	0:30	MDT	4195.1	P	USGS	10010100	5/23/2014	0:30	MDT	4194.3	P
USGS	10010000	5/23/2014	0:45	MDT	4195.1	P	USGS	10010100	5/23/2014	0:45	MDT	4194.4	P
USGS	10010000	5/23/2014	1:00	MDT	4195.1	P	USGS	10010100	5/23/2014	1:00	MDT	4194.4	P
USGS	10010000	5/23/2014	1:15	MDT	4195.1	P	USGS	10010100	5/23/2014	1:15	MDT	4194.4	P
USGS	10010000	5/23/2014	1:30	MDT	4195.1	P	USGS	10010100	5/23/2014	1:30	MDT	4194.4	P
USGS	10010000	5/23/2014	1:45	MDT	4195.1	P	USGS	10010100	5/23/2014	1:45	MDT	4194.4	P
USGS	10010000	5/23/2014	2:00	MDT	4195	P	USGS	10010100	5/23/2014	2:00	MDT	4194.4	P
USGS	10010000	5/23/2014	2:15	MDT	4195	P	USGS	10010100	5/23/2014	2:15	MDT	4194.4	P
USGS	10010000	5/23/2014	2:30	MDT	4195.1	P	USGS	10010100	5/23/2014	2:30	MDT	4194.4	P
USGS	10010000	5/23/2014	2:45	MDT	4195.1	P	USGS	10010100	5/23/2014	2:45	MDT	4194.4	P
USGS	10010000	5/23/2014	3:00	MDT	4195	P	USGS	10010100	5/23/2014	3:00	MDT	4194.4	P
USGS	10010000	5/23/2014	3:15	MDT	4195	P	USGS	10010100	5/23/2014	3:15	MDT	4194.4	P
USGS	10010000	5/23/2014	3:30	MDT	4195	P	USGS	10010100	5/23/2014	3:30	MDT	4194.3	P
USGS	10010000	5/23/2014	3:45	MDT	4195	P	USGS	10010100	5/23/2014	3:45	MDT	4194.3	P
USGS	10010000	5/23/2014	4:00	MDT	4195	P	USGS	10010100	5/23/2014	4:00	MDT	4194.3	P
USGS	10010000	5/23/2014	4:15	MDT	4195.1	P	USGS	10010100	5/23/2014	4:15	MDT	4194.3	P
USGS	10010000	5/23/2014	4:30	MDT	4195	P	USGS	10010100	5/23/2014	4:30	MDT	4194.4	P
USGS	10010000	5/23/2014	4:45	MDT	4195	P	USGS	10010100	5/23/2014	4:45	MDT	4194.3	P
USGS	10010000	5/23/2014	5:00	MDT	4195.1	P	USGS	10010100	5/23/2014	5:00	MDT	4194.3	P
USGS	10010000	5/23/2014	5:15	MDT	4195.1	P	USGS	10010100	5/23/2014	5:15	MDT	4194.3	P
USGS	10010000	5/23/2014	5:30	MDT	4195.1	P	USGS	10010100	5/23/2014	5:30	MDT	4194.3	P
USGS	10010000	5/23/2014	5:45	MDT	4195	P	USGS	10010100	5/23/2014	5:45	MDT	4194.4	P
USGS	10010000	5/23/2014	6:00	MDT	4195.1	P	USGS	10010100	5/23/2014	6:00	MDT	4194.4	P
USGS	10010000	5/23/2014	6:15	MDT	4195.1	P	USGS	10010100	5/23/2014	6:15	MDT	4194.4	P
USGS	10010000	5/23/2014	6:30	MDT	4195.1	P	USGS	10010100	5/23/2014	6:30	MDT	4194.4	P
USGS	10010000	5/23/2014	6:45	MDT	4195	P	USGS	10010100	5/23/2014	6:45	MDT	4194.4	P
USGS	10010000	5/23/2014	7:00	MDT	4195.1	P	USGS	10010100	5/23/2014	7:00	MDT	4194.4	P
USGS	10010000	5/23/2014	7:15	MDT	4195.1	P	USGS	10010100	5/23/2014	7:15	MDT	4194.3	P
USGS	10010000	5/23/2014	7:30	MDT	4195.1	P	USGS	10010100	5/23/2014	7:30	MDT	4194.4	P
USGS	10010000	5/23/2014	7:45	MDT	4195.1	P	USGS	10010100	5/23/2014	7:45	MDT	4194.4	P
USGS	10010000	5/23/2014	8:00	MDT	4195	P	USGS	10010100	5/23/2014	8:00	MDT	4194.4	P
USGS	10010000	5/23/2014	8:15	MDT	4195	P	USGS	10010100	5/23/2014	8:15	MDT	4194.4	P
USGS	10010000	5/23/2014	8:30	MDT	4195.1	P	USGS	10010100	5/23/2014	8:30	MDT	4194.4	P
USGS	10010000	5/23/2014	8:45	MDT	4195.1	P	USGS	10010100	5/23/2014	8:45	MDT	4194.3	P
USGS	10010000	5/23/2014	9:00	MDT	4195	P	USGS	10010100	5/23/2014	9:00	MDT	4194.2	P
USGS	10010000	5/23/2014	9:15	MDT	4195	P	USGS	10010100	5/23/2014	9:15	MDT	4194.3	P
USGS	10010000	5/23/2014	9:30	MDT	4195.1	P	USGS	10010100	5/23/2014	9:30	MDT	4194.3	P
USGS	10010000	5/23/2014	9:45	MDT	4195.1	P	USGS	10010100	5/23/2014	9:45	MDT	4194.4	P
USGS	10010000	5/23/2014	10:00	MDT	4195	P	USGS	10010100	5/23/2014	10:00	MDT	4194.4	P
USGS	10010000	5/23/2014	10:15	MDT	4195.1	P	USGS	10010100	5/23/2014	10:15	MDT	4194.3	P
USGS	10010000	5/23/2014	10:30	MDT	4195.1	P	USGS	10010100	5/23/2014	10:30	MDT	4194.3	P
USGS	10010000	5/23/2014	10:45	MDT	4195	P	USGS	10010100	5/23/2014	10:45	MDT	4194.3	P
USGS	10010000	5/23/2014	11:00	MDT	4195.1	P	USGS	10010100	5/23/2014	11:00	MDT	4194.3	P
USGS	10010000	5/23/2014	11:15	MDT	4195	P	USGS	10010100	5/23/2014	11:15	MDT	4194.3	P
USGS	10010000	5/23/2014	11:30	MDT	4195.1	P	USGS	10010100	5/23/2014	11:30	MDT	4194.3	P
USGS	10010000	5/23/2014	11:45	MDT	4195.1	P	USGS	10010100	5/23/2014	11:45	MDT	4194.2	P

Saltair - South Arm							Saline - North Arm						
Agency	Gage #	Date	Time		WSE (ft)	Qualifier	Agency	Gage #	Date	Time		WSE (ft)	Qualifier
USGS	10010000	5/23/2014	12:00	MDT	4195.1	P	USGS	10010100	5/23/2014	12:00	MDT	4194.2	P
USGS	10010000	5/23/2014	12:15	MDT	4195.1	P	USGS	10010100	5/23/2014	12:15	MDT	4194.2	P
USGS	10010000	5/23/2014	12:30	MDT	4195.1	P	USGS	10010100	5/23/2014	12:30	MDT	4194.2	P
USGS	10010000	5/23/2014	12:45	MDT	4195.1	P	USGS	10010100	5/23/2014	12:45	MDT	4194.2	P
USGS	10010000	5/23/2014	13:00	MDT	4195	P	USGS	10010100	5/23/2014	13:00	MDT	4194.2	P
USGS	10010000	5/23/2014	13:15	MDT	4195	P	USGS	10010100	5/23/2014	13:15	MDT	4194.2	P
USGS	10010000	5/23/2014	13:30	MDT	4195	P	USGS	10010100	5/23/2014	13:30	MDT	4194.2	P
USGS	10010000	5/23/2014	13:45	MDT	4195	P	USGS	10010100	5/23/2014	13:45	MDT	4194.1	P
USGS	10010000	5/23/2014	14:00	MDT	4195.1	P	USGS	10010100	5/23/2014	14:00	MDT	4194.2	P
USGS	10010000	5/23/2014	14:15	MDT	4195	P	USGS	10010100	5/23/2014	14:15	MDT	4194.1	P
USGS	10010000	5/23/2014	14:30	MDT	4195	P	USGS	10010100	5/23/2014	14:30	MDT	4194.1	P
USGS	10010000	5/23/2014	14:45	MDT	4195	P	USGS	10010100	5/23/2014	14:45	MDT	4194.1	P
USGS	10010000	5/23/2014	15:00	MDT	4194.9	P	USGS	10010100	5/23/2014	15:00	MDT	4194.1	P
USGS	10010000	5/23/2014	15:15	MDT	4195	P	USGS	10010100	5/23/2014	15:15	MDT	4194	P
USGS	10010000	5/23/2014	15:30	MDT	4194.9	P	USGS	10010100	5/23/2014	15:30	MDT	4194.1	P
USGS	10010000	5/23/2014	15:45	MDT	4195	P	USGS	10010100	5/23/2014	15:45	MDT	4194	P
USGS	10010000	5/23/2014	16:00	MDT	4195	P	USGS	10010100	5/23/2014	16:00	MDT	4194	P
USGS	10010000	5/23/2014	16:15	MDT	4194.9	P	USGS	10010100	5/23/2014	16:15	MDT	4194.1	P
USGS	10010000	5/23/2014	16:30	MDT	4194.9	P	USGS	10010100	5/23/2014	16:30	MDT	4194.1	P
USGS	10010000	5/23/2014	16:45	MDT	4194.8	P	USGS	10010100	5/23/2014	16:45	MDT	4194.2	P
USGS	10010000	5/23/2014	17:00	MDT	4195	P	USGS	10010100	5/23/2014	17:00	MDT	4194.2	P
USGS	10010000	5/23/2014	17:15	MDT	4195	P	USGS	10010100	5/23/2014	17:15	MDT	4194.2	P
USGS	10010000	5/23/2014	17:30	MDT	4195	P	USGS	10010100	5/23/2014	17:30	MDT	4194.3	P
USGS	10010000	5/23/2014	17:45	MDT	4195	P	USGS	10010100	5/23/2014	17:45	MDT	4194.3	P
USGS	10010000	5/23/2014	18:00	MDT	4195	P	USGS	10010100	5/23/2014	18:00	MDT	4194.2	P
USGS	10010000	5/23/2014	18:15	MDT	4195	P	USGS	10010100	5/23/2014	18:15	MDT	4194.1	P
USGS	10010000	5/23/2014	18:30	MDT	4195	P	USGS	10010100	5/23/2014	18:30	MDT	4194	P
USGS	10010000	5/23/2014	18:45	MDT	4194.9	P	USGS	10010100	5/23/2014	18:45	MDT	4193.9	P
USGS	10010000	5/23/2014	19:00	MDT	4195	P	USGS	10010100	5/23/2014	19:00	MDT	4194	P
USGS	10010000	5/23/2014	19:15	MDT	4195	P	USGS	10010100	5/23/2014	19:15	MDT	4194	P
USGS	10010000	5/23/2014	19:30	MDT	4195	P	USGS	10010100	5/23/2014	19:30	MDT	4193.9	P
USGS	10010000	5/23/2014	19:45	MDT	4195	P	USGS	10010100	5/23/2014	19:45	MDT	4194	P
USGS	10010000	5/23/2014	20:00	MDT	4195.1	P	USGS	10010100	5/23/2014	20:00	MDT	4194.2	P
USGS	10010000	5/23/2014	20:15	MDT	4195	P	USGS	10010100	5/23/2014	20:15	MDT	4194.2	P
USGS	10010000	5/23/2014	20:30	MDT	4195	P	USGS	10010100	5/23/2014	20:30	MDT	4194.1	P
USGS	10010000	5/23/2014	20:45	MDT	4195	P	USGS	10010100	5/23/2014	20:45	MDT	4194.1	P
USGS	10010000	5/23/2014	21:00	MDT	4194.9	P	USGS	10010100	5/23/2014	21:00	MDT	4194.3	P
USGS	10010000	5/23/2014	21:15	MDT	4195	P	USGS	10010100	5/23/2014	21:15	MDT	4194.5	P
USGS	10010000	5/23/2014	21:30	MDT	4195	P	USGS	10010100	5/23/2014	21:30	MDT	4194.5	P
USGS	10010000	5/23/2014	21:45	MDT	4195.1	P	USGS	10010100	5/23/2014	21:45	MDT	4194.4	P
USGS	10010000	5/23/2014	22:00	MDT	4195	P	USGS	10010100	5/23/2014	22:00	MDT	4194.2	P
USGS	10010000	5/23/2014	22:15	MDT	4194.9	P	USGS	10010100	5/23/2014	22:15	MDT	4194.3	P
USGS	10010000	5/23/2014	22:30	MDT	4194.9	P	USGS	10010100	5/23/2014	22:30	MDT	4194.3	P
USGS	10010000	5/23/2014	22:45	MDT	4194.8	P	USGS	10010100	5/23/2014	22:45	MDT	4194.3	P
USGS	10010000	5/23/2014	23:00	MDT	4195.1	P	USGS	10010100	5/23/2014	23:00	MDT	4194.2	P
USGS	10010000	5/23/2014	23:15	MDT	4195.1	P	USGS	10010100	5/23/2014	23:15	MDT	4194.2	P
USGS	10010000	5/23/2014	23:30	MDT	4195.1	P	USGS	10010100	5/23/2014	23:30	MDT	4194.3	P
USGS	10010000	5/23/2014	23:45	MDT	4195.1	P	USGS	10010100	5/23/2014	23:45	MDT	4194.3	P

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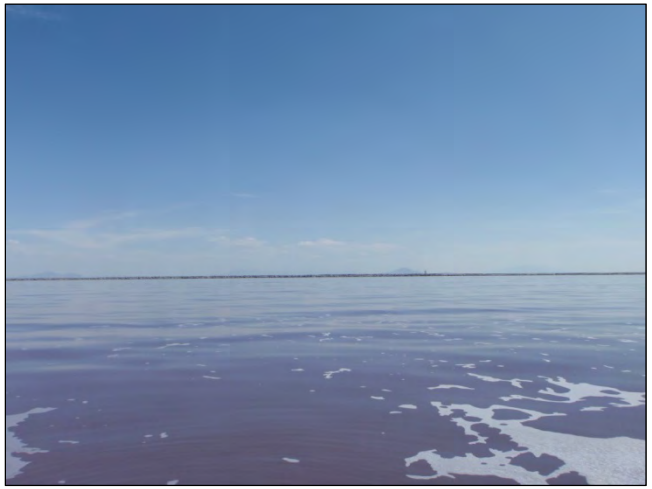
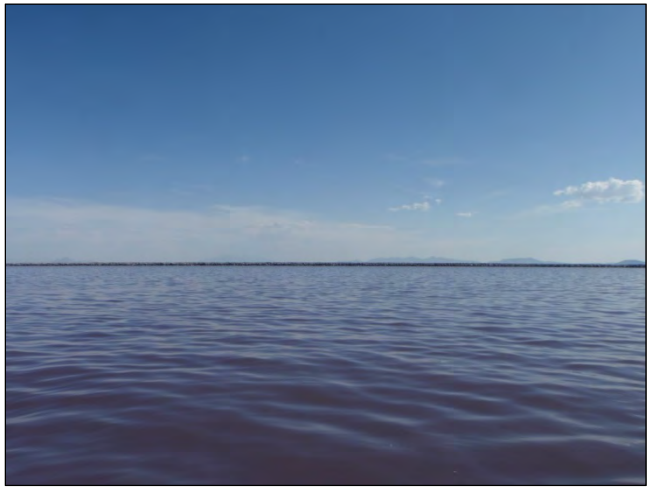
APPENDIX B

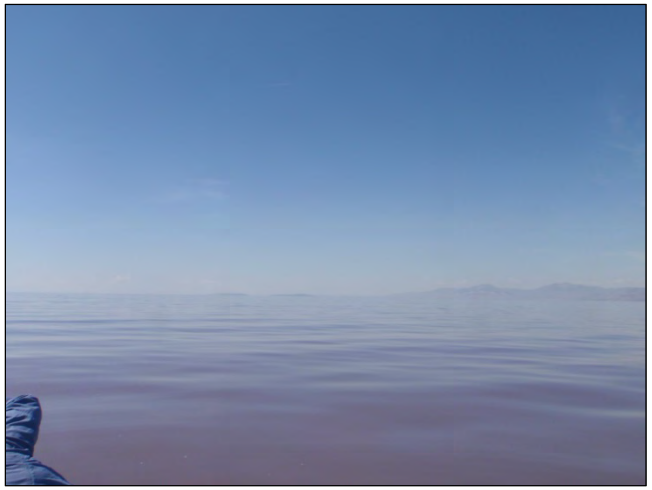
Site Photographs



Photograph B-1. Site 4, facing south, with causeway in the distance.



Photograph B-3. Site 3, facing south, with causeway in the distance.



Photograph B-2. Site 4, facing north.

Photograph B-4. Site 3, facing north.

Photograph B-5. Site 2, facing north, with causeway in the distance.

Photograph B-6. Site 2, facing south.

Photograph B-7. Site 1, facing north, with causeway in the distance.

Photograph B-8. Site 1, facing south.

Photograph B-9. Site 5, facing north.

Photograph B-6. Site 5, facing south.

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APPENDIX C

Surface Water Analytical Results

Table C-1. May 2014 Water Quality Data

Analyte	Sample Location	Method Detection Limit	Method Reporting Limit	Gilbert Bay						Gunnison Bay			
				Site 1		Site 2		Site 5		Site 3		Site 4	
	Sample ID			8180-1		8180-2		8180-5		8180-3		8180-4	
	Coordinates			41.21379	-112.718	41.21329	-112.615	41.16935	-112.657	41.23184	-112.72	41.23085	-112.611
	Date			05/23/14		05/23/14		05/23/14		05/22/14		05/22/14	
	Sample Type			Original		Original		Original		Original		Original	
	Units			Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
PHYSICAL CHARCTERIZATION													
Water Surface Elevation	ft msl	--	--	4194.4						4194.3			
Sechi Depth	m	--	0.1	2.3	--	2.0	--	2.0	--	0.725	--	0.70	--
Depth	m	--	0.1	8.5	--	7.2	--	8.0	--	7.5	--	7.7	--
Brine Layer Interface Depth	m	--	0.1	6.5	--	Not found	--	6.5	--	--	--	--	--
Brine Layer Thickness	m	--	--	2	C	Not found	--	1.5	C	--	--	--	--
UPPER WATER COLUMN													
Specific conductance [a,]	µSiemens/cm	--	0.001	--	NM	--	NM	--	NM	--	NM	--	NM
Dissolved Oxygen[a,b]	mg/L	--	0.1	3.7	--	4.0	--	4.2	--	7.5	--	6.97	--
pH [a,]	su	--	0.1	8.1	--	7.9	--	7.8	--	6.3	--	6.48	--
Temperature [a,]	°C	--	0.1	18.5	--	18.5	--	18.4	--	20.7	--	20.2	--
Alkalinity, Total (as CaCO3)	mg/L	--	50.0	421	--	412	--	443	--	354	--	351	--
Hardness, Total	mg/L	--	10.0	20,500	--	20,100	--	20,200	--	48,700	--	50,400	--
Sulfate	mg/L	--	3,750	10,900	--	9,780	--	9,560	--	20,700	--	23,100	--
Arsenic	µg/L	0.250	0.750	109	--	104	--	113	--	166	--	176	--
Copper	µg/L	0.20	0.60	2.73	--	2.56	--	2.68	--	1.11	--	1.13	--
Lead	µg/L	0.015	0.065	1.22	--	1.21	--	1.43	--	0.428	--	0.640	--
Mercury	ng/L	0.15	0.41	4.83	--	9.67	--	5.04	--	3.73	--	2.89	--
Selenium	µg/L	0.350	1.05	0.440	J	0.510	J	0.513	J	0.480	J	0.542	J
Zinc	µg/L	1.3	3.75	3.09	J	2.62	J	2.22	J	2.45	J	3.18	J
LOWER WATER COLUMN													
Specific conductance	µSiemens/cm	--	0.001	--	NM	--	NM	--	NM	--	NM	--	NM
Dissolved Oxygen[n]	mg/L	--	0.1	0.3	--	2.0	--	0.7	--	7.2	--	6.1	--
pH [a,]	su	--	0.1	7.7	--	8.2	--	7.7	--	7.4	--	7.5	--
Temperature [a,]	°C	--	0.1	12.5	--	15.4	--	12.8	--	18.3	--	17.1	--
Alkalinity, Total (as CaCO3)	mg/L	--	50.0	394	--	398	--	367	--	351	--	340	--
Hardness, Total	mg/L	--	10.0	22,600	--	20,300	--	20,800	--	52,200	--	49,200	--
Sulfate	mg/L	--	3,750	10,600	--	12,800	--	10,600	--	24,800	--	20,400	--
Arsenic	µg/L	0.250	0.750	111	--	123	--	111	--	168	--	162	--
Copper	µg/L	0.20	0.60	2.9	--	14.4	--	2.85	--	1.24	--	1.1	--
Lead	µg/L	0.015	0.065	1.17	--	5.33	--	1.25	--	0.284	--	0.492	--
Mercury	ng/L	0.15	0.41	22.6	--	23	N	15.3	--	2.87	--	2.26	--
Selenium	µg/L	0.350	1.05	0.707	J	0.423	J	0.537	J	0.572	J	0.412	J
Zinc	µg/L	1.3	3.75	1.3	ND	11.5	--	1.30	ND	2.44	J	2.1	J

[a] Results are sonde measurements at 0.2 m from the water surface (upper water column) and 0.5 m from the bottom (lower water column)

[b] Results are sonde measurements. All laboratory dissolved oxygen data were rejected during data verification review and are not reported Laboratory data are provided in Appendix G.

ACRONYMS

m	meters
µg/L	micrograms per liter
mg/L	milligrams per liter
su	standard units
ng/L	nanograms per liter
mg/kg	milligrams per kilogram
µg/kg	micrograms per kilogram
ng/g	nanograms per gram
ft	feet
msl	mean sea level

QUALIFIER DEFINITIONS

--	not collected, not applicable or not required
C	Calculated value
J	Estimated result. Detected by the instrument, but quantity is uncertain. The result is more than the MDL but less than the MRL.
N	Result is estimated. Spike recovery was not within acceptance criteria.
ND	Not detected at the method detection limit.
NM	Sonde conductivity probe was not working on May 22 and May 23, 2014. Conductivity was not collected.

Table C-2. May 2014 Density and Total Dissolved Solid Data

Sample Location	Gilbert Bay												Gunnison Bay							
	Site 1				Site 2				Site 5				Site 3				Site 4			
Sample ID	8180-1				8180-2				8180-5				8180-3				8180-4			
Coordinates	41.213792		-112.718006		41.213294		-112.614617		41.169347		-112.657169		41.231839		-112.719936		41.23085		-112.611308	
Date	05/23/14				05/23/14				05/23/14				05/22/14				05/22/14			
Sample Type	Original				Original				Original				Original				Original			
Depth/ Analyte	Density	Qual	Total Dissolved Solids	Qual	Density	Qual	Total Dissolved Solids	Qual	Density	Qual	Total Dissolved Solids	Qual	Density	Qual	Total Dissolved Solids	Qual	Density	Qual	Total Dissolved Solids	Qual
Units	g/ml		mg/L		lb/ft³		mg/L		lb/ft³		mg/L		lb/ft³		mg/L		lb/ft³		mg/L	
1.5 m	1.10521	R	167,000	--	1.10269	R	163,000	--	1.09891	R	157,000	--	1.21357	R	339,000	--	1.19656	R	312,000	--
3.0 m	1.09576	R	152,000	--	1.09828	R	156,000	--	1.09828	R	156,000	--	1.2142	R	340,000	--	1.21168	R	336,000	--
4.5 m	1.09828	R	156,000	--	1.09828	R	156,000	--	1.09828	R	156,000	--	1.22806	R	362,000	--	1.21798	R	346,000	--
6.0 m	1.09261	R	147,000	--	1.09576	R	152,000	--	1.0945	R	150,000	--	1.20979	R	333,000	--	1.21042	R	334,000	--
6.5 m	1.14301	R	227,000	--	1	R	--	--	1.09324	R	148,000	--	--	--	--	--		--	--	--
7.0 m	1.13419	R	213,000	--	1.10584	R	168,000	--	1.13293	R	211,000	--	--	--	--	--		--	--	--
7.5 m	1.14049	R	223,000	--	1	R	--	--	1.13734	R	218,000	--	--	--	--	--	1.20853	--	331,000	--
Depth to bottm (m)	8.5	--	--	--	7.2	--	--	--	8.0	--	--	--	7.5	--	--	--	7.7	--	--	--

QUALIFIER DEFINITIONS

-- not collected, not applicable or not required

R Rejected during review process.

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APPENDIX D

Brine Shrimp Analytical Results

Table D-1. May 2014 Brine Shrimp Tissue Data

Analyte	Sample Location	Method Detection Limit	Method Reporting Limit	Gilbert Bay					
	Sample Location			Site 1		Site 2		Site 5	
	Sample ID			8180-1		8180-2		8180-5	
	Coordinates			41.213792	-112.71801	41.169347	-112.65717	41.169347	-112.65717
	Date			05/23/14		05/23/14		05/23/14	
	Sample Type			Original		Original		Original	
	Units			Result	Qualifier	Result	Qualifier	Result	Qualifier
Percent Solids									
Total Solids	%	0.3	1.00	20.84	--	16.75	--	21.73	--
Wet-weight									
Arsenic	mg/kg	0.013	0.037	2.73	--	2.65	--	3.07	--
Copper	mg/kg	0.009	0.03	2.31	--	2.28	--	2.86	--
Lead	mg/kg	0.004	0.037	0.163	--	0.353	M	0.214	--
Mercury	ng/g	0.15	0.37	29.1	--	32.5	--	40.3	--
Selenium	mg/kg	0.06	0.14	0.41	--	0.34	--	0.47	--
Zinc	mg/kg	0.37	0.93	12.5	--	15.1	--	16.8	--
Dry-weight									
Arsenic	mg/kg	0.63	0.179	13.1	--	15.8	--	14.1	--
Copper	mg/kg	0.04	0.14	11.1	--	13.6	--	13.2	--
Lead	mg/kg	0.018	0.179	0.781	--	2.11	M	0.983	--
Mercury	ng/g	0.72	1.79	140	--	194	--	182	--
Selenium	mg/kg	0.27	0.67	1.98	--	2.04	--	2.15	--
Zinc	mg/kg	1.79	4.47	59.8	--	90.3	--	77.4	--

ACRONYMS
mg/kg milligrams per kilogram
ng/g nanograms per gram

QUALIFIER DEFINITIONS
-- not collected, not applicable or not required
M Result is estimated. Duplicate precision (RPD) was not within acceptance criteria.

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APPENDIX E

Brine Shrimp Taxonomic Results

Table E-1. Subsample Data

EcoA#	HDR Sample#	Collection Date	Egg	Nauplius	Early Metanauplius	Mid Metanauplius	Late Metanauplius	Subadult	Adult	Initial Mass	Final Mass	Tare	% Subsample
6733.01-1	8180-1	5/23/2014	392	23	312	74	32	16	7	197.57	196.15	31.912	0.86%
6733.01-2	8180-1-DUP	5/23/2014	239	17	247	64	16	11	2	260.60	259.21	31.912	0.61%
6733.01-3	8180-2	5/23/2014	736	26	517	115	1	2	4	300.89	299.31	31.912	0.59%
6733.01-4	8180-5	5/23/2014	530	46	285	36	9	8	7	307.75	306.33	31.912	0.51%

Table E-2. Calculated Whole Sample Data

EcoA#	HDR Sample#	Collection Date	Egg	Nauplius	Early Metanauplius	Mid Metanauplius	Late Metanauplius	Subadult	Adult	Tow Length; 0.5 m from bottom to surface (m)	Tow Opening Diameter (m)	Tow Opening Area (m^2)	Volume of Water Towed (m^3)
6733.01-1	8180-1	5/23/2014	45730.94	2683.193	36398.09577	8632.88169	3733.138028	1866.569	816.6239	8.5	0.5	0.79	6.68
6733.01-2	8180-1-DUP	5/23/2014	39321.17	2796.904	40637.36403	10529.51942	2632.379856	1809.761	329.0475	8.5	0.5	0.79	6.68
6733.01-3	8180-2	5/23/2014	125296.1	4426.22	88013.68734	19577.51266	170.2392405	340.4785	680.957	7.2	0.5	0.79	5.65
6733.01-4	8180-5	5/23/2014	102953.6	8935.597	55361.85211	6993.076056	1748.269014	1554.017	1359.765	8	0.5	0.79	6.28

Table E-3. Calculated Whole Sample Density (Individuals per cubic meter)

EcoA#	HDR Sample#	Collection Date	Egg	Nauplius	Early Metanauplius	Mid Metanauplius	Late Metanauplius	Subadult	Adult	Total
6733.01-1	8180-1	5/23/2014	6,846	402	5,449	1,292	559	279	122	14,949
6733.01-2	8180-1-DUP	5/23/2014	5,886	419	6,083	1,576	394	271	49	14,679
6733.01-3	8180-2	5/23/2014	22,176	783	15,578	3,465	30	60	121	42,213
6733.01-4	8180-5	5/23/2014	16,394	1,423	8,816	1,114	278	247	217	28,488

Table E-4. Life Stage Composition (% of sample)

EcoA#	HDR Sample#	Collection Date	Egg	Nauplius	Early Metanauplius	Mid Metanauplius	Late Metanauplius	Subadult	Adult
6733.01-1	8180-1	5/23/2014	46	3	36	9	4	2	1
6733.01-2	8180-1-DUP	5/23/2014	40	3	41	11	3	2	0
6733.01-3	8180-2	5/23/2014	53	2	37	8	0	0	0
6733.01-4	8180-5	5/23/2014	58	5	31	4	1	1	1

LIFE STAGE DEFINITIONS

Egg-Intact sphere, chorion unbroken, or if broken, filled with material
Nauplius-1st instar, no post-mandibular appendages
Early Metanauplius-trunk elongate, limb buds developing, compound eyes absent or minute
Mid Metanauplius-some thoracopods (less than 11) formed, less than or equal to second antenna in size, compound eyes larger, becoming pedunculate
Late Metanauplius-all 11 thoracopods developed, second antenna still modified for swimming, significantly smaller than larger thoracopods, compound eyes well developed
Subadult-second antenna not modified for swimming, generally adult in form, genitalia and modified second antennae of males only partially developed
Adult-genitalia fully developed, male second antennae fully developed, ovisac of female large, typically filled with eggs

APPENDIX F

Data Quality Assurance Documentation

Appendix F. Data Quality Assurance Documentation

Data were acquired in accordance with UPRR's Quality Assurance Program Plan (QAPP), which was provided as Appendix C to the Interim Monitoring Plan (UPRR 2014). Following each event, UPRR subjected all data to QA/QC procedures including, but not limited to: spot-checks of transcription; review of data submissions for completeness; comparison of GIS maps with field notes on locations; and identification of any inconsistent data (Figure 1). Through this review process, UPRR observed

- Laboratory measurements of density did not differentiate conditions among samples. Dilutions performed when implementing SM 2710F reduced sample precision, such that differences between sites were not observable.
- Dissolved oxygen determinations using the Winkler method (SM 4500-OC) did not produce plausible results. Concentrations indicated anoxic concentrations in the upper layer, despite observable and abundant aquatic life.

Consequently, provided in Appendix C (data tables) and Appendix G (data packages), UPRR determined that the laboratory's density and dissolved oxygen data were not usable and qualified these data as "R" (rejected). UPRR's Corrective Actions are provided in Section 2.6 of the main report and are reflected in data reported in the main report, as well.

The QAPP specifies representativeness, accuracy, precision, comparability and completeness objectives for data acquisition (UPRR 2014). Representativeness was ensured via the location of sample sites as well as the sampling intervals. Representative locations and measurement intervals were prescribed by the USACE and UDWQ and are described above in Table 2 of the main text.

Accuracy for field and laboratory measurements is defined as the degree of conformity of a measured/calculated quantity to its actual (true) value. Calibration records for the Troll 9500 are provided in Table F-1. All sonde probes were calibrated except conductivity; the probe did not provide results at the range of conditions in the Great Salt Lake. Laboratory data packages (Level 2) are provided in Appendix G. Quality assurance samples (method blanks, laboratory control samples, method spikes, and others) were analyzed as appropriate for each method and all quality control analyses were within acceptable limits.

Comparable data was ensured by meeting the target reporting limits provided in Table 4 of the main text. In the analytical data package and Appendix C, some selenium and zinc data were flagged to account for concentrations found below reporting limits, but above detection limits; these data are shown "as is" in Appendix C and Appendix G, but reported as non-detect at the reporting limit in the main body of this report.

Precision is an assessment of reproducibility under a particular set of conditions. Precision was assessed for laboratory samples through the use of field duplicates, field blanks and equipment blanks (Table F-2 and Table F-3). A field duplicate is a second sample collected at the same time or immediately after the primary environmental sample; a field duplicate indicates the precision of field sample collection. The May 2014 field duplicate results were all within 10% of each other. A field blank is a sample of analyte-free water poured into the container in the field and then preserved and shipped to the laboratory with the samples. A field blank indicates whether there was contamination from field conditions during sampling. All field blank results were trace or non-detect. An equipment blank is a sample of analyte-free water

poured over or through decontaminated field sampling equipment prior to the collection of samples. It indicates the adequacy of the decontamination processes. With one exception, the field blank results were all non-detect or in trace quantities. The equipment blank's mercury concentration was 14.7 ng/L, which was confirmed by reanalysis (Appendix G). This concentration was an order of magnitude greater than monitoring samples, suggesting a source other than the Great Salt Lake samples. Though this information had no affect on monitoring results, additional care will be exercised during additional monitoring rounds.

The completeness objective provided in the QAPP for the study was 90 percent (UPRR 2014), and is defined as the number of valid measurements divided by the number of measurements collected. Forty-one (41) analytes were measured for each of the 5 water samples and fourteen (14) analytes were measured for each of the three brine shrimp samples. Though some project variances/non-conformances resulted in data loss (See Section 2.6 of the main text), the completeness objective of 90% for the May 2014 was met: valid measurements were obtained for 93% of the surface water analytes and 100% of the brine shrimp analytes.

Reference:

[UPRR] Union Pacific Railroad

2014 Interim Monitoring Plan. Temporary Closure of the East Culvert, Great Salt Lake Causeway. Appendix C. Quality Assurance Project Plan. Revised March 10.

Figure F-1. Data Verification Checklist

General	
☒	For each sample event, samples have been collected and analyzed at all locations and for all analyses specified in the monitoring plan.
☒	For each sample and analyses, the project file contains records field notes, chain-of-custody, and analytical results, including quality assurance documentation (hardcopy ~~and electronic~~)
Field Data	
☒	Field notes and/or data sheets include date, time of sample collection, field sampling staff, time arrived at site, time left site, site identification, description of site conditions (weather), field parameters, lake level, sample collection procedures, and call-out quality assurance samples collected. If mistakes are found on the field data sheet, changes can be made by crossing out the mistake and marking the change with a date of change, initials, and reason for change.
☒	Documentation of field equipment calibration is in the field notes and/or project records.
☒	Field data entered into Excel, have been checked by a second-party.
Laboratory Report	
☒	Field duplicates, blanks, and rinsates were submitted to the laboratory at the frequency specified in the monitoring plan.
☒	Any constituents found in blanks or rinsates are discussed in the report.
☒	Any duplicate concentrations that differ by more than 10% are discussed in the report.
☒	Samples were received by the laboratory intact and analyzed within method and/or study specified holding times.
☒	On laboratory reports, sample IDs, analyses, reporting/detection limits, units, column labels, footnotes, and titles are accurate. Have lab re-issue report with corrections if there are inconsistencies.
☒	Check that non-detects are always reported in the same manner using consistent notation. For example, either "ND" or "<." Have lab re-issue report with corrections if there are inconsistencies.

Table F-2. Field Equipment Calibration Records

Ph	Conductivity, Low Range	Dissolved Oxygen, RDO
Device Serial Number 51012	Device Serial Number 51012	Device Serial Number 51012
Sensor Serial Number PP14474	Sensor Serial Number LC05116	Sensor Serial Number 351065
Sensor Mfg Date 6/11/2013	Sensor Mfg Date 8/31/2007	Sensor Mfg Date 9/6/2013
Method Traditional	Sensor Type Conductivity, Low Range	Method Traditional
Action COMPLETED	Method Quick Cal	Action COMPLETED
Status Point 1 STABLE	Action COMPLETED	Status Point 1 STABLE
Status Point 2 STABLE	Status Point 1 STABLE	Status Point 2 STABLE
Date 2014-05-02	Date 2014-05-02	Date 2014-05-02
Time 091312	Time 090226	Time 093327
Cal Points: 2	Cal Points: 1	Sensor Firmware Ver 10
Point 1:	Point 1	Cap Serial Number 341382
Stimulus = 4.01 pH	Stimulus = 7980 µS/cm	Cap Mfg Date 6/26/2013
Response = 166.605 mV	Response = 48.1483 ohms	Cap Expiration Date 9/19/2014
Final Reading = 4.01 pH	Final Reading = 7980 µS/cm	Saturation Point: NEW CALIBRATION VALUES
Temperature = 21.2311 C	Temperature = 16.809 C	7.05 mg/l
Point 2:	Kcell = 0.321309	21.48 °C
Stimulus = 7.00 pH	--	850.57 mbar
Response = 0.916349 mV	--	Zero Point: NEW CALIBRATION VALUES
Final Reading = 7.00 pH	--	0.04 mg/l
Temperature = 21.9666 C	--	21.17 °C
Slope = -55.4142 mV/pH	--	Calibration slope 1.05 (mg/l) / (mg/l)
Offset = 388.815 mV	--	Calibration offset -0.04 mg/l

Table F-3. May 2014 Field Quality Assurance Data

Analyte	Media	SURFACE WATER									BRINE SHRIMP TISSUE			
	Sample Location	Gunnison Bay				Equipment Blank		Field Blank		Sample Location	Gilbert Bay			
		Site 4		Site 4							Site 1		Site 1	
	Sample ID	8180-4		8180-4-DUP		8180-EB		8180-FB		Sample ID	8180-1		8180-1-DUP	
	Coordinates	41.23085		-112.611308		--	--	--	--	Coordinates	41.213792		-112.718006	
	Date	05/22/14		05/22/14		05/23/14		05/22/14		Date	05/23/14		05/23/14	
	Sample Type	Original		Duplicate		Original		Original		Sample Type	Original		Duplicate	
	Units	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Units	Result	Qual	Result	Qual
		LOWER WATER COLUMN									BRINE SHRIMP TISSUE			
Alkalinity, Total (as CaCO3)	mg/L	340	--	340	--	10	ND	10	ND	--	--	--	--	--
Hardness, Total	mg/L	49,200	--	48,100	--	10	ND	10	ND	--	--	--	--	--
Sulfate	mg/L	20,400	--	21,200	--	0.750	ND	0.750	ND	--	--	--	--	--
Percent Solids	%	--	--	--	--	--	--	--	--	%	20.84	--	19.54	--
Arsenic	µg/L	162	--	134	--	0.15	ND	0.15	ND	mg/kg	2.73	--	2.69	--
Copper	µg/L	1.1	--	0.87	--	0.17	--	0.12	ND	mg/kg	2.31	--	2.91	--
Lead	µg/L	0.492	--	0.530	--	0.127	--	0.013	ND	mg/kg	0.163	--	0.088	--
Mercury	ng/L	2.26	--	3.39	--	14.7	--	0.41	ND	ng/g	29.1	--	31.4	--
Selenium	µg/L	1.05	ND	1.05	ND	0.210	ND	0.210	ND	mg/kg	0.41	--	0.38	--
Zinc	µg/L	3.75	ND	3.75	ND	2.95	--	0.75	ND	mg/kg	12.5	--	7.16	--

QUALIFIER DEFINITIONS

-- not collected, not applicable or not required

ND Not detected at the method reporting limit. The method reporting limit is the minimum concentration that an be reported by the method referenced and the sample matrix..

Table F-4. May 2014 Density and TDS Field Quality Assurance Data

Analyte	Sample Location	SURFACE WATER DUPLICATE										FIELD QUALITY ASSURANCE			
		Gilbert Bay					Gunnison Bay					Equipment Blank		Field Blank	
		Site 1					Site 3								
	Sample ID	8180-1				RPD	8180-3				RPD	8180-EB		8180-FB	
	Coordinates	41.213792		-112.614617			41.231839		-112.719936			--	--	--	--
	Date	05/23/14					05/22/14					05/23/14		05/22/14	
	Sample Type	Original		Duplicate			Original		Duplicate			Original		Original	
	Depth	7.0 ft					7.0 ft								
	Units	Result	Qual	Result	Qual		Result	Qual	Result	Qual		Result	Qual	Result	Qual
Density	lb/ft^3	66.3	--	68.3	--	3%	72.7	--	71.1	--	2%	60.3	--	58.1	--
Total Dissolved Solids	g/ml	0.213	--	0.222	--	4%	0.333	--	0.335	--	<1%	0.000	--	10	ND

QUALIFIER DEFINITIONS

-- not collected, not applicable or not required

ND Not detected at the method reporting limit. The method reporting limit is the minimum concentration that an be reported by the method referenced and the sample matrix..

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APPENDIX G

Field and Analytical Laboratory Data Reports

HDR INC - UPRR GSL WQ

General Site Information				
Date: 5.23.14	Time: 1135	Field Crew: CW, CW NN		
Weather: sunny slight breeze	Sample ID: 8180-1	Sample Location: #1 - #1 South of causeway		
Northing: See GPS site #1	Easting:	GPS Point Saved	YES	NO
Total Depth (m): 8.5 m	Brine Depth (m): not recorded ≈ 6.5m	Secchi Depth (m): 2.3		
Vertical Profile File Name: profile - gsl1	Photo Numbers and descriptions: 331 - Looking @ causeway 332 - looking @ NW			

Surface Water Samples (check when done)								
A - Surface (0.2m)	DO	~~X~~ NO	Mercury	X	Metals	X	Sulfate	X
	Hardness	X	Cations	X	Anions	X	Alkalinity	X
B - Bottom (0.5m)	DO	X	Mercury	X	Metals	X	Sulfate	X
	Hardness	X	Cations	X	Anions	X	Alkalinity	X
Field duplicate collected (1 per trip)?				YES			NO	

Brine Shrimp Samples (check when done)							
Tow 1	X	Tow 2	—	Tow 3	—	Composited:	—
Field duplicate collected (1 per trip)?				YES		NO	
Tow 4 (taxon)	X	Taxon Field duplicate collected (1 per trip)?				YES	NO

Notes:

no multi-tow due to time/weather concerns.

no surface DO lack of bottles

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

Profile Samples								
From Troll 9500					Lab Samples (check		QC Sample every 10	
Depth (m)	Temp (C)	DO (mg/L)	pH	Cond.	TDS	Density	TDS	Density
.5	18.5	3.7	8.1	NO				
1	18.4	3.5	8.1					
1.5	17.9	3.4	8.1		X	X		
2	17.4	3.5	8.1					
2.5	17.4	3.6	8.2					
3	17.3	3.6	8.2		X	X		
3.5	17.0	3.9	8.2					
4	16.8	4.3	8.2					
4.5	16.7	4.4	8.2		X	X		
5	16.7	4.5	8.2					
5.5	16.4	4.5	8.2					
6	16.3	3.8	8.2		X	X		
6.5	16.0	2.6	8.2		X	X		
7	15.2	2.0	8.2		X	X		
7.5	13.7	0.8	8.1		X	X		
8	12.5	0.3	7.7					
8.5	11.5	0.2	7.5					

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

General Site Information					
Date: 5.23.14	Time: 945	Field Crew: CV, CW, NN			
Weather: sunny calm	Sample ID: 8180-2	Sample Location: #2 - South of Causeway			
Northing: See GPS	Easting: site 2	GPS Point Saved	YES	NO	
Total Depth (m): 7.2	Brine Depth (m): could not identify	Secchi Depth (m): 2.0 m			
Vertical Profile File Name: profile_gsl2	Photo Numbers and descriptions: 329 - Looking N to causeway 330 - Looking SW to shore				

Surface Water Samples (check when done)								
A - Surface (0.2m)	DO	X	Mercury	X	Metals	X	Sulfate	X
	Hardness	X	Cations	X	Anions	X	Alkalinity	X
B - Bottom (0.5m)	DO	NO	Mercury	X	Metals	X	Sulfate	X
	Hardness	X	Cations	X	Anions	X	Alkalinity	X
Field duplicate collected (1 per trip)?				YES			NO	

Brine Shrimp Samples (check when done)							
Tow 1	X	Tow 2	—	Tow 3	—	Composited:	—
Field duplicate collected (1 per trip)?				YES		NO	
Tow 4 (taxon)	X	Taxon Field duplicate collected (1 per trip)?			YES	NO	

Notes:

- conductivity meter did not work
- turbidity did not change enough to notice a brine layer
- photo on Chuck's phone of water from near bottom
- no DO @ bottom samples.

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

Profile Samples								
From Troll 9500					Lab Samples (check		QC Sample every 10	
Depth (m)	Temp (C)	DO (mg/L)	pH	Cond.	TDS	Density	TDS	Density
.5	18.5	4.0	7.9					
1 ~~1.0~~	18.5	3.5	8.0					
1.5 ~~1~~	18.1	3.4	8.1		X	X		
2 ~~1.5~~	17.7	3.6	8.1					
2.5 ~~2~~	17.6	3.8	8.1					
3 ~~2.5~~	17.5	3.9	8.1		X	X		
3.5 ~~3~~	17.3	3.9	8.2					
4 ~~3.5~~	17.2	4.0	8.2					
4.5 ~~4~~	17.0	3.9	8.2		X	X		
5 ~~4.5~~	16.9	3.6	8.2					
5.5 ~~5~~	16.7	3.4	8.2					
6 ~~5.5~~	16.4	2.9	8.2		X	X		
6.5	15.4	2.0	8.2					
7	14.5	2.0	8.2					

4 total

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

General Site Information				
Date: 5-22-14	Time: 17:25	Field Crew: CN, CW, NN		
Weather: sunny breeze	Sample ID: 8180-3	Sample Location: #3 @ North of Causeway		
Northing: See GPS	Easting: —	GPS Point Saved	YES	NO
Total Depth (m): 20ft 7.5m	Brine Depth (m): —	Secchi Depth (m): 0.725 m		
Vertical Profile File Name: profile_gsl3	Photo Numbers and descriptions: 327 - Looking @ causeway (S) 328 - looking NW			

Surface Water Samples (check when done)								
A - Surface (0.2m)	DO	X	Mercury	X	Metals	X	Sulfate	X
	Hardness	X	Cations	X	Anions	X	Alkalinity	X
B - Bottom (0.5m)	DO	X	Mercury	X	Metals	X	Sulfate	X
	Hardness	X	Cations	X	Anions	X	Alkalinity	X
Field duplicate collected (1 per trip)?				YES			NO	

Brine Shrimp Samples (check when done)							
Tow 1	—	Tow 2	—	Tow 3	—	Composited:	—
Field duplicate collected (1 per trip)?				YES		NO	
Tow 4 (taxon)	—	Taxon Field duplicate collected (1 per trip)?				YES	NO

Notes:

No shrimp

TDS/DEN DUP 8180-3-6-DUP.

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

Profile Samples									
From Troll 9500					Lab Samples (check		QC Sample every 10		
Depth (m)	Temp (C)	DO (mg/L)	pH	Cond.	TDS	Density	TDS	Density	
.5	20.7	7.5	6.3	—					
1	21.6	7.3	6.9	—					
1.5	18.3	7.2	7.1	—	X	X			—
2	18.1	7.2	7.3	—					
2.5	17.7	7.2	7.3	—					
3	17.7	7.3	7.4	—	X	X			—
3.5	18.0	7.3	7.4	—					
4	18.1	7.4	7.3	—					
4.5	18.1	7.3	7.4	—	X	X			—
5	18.2	7.3	7.4	—					
5.5	18.3	7.2	7.4	—					
6	18.3	7.2	7.4	—					
6.5	18.3	7.2	7.4	—	X	X	X	X	—
									4

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

General Site Information					
Date: 10/22/14	Time: 1532	Field Crew: CW, CW, NN			
Weather: sunny calm	Sample ID: 8180-4	Sample Location: #4, North of causeway			
Northing: See GPS	Easting: —	GPS Point Saved	YES	NO	
Total Depth (m): 21ft 7.1m	Brine Depth (m): N/A	Secchi Depth (m): 0.70 m			
Vertical Profile File Name: profile-gsl4	Photo Numbers and descriptions: 325 - Looking @ causway, S; 326 - Looking North				

Surface Water Samples (check when done)								
A - Surface (0.2m)	DO	X	Mercury	X	Metals	X	Sulfate	X
	Hardness	X	Cations	X	Anions	X	Alkalinity	X
B - Bottom (0.5m) 7.2m	DO	X	Mercury	X	Metals	X	Sulfate	X
	Hardness	X	Cations	X	Anions	X	Alkalinity	X
Field duplicate collected (1 per trip)?				YES 4-B			NO	

Brine Shrimp Samples (check when done)							
Tow 1	—	Tow 2	NO	Tow 3	NO	Composited:	NO
Field duplicate collected (1 per trip)?				YES		NO	
Tow 4 (taxon)	NO	Taxon Field duplicate collected (1 per trip)?				YES	NO

Notes:

no conductivity measures

NO SHRIMP ON N. SIDE

Duplicate water sample

~~metals, anions~~, 8180-4-B-DUP

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

Profile Samples									
From Troll 9500					Lab Samples (check		QC Sample every 10		
Depth (m)	Temp (C)	DO (mg/L)	pH	Cond.	TDS	Density	TDS	Density	
.5	20.2	6.97	6.48	—	X	X	—	—	
1	19.43	7.31	6.5	—					
1.5	18.47	7.36	7.36	—		X	—	—	— 1.5
2	18.4	6.7	7.4	—					
2.5	18.2	6.8	7.4	—					
3	17.8	6.7	7.4	—	X	X	X	—	— 3
3.5	17.6	6.7	7.5	—					
4	17.5	6.6	7.4	—					
4.5	17.3	6.4	7.5	—	X	X	X	—	— 4.5
5	17.3	6.4	7.5	—					
5.5	17.2	6.3	7.5	—					
6	17.1	6.2	7.5	—	X	X	X	—	— 6
6.5	17.1	6.2	7.5	—					
7	17.1	6.2	7.5	—					
7.5	17.1	6.1	7.5	—	X	X	—	—	— 7.5
									5

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

General Site Information					
Date: 5.23.14	Time: 1320	Field Crew: CV, CW, NN			
Weather: sunny breeze	Sample ID: 8180-5	Sample Location: #5, most Southern			
Northing: See GPS #5	Easting: —	GPS Point Saved	YES	NO	
Total Depth (m): 8m	Brine Depth (m): ≈ 6.5 m	Secchi Depth (m): 2.0m			
Vertical Profile File Name: profile-gsl 5	Photo Numbers and descriptions: 333 - looking NW to causeway; 334 - looking W to land				

Surface Water Samples (check when done)								
A - Surface (0.2m)	DO	NO	Mercury	✓	Metals	✓	Sulfate	✓
	Hardness	✓	Cations	✓	Anions	✓	Alkalinity	✓
B - Bottom (0.5m)	DO	✓	Mercury	✓	Metals	✓	Sulfate	✓
	Hardness	✓	Cations	✓	Anions	✓	Alkalinity	✓
Field duplicate collected (1 per trip)?				YES			NO	

Brine Shrimp Samples (check when done)							
Tow 1	✓	Tow 2	NO	Tow 3	NO	Composited:	NO
Field duplicate collected (1 per trip)?				YES			NO
Tow 4 (taxon)	✓	Taxon Field duplicate collected (1 per trip)?				YES	NO

Notes:

no composite due to time/weather limits

If found please contact Charles Vertucci, 916.838.9126

HDR INC - UPRR GSL WQ

Profile Samples								
From Troll 9500					Lab Samples (check		QC Sample every 10	
Depth (m)	Temp (C)	DO (mg/L)	pH	Cond.	TDS	Density	TDS	Density
.5	18.4	4.2	7.8					
1.0	18.5	3.4	8.0					
1.5	18.4	2.9	8.1					
2	18.0	2.6	8.1					
2.5	17.7	2.6	8.1					
3	17.6	2.6	8.2					
3.5	17.3	2.6	8.2					
4	16.9	2.9	8.2					
4.5	16.8	2.9	8.2					
5	16.8	2.9	8.2					
5.5	16.8	2.7	8.2					
6	16.7	2.6	8.2					
6.5	16.3	1.9	8.2					
7	15.9	1.5	8.2					
7.5	14.8	1.1	7.9					
8	12.8	0.7	7.7					
	10.5	0.3	7.5					

If found please contact Charles Vertucci, 916.838.9126

July 4, 2014

HDR Engineering, Inc.
ATTN: Carin Loy
2373 Gateway Oaks Dr., Suite 200
Sacramento, CA 95833
carin.loy@hdrinc.com

RE: Project HDR-CA1401 Client Project: 217879

Dear Ms. Loy,

On May 28, 2014, Brooks Rand Labs (BRL) received four (4) brine shrimp samples. The samples were logged-in for the analyses of total mercury (Hg), arsenic (As), copper (Cu), lead (Pb), selenium (Se), and zinc (Zn) according to the chain-of-custody form. All samples were received, prepared, analyzed, and stored according to BRL SOPs and EPA methodology.

The results were method blank corrected as described in the calculations section of the relevant BRL SOP(s) and may have been evaluated using reporting limits that have been adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details. Sample results were reported on a wet- and dry-weight basis.

Sequence 1400527, batch B140928 (As)
The result of the initial calibration blank ICB2 was greater than the low calibration standard. However, this ICB did not bracket the analysis of client samples and there was no evidence of carryover contamination during the analytical run.

Sequence 1400516, batch B140984 (Pb & Zn)
Several of the continuing calibration blanks (CCBJ through CCBO) were considerably elevated during the Zn analysis. No client samples were reported that were bracketed by the analysis of these CCBs.

Standard reference material DORM-4 (a fish protein) recovered at 58% for Pb analysis and the recovery was less than the lower limit of the acceptance criteria range. DORM-4 is a replacement to DORM-3, which BRL has achieved historical recoveries of 56%. The recoveries of TORT-3 and the matrix spike/matrix spike duplicate set were very good and, on this basis, no qualification of the data was deemed necessary.

The method duplicate Pb analysis of sample *8180-2* (1422006-01) produced an elevated relative percent difference of 45%. The sample result was qualified **M** for imprecision. The cause could potentially be attributed to sample heterogeneity – inconsistent pieces of the brine shrimp.

The Pb analysis of the first method blank was determined to be a Grubb's outlier with a result of 0.045 mg/kg and was omitted from the batch. Sample results were method blank-corrected by the average of the three remaining method blank results.

Sequence 1400568, batch B141071 (Se)
The result of the initial calibration blank ICB2 was greater than the low calibration standard. Additionally, the results of CCB1 and CCB3 were also elevated. However, the ICB2 and CCB1/CCB3 did not bracket the analysis of client samples. Client samples were bracketed by the analysis of CCB4 through CCB6.

All data was reported without further qualification and all other associated quality control sample results met the acceptance criteria.

BRL, an accredited laboratory, certifies that the reported results of all analyses for which BRL is NELAP accredited meet all NELAP requirements. For more information please see the *Report Information* page in your report. Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Tiffany Stilwater
Client Services Manager
tiffany@brooksrand.com

Amanda Royal
Project Manager
amanda@brooksrand.com

Report Information

Laboratory Accreditation

BRL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BRL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksrand.com/about/accreditations-certifications/>. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

BLK	method blank	**MS**	matrix spike
BRL	Brooks Rand Labs	**MSD**	matrix spike duplicate
BS	laboratory fortified blank	**ND**	non-detect
CAL	calibration standard	**NR**	non-reportable
CCV	continuing calibration verification	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
COC	chain of custody record	**REC**	percent recovery
D	dissolved fraction	**RPD**	relative percent difference
DUP	duplicate	**RSD**	relative standard deviation
ICV	initial calibration verification	**SCV**	secondary calibration verification
MDL	method detection limit	**SOP**	standard operating procedure
MRL	method reporting limit	**SRM**	standard reference material
IBL	instrument blank	**T**	total recoverable fraction

Definition of Data Qualifiers

(Effective 9/23/09)

B Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
E An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H Holding time and/or preservation requirements not met. Result is estimated.
J Estimated value. A full explanation is presented in the narrative.
J-M Duplicate precision (RPD) for associated QC sample was not within acceptance criteria. Result is estimated.
J-N Spike recovery for associated QC sample was not within acceptance criteria. Result is estimated.
M Duplicate precision (RPD) was not within acceptance criteria. Result is estimated.
N Spike recovery was not within acceptance criteria. Result is estimated.
R Rejected, unusable value. A full explanation is presented in the narrative.
U Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.

These qualifiers are based on those previously utilized by Brooks Rand Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BRL.

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
8180-2	1422006-01	Brine Shrimp	Sample	05/23/2014	05/28/2014
8180-1	1422006-02	Brine Shrimp	Sample	05/23/2014	05/28/2014
8180-1-DUP	1422006-03	Brine Shrimp	Field Duplicate	05/23/2014	05/28/2014
8180-5	1422006-04	Brine Shrimp	Sample	05/23/2014	05/28/2014
8180-2	1422006-05	Water	Sample	05/23/2014	05/28/2014
8180-1	1422006-06	Water	Sample	05/23/2014	05/28/2014
8180-1-DUP	1422006-07	Water	Field Duplicate	05/23/2014	05/28/2014
8180-5	1422006-08	Water	Sample	05/23/2014	05/28/2014

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
%TS	Biota	SM 2540G	06/10/2014	06/16/2014	B140960	N/A
As	Biota	EPA 1638 DRC	06/10/2014	06/16/2014	B140982	1400527
Cu	Biota	EPA 1638 DRC	05/30/2014	06/18/2014	B140983	1400543
Hg	Biota	EPA 1631 Appendix	06/12/2014	06/13/2014	B140959	1400529
Pb	Biota	EPA 1638	06/10/2014	06/11/2014	B140984	1400516
Se	Biota	EPA 1638 DRC	06/10/2014	06/26/2014	B141071	1400568
Zn	Biota	EPA 1638	06/10/2014	06/11/2014	B140984	1400516

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
8180-1										
1422006-02	%TS	Brine Shrimp	NA	20.84		0.30	1.00	%	B140960	N/A
1422006-02	As	Brine Shrimp	dry	13.1		0.063	0.179	mg/kg	B140982	1400527
1422006-02	As	Brine Shrimp	wet	2.73		0.013	0.037	mg/kg	B140982	1400527
1422006-02	Cu	Brine Shrimp	dry	11.1		0.04	0.14	mg/kg	B140983	1400543
1422006-02	Cu	Brine Shrimp	wet	2.31		0.009	0.03	mg/kg	B140983	1400543
1422006-02	Hg	Brine Shrimp	dry	140		0.72	1.79	ng/g	B140959	1400529
1422006-02	Hg	Brine Shrimp	wet	29.1		0.15	0.37	ng/g	B140959	1400529
1422006-02	Pb	Brine Shrimp	dry	0.781		0.018	0.179	mg/kg	B140984	1400516
1422006-02	Pb	Brine Shrimp	wet	0.163		0.004	0.037	mg/kg	B140984	1400516
1422006-02	Se	Brine Shrimp	dry	1.98		0.27	0.67	mg/kg	B141071	1400568
1422006-02	Se	Brine Shrimp	wet	0.41		0.06	0.14	mg/kg	B141071	1400568
1422006-02	Zn	Brine Shrimp	dry	59.8		1.79	4.47	mg/kg	B140984	1400516
1422006-02	Zn	Brine Shrimp	wet	12.5		0.37	0.93	mg/kg	B140984	1400516
8180-1-DUP										
1422006-03	%TS	Brine Shrimp	NA	19.54		0.30	1.00	%	B140960	N/A
1422006-03	As	Brine Shrimp	dry	13.8		0.068	0.193	mg/kg	B140982	1400527
1422006-03	As	Brine Shrimp	wet	2.69		0.013	0.038	mg/kg	B140982	1400527
1422006-03	Cu	Brine Shrimp	dry	14.9		0.05	0.15	mg/kg	B140983	1400543
1422006-03	Cu	Brine Shrimp	wet	2.91		0.009	0.03	mg/kg	B140983	1400543
1422006-03	Hg	Brine Shrimp	dry	160		0.77	1.93	ng/g	B140959	1400529
1422006-03	Hg	Brine Shrimp	wet	31.4		0.15	0.38	ng/g	B140959	1400529
1422006-03	Pb	Brine Shrimp	dry	0.452		0.019	0.193	mg/kg	B140984	1400516
1422006-03	Pb	Brine Shrimp	wet	0.088		0.004	0.038	mg/kg	B140984	1400516
1422006-03	Se	Brine Shrimp	dry	1.96		0.29	0.72	mg/kg	B141071	1400568
1422006-03	Se	Brine Shrimp	wet	0.38		0.06	0.14	mg/kg	B141071	1400568
1422006-03	Zn	Brine Shrimp	dry	36.6		1.93	4.83	mg/kg	B140984	1400516
1422006-03	Zn	Brine Shrimp	wet	7.16		0.38	0.94	mg/kg	B140984	1400516

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
8180-2										
1422006-01	%TS	Brine Shrimp	NA	16.75		0.30	1.00	%	B140960	N/A
1422006-01	As	Brine Shrimp	dry	15.8		0.081	0.230	mg/kg	B140982	1400527
1422006-01	As	Brine Shrimp	wet	2.65		0.013	0.039	mg/kg	B140982	1400527
1422006-01	Cu	Brine Shrimp	dry	13.6		0.06	0.18	mg/kg	B140983	1400543
1422006-01	Cu	Brine Shrimp	wet	2.28		0.01	0.03	mg/kg	B140983	1400543
1422006-01	Hg	Brine Shrimp	dry	194		7.36	18.4	ng/g	B140959	1400529
1422006-01	Hg	Brine Shrimp	wet	32.5		1.23	3.08	ng/g	B140959	1400529
1422006-01	Pb	Brine Shrimp	dry	2.11	M	0.023	0.230	mg/kg	B140984	1400516
1422006-01	Pb	Brine Shrimp	wet	0.353	M	0.004	0.039	mg/kg	B140984	1400516
1422006-01	Se	Brine Shrimp	dry	2.04		0.35	0.86	mg/kg	B141071	1400568
1422006-01	Se	Brine Shrimp	wet	0.34		0.06	0.14	mg/kg	B141071	1400568
1422006-01	Zn	Brine Shrimp	dry	90.3		2.30	5.75	mg/kg	B140984	1400516
1422006-01	Zn	Brine Shrimp	wet	15.1		0.39	0.96	mg/kg	B140984	1400516
8180-5										
1422006-04	%TS	Brine Shrimp	NA	21.73		0.30	1.00	%	B140960	N/A
1422006-04	As	Brine Shrimp	dry	14.1		0.057	0.163	mg/kg	B140982	1400527
1422006-04	As	Brine Shrimp	wet	3.07		0.012	0.035	mg/kg	B140982	1400527
1422006-04	Cu	Brine Shrimp	dry	13.2		0.04	0.13	mg/kg	B140983	1400543
1422006-04	Cu	Brine Shrimp	wet	2.86		0.009	0.03	mg/kg	B140983	1400543
1422006-04	Hg	Brine Shrimp	dry	185		0.65	1.63	ng/g	B140959	1400529
1422006-04	Hg	Brine Shrimp	wet	40.3		0.14	0.35	ng/g	B140959	1400529
1422006-04	Pb	Brine Shrimp	dry	0.983		0.016	0.163	mg/kg	B140984	1400516
1422006-04	Pb	Brine Shrimp	wet	0.214		0.004	0.035	mg/kg	B140984	1400516
1422006-04	Se	Brine Shrimp	dry	2.15		0.24	0.61	mg/kg	B141071	1400568
1422006-04	Se	Brine Shrimp	wet	0.47		0.05	0.13	mg/kg	B141071	1400568
1422006-04	Zn	Brine Shrimp	dry	77.4		1.63	4.07	mg/kg	B140984	1400516
1422006-04	Zn	Brine Shrimp	wet	16.8		0.35	0.88	mg/kg	B140984	1400516

Accuracy & Precision Summary

Batch: B140959
Lab Matrix: Biota
Method: EPA 1631 Appendix

Sample	Analyte	Native	Spike	Result	Units	REC & Limits	RPD & Limits
B140959-BS1	**Laboratory Fortified Blank (1352001)**						
	Hg		2000	2215	ng/g	111% 75-125	
B140959-SRM1	**Certified Reference Material (1421022, DORM-4)**						
	Hg		410.0	423.2	ng/g	103% 75-125	
B140959-SRM2	**Certified Reference Material (1327017, TORT-3)**						
	Hg		292.0	298.7	ng/g	102% 75-125	
B140959-DUP1	**Duplicate (1422006-01)**						
	Hg	193.9		187.9	ng/g		3% 30
B140959-MS1	**Matrix Spike (1422006-01)**						
	Hg	193.9	11930	13360	ng/g	110% 70-130	
B140959-MSD1	**Matrix Spike Duplicate (1422006-01)**						
	Hg	193.9	9962	10360	ng/g	102% 70-130	25% 30

Project ID: HDR-CA1401
PM: Tiffany Stilwater

BRL Report 1422006
Client PM: Carin Loy
Client PO: UPRR WQ

Accuracy & Precision Summary

Batch: B140960
Lab Matrix: Biota
Method: SM 2540G

Sample	Analyte	Native	Spike	Result	Units	REC & Limits	RPD & Limits
B140960-DUP1	**Duplicate (1422006-01)**						
	%TS	16.75		16.69	%		0.4% 15

Accuracy & Precision Summary

Batch: B140982
Lab Matrix: Biota
Method: EPA 1638 DRC

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B140982-BS1	**Laboratory Fortified Blank (1424002)**								
	As		50.00	52.06	mg/kg	104%	75-125		
B140982-SRM1	**Certified Reference Material (1421022, DORM-4)**								
	As		6.800	6.588	mg/kg	97%	75-125		
B140982-SRM2	**Certified Reference Material (1327017, TORT-3)**								
	As		59.50	63.58	mg/kg	107%	75-125		
B140982-DUP1	**Duplicate (1422006-01)**								
	As	15.79		15.57	mg/kg			1%	30
B140982-MS1	**Matrix Spike (1422006-01)**								
	As	15.79	298.3	338.2	mg/kg	108%	70-130		
B140982-MSD1	**Matrix Spike Duplicate (1422006-01)**								
	As	15.79	249.1	284.7	mg/kg	108%	70-130	17%	30

Accuracy & Precision Summary

Batch: B140983
Lab Matrix: Biota
Method: EPA 1638 DRC

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B140983-BS1	**Laboratory Fortified Blank (1424002)**								
	Cu		35.00	37.64	mg/kg	108%	75-125		
B140983-SRM1	**Certified Reference Material (1421022, DORM-4)**								
	Cu		15.90	15.63	mg/kg	98%	75-125		
B140983-SRM2	**Certified Reference Material (1327017, TORT-3)**								
	Cu		497.0	433.5	mg/kg	87%	75-125		
B140983-DUP1	**Duplicate (1422006-01)**								
	Cu	13.63		13.96	mg/kg			2%	30
B140983-MS1	**Matrix Spike (1422006-01)**								
	Cu	13.63	208.8	238.9	mg/kg	108%	70-130		
B140983-MSD1	**Matrix Spike Duplicate (1422006-01)**								
	Cu	13.63	174.3	194.5	mg/kg	104%	70-130	20%	30

Accuracy & Precision Summary

Batch: B140984
Lab Matrix: Biota
Method: EPA 1638

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B140984-BS1	**Laboratory Fortified Blank (1424002)**								
	Pb		9.990	10.29	mg/kg	103%	75-125		
	Zn		80.00	77.09	mg/kg	96%	75-125		
B140984-SRM1	**Certified Reference Material (1421022, DORM-4)**								
	Pb		0.4160	0.241	mg/kg	*58%*	75-125		
	Zn		52.20	52.36	mg/kg	100%	75-125		
B140984-SRM2	**Certified Reference Material (1327017, TORT-3)**								
	Pb		0.2250	0.196	mg/kg	87%	75-125		
	Zn		136.0	127.9	mg/kg	94%	75-125		
B140984-DUP1	**Duplicate (1422006-01)**								
	Pb	2.106		1.330	mg/kg			*45%*	30
	Zn	90.30		112.4	mg/kg			22%	30
B140984-MS1	**Matrix Spike (1422006-01)**								
	Pb	2.106	59.61	52.23	mg/kg	84%	70-130		
	Zn	90.30	477.4	472.3	mg/kg	80%	70-130		
B140984-MSD1	**Matrix Spike Duplicate (1422006-01)**								
	Pb	2.106	49.76	49.78	mg/kg	96%	70-130	5%	30
	Zn	90.30	398.5	460.0	mg/kg	93%	70-130	3%	30

Accuracy & Precision Summary

Batch: B141071
Lab Matrix: Biota
Method: EPA 1638 DRC

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B141071-BS1	**Laboratory Fortified Blank (1424002)**								
	Se		2.000	1.95	mg/kg	98%	75-125		
B141071-SRM1	**Certified Reference Material (1421022, DORM-4)**								
	Se		3.560	3.65	mg/kg	103%	75-125		
B141071-SRM2	**Certified Reference Material (1327017, TORT-3)**								
	Se		10.90	10.33	mg/kg	95%	75-125		
B141071-DUP1	**Duplicate (1422006-01)**								
	Se	2.04		2.18	mg/kg			6%	30
B141071-MS1	**Matrix Spike (1422006-01)**								
	Se	2.04	11.93	14.48	mg/kg	104%	70-130		
B141071-MSD1	**Matrix Spike Duplicate (1422006-01)**								
	Se	2.04	9.962	12.64	mg/kg	106%	70-130	14%	30

Method Blanks & Reporting Limits

Batch: B140959
Matrix: Biota
Method: EPA 1631 Appendix
Analyte: Hg

Sample	Result	Units
B140959-BLK1	0.25	ng/g wet
B140959-BLK2	0.36	ng/g wet
B140959-BLK3	0.27	ng/g wet
B140959-BLK4	0.19	ng/g wet

Average: 0.27 **Standard Deviation:** 0.07 **MDL:** 0.16
Limit: 0.32 **Limit:** 0.11 **MRL:** 0.40

Method Blanks & Reporting Limits

Batch: B140960
Matrix: Biota
Method: SM 2540G
Analyte: %TS

Sample	Result	Units
B140960-BLK1	-0.08	%
B140960-BLK2	0.00	%

Average: -0.04 **MDL:** 0.30
Limit: 1.00 **MRL:** 1.00

Method Blanks & Reporting Limits

Batch: B140982
Matrix: Biota
Method: EPA 1638 DRC
Analyte: As 91

Sample	Result	Units
B140982-BLK1	0.007	mg/kg wet
B140982-BLK2	0.007	mg/kg wet
B140982-BLK3	0.005	mg/kg wet
B140982-BLK4	0.002	mg/kg wet

Average: 0.005 **Standard Deviation:** 0.002 **MDL:** 0.014
Limit: 0.040 **Limit:** 0.014 **MRL:** 0.040

Method Blanks & Reporting Limits

Batch: B140983
Matrix: Biota
Method: EPA 1638 DRC
Analyte: Cu 63

Sample	Result	Units
B140983-BLK1	-0.001	mg/kg wet
B140983-BLK2	-0.001	mg/kg wet
B140983-BLK3	-0.0005	mg/kg wet
B140983-BLK4	-0.003	mg/kg wet

Average: 0.00 **Standard Deviation:** 0.00 **MDL:** 0.01
Limit: 0.03 **Limit:** 0.01 **MRL:** 0.03

Method Blanks & Reporting Limits

Batch: B140984
Matrix: Biota
Method: EPA 1638
Analyte: Pb

Sample	Result	Units
B140984-BLK2	0.008	mg/kg wet
B140984-BLK3	0.008	mg/kg wet
B140984-BLK4	0.008	mg/kg wet

Average: 0.008 **Standard Deviation:** 0.000 **MDL:** 0.004
Limit: 0.040 **Limit:** 0.004 **MRL:** 0.040

Analyte: Zn 66

Sample	Result	Units
B140984-BLK1	0.45	mg/kg wet
B140984-BLK2	0.10	mg/kg wet
B140984-BLK3	0.03	mg/kg wet
B140984-BLK4	0.006	mg/kg wet

Average: 0.15 **Standard Deviation:** 0.21 **MDL:** 0.40
Limit: 1.00 **Limit:** 0.40 **MRL:** 1.00

Method Blanks & Reporting Limits

Batch: B141071
Matrix: Biota
Method: EPA 1638 DRC
Analyte: Se 78

Sample	Result	Units
B141071-BLK1	0.009	mg/kg wet
B141071-BLK2	0.02	mg/kg wet
B141071-BLK3	0.01	mg/kg wet
B141071-BLK4	0.02	mg/kg wet

Average: 0.01 **Standard Deviation:** 0.01 **MDL:** 0.06
Limit: 0.15 **Limit:** 0.06 **MRL:** 0.15

Instrument Calibration

Sequence: 1400516
Instrument: ICP-MS-3
Date: 06/11/2014
Analyte: Pb

Trace Metals by ICP-MS
Method: EPA 1638

Lab ID	True Value	Result	Units	REC & Limits	
1400516-ICB1		0.000	µg/L		
1400516-CAL1	0.02498	0.025	µg/L	99%	
1400516-CAL2	0.04996	0.051	µg/L	102%	
1400516-CAL3	0.2498	0.267	µg/L	107%	
1400516-CAL4	0.4996	0.530	µg/L	106%	
1400516-CAL5	2.498	2.130	µg/L	85%	
1400516-CAL6	4.996	5.134	µg/L	103%	
1400516-CAL7	24.98	24.77	µg/L	99%	
1400516-CAL8	49.96	50.10	µg/L	100%	
1400516-ICB2		0.005	µg/L		
1400516-ICV1	2.500	2.680	µg/L	107%	85-115
1400516-ICB3		0.001	µg/L		
1400516-IBL1		0.0002	µg/L		
1400516-IBL2		-0.0002	µg/L		
1400516-IBL3		-0.0002	µg/L		
1400516-IBL4		0.000	µg/L		
1400516-SCV1	12.10	12.51	µg/L	103%	75-125
1400516-SCV3	12.50	10.29	µg/L	82%	75-125
1400516-CCV1	0.4996	0.541	µg/L	108%	75-125
1400516-CCB1		0.001	µg/L		
1400516-CCV2	0.4996	0.548	µg/L	110%	75-125
1400516-CCB2		0.001	µg/L		
1400516-CCV3	0.4996	0.542	µg/L	109%	75-125
1400516-CCB3		0.001	µg/L		
1400516-CCV4	0.4996	0.554	µg/L	111%	75-125
1400516-CCB4		0.001	µg/L		
1400516-CCV5	0.4996	0.549	µg/L	110%	75-125
1400516-CCB5		0.0008	µg/L		
1400516-CCV6	0.4996	0.553	µg/L	111%	75-125
1400516-CCB6		0.0009	µg/L		
1400516-CCV7	0.4996	0.552	µg/L	110%	75-125
1400516-CCB7		0.001	µg/L		
1400516-CCV8	0.4996	0.559	µg/L	112%	75-125
1400516-CCB8		0.001	µg/L		
1400516-CCV9	0.4996	0.564	µg/L	113%	75-125
1400516-CCB9		0.001	µg/L		
1400516-CCVA	0.4996	0.557	µg/L	111%	75-125
1400516-CCBA		0.0006	µg/L		
1400516-CCVB	0.4996	0.559	µg/L	112%	75-125
1400516-CCBB		0.0008	µg/L		

Instrument Calibration

Sequence: 1400516
Instrument: ICP-MS-3
Date: 06/11/2014
Analyte: Pb

Trace Metals by ICP-MS
Method: EPA 1638

Lab ID	True Value	Result	Units	REC & Limits	
1400516-CCVC	0.4996	0.562	µg/L	112%	75-125
1400516-CCBC		0.0007	µg/L		
1400516-CCVD	0.4996	0.560	µg/L	112%	75-125
1400516-CCBD		0.0008	µg/L		
1400516-CCVE	0.4996	0.564	µg/L	113%	75-125
1400516-CCBE		0.0006	µg/L		
1400516-CCVF	0.4996	0.552	µg/L	110%	75-125
1400516-CCBF		0.0007	µg/L		
1400516-CCVG	0.4996	0.553	µg/L	111%	75-125
1400516-CCBG		0.0006	µg/L		
1400516-CCVH	0.4996	0.551	µg/L	110%	75-125
1400516-CCBH		0.0006	µg/L		
1400516-CCVI	0.4996	0.536	µg/L	107%	75-125
1400516-CCBI		0.0006	µg/L		
1400516-CCVJ	0.4996	0.529	µg/L	106%	75-125
1400516-CCBJ		0.001	µg/L		
1400516-CCVK	0.4996	0.545	µg/L	109%	75-125
1400516-CCBK		0.001	µg/L		
1400516-CCVL	0.4996	0.547	µg/L	109%	75-125
1400516-CCBL		0.001	µg/L		
1400516-CCVM	0.4996	0.550	µg/L	110%	75-125
1400516-CCBM		0.002	µg/L		
1400516-CCVN	0.4996	0.533	µg/L	107%	75-125
1400516-CCBN		0.001	µg/L		
1400516-CCVO	0.4996	0.529	µg/L	106%	75-125
1400516-CCBO		0.001	µg/L		

Instrument Calibration

Sequence: 1400516
Instrument: ICP-MS-3
Date: 06/11/2014
Analyte: Zn 66

Trace Metals by ICP-MS
Method: EPA 1638

Lab ID	True Value	Result	Units	REC & Limits	
1400516-ICB1		0.00	µg/L		
1400516-CAL1	0.2000	0.19	µg/L	95%	
1400516-CAL2	0.4000	0.43	µg/L	108%	
1400516-CAL3	2.000	2.10	µg/L	105%	
1400516-CAL4	4.000	4.19	µg/L	105%	
1400516-CAL5	50.00	41.21	µg/L	82%	
1400516-CAL6	100.0	101.9	µg/L	102%	
1400516-CAL7	500.0	512.3	µg/L	102%	
1400516-CAL8	1000	1000	µg/L	100%	
1400516-ICB2		0.13	µg/L		
1400516-ICV1	5.000	5.23	µg/L	105%	85-115
1400516-ICB3		0.04	µg/L		
1400516-IBL1		0.004	µg/L		
1400516-IBL2		0.004	µg/L		
1400516-IBL3		0.0002	µg/L		
1400516-IBL4		0.005	µg/L		
1400516-SCV1	55.64	57.27	µg/L	103%	75-125
1400516-SCV3	25.00	21.03	µg/L	84%	75-125
1400516-CCV1	4.000	4.23	µg/L	106%	75-125
1400516-CCB1		0.009	µg/L		
1400516-CCV2	4.000	4.45	µg/L	111%	75-125
1400516-CCB2		0.004	µg/L		
1400516-CCV3	4.000	4.41	µg/L	110%	75-125
1400516-CCB3		0.01	µg/L		
1400516-CCV4	4.000	4.45	µg/L	111%	75-125
1400516-CCB4		0.01	µg/L		
1400516-CCV5	4.000	4.34	µg/L	108%	75-125
1400516-CCB5		-0.005	µg/L		
1400516-CCV6	4.000	4.39	µg/L	110%	75-125
1400516-CCB6		-0.004	µg/L		
1400516-CCV7	4.000	4.38	µg/L	110%	75-125
1400516-CCB7		0.005	µg/L		
1400516-CCV8	4.000	4.47	µg/L	112%	75-125
1400516-CCB8		-0.0008	µg/L		
1400516-CCV9	4.000	4.48	µg/L	112%	75-125
1400516-CCB9		-0.002	µg/L		
1400516-CCVA	4.000	4.41	µg/L	110%	75-125
1400516-CCBA		0.05	µg/L		
1400516-CCVB	4.000	4.39	µg/L	110%	75-125
1400516-CCBB		0.06	µg/L		
1400516-CCVC	4.000	4.40	µg/L	110%	75-125

Project ID: HDR-CA1401
PM: Tiffany Stilwater

BRL Report 1422006
Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400516
Instrument: ICP-MS-3
Date: 06/11/2014
Analyte: Zn 66

Trace Metals by ICP-MS
Method: EPA 1638

Lab ID	True Value	Result	Units	REC & Limits	
1400516-CCBC		0.06	µg/L		
1400516-CCVD	4.000	4.43	µg/L	111%	75-125
1400516-CCBD		0.08	µg/L		
1400516-CCVE	4.000	4.38	µg/L	110%	75-125
1400516-CCBE		0.07	µg/L		
1400516-CCVF	4.000	4.25	µg/L	106%	75-125
1400516-CCBF		0.05	µg/L		
1400516-CCVG	4.000	4.25	µg/L	106%	75-125
1400516-CCBG		0.06	µg/L		
1400516-CCVH	4.000	4.26	µg/L	107%	75-125
1400516-CCBH		0.06	µg/L		
1400516-CCVI	4.000	4.20	µg/L	105%	75-125
1400516-CCBI		0.07	µg/L		
1400516-CCVJ	4.000	4.28	µg/L	107%	75-125
1400516-CCBJ		1.20	µg/L		
1400516-CCVK	4.000	4.27	µg/L	107%	75-125
1400516-CCBK		1.21	µg/L		
1400516-CCVL	4.000	4.36	µg/L	109%	75-125
1400516-CCBL		1.21	µg/L		
1400516-CCVM	4.000	4.25	µg/L	106%	75-125
1400516-CCBM		1.24	µg/L		
1400516-CCVN	4.000	4.32	µg/L	108%	75-125
1400516-CCBN		1.24	µg/L		
1400516-CCVO	4.000	4.37	µg/L	109%	75-125
1400516-CCBO		1.23	µg/L		

Instrument Calibration

Sequence: 1400527
Instrument: ICP-MS-2
Date: 06/16/2014
Analyte: As 91

Trace Metals by ICP-DRC-MS
Method: EPA 1638 DRC

Lab ID	True Value	Result	Units	REC & Limits	
1400527-ICB1		0.000	µg/L		
1400527-CAL1	0.02500	0.025	µg/L	100%	
1400527-CAL2	0.05000	0.050	µg/L	100%	
1400527-CAL3	0.2500	0.252	µg/L	101%	
1400527-CAL4	1.000	0.965	µg/L	97%	
1400527-CAL5	5.000	5.101	µg/L	102%	
1400527-CAL6	25.00	25.37	µg/L	101%	
1400527-CAL7	125.0	126.5	µg/L	101%	
1400527-CAL8	500.0	490.3	µg/L	98%	
1400527-ICB2		0.116	µg/L		
1400527-ICV1	5.000	4.842	µg/L	97%	85-115
1400527-ICB3		0.008	µg/L		
1400527-IBL1		0.009	µg/L		
1400527-IBL2		0.011	µg/L		
1400527-IBL3		0.007	µg/L		
1400527-IBL4		0.006	µg/L		
1400527-SCV1	8.075	7.904	µg/L	98%	75-125
1400527-CCV1	1.000	0.981	µg/L	98%	75-125
1400527-CCB1		0.009	µg/L		
1400527-CCV2	1.000	1.035	µg/L	103%	75-125
1400527-CCB2		0.007	µg/L		
1400527-CCV3	1.000	1.020	µg/L	102%	75-125
1400527-CCB3		0.008	µg/L		
1400527-CCV4	1.000	1.033	µg/L	103%	75-125
1400527-CCB4		0.010	µg/L		
1400527-CCV5	1.000	1.065	µg/L	106%	75-125
1400527-CCB5		0.007	µg/L		
1400527-CCV6	1.000	1.048	µg/L	105%	75-125
1400527-CCB6		0.010	µg/L		
1400527-CCV7	1.000	1.070	µg/L	107%	75-125
1400527-CCB7		0.009	µg/L		
1400527-CCV8	1.000	1.060	µg/L	106%	75-125
1400527-CCB8		0.012	µg/L		
1400527-CCV9	1.000	1.056	µg/L	106%	75-125
1400527-CCB9		0.007	µg/L		
1400527-CCVA	5.000	5.376	µg/L	108%	75-125
1400527-CCBA		0.014	µg/L		
1400527-CCVB	5.000	5.656	µg/L	113%	75-125
1400527-CCBB		0.018	µg/L		
1400527-CCVC	5.000	5.258	µg/L	105%	75-125
1400527-CCBC		0.022	µg/L		

Project ID: HDR-CA1401
PM: Tiffany Stilwater

BRL Report 1422006
Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400527
Instrument: ICP-MS-2
Date: 06/16/2014
Analyte: As 91

Trace Metals by ICP-DRC-MS
Method: EPA 1638 DRC

Lab ID	True Value	Result	Units	REC & Limits	
1400527-CCVD	5.000	5.479	µg/L	110%	75-125
1400527-CCBD		0.016	µg/L		
1400527-CCVE	5.000	5.488	µg/L	110%	75-125
1400527-CCBE		0.013	µg/L		
1400527-CCVF	5.000	5.586	µg/L	112%	75-125
1400527-CCBF		0.012	µg/L		
1400527-CCVG	5.000	5.732	µg/L	115%	75-125
1400527-CCBG		0.016	µg/L		
1400527-CCVH	5.000	5.832	µg/L	117%	75-125
1400527-CCBH		0.019	µg/L		
1400527-CCVI	5.000	5.761	µg/L	115%	75-125
1400527-CCBI		0.012	µg/L		
1400527-CCVJ	0.2500	0.282	µg/L	113%	75-125
1400527-CCBJ		0.016	µg/L		
1400527-CCVK	0.2500	0.308	µg/L	123%	75-125
1400527-CCBK		0.013	µg/L		
1400527-CCVL	0.2500	0.304	µg/L	121%	75-125
1400527-CCBL		0.010	µg/L		

Instrument Calibration

Sequence: 1400529
Instrument: THG-05
Date: 06/13/2014
Analyte: Hg

Total Mercury and Mercury Speciation by CVAFS
Method: EPA 1631 Appendix

Lab ID	True Value	Result	Units	REC & Limits	
1400529-IBL1		1.09	pg of Hg		
1400529-IBL2		1.69	pg of Hg		
1400529-IBL3		2.39	pg of Hg		
1400529-IBL4		1.84	pg of Hg		
1400529-CAL1	10.00	9.95	pg of Hg	99%	
1400529-CAL2	25.00	25.15	pg of Hg	101%	
1400529-CAL3	100.0	98.76	pg of Hg	99%	
1400529-CAL4	500.0	496.5	pg of Hg	99%	
1400529-CAL5	2500	2482	pg of Hg	99%	
1400529-CAL6	10000	10270	pg of Hg	103%	
1400529-ICV1	1568	1593	pg of Hg	102%	85-115
1400529-CCB1		5.03	pg of Hg		
1400529-CCV1	500.0	481.6	pg of Hg	96%	77-123
1400529-CCB2		3.25	pg of Hg		
1400529-CCB3		2.68	pg of Hg		
1400529-CCB4		2.60	pg of Hg		
1400529-CCV2	500.0	494.8	pg of Hg	99%	77-123
1400529-CCB5		2.62	pg of Hg		
1400529-CCV3	500.0	482.1	pg of Hg	96%	77-123
1400529-CCB6		4.36	pg of Hg		
1400529-CCV4	500.0	485.3	pg of Hg	97%	77-123
1400529-CCB7		3.34	pg of Hg		

Project ID: HDR-CA1401
PM: Tiffany Stilwater

BRL Report 1422006
Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400543
Instrument: ICP-MS-2
Date: 06/18/2014
Analyte: Cu 63

Trace Metals by ICP-MS
Method: EPA 1638 DRC

Lab ID	True Value	Result	Units	REC & Limits	
1400543-ICB1		0.00	µg/L		
1400543-CAL1	0.04400	0.04	µg/L	89%	
1400543-CAL2	0.2200	0.22	µg/L	99%	
1400543-CAL3	0.4400	0.41	µg/L	92%	
1400543-CAL4	2.200	2.08	µg/L	95%	
1400543-CAL5	0.1200	4.84	µg/L		
1400543-CAL6	0.2400	10.15	µg/L		
1400543-CAL7	1.200	49.54	µg/L		
1400543-CAL8	5.000	94.04	µg/L		
1400543-CAL9	10.00	191.7	µg/L		
1400543-ICB2		0.03	µg/L		
1400543-ICV1	5.000	5.41	µg/L	108%	85-115
1400543-ICB3		0.0007	µg/L		
1400543-IBL1		0.00	µg/L		
1400543-IBL2		0.00	µg/L		
1400543-IBL3		0.00	µg/L		
1400543-IBL4		0.00	µg/L		
1400543-SCV1	85.75	84.23	µg/L	98%	75-125
1400543-SCV2	25.00	20.51	µg/L	82%	75-125
1400543-CCV1	2.200	2.44	µg/L	111%	75-125
1400543-CCB1		-0.003	µg/L		
1400543-CCV2	2.200	2.09	µg/L	95%	75-125
1400543-CCB2		-0.005	µg/L		
1400543-CCV3	2.200	2.43	µg/L	110%	75-125
1400543-CCB3		-0.002	µg/L		
1400543-CCV4	2.200	2.39	µg/L	109%	75-125
1400543-CCB4		-0.002	µg/L		
1400543-CCV5	2.200	2.34	µg/L	106%	75-125
1400543-CCB5		-0.001	µg/L		
1400543-CCV6	2.200	2.30	µg/L	105%	75-125
1400543-CCB6		-0.0004	µg/L		
1400543-CCV7	2.200	2.32	µg/L	106%	75-125
1400543-CCB7		-0.0001	µg/L		
1400543-CCV8	2.200	2.35	µg/L	107%	75-125
1400543-CCB8		-0.002	µg/L		
1400543-CCV9	2.200	2.28	µg/L	104%	75-125
1400543-CCB9		0.0004	µg/L		
1400543-CCVA	5.000	5.43	µg/L	109%	75-125
1400543-CCBA		0.007	µg/L		
1400543-CCVB	5.000	5.55	µg/L	111%	75-125
1400543-CCBB		0.006	µg/L		

Instrument Calibration

Sequence: 1400543
Instrument: ICP-MS-2
Date: 06/18/2014
Analyte: Cu 63

Trace Metals by ICP-MS
Method: EPA 1638 DRC

Lab ID	True Value	Result	Units	REC & Limits	
1400543-CCVC	5.000	5.53	µg/L	111%	75-125
1400543-CCBC		0.0006	µg/L		
1400543-CCVD	5.000	5.59	µg/L	112%	75-125
1400543-CCBD		0.003	µg/L		
1400543-CCVE	5.000	5.58	µg/L	112%	75-125
1400543-CCBE		0.002	µg/L		
1400543-CCVF	5.000	5.55	µg/L	111%	75-125
1400543-CCBF		0.0009	µg/L		

Instrument Calibration

Sequence: 1400568
Instrument: ICP-MS-2
Date: 06/26/2014
Analyte: Se 78

Trace Metals by ICP-DRC-MS
Method: EPA 1638 DRC

Lab ID	True Value	Result	Units	REC & Limits	
1400568-ICB1		0.00	µg/L		
1400568-CAL1	0.05000	0.05	µg/L	107%	
1400568-CAL2	0.1000	0.09	µg/L	87%	
1400568-CAL3	0.2500	0.24	µg/L	97%	
1400568-CAL4	1.000	1.04	µg/L	104%	
1400568-CAL5	5.000	5.13	µg/L	103%	
1400568-CAL6	25.00	25.54	µg/L	102%	
1400568-CAL7	125.0	127.1	µg/L	102%	
1400568-CAL8	500.0	493.2	µg/L	99%	
1400568-ICB2		0.50	µg/L		
1400568-ICV1	10.00	10.26	µg/L	103%	85-115
1400568-ICB3		0.22	µg/L		
1400568-IBL1		0.18	µg/L		
1400568-IBL2		0.14	µg/L		
1400568-IBL3		0.14	µg/L		
1400568-IBL4		0.10	µg/L		
1400568-SCV1	20.13	20.97	µg/L	104%	75-125
1400568-CCV1	1.000	1.13	µg/L	113%	75-125
1400568-CCB1		0.08	µg/L		
1400568-CCV2	1.000	1.08	µg/L	108%	75-125
1400568-CCB2		0.04	µg/L		
1400568-CCV3	1.000	1.14	µg/L	114%	75-125
1400568-CCB3		0.11	µg/L		
1400568-CCV4	1.000	1.03	µg/L	103%	75-125
1400568-CCB4		0.03	µg/L		
1400568-IFA1	44.00	12.75	µg/L	*29%*	100-100
1400568-IFB1	100.0	112.1	µg/L	112%	80-120
1400568-CCV5	1.000	1.06	µg/L	106%	75-125
1400568-CCB5		0.009	µg/L		
1400568-CCV6	1.000	1.00	µg/L	100%	75-125
1400568-CCB6		0.008	µg/L		
1400568-CCV7	1.000	0.99	µg/L	99%	75-125
1400568-CCB7		0.006	µg/L		
1400568-CCV8	1.000	1.06	µg/L	106%	75-125
1400568-CCB8		-0.004	µg/L		
1400568-CCV9	1.000	0.99	µg/L	99%	75-125
1400568-CCB9		-0.007	µg/L		
1400568-CCVA	5.000	5.18	µg/L	104%	75-125
1400568-CCBA		-0.005	µg/L		
1400568-CCVB	5.000	5.19	µg/L	104%	75-125
1400568-CCBB		-0.002	µg/L		

Instrument Calibration

Sequence: 1400568
Instrument: ICP-MS-2
Date: 06/26/2014
Analyte: Se 78

Trace Metals by ICP-DRC-MS
Method: EPA 1638 DRC

Lab ID	True Value	Result	Units	REC & Limits	
1400568-CCVC	5.000	5.21	µg/L	104%	75-125
1400568-CCBC		-0.01	µg/L		
1400568-CCVD	5.000	5.23	µg/L	105%	75-125
1400568-CCBD		-0.002	µg/L		
1400568-CCVE	5.000	5.15	µg/L	103%	75-125
1400568-CCBE		-0.005	µg/L		
1400568-CCVF	5.000	5.06	µg/L	101%	75-125
1400568-CCBF		-0.02	µg/L		
1400568-CCVG	5.000	5.13	µg/L	103%	75-125
1400568-CCBG		-0.01	µg/L		
1400568-CCVH	5.000	5.11	µg/L	102%	75-125
1400568-CCBH		-0.007	µg/L		
1400568-CCVI	5.000	5.20	µg/L	104%	75-125
1400568-CCBI		-0.006	µg/L		
1400568-CCVJ	25.00	25.62	µg/L	102%	75-125
1400568-CCBJ		0.003	µg/L		
1400568-CCVK	25.00	25.17	µg/L	101%	75-125
1400568-CCBK		0.006	µg/L		
1400568-CCVL	25.00	25.45	µg/L	102%	75-125
1400568-CCBL		0.0004	µg/L		
1400568-CCVM	25.00	25.73	µg/L	103%	75-125
1400568-CCBM		0.008	µg/L		
1400568-CCVN	25.00	25.45	µg/L	102%	75-125
1400568-CCBN		0.004	µg/L		

Sample Containers

Lab ID: 1422006-01 **Report Matrix:** Brine Shrimp **Collected:** 05/23/2014
Sample: 8180-2 **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided	1L	14-0066	none	n/a		Cooler

Lab ID: 1422006-02 **Report Matrix:** Brine Shrimp **Collected:** 05/23/2014
Sample: 8180-1 **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided	1L	14-0066	none	n/a		Cooler

Lab ID: 1422006-03 **Report Matrix:** Brine Shrimp **Collected:** 05/23/2014
Sample: 8180-1-DUP **Sample Type:** Field Duplicate **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided	1L	14-0066	none	n/a		Cooler

Lab ID: 1422006-04 **Report Matrix:** Brine Shrimp **Collected:** 05/23/2014
Sample: 8180-5 **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided	1L	14-0066	none	n/a		Cooler

Lab ID: 1422006-05 **Report Matrix:** Water **Collected:** 05/23/2014
Sample: 8180-2 **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided	1L	14-0066	none	n/a		Cooler

Lab ID: 1422006-06 **Report Matrix:** Water **Collected:** 05/23/2014
Sample: 8180-1 **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided	1L	14-0066	none	n/a		Cooler

Lab ID: 1422006-07 **Report Matrix:** Water **Collected:** 05/23/2014
Sample: 8180-1-DUP **Sample Type:** Field Duplicate **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided	1L	14-0066	none	n/a		Cooler

Project ID: HDR-CA1401
PM: Tiffany Stilwater

BRL Report 1422006
Client PM: Carin Loy
Client PO: UPRR WQ

Sample Containers

Lab ID: 1422006-08
Sample: 8180-5

Report Matrix: Water
Sample Type: Sample

Collected: 05/23/2014
Received: 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided	1L	14-0066	none	n/a		Cooler

Shipping Containers

Cooler

Received: May 28, 2014 9:35
Tracking No: 1ZF8R8010198459037 via UPS
Coolant Type: None
Temperature: -1.5 °C

Description: Cooler
Damaged in transit? No
Returned to client? No

Custody seals present? Yes
Custody seals intact? Yes
COC present? Yes

BROOKS RAND LABS
MEANINGFUL METALS DATA

3958 6th Avenue NW
Seattle, WA 98107
Phone: 206-632-6206
Fax: 206-632-6017
samples@brooksrand.com
www.brooksrand.com

Chain of Custody Record

Page 1 of 1

BRL Report 1422006

1422006

White: LAB COPY
Yellow: CUSTOMER COPY

Client: HDR, Inc.
Contact: Mike Funk (billing)
Client project ID: 217879
PO #: UPRR WQ

Address:
3949 South 700 East, Ste. 500
Salt Lake City, UT 84107
Phone #: 801-743-7818

COC receipt confirmation? (Y) / N
If so, by: email / fax (circle one)
Email: Michael.funk@hdrinc.com
carin.loy@hdrinc.com
Fax #:

Requested TAT in business days:
☐ 20 (standard)
☐ 15
☐ 10
☐ 5
☐ Other ____
Surcharges apply for expedited turn around times.

	Sample ID	Collection: Date	Collection: Time	Miscellaneous: Sampler (initials)	Miscellaneous: Matrix type	Miscellaneous: # of containers	Miscellaneous: Field filtered? (Y/N)	Field Preservation: Unpreserved / ice only	Field Preservation: HCl / HNO_3 (circle one)	Field Preservation: Other (specify)	Analyses required: Total Hg, EPA 1631	Analyses required: Total Metals (As, Cu, Pb, Se, Zn), EPA 1640	Analyses required: Percent (%) Moisture	Analyses required: Total Hg, EPA 1631	Analyses required: Total Metals (As, Cu, Pb, Se, Zn), EPA 1638				Comments
1	8180-2	5/23/14	1000	TNW	Tissue	1	N						X	X	X				For sample collection questions please email Charles Vertucci charles.vertucci@hdrinc.com Please email results to Carin Loy (HDR) Carin.loy@hdrinc.com
2	8180-1		1145										X	X	X				
3	8180-1-DUP		1145										X	X	X				
4	8180-5		1415										X	X	X				
5																			
6																			
7																			
8																			
9																			
10																			

Relinquished by:	Date: 5/27/14	Time: 1033	Relinquished by:
Received by:	Date:	Time:	Received at BRL by:
Shipping carrier:	# of coolers:		BRL work order ID:

Date:	Time:	
Date: 5/28/14	Time: 0935	
BRL project ID:		

July 22, 2014

HDR Engineering, Inc.
ATTN: Carin Loy
2373 Gateway Oaks Dr., Suite 200
Sacramento, CA 95833
carin.loy@hdrinc.com

RE: Project HDR-CA1401 Client Project: 217879

Dear Ms. Loy,

On May 28, 2014, Brooks Rand Labs (BRL) received thirteen (13) great salt lake (GSL) water samples. The samples were logged-in for the analyses of total mercury (Hg), arsenic (As), copper (Cu), lead (Pb), selenium (Se), and zinc (Zn) according to the chain-of-custody form. All samples were received, prepared, analyzed, and stored according to BRL SOPs and EPA methodology.

The results were method blank corrected as described in the calculations section of the relevant BRL SOP(s) and may have been evaluated using reporting limits that have been adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

Instances when the native sample and/or the corresponding duplicate (DUP) produced non-detectable results, the relative percent difference (RPD) was not calculated (**N/C**).

The recovery criteria limits did not apply to specific elements when the standard reference materials (SRMs) only listed information values. The recovery limits were not applicable (N/A). Not all SRMs provided certified or information values for all elements; therefore, not all elements were reported.

Sequence 1400489, 1400495, batch B140961 (Hg)
The analysis of continuing calibration verification standard CCV7 recovered at 124%, exceeding the upper limit of the acceptance criteria range. The bracketing samples were re-batched for re-analysis in sequence 1400495. All four method blanks were re-analyzed as was sample *8180-EB* (1422007-13). Sample *8180-FB* (1422007-12) was not re-analyzed as the result was non-detectable and the potential for high bias was considered a non-issue.

The concentration of equipment blank sample *8180-EB* (1422007-13) was confirmed by re-analyses. The final reported concentration was 14.7 ng/L.

The matrix spike/matrix spike duplicate (MS2/MSD2), performed on sample *8180-2-B* (1422007-04), produced recoveries of 64% and 41%. The sample result was qualified **N** for potential low bias.

Sequence 1400531, batch B140981 (Pb, Se, Zn)
The CCV1 produced an elevated recovery for the Se analysis, while CCV2 recovered high for Pb, Se, and Zn analysis. Additionally CCVG and CCVH produced elevated recoveries for Zn.

None of the CCVs bracketed the analysis of client samples and no further corrective action was warranted.

All samples were bracketed by the analysis of CCV4 through CCV7.

The analysis of B140981-MS3 is native seawater from Puget Sound. The SRM, SLEW-3, was certified at Pb and Zn level less than the MRL and the recoveries were therefore not reported. SLEW-3 was not certified for Se analysis.

The RPD produced by the analysis of sample *8180-1-A* (1422007-01) and the corresponding DUP1 for Se analysis met the secondary acceptance criteria, as the results were less than five times the MRL and the difference between the two values was less than the MRL.

The Pb analysis of the fourth method blank produced a result (0.095 µg/L) that was determined to be a Grubb's outlier. The method blank was omitted from the batch and samples results were method blank-corrected by the average of the three remaining method blanks. Furthermore, the average of the method blanks was elevated, but the standard deviation was extremely low indicating the use of method blank-correction was appropriately accounted for in the final sample results.

Sequence 1400563, batch B141130 (As, Cu)
The original analysis of the SRM SLEW-3 and seawater blank spike MS5 did not produce acceptable recoveries. The results were closely examined and BRL suspected the sample had either been switched at preparation or analysis. Client data was reported and this was noted in the original narrative. Both QC samples were re-analyzed in a later sequence 1400594 (not reported). The results were confirmed and confirmed that sample had indeed been switched at the time of preparation. The data was re-uploaded and re-named correctly in this sequence.

Additionally, the batch QC in the original report had not yet been efficiency-factored (EF) corrected. EF correction is typical for seawater data and all arsenic batch QC results and recoveries were corrected by a factor of 0.87, which was based on historic, control charted recoveries of the seawater blank spike and SRMs. None of the sample results were affected as this EF-correction was already accounted for in the final result.

All As and Cu data is being reported without qualification as the blank spike recoveries and all MS/MSD/DUP recoveries indicated the preparation and analysis was valid. All other associated quality control sample results met the acceptance criteria.

BRL, an accredited laboratory, certifies that the reported results of all analyses for which BRL is NELAP accredited meet all NELAP requirements. For more information please see the *Report Information* page in your report. Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Tiffany Stilwater
Client Services Manager
tiffany@brooksrand.com

Lydia Greaves
Project Manager
lydia@brooksrand.com

Report Information

Laboratory Accreditation

BRL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BRL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksrand.com/about/accreditations-certifications/>. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

BLK	method blank	**MS**	matrix spike
BRL	Brooks Rand Labs	**MSD**	matrix spike duplicate
BS	laboratory fortified blank	**ND**	non-detect
CAL	calibration standard	**NR**	non-reportable
CCV	continuing calibration verification	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
COC	chain of custody record	**REC**	percent recovery
D	dissolved fraction	**RPD**	relative percent difference
DUP	duplicate	**RSD**	relative standard deviation
ICV	initial calibration verification	**SCV**	secondary calibration verification
MDL	method detection limit	**SOP**	standard operating procedure
MRL	method reporting limit	**SRM**	standard reference material
IBL	instrument blank	**T**	total recoverable fraction

Definition of Data Qualifiers

(Effective 9/23/09)

B	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Result is estimated.
J	Estimated value. A full explanation is presented in the narrative.
J-M	Duplicate precision (RPD) for associated QC sample was not within acceptance criteria. Result is estimated.
J-N	Spike recovery for associated QC sample was not within acceptance criteria. Result is estimated.
M	Duplicate precision (RPD) was not within acceptance criteria. Result is estimated.
N	Spike recovery was not within acceptance criteria. Result is estimated.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.

These qualifiers are based on those previously utilized by Brooks Rand Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BRL.

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
8180-1-A	1422007-01	GSL water	Sample	05/23/2014	05/28/2014
8180-1-B	1422007-02	GSL water	Sample	05/23/2014	05/28/2014
8180-2-A	1422007-03	GSL water	Sample	05/23/2014	05/28/2014
8180-2-B	1422007-04	GSL water	Sample	05/23/2014	05/28/2014
8180-3-A	1422007-05	GSL water	Sample	05/22/2014	05/28/2014
8180-3-B	1422007-06	GSL water	Sample	05/22/2014	05/28/2014
8180-4-A	1422007-07	GSL water	Sample	05/22/2014	05/28/2014
8180-4-B	1422007-08	GSL water	Sample	05/22/2014	05/28/2014
8180-4-B-Dup	1422007-09	GSL water	Field Duplicate	05/22/2014	05/28/2014
8180-5-A	1422007-10	GSL water	Sample	05/23/2014	05/28/2014
8180-5-B	1422007-11	GSL water	Sample	05/23/2014	05/28/2014
8180-FB	1422007-12	DIW	Field Blank	05/23/2014	05/28/2014
8180-EB	1422007-13	DIW	Equip. Blank	05/23/2014	05/28/2014

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
As	Water	EPA 1640 RP	06/23/2014	07/03/2014	B141130	1400563
Cu	Water	EPA 1640 RP	06/23/2014	07/03/2014	B141130	1400563
Hg	Water	EPA 1631	05/29/2014	06/03/2014	B140961	1400489
Hg	Water	EPA 1631	05/29/2014	06/04/2014	B140961	1400495
Pb	Water	EPA 1640 RP	06/11/2014	06/16/2014	B140981	1400531
Se	Water	EPA 1640 RP	06/11/2014	06/16/2014	B140981	1400531
Zn	Water	EPA 1640 RP	06/11/2014	06/16/2014	B140981	1400531

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
8180-1-A										
1422007-01	As	GSL water	T	109		0.250	0.750	µg/L	B141130	1400563
1422007-01	Cu	GSL water	T	2.73		0.20	0.60	µg/L	B141130	1400563
1422007-01	Hg	GSL water	T	4.83		0.15	0.41	ng/L	B140961	1400489
1422007-01	Pb	GSL water	T	1.22		0.015	0.065	µg/L	B140981	1400531
1422007-01	Se	GSL water	T	0.440	B	0.350	1.05	µg/L	B140981	1400531
1422007-01	Zn	GSL water	T	3.09	B	1.30	3.75	µg/L	B140981	1400531
8180-1-B										
1422007-02	As	GSL water	T	111		0.250	0.750	µg/L	B141130	1400563
1422007-02	Cu	GSL water	T	2.90		0.20	0.60	µg/L	B141130	1400563
1422007-02	Hg	GSL water	T	22.6		0.15	0.41	ng/L	B140961	1400489
1422007-02	Pb	GSL water	T	1.17		0.015	0.065	µg/L	B140981	1400531
1422007-02	Se	GSL water	T	0.707	B	0.350	1.05	µg/L	B140981	1400531
1422007-02	Zn	GSL water	T	1.30	U	1.30	3.75	µg/L	B140981	1400531
8180-2-A										
1422007-03	As	GSL water	T	104		0.250	0.750	µg/L	B141130	1400563
1422007-03	Cu	GSL water	T	2.56		0.20	0.60	µg/L	B141130	1400563
1422007-03	Hg	GSL water	T	9.67		0.15	0.41	ng/L	B140961	1400489
1422007-03	Pb	GSL water	T	1.21		0.015	0.065	µg/L	B140981	1400531
1422007-03	Se	GSL water	T	0.510	B	0.350	1.05	µg/L	B140981	1400531
1422007-03	Zn	GSL water	T	2.62	B	1.30	3.75	µg/L	B140981	1400531
8180-2-B										
1422007-04	As	GSL water	T	123		0.250	0.750	µg/L	B141130	1400563
1422007-04	Cu	GSL water	T	14.4		0.20	0.60	µg/L	B141130	1400563
1422007-04	Hg	GSL water	T	23.0	N	0.15	0.41	ng/L	B140961	1400489
1422007-04	Pb	GSL water	T	5.33		0.015	0.065	µg/L	B140981	1400531
1422007-04	Se	GSL water	T	0.423	B	0.350	1.05	µg/L	B140981	1400531
1422007-04	Zn	GSL water	T	11.5		1.30	3.75	µg/L	B140981	1400531
8180-3-A										
1422007-05	As	GSL water	T	166		0.250	0.750	µg/L	B141130	1400563
1422007-05	Cu	GSL water	T	1.11		0.20	0.60	µg/L	B141130	1400563
1422007-05	Hg	GSL water	T	3.73		0.15	0.41	ng/L	B140961	1400489
1422007-05	Pb	GSL water	T	0.428		0.015	0.065	µg/L	B140981	1400531
1422007-05	Se	GSL water	T	0.480	B	0.350	1.05	µg/L	B140981	1400531
1422007-05	Zn	GSL water	T	2.45	B	1.30	3.75	µg/L	B140981	1400531

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
8180-3-B										
1422007-06	As	GSL water	T	168		0.250	0.750	µg/L	B141130	1400563
1422007-06	Cu	GSL water	T	1.24		0.20	0.60	µg/L	B141130	1400563
1422007-06	Hg	GSL water	T	2.87		0.15	0.41	ng/L	B140961	1400489
1422007-06	Pb	GSL water	T	0.284		0.015	0.065	µg/L	B140981	1400531
1422007-06	Se	GSL water	T	0.572	B	0.350	1.05	µg/L	B140981	1400531
1422007-06	Zn	GSL water	T	2.44	B	1.30	3.75	µg/L	B140981	1400531
8180-4-A										
1422007-07	As	GSL water	T	176		0.250	0.750	µg/L	B141130	1400563
1422007-07	Cu	GSL water	T	1.13		0.20	0.60	µg/L	B141130	1400563
1422007-07	Hg	GSL water	T	2.89		0.15	0.41	ng/L	B140961	1400489
1422007-07	Pb	GSL water	T	0.640		0.015	0.065	µg/L	B140981	1400531
1422007-07	Se	GSL water	T	0.542	B	0.350	1.05	µg/L	B140981	1400531
1422007-07	Zn	GSL water	T	3.18	B	1.30	3.75	µg/L	B140981	1400531
8180-4-B										
1422007-08	As	GSL water	T	162		0.250	0.750	µg/L	B141130	1400563
1422007-08	Cu	GSL water	T	1.10		0.20	0.60	µg/L	B141130	1400563
1422007-08	Hg	GSL water	T	2.26		0.15	0.41	ng/L	B140961	1400489
1422007-08	Pb	GSL water	T	0.492		0.015	0.065	µg/L	B140981	1400531
1422007-08	Se	GSL water	T	0.412	B	0.350	1.05	µg/L	B140981	1400531
1422007-08	Zn	GSL water	T	2.10	B	1.30	3.75	µg/L	B140981	1400531
8180-4-B-Dup										
1422007-09	As	GSL water	T	134		0.250	0.750	µg/L	B141130	1400563
1422007-09	Cu	GSL water	T	0.87		0.20	0.60	µg/L	B141130	1400563
1422007-09	Hg	GSL water	T	3.39		0.15	0.41	ng/L	B140961	1400489
1422007-09	Pb	GSL water	T	0.530		0.015	0.065	µg/L	B140981	1400531
1422007-09	Se	GSL water	T	0.837	B	0.350	1.05	µg/L	B140981	1400531
1422007-09	Zn	GSL water	T	2.66	B	1.30	3.75	µg/L	B140981	1400531
8180-5-A										
1422007-10	As	GSL water	T	113		0.250	0.750	µg/L	B141130	1400563
1422007-10	Cu	GSL water	T	2.68		0.20	0.60	µg/L	B141130	1400563
1422007-10	Hg	GSL water	T	5.04		0.15	0.41	ng/L	B140961	1400489
1422007-10	Pb	GSL water	T	1.43		0.015	0.065	µg/L	B140981	1400531
1422007-10	Se	GSL water	T	0.513	B	0.350	1.05	µg/L	B140981	1400531
1422007-10	Zn	GSL water	T	2.22	B	1.30	3.75	µg/L	B140981	1400531

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
8180-5-B										
1422007-11	As	GSL water	T	111		0.250	0.750	µg/L	B141130	1400563
1422007-11	Cu	GSL water	T	2.85		0.20	0.60	µg/L	B141130	1400563
1422007-11	Hg	GSL water	T	15.3		0.15	0.41	ng/L	B140961	1400489
1422007-11	Pb	GSL water	T	1.25		0.015	0.065	µg/L	B140981	1400531
1422007-11	Se	GSL water	T	0.537	B	0.350	1.05	µg/L	B140981	1400531
1422007-11	Zn	GSL water	T	1.30	U	1.30	3.75	µg/L	B140981	1400531
8180-EB										
1422007-13	As	DIW	T	0.050	U	0.050	0.150	µg/L	B141130	1400563
1422007-13	Cu	DIW	T	0.17		0.04	0.12	µg/L	B141130	1400563
1422007-13	Hg	DIW	T	14.7		0.15	0.41	ng/L	B140961	1400495
1422007-13	Pb	DIW	T	0.127		0.003	0.013	µg/L	B140981	1400531
1422007-13	Se	DIW	T	0.070	U	0.070	0.210	µg/L	B140981	1400531
1422007-13	Zn	DIW	T	2.95		0.26	0.75	µg/L	B140981	1400531
8180-FB										
1422007-12	As	DIW	T	0.050	U	0.050	0.150	µg/L	B141130	1400563
1422007-12	Cu	DIW	T	0.04	U	0.04	0.12	µg/L	B141130	1400563
1422007-12	Hg	DIW	T	0.15	U	0.15	0.41	ng/L	B140961	1400489
1422007-12	Pb	DIW	T	0.007	B	0.003	0.013	µg/L	B140981	1400531
1422007-12	Se	DIW	T	0.070	U	0.070	0.210	µg/L	B140981	1400531
1422007-12	Zn	DIW	T	0.26	U	0.26	0.75	µg/L	B140981	1400531

Accuracy & Precision Summary

Batch: B140961
Lab Matrix: Water
Method: EPA 1631

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B140961-SRM1	**Certified Reference Material (1423019, NIST 1641d 1000x dilution)**								
	Hg		15.68	14.80	ng/L	94%	85-115		
B140961-MS1	**Matrix Spike (1422005-01)**								
	Hg	16.73	40.82	51.88	ng/L	86%	71-125		
B140961-MSD1	**Matrix Spike Duplicate (1422005-01)**								
	Hg	16.73	40.82	46.78	ng/L	74%	71-125	10%	24
B140961-MS2	**Matrix Spike (1422007-04)**								
	Hg	23.04	40.82	49.10	ng/L	*64%*	71-125		
B140961-MSD2	**Matrix Spike Duplicate (1422007-04)**								
	Hg	23.04	40.82	39.61	ng/L	*41%*	71-125	21%	24

Accuracy & Precision Summary

Batch: B140981
Lab Matrix: Water
Method: EPA 1640 RP

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B140981-BS1	**Laboratory Fortified Blank (1424019)**								
	Pb		2.997	2.280	µg/L	76%	70-130		
	Se		2.500	2.243	µg/L	90%	70-130		
	Zn		7.500	6.83	µg/L	91%	70-130		
B140981-MS3	**Matrix Spike (1331056-17)**								
	Zn	11.94	7.500	18.36	µg/L	86%	70-130		
B140981-DUP1	**Duplicate (1422007-01)**								
	Pb	1.222		1.299	µg/L			6%	30
	Se	0.440		0.748	µg/L			*52%*	30
	Zn	3.09		3.20	µg/L			4%	30
B140981-MS1	**Matrix Spike (1422007-01)**								
	Pb	1.222	14.98	13.51	µg/L	82%	70-130		
	Se	0.440	12.50	10.93	µg/L	84%	70-130		
	Zn	3.09	37.50	33.56	µg/L	81%	70-130		
B140981-MSD1	**Matrix Spike Duplicate (1422007-01)**								
	Pb	1.222	14.98	14.06	µg/L	86%	70-130	4%	30
	Se	0.440	12.50	11.42	µg/L	88%	70-130	4%	30
	Zn	3.09	37.50	33.99	µg/L	82%	70-130	1%	30
B140981-DUP2	**Duplicate (1422007-11)**								
	Pb	1.254		1.242	µg/L			0.9%	30
	Se	0.537		0.486	µg/L			10%	30
	Zn	ND		ND	µg/L			N/C	30
B140981-MS2	**Matrix Spike (1422007-11)**								
	Pb	1.254	14.98	13.69	µg/L	83%	70-130		
	Se	0.537	12.50	11.72	µg/L	89%	70-130		
	Zn	ND	37.50	31.28	µg/L	83%	70-130		

Project ID: HDR-CA1401
PM: Tiffany Stilwater

BRL Report 1422007, Rev.1
Client PM: Carin Loy
Client PO: UPRR WQ

Accuracy & Precision Summary

Batch: B140981
Lab Matrix: Water
Method: EPA 1640 RP

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B140981-MSD2	**Matrix Spike Duplicate (1422007-11)**								
	Pb	1.254	14.98	15.49	µg/L	95%	70-130	12%	30
	Se	0.537	12.50	11.71	µg/L	89%	70-130	0.03%	30
	Zn	ND	37.50	34.86	µg/L	93%	70-130	11%	30

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Accuracy & Precision Summary

Batch: B141130
Lab Matrix: Water
Method: EPA 1640 RP

Sample	Analyte	Native	Spike	Result	Units	REC & Limits	RPD & Limits
B141130-BS1	**Laboratory Fortified Blank (1426032)**						
	As		40.00	33.76	µg/L	84% 70-130	
	Cu		10.00	9.24	µg/L	92% 70-130	
B141130-SRM1	**Certified Reference Material (1345040, SLEW-3)**						
	As		1.360	1.66	µg/L	122% 75-125	
	Cu		1.550	1.61	µg/L	104% 75-125	
B141130-MS5	**Matrix Spike (1331056-19)**						
	As	1.182	40.00	41.79	µg/L	102% 70-130	
	Cu	11.16	10.00	20.53	µg/L	94% 70-130	
B141130-DUP1	**Duplicate (1422007-01)**						
	As	109.4		103.7	µg/L		5% 30
	Cu	2.73		2.61	µg/L		4% 30
B141130-MS1	**Matrix Spike (1422007-01)**						
	As	109.4	200.0	327.36	µg/L	109% 70-130	
	Cu	2.73	50.00	51.36	µg/L	97% 70-130	
B141130-MSD1	**Matrix Spike Duplicate (1422007-01)**						
	As	109.4	200.0	309.89	µg/L	100% 70-130	5% 30
	Cu	2.73	50.00	47.99	µg/L	91% 70-130	7% 30
B141130-DUP2	**Duplicate (1422007-11)**						
	As	111.0		109.6	µg/L		1% 30
	Cu	2.85		2.82	µg/L		0.9% 30
B141130-MS2	**Matrix Spike (1422007-11)**						
	As	111.0	200.0	323.45	µg/L	106% 70-130	
	Cu	2.85	50.00	49.05	µg/L	92% 70-130	

BRL Report 1422007, Rev.1

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Accuracy & Precision Summary

Batch: B141130
Lab Matrix: Water
Method: EPA 1640 RP

Sample	Analyte	Native	Spike	Result	Units	REC & Limits	RPD & Limits
B141130-MSD2	**Matrix Spike Duplicate (1422007-11)**						
	As	111.0	200.0	326.21	µg/L	108% 70-130	0.8% 30
	Cu	2.85	50.00	49.70	µg/L	94% 70-130	1% 30

Method Blanks & Reporting Limits

Batch: B140961
Matrix: Water
Method: EPA 1631
Analyte: Hg

Sample	Result	Units
B140961-BLK5	0.17	ng/L
B140961-BLK6	0.20	ng/L
B140961-BLK7	0.20	ng/L
B140961-BLK8	0.26	ng/L

Average: 0.21 **Standard Deviation:** 0.04 **MDL:** 0.15
Limit: 0.50 **Limit:** 0.10 **MRL:** 0.40

Method Blanks & Reporting Limits

Batch: B140981
Matrix: Water
Method: EPA 1640 RP
Analyte: Pb

Sample	Result	Units
B140981-BLK1	0.086	µg/L
B140981-BLK2	0.085	µg/L
B140981-BLK3	0.087	µg/L

Average: *0.086* **Standard Deviation:** 0.001 **MDL:** 0.003
Limit: 0.013 **Limit:** 0.003 **MRL:** 0.013

Analyte: Se 82

Sample	Result	Units
B140981-BLK1	0.016	µg/L
B140981-BLK2	0.015	µg/L
B140981-BLK3	0.013	µg/L
B140981-BLK4	0.020	µg/L

Average: 0.016 **Standard Deviation:** 0.003 **MDL:** 0.070
Limit: 0.210 **Limit:** 0.070 **MRL:** 0.210

Analyte: Zn 66

Sample	Result	Units
B140981-BLK1	0.21	µg/L
B140981-BLK2	0.21	µg/L
B140981-BLK3	0.23	µg/L
B140981-BLK4	0.23	µg/L

Average: 0.22 **Standard Deviation:** 0.01 **MDL:** 0.26
Limit: 0.75 **Limit:** 0.26 **MRL:** 0.75

Method Blanks & Reporting Limits

Batch: B141130
Matrix: Water
Method: EPA 1640 RP
Analyte: As 75

Sample	Result	Units
B141130-BLK1	0.006	µg/L
B141130-BLK2	0.007	µg/L
B141130-BLK3	0.010	µg/L
B141130-BLK4	0.005	µg/L

Average: 0.007 **Standard Deviation:** 0.002 **MDL:** 0.050
Limit: 0.150 **Limit:** 0.050 **MRL:** 0.150

Analyte: Cu 63

Sample	Result	Units
B141130-BLK1	0.005	µg/L
B141130-BLK2	0.003	µg/L
B141130-BLK3	0.005	µg/L
B141130-BLK4	0.005	µg/L

Average: 0.00 **Standard Deviation:** 0.00 **MDL:** 0.04
Limit: 0.12 **Limit:** 0.04 **MRL:** 0.12

Instrument Calibration

Sequence: 1400489
Instrument: THG-05
Date: 06/03/2014
Analyte: Hg

Total Mercury and Mercury Speciation by CVAFS
Method: EPA 1631

Lab ID	True Value	Result	Units	REC & Limits	
1400489-IBL1		3.29	pg of Hg		
1400489-IBL2		4.22	pg of Hg		
1400489-IBL3		3.62	pg of Hg		
1400489-IBL4		4.48	pg of Hg		
1400489-CAL1	10.00	9.12	pg of Hg	91%	
1400489-CAL2	25.00	27.77	pg of Hg	111%	
1400489-CAL3	100.0	91.45	pg of Hg	91%	
1400489-CAL4	500.0	556.2	pg of Hg	111%	
1400489-CAL5	2500	2262	pg of Hg	90%	
1400489-CAL6	10000	11040	pg of Hg	110%	
1400489-ICV1	1568	1480	pg of Hg	94%	85-115
1400489-CCB1		6.53	pg of Hg		
1400489-CCV1	500.0	464.7	pg of Hg	93%	77-123
1400489-CCB2		5.19	pg of Hg		
1400489-CCB3		5.04	pg of Hg		
1400489-CCB4		5.66	pg of Hg		
1400489-CCV2	500.0	485.5	pg of Hg	97%	77-123
1400489-CCB5		8.07	pg of Hg		
1400489-CCV3	500.0	495.7	pg of Hg	99%	77-123
1400489-CCB6		19.3	pg of Hg		
1400489-CCV4	500.0	478.9	pg of Hg	96%	77-123
1400489-CCB7		11.6	pg of Hg		
1400489-CCV5	500.0	481.1	pg of Hg	96%	77-123
1400489-CCB8		6.98	pg of Hg		
1400489-CCV6	500.0	499.4	pg of Hg	100%	77-123
1400489-CCB9		8.04	pg of Hg		
1400489-CCV7	500.0	618.2	pg of Hg	*124%*	77-123
1400489-CCBA		8.81	pg of Hg		
1400489-CCV8	500.0	587.4	pg of Hg	117%	77-123
1400489-CCBB		6.84	pg of Hg		
1400489-CCV9	500.0	587.9	pg of Hg	118%	77-123
1400489-CCBC		8.20	pg of Hg		
1400489-CCVA	500.0	578.0	pg of Hg	116%	77-123
1400489-CCBD		9.76	pg of Hg		
1400489-CCVB	500.0	494.1	pg of Hg	99%	77-123
1400489-CCBE		16.4	pg of Hg		

Instrument Calibration

Sequence: 1400495
Instrument: THG-05
Date: 06/04/2014
Analyte: Hg

Total Mercury and Mercury Speciation by CVAFS
Method: EPA 1631

Lab ID	True Value	Result	Units	REC & Limits	
1400495-IBL1		4.73	pg of Hg		
1400495-IBL2		4.24	pg of Hg		
1400495-IBL3		6.61	pg of Hg		
1400495-IBL4		8.64	pg of Hg		
1400495-CAL1	10.00	10.44	pg of Hg	104%	
1400495-CAL2	25.00	26.41	pg of Hg	106%	
1400495-CAL3	100.0	96.55	pg of Hg	97%	
1400495-CAL4	500.0	493.8	pg of Hg	99%	
1400495-CAL5	2500	2426	pg of Hg	97%	
1400495-CAL6	10000	9841	pg of Hg	98%	
1400495-ICV1	1568	1456	pg of Hg	93%	85-115
1400495-CCB1		16.3	pg of Hg		
1400495-CCV1	500.0	489.5	pg of Hg	98%	77-123
1400495-CCB2		12.1	pg of Hg		
1400495-CCB3		8.29	pg of Hg		
1400495-CCB4		9.77	pg of Hg		
1400495-CCV2	500.0	464.2	pg of Hg	93%	77-123
1400495-CCB5		6.66	pg of Hg		
1400495-CCV3	500.0	486.9	pg of Hg	97%	77-123
1400495-CCB6		6.51	pg of Hg		
1400495-CCV4	500.0	464.9	pg of Hg	93%	77-123
1400495-CCB7		4.95	pg of Hg		
1400495-CCV5	500.0	467.4	pg of Hg	93%	77-123
1400495-CCB8		4.70	pg of Hg		
1400495-CCV6	500.0	476.0	pg of Hg	95%	77-123
1400495-CCB9		4.68	pg of Hg		
1400495-CCV7	500.0	456.9	pg of Hg	91%	77-123
1400495-CCBA		3.72	pg of Hg		
1400495-CCV8	500.0	466.2	pg of Hg	93%	77-123
1400495-CCBB		3.99	pg of Hg		
1400495-CCV9	500.0	480.9	pg of Hg	96%	77-123
1400495-CCBC		4.19	pg of Hg		
1400495-CCVA	500.0	496.7	pg of Hg	99%	77-123
1400495-CCBD		6.25	pg of Hg		
1400495-CCVB	500.0	459.8	pg of Hg	92%	77-123
1400495-CCBE		4.42	pg of Hg		

Instrument Calibration

Sequence: 1400531
Instrument: ICP-MS-2
Date: 06/16/2014
Analyte: Pb

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400531-ICB1		0.000	µg/L		
1400531-CAL1	0.02498	0.024	µg/L	98%	
1400531-CAL2	0.04996	0.052	µg/L	105%	
1400531-CAL3	0.2498	0.252	µg/L	101%	
1400531-CAL4	0.4996	0.506	µg/L	101%	
1400531-CAL5	2.498	2.632	µg/L	105%	
1400531-CAL6	4.996	5.092	µg/L	102%	
1400531-CAL7	24.98	23.73	µg/L	95%	
1400531-CAL8	49.96	47.02	µg/L	94%	
1400531-ICB2		0.002	µg/L		
1400531-ICV1	2.500	2.369	µg/L	95%	85-115
1400531-ICV2	2.500	2.381	µg/L	95%	85-115
1400531-ICB3		0.0007	µg/L		
1400531-IBL1		0.0002	µg/L		
1400531-IBL2		0.00002	µg/L		
1400531-IBL3		-0.0001	µg/L		
1400531-IBL4		0.0002	µg/L		
1400531-SCV1	12.10	12.15	µg/L	100%	75-125
1400531-CCV1	0.4996	0.517	µg/L	103%	75-125
1400531-CCB1		0.0001	µg/L		
1400531-CCV2	0.4996	0.733	µg/L	*147%*	75-125
1400531-CCB2		0.0004	µg/L		
1400531-CCV3	0.4996	0.500	µg/L	100%	75-125
1400531-CCB3		0.0002	µg/L		
1400531-CCV4	0.4996	0.479	µg/L	96%	75-125
1400531-CCB4		0.0004	µg/L		
1400531-CCV5	0.4996	0.494	µg/L	99%	75-125
1400531-CCB5		0.0005	µg/L		
1400531-CCV6	0.4996	0.511	µg/L	102%	75-125
1400531-CCB6		0.0004	µg/L		
1400531-CCV7	0.4996	0.518	µg/L	104%	75-125
1400531-CCB7		0.0004	µg/L		
1400531-CCV8	0.4996	0.531	µg/L	106%	75-125
1400531-CCB8		0.003	µg/L		
1400531-CCV9	0.4996	0.515	µg/L	103%	75-125
1400531-CCB9		0.0005	µg/L		
1400531-CCVA	0.4996	0.522	µg/L	104%	75-125
1400531-CCBA		0.0005	µg/L		
1400531-CCVB	0.4996	0.517	µg/L	103%	75-125
1400531-CCBB		0.0006	µg/L		
1400531-CCVC	0.4996	0.501	µg/L	100%	75-125

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400531
Instrument: ICP-MS-2
Date: 06/16/2014
Analyte: Pb

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400531-CCBC		0.0007	µg/L		
1400531-CCVD	0.4996	0.499	µg/L	100%	75-125
1400531-CCBD		0.0006	µg/L		
1400531-CCVE	0.4996	0.504	µg/L	101%	75-125
1400531-CCBE		0.0006	µg/L		
1400531-CCVF	0.4996	0.501	µg/L	100%	75-125
1400531-CCBF		0.0006	µg/L		
1400531-CCVG	0.4996	0.536	µg/L	107%	75-125
1400531-CCBG		0.0005	µg/L		
1400531-CCVH	0.4996	0.561	µg/L	112%	75-125
1400531-CCBH		0.0008	µg/L		
1400531-CCVI	0.4996	0.466	µg/L	93%	75-125
1400531-CCBI		0.0006	µg/L		
1400531-CCVJ	0.4996	0.478	µg/L	96%	75-125
1400531-CCBJ		0.0005	µg/L		

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400531
Instrument: ICP-MS-2
Date: 06/16/2014
Analyte: Se 82

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400531-ICB1		0.000	µg/L		
1400531-CAL1	0.5000	0.509	µg/L	102%	
1400531-CAL2	1.000	0.972	µg/L	97%	
1400531-CAL3	5.000	4.836	µg/L	97%	
1400531-CAL4	10.00	10.17	µg/L	102%	
1400531-CAL5	10.00	9.651	µg/L	97%	
1400531-CAL6	20.00	19.09	µg/L	95%	
1400531-CAL7	100.0	102.3	µg/L	102%	
1400531-CAL8	200.0	216.4	µg/L	108%	
1400531-ICB2		0.098	µg/L		
1400531-ICV1	10.00	10.00	µg/L	100%	85-115
1400531-ICV2	10.00	9.853	µg/L	99%	85-115
1400531-ICB3		1.352	µg/L		
1400531-IBL1		0.017	µg/L		
1400531-IBL2		0.065	µg/L		
1400531-IBL3		0.105	µg/L		
1400531-IBL4		0.071	µg/L		
1400531-SCV1	20.13	21.54	µg/L	107%	75-125
1400531-CCV1	10.00	13.38	µg/L	*134%*	75-125
1400531-CCB1		0.092	µg/L		
1400531-CCV2	10.00	27.87	µg/L	*279%*	75-125
1400531-CCB2		0.114	µg/L		
1400531-CCV3	10.00	10.01	µg/L	100%	75-125
1400531-CCB3		0.018	µg/L		
1400531-CCV4	10.00	9.780	µg/L	98%	75-125
1400531-CCB4		0.029	µg/L		
1400531-CCV5	10.00	10.38	µg/L	104%	75-125
1400531-CCB5		0.162	µg/L		
1400531-CCV6	10.00	10.62	µg/L	106%	75-125
1400531-CCB6		0.137	µg/L		
1400531-CCV7	10.00	10.97	µg/L	110%	75-125
1400531-CCB7		0.124	µg/L		
1400531-CCV8	10.00	11.58	µg/L	116%	75-125
1400531-CCB8		0.104	µg/L		
1400531-CCV9	10.00	10.93	µg/L	109%	75-125
1400531-CCB9		0.049	µg/L		
1400531-CCVA	10.00	11.04	µg/L	110%	75-125
1400531-CCBA		0.049	µg/L		
1400531-CCVB	10.00	10.95	µg/L	110%	75-125
1400531-CCBB		0.052	µg/L		
1400531-CCVC	10.00	10.29	µg/L	103%	75-125

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400531
Instrument: ICP-MS-2
Date: 06/16/2014
Analyte: Se 82

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400531-CCBC		0.055	µg/L		
1400531-CCVD	10.00	10.49	µg/L	105%	75-125
1400531-CCBD		0.056	µg/L		
1400531-CCVE	10.00	10.32	µg/L	103%	75-125
1400531-CCBE		0.156	µg/L		
1400531-CCVF	10.00	10.55	µg/L	106%	75-125
1400531-CCBF		0.043	µg/L		
1400531-CCVG	10.00	10.64	µg/L	106%	75-125
1400531-CCBG		0.077	µg/L		
1400531-CCVH	10.00	10.72	µg/L	107%	75-125
1400531-CCBH		0.041	µg/L		
1400531-CCVI	10.00	10.25	µg/L	103%	75-125
1400531-CCBI		0.064	µg/L		
1400531-CCVJ	10.00	10.67	µg/L	107%	75-125
1400531-CCBJ		-0.067	µg/L		

BRL Report 1422007, Rev.1

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400531
Instrument: ICP-MS-2
Date: 06/16/2014
Analyte: Zn 66

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400531-ICB1		0.00	µg/L		
1400531-CAL1	0.2000	0.19	µg/L	94%	
1400531-CAL2	0.4000	0.45	µg/L	111%	
1400531-CAL3	2.000	1.98	µg/L	99%	
1400531-CAL4	4.000	4.22	µg/L	106%	
1400531-CAL5	50.00	47.92	µg/L	96%	
1400531-CAL6	100.0	94.00	µg/L	94%	
1400531-CAL7	500.0	488.2	µg/L	98%	
1400531-CAL8	1000	1026	µg/L	103%	
1400531-ICB2		0.09	µg/L		
1400531-ICV1	5.000	4.82	µg/L	96%	85-115
1400531-ICV2	5.000	4.94	µg/L	99%	85-115
1400531-ICB3		0.03	µg/L		
1400531-IBL1		0.02	µg/L		
1400531-IBL2		0.02	µg/L		
1400531-IBL3		0.02	µg/L		
1400531-IBL4		0.05	µg/L		
1400531-SCV1	55.64	57.53	µg/L	103%	75-125
1400531-CCV1	4.000	4.28	µg/L	107%	75-125
1400531-CCB1		0.02	µg/L		
1400531-CCV2	4.000	5.57	µg/L	*139%*	75-125
1400531-CCB2		0.03	µg/L		
1400531-CCV3	4.000	4.22	µg/L	105%	75-125
1400531-CCB3		0.02	µg/L		
1400531-CCV4	4.000	4.23	µg/L	106%	75-125
1400531-CCB4		0.03	µg/L		
1400531-CCV5	4.000	4.18	µg/L	104%	75-125
1400531-CCB5		0.03	µg/L		
1400531-CCV6	4.000	4.19	µg/L	105%	75-125
1400531-CCB6		0.03	µg/L		
1400531-CCV7	4.000	4.25	µg/L	106%	75-125
1400531-CCB7		0.03	µg/L		
1400531-CCV8	4.000	4.41	µg/L	110%	75-125
1400531-CCB8		0.02	µg/L		
1400531-CCV9	4.000	4.77	µg/L	119%	75-125
1400531-CCB9		0.03	µg/L		
1400531-CCVA	4.000	4.85	µg/L	121%	75-125
1400531-CCBA		0.04	µg/L		
1400531-CCVB	4.000	4.85	µg/L	121%	75-125
1400531-CCBB		0.04	µg/L		
1400531-CCVC	4.000	4.80	µg/L	120%	75-125

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400531
Instrument: ICP-MS-2
Date: 06/16/2014
Analyte: Zn 66

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400531-CCBC		0.04	µg/L		
1400531-CCVD	4.000	4.73	µg/L	118%	75-125
1400531-CCBD		0.03	µg/L		
1400531-CCVE	4.000	4.84	µg/L	121%	75-125
1400531-CCBE		0.04	µg/L		
1400531-CCVF	4.000	4.74	µg/L	119%	75-125
1400531-CCBF		0.04	µg/L		
1400531-CCVG	4.000	5.09	µg/L	*127%*	75-125
1400531-CCBG		0.04	µg/L		
1400531-CCVH	4.000	5.41	µg/L	*135%*	75-125
1400531-CCBH		0.04	µg/L		
1400531-CCVI	4.000	4.15	µg/L	104%	75-125
1400531-CCBI		0.06	µg/L		
1400531-CCVJ	4.000	4.15	µg/L	104%	75-125
1400531-CCBJ		0.03	µg/L		

BRL Report 1422007, Rev.1

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400563
Instrument: ICP-MS-3
Date: 07/03/2014
Analyte: As 75

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400563-ICB1		0.000	µg/L		
1400563-CAL1	0.2700	0.264	µg/L	98%	
1400563-CAL2	0.5400	0.567	µg/L	105%	
1400563-CAL3	2.700	2.625	µg/L	97%	
1400563-CAL4	5.400	5.545	µg/L	103%	
1400563-CAL5	10.00	9.801	µg/L	98%	
1400563-CAL6	20.00	20.20	µg/L	101%	
1400563-CAL7	100.0	99.51	µg/L	100%	
1400563-CAL8	200.0	197.8	µg/L	99%	
1400563-ICB2		0.041	µg/L		
1400563-ICV1	5.000	4.988	µg/L	100%	85-115
1400563-ICB3		0.016	µg/L		
1400563-IBL1		0.005	µg/L		
1400563-IBL2		0.009	µg/L		
1400563-IBL3		0.010	µg/L		
1400563-IBL4		0.014	µg/L		
1400563-SCV1	8.075	8.233	µg/L	102%	75-125
1400563-SCV3	25.00	19.50	µg/L	78%	75-125
1400563-CCV1	5.400	5.353	µg/L	99%	75-125
1400563-CCB1		0.009	µg/L		
1400563-CCV2	5.400	5.399	µg/L	100%	75-125
1400563-CCB2		0.014	µg/L		
1400563-CCV3	5.400	5.459	µg/L	101%	75-125
1400563-CCB3		0.023	µg/L		
1400563-CCV4	5.400	5.312	µg/L	98%	75-125
1400563-CCB4		0.003	µg/L		
1400563-CCV5	5.400	5.242	µg/L	97%	75-125
1400563-CCB5		0.016	µg/L		
1400563-CCV6	5.400	5.404	µg/L	100%	75-125
1400563-CCB6		0.015	µg/L		
1400563-CCV7	5.400	5.284	µg/L	98%	75-125
1400563-CCB7		0.012	µg/L		
1400563-CCV8	5.400	5.264	µg/L	97%	75-125
1400563-CCB8		-0.007	µg/L		
1400563-CCV9	5.400	5.391	µg/L	100%	75-125
1400563-CCB9		0.015	µg/L		
1400563-CCVA	5.400	5.245	µg/L	97%	75-125
1400563-CCBA		0.026	µg/L		
1400563-CCVB	5.400	5.469	µg/L	101%	75-125
1400563-CCBB		0.034	µg/L		
1400563-CCVC	5.400	5.336	µg/L	99%	75-125

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400563
Instrument: ICP-MS-3
Date: 07/03/2014
Analyte: As 75

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400563-CCBC		0.017	µg/L		
1400563-CCVD	5.400	5.368	µg/L	99%	75-125
1400563-CCBD		0.011	µg/L		
1400563-CCVE	5.400	5.414	µg/L	100%	75-125
1400563-CCBE		0.012	µg/L		
1400563-CCVF	5.400	5.299	µg/L	98%	75-125
1400563-CCBF		-0.005	µg/L		
1400563-CCVG	5.400	5.377	µg/L	100%	75-125
1400563-CCBG		0.010	µg/L		
1400563-CCVH	5.400	5.354	µg/L	99%	75-125
1400563-CCBH		0.006	µg/L		
1400563-CCVI	5.400	5.310	µg/L	98%	75-125
1400563-CCBI		0.017	µg/L		
1400563-CCVJ	5.400	5.468	µg/L	101%	75-125
1400563-CCBJ		0.012	µg/L		
1400563-CCVK	5.400	5.410	µg/L	100%	75-125
1400563-CCBK		0.021	µg/L		
1400563-CCVL	5.400	5.400	µg/L	100%	75-125
1400563-CCBL		0.040	µg/L		
1400563-CCVM	5.400	5.449	µg/L	101%	75-125
1400563-CCBM		0.030	µg/L		
1400563-CCVN	5.400	5.585	µg/L	103%	75-125
1400563-CCBN		0.008	µg/L		

BRL Report 1422007, Rev.1

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Instrument Calibration

Sequence: 1400563
Instrument: ICP-MS-3
Date: 07/03/2014
Analyte: Cu 63

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400563-ICB1		0.00	µg/L		
1400563-CAL1	0.1200	0.12	µg/L	99%	
1400563-CAL2	0.2400	0.25	µg/L	102%	
1400563-CAL3	1.200	1.18	µg/L	99%	
1400563-CAL4	2.400	2.44	µg/L	102%	
1400563-CAL5	10.00	10.13	µg/L	101%	
1400563-CAL6	20.00	20.55	µg/L	103%	
1400563-CAL7	100.0	98.62	µg/L	99%	
1400563-CAL8	200.0	191.5	µg/L	96%	
1400563-ICB2		0.02	µg/L		
1400563-ICV1	5.000	5.13	µg/L	103%	85-115
1400563-ICB3		-0.0002	µg/L		
1400563-IBL1		-0.006	µg/L		
1400563-IBL2		-0.007	µg/L		
1400563-IBL3		-0.006	µg/L		
1400563-IBL4		-0.006	µg/L		
1400563-SCV1	85.75	84.57	µg/L	99%	75-125
1400563-CCV1	2.400	2.39	µg/L	100%	75-125
1400563-CCB1		-0.003	µg/L		
1400563-CCV2	2.400	2.41	µg/L	101%	75-125
1400563-CCB2		-0.006	µg/L		
1400563-CCV3	2.400	2.42	µg/L	101%	75-125
1400563-CCB3		-0.008	µg/L		
1400563-CCV4	2.400	2.43	µg/L	101%	75-125
1400563-CCB4		-0.009	µg/L		
1400563-CCV5	2.400	2.37	µg/L	99%	75-125
1400563-CCB5		-0.01	µg/L		
1400563-CCV6	2.400	2.42	µg/L	101%	75-125
1400563-CCB6		-0.01	µg/L		
1400563-CCV7	2.400	2.39	µg/L	100%	75-125
1400563-CCB7		-0.01	µg/L		
1400563-CCV8	2.400	2.35	µg/L	98%	75-125
1400563-CCB8		-0.007	µg/L		
1400563-CCV9	2.400	2.39	µg/L	99%	75-125
1400563-CCB9		-0.006	µg/L		
1400563-CCVA	2.400	2.40	µg/L	100%	75-125
1400563-CCBA		-0.009	µg/L		
1400563-CCVB	2.400	2.40	µg/L	100%	75-125
1400563-CCBB		-0.006	µg/L		
1400563-CCVC	2.400	2.43	µg/L	101%	75-125
1400563-CCBC		-0.009	µg/L		

Instrument Calibration

Sequence: 1400563
Instrument: ICP-MS-3
Date: 07/03/2014
Analyte: Cu 63

Trace Metals by ICP-MS
Method: EPA 1640 RP

Lab ID	True Value	Result	Units	REC & Limits	
1400563-CCVD	2.400	2.44	µg/L	101%	75-125
1400563-CCBD		-0.003	µg/L		
1400563-CCVE	2.400	2.40	µg/L	100%	75-125
1400563-CCBE		-0.01	µg/L		
1400563-CCVF	2.400	2.44	µg/L	102%	75-125
1400563-CCBF		-0.009	µg/L		
1400563-CCVG	2.400	2.40	µg/L	100%	75-125
1400563-CCBG		-0.02	µg/L		
1400563-CCVH	2.400	2.41	µg/L	100%	75-125
1400563-CCBH		-0.02	µg/L		
1400563-CCVI	2.400	2.37	µg/L	99%	75-125
1400563-CCBI		-0.02	µg/L		
1400563-CCVJ	2.400	2.43	µg/L	101%	75-125
1400563-CCBJ		-0.01	µg/L		
1400563-CCVK	2.400	2.44	µg/L	102%	75-125
1400563-CCBK		-0.02	µg/L		
1400563-CCVL	2.400	2.49	µg/L	104%	75-125
1400563-CCBL		-0.006	µg/L		
1400563-CCVM	2.400	2.41	µg/L	101%	75-125
1400563-CCBM		-0.02	µg/L		
1400563-CCVN	2.400	2.43	µg/L	101%	75-125
1400563-CCBN		-0.02	µg/L		

Sample Containers

Lab ID: 1422007-01 **Report Matrix:** GSL water **Collected:** 05/23/2014
Sample: 8180-1-A **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-02 **Report Matrix:** GSL water **Collected:** 05/23/2014
Sample: 8180-1-B **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-03 **Report Matrix:** GSL water **Collected:** 05/23/2014
Sample: 8180-2-A **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-04 **Report Matrix:** GSL water **Collected:** 05/23/2014
Sample: 8180-2-B **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-05 **Report Matrix:** GSL water **Collected:** 05/22/2014
Sample: 8180-3-A **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-06 **Report Matrix:** GSL water **Collected:** 05/22/2014
Sample: 8180-3-B **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Sample Containers

Lab ID: 1422007-07 **Report Matrix:** GSL water **Collected:** 05/22/2014
Sample: 8180-4-A **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-08 **Report Matrix:** GSL water **Collected:** 05/22/2014
Sample: 8180-4-B **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-09 **Report Matrix:** GSL water **Collected:** 05/22/2014
Sample: 8180-4-B-Dup **Sample Type:** Field Duplicate **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-10 **Report Matrix:** GSL water **Collected:** 05/23/2014
Sample: 8180-5-A **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-11 **Report Matrix:** GSL water **Collected:** 05/23/2014
Sample: 8180-5-B **Sample Type:** Sample **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Lab ID: 1422007-12 **Report Matrix:** DIW **Collected:** 05/23/2014
Sample: 8180-FB **Sample Type:** Field Blank **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	1L	14-0066	0.2% HNO3 (BRL)	1350086	<2	Cooler

Project ID: HDR-CA1401
PM: Tiffany Stilwater

Client PM: Carin Loy
Client PO: UPRR WQ

Sample Containers

Lab ID: 1422007-13 **Report Matrix:** DIW **Collected:** 05/23/2014
Sample: 8180-EB **Sample Type:** Equip. Blank **Received:** 05/28/2014

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Bottle FLPE Hg-T	250mL	13-0291	0.5% HCl (BRL)	1416015	<2	Cooler
B	Bottle HDPE ICP-RP	2L	not provided	0.2% HNO3 (BRL)	1350086	<2	Cooler

Shipping Containers

Cooler

Received: May 28, 2014 9:35
Tracking No: 1ZF8R8010199825442 via UPS
Coolant Type: None
Temperature: ambient

Description: Cooler
Damaged in transit? No
Returned to client? No

Custody seals present? Yes
Custody seals intact? Yes
COC present? Yes

BROOKS RAND LABS
MEANINGFUL METALS DATA
3958 6th Avenue NW
Seattle, WA 98107
Phone: 206-632-6206
Fax: 206-632-6017
samples@brooksrand.com
www.brooksrand.com

Chain of Custody Record

BRL Report 1422007, Rev.1

1422007

White: LAB COPY
Yellow: CUSTOMER COPY

Client: HDR, Inc.	Address:	COC receipt confirmation? Y / N If so, by: email / fax (circle one)
Contact: Mike Funk (billing)	3949 South 700 East, Ste. 500 Salt Lake City, UT 84107	Email: Michael.funk@hdrinc.com carin.loy@hdrinc.com
Client project ID: 217879		
PO #: UPRR WQ	Phone #: 801-743-7818	Fax #:

Requested TAT in business days:
☐ 20 (standard)
☐ 15
☐ 10
☐ 5
☐ Other ____

Surcharges apply for expedited turn around times.

	Sample ID	Collection: Date	Collection: Time	Miscellaneous: Sampler (initials)	Miscellaneous: Matrix type	Miscellaneous: # of containers	Miscellaneous: Field filtered? (Y/N)	Field Preservation: Unpreserved / ice only	Field Preservation: HCl / HNO_3 (circle one)	Field Preservation: Other (specify)	Analyses required: Total Hg, EPA 1631	Analyses required: Total Metals (As, Cu, Pb, Se, Zn), EPA 1640	Analyses required: Percent (%) Moisture	Analyses required: Total Hg, EPA 1631	Analyses required: Total Metals (As, Cu, Pb, Se, Zn), EPA 1638				Comments
1	8180-1-A	5/23/14	12:30	NN	A	1	N				X								For sample collection questions please email Charles Vertucci charles.vertucci@hdrinc.com Please email results to Carin Loy (HDR) Carin.loy@hdrinc.com
2	↓	↓	↓	↓	↓	↓	↓					X							
3	8180-1-B	5/23	12:25	NN	A	1	N				X								
4	↓	↓	↓	↓	↓	↓	↓					X							
5	8180-2-A	5/23	10:15	NN	A	1	N				X								
6	↓	↓	↓	↓	↓	↓	↓					X							
7	8180-2-B	5/23	9:55	NN	A	1	N				X								
8	↓	↓	↓	↓	↓	↓	↓					X							
9	8180-3-A	5/22	17:30	NN	A	1	N				X								
10	↓	↓	↓	↓	↓	↓	↓					X							

Relinquished by: [signature]	Date: 5/27/14	Time: 10:35	Relinquished by:	Date:	Time:
Received by:	Date:	Time:	Received at BRL by: [signature]	Date: 5/28/14	Time: 0935
Shipping carrier:	# of coolers:		BRL work order ID:	BRL project ID:	

BROOKS RAND LABS
MEANINGFUL METALS DATA
3958 6th Avenue NW
Seattle, WA 98107
Phone: 206-632-6206
Fax: 206-632-6017
samples@brooksrand.com
www.brooksrand.com

Chain of Custody Record

BRL Report 1422007, Rev.1

White: LAB COPY
Yellow: CUSTOMER COPY

Client: HDR, Inc.	Address:	COC receipt confirmation? Y / N If so, by: email / fax (circle one)
Contact: Mike Funk (billing)	3949 South 700 East, Ste. 500 Salt Lake City, UT 84107	Email: Michael.funk@hdrinc.com carin.loy@hdrinc.com
Client project ID: 217879		
PO #: UPRR WQ	Phone #: 801-743-7818	Fax #:

Requested TAT in business days:
☐ 20 (standard)
☐ 15
☐ 10
☐ 5
☐ Other ____

Surcharges apply for expedited turn around times.

	Sample ID	Collection: Date	Collection: Time	Miscellaneous: Sampler (initials)	Miscellaneous: Matrix type	Miscellaneous: # of containers	Miscellaneous: Field filtered? (Y/N)	Field Preservation: Unpreserved / ice only	Field Preservation: HCl / HNO_3 (circle one)	Field Preservation: Other (specify)	Analyses required: Total Hg, EPA 1631	Analyses required: Total Metals (As, Cu, Pb, Se, Zn), EPA 1640	Analyses required: Percent (%) Moisture	Analyses required: Total Hg, EPA 1631	Analyses required: Total Metals (As, Cu, Pb, Se, Zn), EPA 1638				Comments
1	8180-3-B	5/22	17:30	NN	A	1	N				X								For sample collection questions please email Charles Vertucci charles.vertucci@hdrinc.com Please email results to Carin Loy (HDR) Carin.loy@hdrinc.com
2	↓	↓	↓	↓	↓	↓	↓					X							
3	8180-4-A	5/22	16:15	NN	A	1	N				X								
4	↓	↓	↓	↓	↓	↓	↓					X							
5	8180-4-B	5/22	15:45	NN	A	1	N				X								
6	↓	↓	↓	↓	↓	↓	↓					X							
7	8180-4-B DUP	5/22	15:45	NN	A	1	N				X								
8	↓	↓	↓	↓	↓	↓	↓					X							
9	8180-5-A	5/23	3:35	NN	A	1	N				X								
10	↓	↓	↓	↓	↓	↓	↓					X							

Relinquished by: [signature]	Date: 5/27/14	Time: 10:35	Relinquished by:	Date:	Time:
Received by:	Date:	Time:	Received at BRL by: [signature]	Date: 5/28/14	Time: 0935
Shipping carrier:	# of coolers:		BRL work order ID:	BRL project ID:	

BROOKS RAND LABS
MEANINGFUL METALS DATA
3958 6th Avenue NW
Seattle, WA 98107
Phone: 206-632-6206
Fax: 206-632-6017
samples@brooksrand.com
www.brooksrand.com

Chain of Custody Record

BRL Report 102007, Rev.1

White: LAB COPY
Yellow: CUSTOMER COPY

Client: HDR, Inc.	Address:	COC receipt confirmation? Y / N If so, by: email / fax (circle one)
Contact: Mike Funk (billing)	3949 South 700 East, Ste. 500 Salt Lake City, UT 84107	Email: Michael.funk@hdrinc.com carin.loy@hdrinc.com
Client project ID: 217879		
PO #: UPRR WQ	Phone #: 801-743-7818	Fax #:

Requested TAT in business days:
- ☐ 20 (standard)
- ☐ 15
- ☐ 10
- ☐ 5
- ☐ Other ____

Surcharges apply for expedited turn around times.

	Sample ID	Collection: Date	Collection: Time	Miscellaneous: Sampler (initials)	Miscellaneous: Matrix type	Miscellaneous: # of containers	Miscellaneous: Field filtered? (Y/N)	Field Preservation: Unpreserved / ice only	Field Preservation: HCl / HNO_3 (circle one)	Field Preservation: Other (specify)	Analyses required: Total Hg, EPA 1631	Analyses required: Total Metals (As, Cu, Pb, Se, Zn), EPA 1640	Analyses required: Percent (%) Moisture	Analyses required: Total Hg, EPA 1631	Analyses required: Total Metals (As, Cu, Pb, Se, Zn), EPA 1638				Comments
1	SB0-SB	5/23	13:25	NN	A	1	N				X								For sample collection questions please email Charles Vertucci charles.vertucci@hdrinc.com Please email results to Carin Loy (HDR) Carin.loy@hdrinc.com
2	↓	↓	↓	↓	↓	↓	↓					X							
3	SB0-FB	5/22	17:30	NN	A	1	N				X								
4	↓	↓	↓	↓	↓	↓	↓					X							
5	SB0-EB	5/24	16:30	NN	A	1	N				X								
6	↓	↓	↓	↓	↓	1	↓					X							
7																			
8																			
9																			
10																			

Relinquished by: [signature]	Date: 5/27/14	Time: 10:35	Relinquished by:	Date:	Time:
Received by:	Date:	Time:	Received at BRL by: CA	Date: 5/28/14	Time: 0935
Shipping carrier:	# of coolers:		BRL work order ID:	BRL project ID:	

Carin Loy
HDR Engineering
3949 South 700 East # 500
Salt Lake City, UT 84107
TEL: (916) 679-8737

RE: UPRR WQ / 217879

Dear Carin Loy: Lab Set ID: 1405510

463 West 3600 South
Salt Lake City, UT 84115

Phone: (801) 263-8686
Toll Free: (888) 263-8686
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web: www.awal-labs.com

Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

American West Analytical Laboratories received 16 sample(s) on 5/23/2014 for the analyses presented in the following report.

American West Analytical Laboratories (AWAL) is accredited by The National Environmental Laboratory Accreditation Program (NELAP) in Utah and Texas; and is state accredited in Colorado, Idaho, New Mexico, and Missouri.

All analyses were performed in accordance to the NELAP protocols unless noted otherwise. Accreditation scope documents are available upon request. If you have any questions or concerns regarding this report please feel free to call.

The abbreviation "Surr" found in organic reports indicates a surrogate compound that is intentionally added by the laboratory to determine sample injection, extraction, and/or purging efficiency. The "Reporting Limit" found on the report is equivalent to the practical quantitation limit (PQL). This is the minimum concentration that can be reported by the method referenced and the sample matrix. The reporting limit must not be confused with any regulatory limit. Analytical results are reported to three significant figures for quality control and calculation purposes.

The client was advised not to chill the brine sample(s). Chilling such samples alters the chemistries by creating insoluble crystals. The samples were received and stored at ambient temperature for the purpose of gathering accurate and useful data.

6/11/2014: This is a revision to a report originally issued on 6/10/2014. The cover sheet has been updated. Page 1 has been revised.

7/28/2014: Batch QC added by request. All pages updated for pagination.

Thank You,

Approved: Patrick Noteboom — Digitally signed by Patrick Noteboom DN: cn=Patrick Noteboom, o=American West Analytical Laboratories, ou=Senior Chemist, email=pat@awal-labs.com, c=US Date: 2014.07.28 16:07:13 -06'00'

Laboratory Director or designee

All analyses applicable to the CWA, SDWA, and RCRA are performed in accordance to NELAC protocols. Pertinent sampling information is located on the attached COC. Confidential Business Information: This report is provided for the exclusive use of the addressee. Privileges of subsequent use of the name of this company or any member of its staff, or reproduction of this report in connection with the advertisement, promotion or sale of any product or process, or in connection with the re-publication of this report for any purpose other than for the addressee will be granted only on contact. This company accepts no responsibility except for the due performance of inspection and/or analysis in good faith and according to the rules of the trade and of science

INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-001
Client Sample ID: 8180-4-B
Collection Date: 5/22/2014 1545h
Received Date: 5/23/2014 1458h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1203h	SW6010C	100	**329**	
Magnesium	mg/L	5/27/2014 1555h	6/3/2014 1338h	SW6010C	5,000	**11,800**	
Potassium	mg/L	5/27/2014 1555h	6/4/2014 1059h	SW6010C	500	**6,860**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1338h	SW6010C	5,000	**108,000**	

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Kyle F. Gross
Laboratory Director

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-002
Client Sample ID: 8180-4-B Dup
Collection Date: 5/22/2014 1545h
Received Date: 5/23/2014 1458h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1205h	SW6010C	100	**326**	
Magnesium	mg/L	5/27/2014 1555h	6/3/2014 1217h	SW6010C	5,000	**11,500**	
Potassium	mg/L	5/27/2014 1555h	6/4/2014 1043h	SW6010C	500	**6,640**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1217h	SW6010C	5,000	**104,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-003
Client Sample ID: 8180-4-A
Collection Date: 5/22/2014 1615h
Received Date: 5/23/2014 1458h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1207h	SW6010C	100	**342**	
Magnesium	mg/L	5/27/2014 1555h	6/3/2014 1220h	SW6010C	5,000	**12,000**	
Potassium	mg/L	5/27/2014 1555h	6/4/2014 1047h	SW6010C	500	**7,110**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1220h	SW6010C	5,000	**109,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-004
Client Sample ID: 8180-3-A
Collection Date: 5/22/2014 1730h
Received Date: 5/23/2014 1458h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1209h	SW6010C	100	**336**	
Magnesium	mg/L	5/27/2014 1555h	6/3/2014 1222h	SW6010C	5,000	**11,600**	
Potassium	mg/L	5/27/2014 1555h	6/4/2014 1051h	SW6010C	500	**7,260**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1222h	SW6010C	5,000	**105,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-005
Client Sample ID: 8180-3-B
Collection Date: 5/22/2014 1730h
Received Date: 5/23/2014 1458h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1211h	SW6010C	100	**350**	
Magnesium	mg/L	5/27/2014 1555h	6/3/2014 1224h	SW6010C	5,000	**12,500**	
Potassium	mg/L	5/27/2014 1555h	6/4/2014 1055h	SW6010C	500	**7,270**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1224h	SW6010C	5,000	**113,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-011
Client Sample ID: 8180-FB
Collection Date: 5/22/2014 1730h
Received Date: 5/23/2014 1458h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/9/2014 0914h	SW6010C	10.0	< 10.0	
Magnesium	mg/L	5/27/2014 1555h	6/9/2014 0914h	SW6010C	10.0	< 10.0	
Potassium	mg/L	5/27/2014 1555h	6/9/2014 0914h	SW6010C	10.0	< 10.0	
Sodium	mg/L	5/27/2014 1555h	6/9/2014 0914h	SW6010C	10.0	< 10.0	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-001
Client Sample ID: 8180-4-B
Collection Date: 5/22/2014 1545h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/27/2014 0700h	SM2320B	40.0	**340**	
Chloride	mg/L		6/5/2014 1315h	E300 0	5,000	**128,000**	1
Dissolved Oxygen	mg/L		5/23/2014 1733h	SM4500-O-G	0.500	**1.50**	
Hardness (as CaCO3)	mg/L		6/9/2014 1502h	SM2340B	10.0	**49,200**	
Sulfate	mg/L		6/5/2014 1814h	E300 0	3,750	**20,400**	1

[1] - Matrix spike recovery indicates matrix interference. The method is in control as indicated by the LCS.

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-002
Client Sample ID: 8180-4-B Dup
Collection Date: 5/22/2014 1545h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/27/2014 0700h	SM2320B	40.0	**340**	
Chloride	mg/L		6/5/2014 1402h	E300.0	5,000	**137,000**	
Hardness (as CaCO3)	mg/L		6/9/2014 1502h	SM2340B	10.0	**48,100**	
Sulfate	mg/L		6/5/2014 1830h	E300.0	3,750	**21,200**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-003
Client Sample ID: 8180-4-A
Collection Date: 5/22/2014 1615h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/27/2014 0700h	SM2320B	40.0	**351**	
Chloride	mg/L		6/5/2014 1449h	E300.0	5,000	**147,000**	
Dissolved Oxygen	mg/L		5/23/2014 1739h	SM4500-O-G	0.500	**1.05**	
Hardness (as CaCO3)	mg/L		6/9/2014 1502h	SM2340B	10.0	**50,400**	
Sulfate	mg/L		6/5/2014 1845h	E300.0	3,750	**23,100**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-004
Client Sample ID: 8180-3-A
Collection Date: 5/22/2014 1730h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/27/2014 0700h	SM2320B	40.0	**354**	
Chloride	mg/L		6/5/2014 1505h	E300.0	5,000	**138,000**	
Dissolved Oxygen	mg/L		5/23/2014 1743h	SM4500-O-G	0.500	**1.25**	
Hardness (as CaCO3)	mg/L		6/9/2014 1502h	SM2340B	10.0	**48,700**	
Sulfate	mg/L		6/5/2014 1901h	E300.0	3,750	**20,700**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-005
Client Sample ID: 8180-3-B
Collection Date: 5/22/2014 1730h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/27/2014 0700h	SM2320B	40.0	**351**	
Chloride	mg/L		6/5/2014 1521h	E300.0	5,000	**151,000**	
Dissolved Oxygen	mg/L		5/23/2014 1747h	SM4500-O-G	0.500	**1.05**	
Hardness (as CaCO3)	mg/L		6/9/2014 1502h	SM2340B	10.0	**52,200**	
Sulfate	mg/L		6/5/2014 1917h	E300.0	3,750	**24,800**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-006
Client Sample ID: 8180-4-1.5
Collection Date: 5/22/2014 1630h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**77.7**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**312,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-007
Client Sample ID: 8180-4-3.0
Collection Date: 5/22/2014 1630h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**72.0**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**336,000**	

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Jose Rocha
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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-008
Client Sample ID: 8180-4-4.5
Collection Date: 5/22/2014 1630h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**72.9**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**346,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-009
Client Sample ID: 8180-4-6.0
Collection Date: 5/22/2014 1630h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**73.0**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**334,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-010
Client Sample ID: 8180-4-7.5
Collection Date: 5/22/2014 1630h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**72.5**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**331,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-011
Client Sample ID: 8180-FB
Collection Date: 5/22/2014 1730h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/27/2014 0700h	SM2320B	10.0	< 10.0	
Chloride	mg/L		6/9/2014 1746h	E300.0	0.100	**0.249**	
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**58.1**	
Hardness (as CaCO3)	mg/L		6/9/2014 1502h	SM2340B	10.0	< 10.0	
Sulfate	mg/L		6/9/2014 1746h	E300.0	0.750	< 0.750	[1]
Total Dissolved Solids	mg/L		6/2/2014 1520h	SM2540C	10.0	< 10.0	H

[1] - Matrix spike recovery indicates matrix interference. The method is in control as indicated by the LCS.
H - Analyzed outside the hold time. The original analyses performed within the hold time required less dilution.

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-012
Client Sample ID: 8180-3-1.5
Collection Date: 5/22/2014 1800h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**73.4**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**339,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-013
Client Sample ID: 8180-3-3.0
Collection Date: 5/22/2014 1800h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 1020h	SM2710F	0	**75.9**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**340,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-014
Client Sample ID: 8180-3-4.5
Collection Date: 5/22/2014 1800h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**73.9**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**362,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-015
Client Sample ID: 8180-3-6
Collection Date: 5/22/2014 1800h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**72.7**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**333,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering
Contact: Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405510-016
Client Sample ID: 8180-3-6-Dup
Collection Date: 5/22/2014 1800h
Received Date: 5/23/2014 1458h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/27/2014 0632h	SM2710F	0	**71.1**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**335,000**	

American West
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QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: ME
QC Type: LCS

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: LCS-32537	Date Analyzed:	06/03/2014 1140h											
Test Code: 6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium	9.79	mg/L	SW6010C	0.0298	1.00	10.00	0	97.9	80 - 120				
Magnesium	9.46	mg/L	SW6010C	0.0386	1.00	10.00	0	94.6	80 - 120				
Potassium	9.87	mg/L	SW6010C	0.0709	1.00	10.00	0	98.7	80 - 120				
Sodium	9.99	mg/L	SW6010C	0.0287	1.00	10.00	0	99.9	80 - 120				

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Jose Rocha
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QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: ME
QC Type: MBLK

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: MB-32537	Date Analyzed:	06/03/2014 1138h											
Test Code: 6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium	< 1.00	mg/L	SW6010C	0.0298	1.00								
Magnesium	< 1.00	mg/L	SW6010C	0.0386	1.00								
Potassium	< 1.00	mg/L	SW6010C	0.0709	1.00								
Sodium	< 1.00	mg/L	SW6010C	0.0287	1.00								

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QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: ME
QC Type: MS

Analyte		Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID:	**1405501-001HMS**	Date Analyzed:	06/03/2014 1207h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Sodium		546	mg/L	SW6010C	1.44	50.0	10.00	550	-34.3	75 - 125				2
Lab Sample ID:	**1405501-001HMS**	Date Analyzed:	06/05/2014 1159h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium		33.2	mg/L	SW6010C	0.298	10.0	10.00	24.7	84.8	75 - 125				
Magnesium		117	mg/L	SW6010C	0.386	10.0	10.00	109	81.0	75 - 125				
Potassium		37.5	mg/L	SW6010C	0.709	10.0	10.00	29.2	82.8	75 - 125				
Lab Sample ID:	**1405520-027BMS**	Date Analyzed:	06/09/2014 0918h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium		95.3	mg/L	SW6010C	0.298	10.0	100.0	0	95.3	75 - 125				
Magnesium		99.1	mg/L	SW6010C	0.386	10.0	100.0	0	99.1	75 - 125				
Potassium		98.2	mg/L	SW6010C	0.709	10.0	100.0	0	98.2	75 - 125				
Sodium		100	mg/L	SW6010C	0.287	10.0	100.0	1.42	99.0	75 - 125				

[2] - Analyte concentration is too high for accurate matrix spike recovery and/or RPD.
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Jose Rocha
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QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: ME
QC Type: MSD

Analyte		Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID:	**1405501-001HMSD**	Date Analyzed:	06/03/2014 1209h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Sodium		604	mg/L	SW6010C	1.44	50.0	10.00	550	539	75 - 125	546	9.97	20	2
Lab Sample ID:	**1405501-001HMSD**	Date Analyzed:	06/05/2014 1201h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium		34.1	mg/L	SW6010C	0.298	10.0	10.00	24.7	94.0	75 - 125	33.2	2.75	20	
Magnesium		120	mg/L	SW6010C	0.386	10.0	10.00	109	120	75 - 125	117	3.26	20	
Potassium		39.2	mg/L	SW6010C	0.709	10.0	10.00	29.2	99.2	75 - 125	37.5	4.27	20	
Lab Sample ID:	**1405520-027BMSD**	Date Analyzed:	06/09/2014 0920h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium		94.3	mg/L	SW6010C	0.298	10.0	100.0	0	94.3	75 - 125	95.3	1.12	20	
Magnesium		97.2	mg/L	SW6010C	0.386	10.0	100.0	0	97.2	75 - 125	99.1	1.96	20	
Potassium		95.0	mg/L	SW6010C	0.709	10.0	100.0	0	95.0	75 - 125	98.2	3.30	20	
Sodium		101	mg/L	SW6010C	0.287	10.0	100.0	1.42	99.2	75 - 125	100	0.236	20	

[2] - Analyte concentration is too high for accurate matrix spike recovery and/or RPD.
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Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: DUP

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: 1405510-006ADUP Date Analyzed: 05/27/2014 0632h													
Test Code: DENSITY-2710F													
Density	74.9	lb/ft³	SM2710F	0	0					77.7	3.67	20	
Lab Sample ID: 1405510-013ADUP Date Analyzed: 05/27/2014 1020h													
Test Code: DENSITY-2710F													
Density	75.1	lb/ft³	SM2710F	0	0					75.9	1.03	20	
Lab Sample ID: 1405510-006ADUP Date Analyzed: 05/28/2014 1130h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	324,000	mg/L	SM2540C	108	500					312000	3.86	5	
Lab Sample ID: 1405520-007ADUP Date Analyzed: 05/28/2014 1130h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	157,000	mg/L	SM2540C	108	500					157000	0.0637	5	
Lab Sample ID: 1405626-001ADUP Date Analyzed: 06/02/2014 1520h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	4,950	mg/L	SM2540C	4.34	20.0					5190	4.73	5	

Reissue of a previously generated report. Information has been added. Information herein supersedes that of the previously issued reports.

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Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: LCS

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: LCS-R69927 Date Analyzed: 06/05/2014 1228h													
Test Code: 300.0-W													
Chloride	5.12	mg/L	E300.0	0.00623	0.100	5.000	0	102	90 - 110				
Sulfate	4.99	mg/L	E300.0	0.0331	0.750	5.000	0	99.9	90 - 110				
Lab Sample ID: LCS-R70016 Date Analyzed: 06/09/2014 1730h													
Test Code: 300.0-W													
Chloride	4.72	mg/L	E300.0	0.00623	0.100	5.000	0	94.4	90 - 110				
Sulfate	4.63	mg/L	E300.0	0.0331	0.750	5.000	0	92.7	90 - 110				
Lab Sample ID: LCS-R69350 Date Analyzed: 05/27/2014 0700h													
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	51,000	mg/L	SM2320B	0.719	10.0	50,000	0	102	90 - 110				
Lab Sample ID: LCS-R69596 Date Analyzed: 05/28/2014 1130h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	208	mg/L	SM2540C	2.17	10.0	205.0	0	101	80 - 120				
Lab Sample ID: LCS-R69735 Date Analyzed: 06/02/2014 1520h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	196	mg/L	SM2540C	2.17	10.0	205.0	0	95.6	80 - 120				

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Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: MBLK

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: MB-R69927	Date Analyzed:	06/05/2014 1141h											
Test Code: 300.0-W													
Chloride	< 0.100	mg/L	E300.0	0.00623	0.100								
Sulfate	< 0.750	mg/L	E300.0	0.0331	0.750								
Lab Sample ID: MB-R70016	Date Analyzed:	06/09/2014 1714h											
Test Code: 300.0-W													
Chloride	< 0.100	mg/L	E300.0	0.00623	0.100								
Sulfate	< 0.750	mg/L	E300.0	0.0331	0.750								
Lab Sample ID: MB-R69350	Date Analyzed:	05/27/2014 0700h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	< 10.0	mg/L	SM2320B	0.719	10.0								
Lab Sample ID: MB-R69596	Date Analyzed:	05/28/2014 1130h											
Test Code: TDS-W-2540C													
Total Dissolved Solids	< 10.0	mg/L	SM2540C	2.17	10.0								
Lab Sample ID: MB-R69735	Date Analyzed:	06/02/2014 1520h											
Test Code: TDS-W-2540C													
Total Dissolved Solids	< 10.0	mg/L	SM2540C	2.17	10.0								

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Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: MS

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: 1406076-001AMS	Date Analyzed:	06/05/2014 1243h											
Test Code: 300.0-W													
Chloride	5.40	mg/L	E300.0	0.00623	0.100	5.000	0.405	99.8	90 - 110				
Sulfate	5.31	mg/L	E300.0	0.0331	0.750	5.000	0.116	104	90 - 110				
Lab Sample ID: 1405510-001CMS	Date Analyzed:	06/05/2014 1331h											
Test Code: 300.0-W													
Chloride	378,000	mg/L	E300.0	312	5,000	250,000	128000	100	90 - 110				
Sulfate	268,000	mg/L	E300.0	1,660	37,500	250,000	0	107	90 - 110				
Lab Sample ID: 1405510-011BMS	Date Analyzed:	06/09/2014 1801h											
Test Code: 300.0-W													
Chloride	52.0	mg/L	E300.0	0.0623	1.00	50.00	0.249	104	90 - 110				
Sulfate	56.2	mg/L	E300.0	0.331	7.50	50.00	0.489	111	90 - 110				[1]
Lab Sample ID: 1405608-006BMS	Date Analyzed:	06/09/2014 1952h											
Test Code: 300.0-W													
Chloride	23,700	mg/L	E300.0	31.2	500	25,000	81.2	94.5	90 - 110				
Sulfate	26,900	mg/L	E300.0	166	3,750	25,000	2890	96.0	90 - 110				
Lab Sample ID: 1405501-001GMS	Date Analyzed:	05/27/2014 0700h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	1,350	mg/L	SM2320B	7.19	100	500.0	832	104	80 - 120				

[1] - Matrix spike recovery indicates matrix interference. The method is in control as indicated by the LCS.
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Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405510
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: MSD

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: 1406076-001AMSD	Date Analyzed:	06/05/2014 1259h											
Test Code: 300.0-W													
Chloride	5.88	mg/L	E300.0	0.00623	0.100	5.000	0.405	109	90 - 110	5.4	8.53	20	
Sulfate	5.85	mg/L	E300.0	0.0331	0.750	5.000	0.116	115	90 - 110	5.31	9.71	20	[1]
Lab Sample ID: 1405510-001CMSD	Date Analyzed:	06/05/2014 1346h											
Test Code: 300.0-W													
Chloride	405,000	mg/L	E300.0	312	5,000	250,000	128000	111	90 - 110	378000	6.91	20	[1]
Sulfate	295,000	mg/L	E300.0	1,660	37,500	250,000	0	118	90 - 110	268000	9.76	20	[1]
Lab Sample ID: 1405510-011BMSD	Date Analyzed:	06/09/2014 1817h											
Test Code: 300.0-W													
Chloride	51.3	mg/L	E300.0	0.0623	1.00	50.00	0.249	102	90 - 110	52	1.30	20	
Sulfate	53.3	mg/L	E300.0	0.331	7.50	50.00	0.489	106	90 - 110	56.2	5.28	20	
Lab Sample ID: 1405608-006BMSD	Date Analyzed:	06/09/2014 2007h											
Test Code: 300.0-W													
Chloride	25,800	mg/L	E300.0	31.2	500	25,000	81.2	103	90 - 110	23700	8.41	20	
Sulfate	28,900	mg/L	E300.0	166	3,750	25,000	2890	104	90 - 110	26900	7.13	20	
Lab Sample ID: 1405501-001GMSD	Date Analyzed:	05/27/2014 0700h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	1,350	mg/L	SM2320B	7.19	100	500.0	832	104	80 - 120	1350	0	10	

[1] - Matrix spike recovery indicates matrix interference. The method is in control as indicated by the LCS.
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American West Analytical Laboratories

REVISED: 7/28/2014
Batch QC Added. MH

WORK ORDER Summary

Work Order: **1405510** Page 1 of 3
Due Date: 6/9/2014

Client: HDR Engineering
Client ID: HDR200
Project: **UPRR WQ / 217879**
Contact: Carin Loy
QC Level: II
WO Type: Standard
Comments: Email 2 people. Do not refrigerate per Pat. Samples are on check-in shelf by coolers.;

Sample ID	Client Sample ID	Collected Date	Received Date	Test Code	Matrix	Sel	Storage
1405510-001A	**8180-4-B**	5/22/2014 1545h	5/23/2014 1458h	**3005A-ICPMS-PR**	Aqueous	☐	df - metals
				6010C-W		☑	df - metals
				4 SEL Analytes: CA MG K NA			
				HARD-2340B		☐	df - metals
1405510-001B				**DO-4500OG**		☐	ww - DO
1405510-001C				**300.0-W**		☑	df - wc
				2 SEL Analytes: CL SO4			
				ALK-W-2320B		☑	df - wc
				1 SEL Analytes: ALK			
1405510-002A	**8180-4-B Dup**	5/22/2014 1545h	5/23/2014 1458h	**3005A-ICPMS-PR**	Aqueous	☐	df - metals
				6010C-W		☑	df - metals
				4 SEL Analytes: CA MG K NA			
				HARD-2340B		☐	df - metals
1405510-002B						☐	Not received
1405510-002C				**300.0-W**		☑	df - wc
				2 SEL Analytes: CL SO4			
				ALK-W-2320B		☑	df - wc
				1 SEL Analytes: ALK			
1405510-003A	**8180-4-A**	5/22/2014 1615h	5/23/2014 1458h	**3005A-ICPMS-PR**	Aqueous	☐	df - metals
				6010C-W		☑	df - metals
				4 SEL Analytes: CA MG K NA			
				HARD-2340B		☐	df - metals
1405510-003B				**DO-4500OG**		☐	ww - DO
1405510-003C				**300.0-W**		☑	df - wc
				2 SEL Analytes: CL SO4			
				ALK-W-2320B		☑	df - wc
				1 SEL Analytes: ALK			
1405510-004A	**8180-3-A**	5/22/2014 1730h	5/23/2014 1458h	**3005A-ICPMS-PR**	Aqueous	☐	df - metals
				6010C-W		☑	df - metals
				4 SEL Analytes: CA MG K NA			
				HARD-2340B		☐	df - metals
1405510-004B				**DO-4500OG**		☐	ww - DO

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WORK ORDER Summary

Work Order: **1405510**

Client: HDR Engineering

Due Date: 6/9/2014

Sample ID	Client Sample ID	Collected Date	Received Date	Test Code	Matrix	Sel	Storage	
1405510-004C	**8180-3-A**	5/22/2014 1730h	5/23/2014 1458h	**300.0-W**	Aqueous	☑	df - wc	I
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405510-005A	**8180-3-B**	5/22/2014 1730h	5/23/2014 1458h	**3005A-ICPMS-PR**	Aqueous	☐	df - metals	I
				6010C-W		☑	df - metals	
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405510-005B				**DO-4500OG**		☐	ww - DO	
1405510-005C				**300.0-W**		☑	df - wc	
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405510-006A	**8180-4-1.5**	5/22/2014 1630h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-007A	**8180-4-3.0**	5/22/2014 1630h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-008A	**8180-4-4.5**	5/22/2014 1630h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-009A	**8180-4-6.0**	5/22/2014 1630h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-010A	**8180-4-7.5**	5/22/2014 1630h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-011A	**8180-FB**	5/22/2014 1730h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-011B				**300.0-W**		☑	df - wc	
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405510-011C				**3005A-ICPMS-PR**		☐	df - metals	
				6010C-W		☑	df - metals	
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405510-012A	**8180-3-1.5**	5/22/2014 1800h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-013A	**8180-3-3.0**	5/22/2014 1800h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-014A	**8180-3-4.5**	5/22/2014 1800h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	

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WORK ORDER Summary

Work Order: **1405510**

Client: HDR Engineering

Due Date: 6/9/2014

Sample ID	Client Sample ID	Collected Date	Received Date	Test Code	Matrix	Sel	Storage	
1405510-015A	**8180-3-6**	5/22/2014 1800h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	
1405510-016A	**8180-3-6-Dup**	5/22/2014 1800h	5/23/2014 1458h	**DENSITY-2710F**	Aqueous	☐	df - wc	I
				TDS-W-2540C		☐	df - wc	

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American West Analytical Laboratories

Chain of Custody

Lab Sample Set # 1405510

Client: **HDR, Inc.**
Address: 3949 South 700 East, Ste. 500
Salt Lake City, UT 84107

Project Name: **UPRR WQ**
PO#: **217879**

Contact: **Mike Funk** (billing), **Carin Loy** (sampling)
Phone: Funk - 801-743-7818, Loy - 916-679-8737
Fax :
Email: michael.funk@hdrinc.com, carin.loy@hdrinc.com

Page 1 of 2

QC Level: 1

Turn Around Time: Standard

	Sample ID:	Date Sampled	Time	# of Containers	Sample Matrix	SM 2710F, Density	SM 2540 C, TDS	EPA 300.0, Anions (Cl, SO4)	SM2320 B, Alkalinity	EPA 6010B, Cations (NA, K, Mg, CA	SM 4500, Dissolved Oxygen	SM 2340 C, Hardness				Comments
1	8180-4-B	5-22-14	1545	1	A					X		X				Please email sample results to Carin Loy carin.loy@hdrinc.com
2	↓	↓	↓	↓	↓						X					
3	↓	↓	↓	↓	↓			X	X							
4	8180-4-BDUP	5-22-14	1545	1	A					X		X				
5	↓	↓	↓	↓	↓						X					← Not received
6	↓	↓	↓	↓	↓			X	X							For sample collection questions please contact Charles Vertucci charles.vertucci@hdrinc.com
7	8180-4-A	5-22-14	1615	1	A			X	X							
8	↓	↓	↓	↓	↓					X		X				
9	↓	↓	↓	↓	↓						X					
10	8180-3-A	5-22-14	1730	1	A			X	X							
11	↓	↓	↓	↓	↓					X		X				
12	↓	↓	↓	↓	↓						X					
13	8180-3-B	5-22-14	1730	1	A			X	X							
14	↓	↓	↓	↓	↓					X		X				
15	↓	↓	↓	↓	↓						X					

Special Instructions: * Per Pat - Do not put on ice - DB 5/23/14

Relinquished by: Signature	Date:	Received by: Signature	Date:
Print Name: Nate Nichols	Time: 20:30	Print Name:	Time:
Relinquished by: Alyssa LeBaron	Date: 5/23/14	Received by: Denise Bruun	Date: 5/23/14
Print Name: Alyssa LeBaron	Time: 14:58	Print Name: Denise Bruun	Time: 14:58

American West Analytical Laboratories

Chain of Custody

Lab Sample Set # 1405510

Client: **HDR, Inc.**
Address: 3949 South 700 East, Ste. 500
Salt Lake City, UT 84107

Project Name: **UPRR WQ**
PO#: **217879**

Contact: **Mike Funk** (billing), **Carin Loy** (sampling)
Phone: Funk - 801-743-7818, Loy - 916-679-8737
Fax :
Email: michael.funk@hdrinc.com, carin.loy@hdrinc.com

Page 2 of 2

QC Level: 1

Turn Around Time: Standard

	Sample ID:	Date Sampled	Time	# of Containers	Sample Matrix	SM 2710F, Density	SM 2540 C, TDS	EPA 300.0, Anions (Cl, SO4)	SM2320 B, Alkalinity	EPA 6010B, Cations (NA, K, Mg, CA	SM 4500, Dissolved Oxygen	SM 2340 C, Hardness				Comments
6	8180-4-1.5	5-22-14	1630	1	AQ	X	X									Please email sample results to Carin Loy carin.loy@hdrinc.com
7	8180-4-3.0	↓	1630	↓	↓	X	X									
8	8180-4-4.5	↓	↓	↓	↓	X	X									
9	8180-4-6.0	↓	↓	↓	↓	X	X									
10	8180-4-7.5	↓	↓	↓	↓	X	X									
*	8180-FB	↓	1730	1	AQ	X	X									For sample collection questions please contact Charles Vertucci charles.vertucci@hdrinc.com
11	8180-FB	↓	1730	↓	↓			X	X							
	8180-FB	↓	1730	↓	↓					X		X				
12	8180-3-1.5	↓	1800	↓	↓	X	X									
13	8180-3-3.0	↓	↓	↓	↓	X	X									
14	8180-3-4.5	↓	↓	↓	↓	X	X									
15	8180-3-6	↓	↓	↓	↓	X	X									
16	8180-3-6-DUP	↓	↓	↓	↓	X	X									

DB 5/23/14

Special Instructions:

Relinquished by: Signature	Date:	Received by: Signature	Date:
Print Name: Nate Nichols	Time: 20:30	Print Name:	Time:
Relinquished by: Alyssa LeBaron	Date: 5/23/14	Received by: Denise Bruun	Date: 5/23/14
Print Name: Alyssa LeBaron	Time: 14:58	Print Name: Denise Bruun	Time: 14:58

Lab Set ID: 1405510

Preservation Check Sheet

Sample Set Extension and pH

Analysis	Preservative	-001	-002	-003	-004	-005	-011											
Ammonia	pH <2 H_2SO_4																	
COD	pH <2 H_2SO_4																	
Cyanide	pH >12 NaOH																	
Metals	pH <2 HNO_3	yes	yes	yes	yes	yes	yes											
NO_2 & NO_3	pH <2 H_2SO_4																	
O & G	pH <2 HCL																	
Phenols	pH <2 H_2SO_4																	
Sulfide	pH > 9NaOH, Zn Acetate																	
TKN	pH <2 H_2SO_4																	
T PO_4	pH <2 H_2SO_4																	

Procedure:

1) Pour a small amount of sample in the sample lid
2) Pour sample from Lid gently over wide range pH paper
3) **Do Not** dip the pH paper in the sample bottle or lid
4) If sample is not preserved, properly list its extension and receiving pH in the appropriate column above
5) Flag COC, notify client if requested
6) Place client conversation on COC
7) Samples may be adjusted

Frequency: All samples requiring preservation

* The sample required additional preservative upon receipt.

\+ The sample was received unpreserved

▲ The Sample was received unpreserved and therefore preserved upon receipt.

\# The sample pH was unadjustable to a pH < 2 due to the sample matrix

• The sample pH was unadjustable to a pH > ____ due to the sample matrix interference

Carin Loy
HDR Engineering
3949 South 700 East # 500
Salt Lake City, UT 84107
TEL: (916) 679-8737

RE: UPRR WQ / 217879

Dear Carin Loy: Lab Set ID: 1405520

463 West 3600 South
Salt Lake City, UT 84115

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Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

American West Analytical Laboratories received 27 sample(s) on 5/27/2014 for the analyses presented in the following report.

American West Analytical Laboratories (AWAL) is accredited by The National Environmental Laboratory Accreditation Program (NELAP) in Utah and Texas; and is state accredited in Colorado, Idaho, New Mexico, and Missouri.

All analyses were performed in accordance to the NELAP protocols unless noted otherwise. Accreditation scope documents are available upon request. If you have any questions or concerns regarding this report please feel free to call.

The abbreviation "Surr" found in organic reports indicates a surrogate compound that is intentionally added by the laboratory to determine sample injection, extraction, and/or purging efficiency. The "Reporting Limit" found on the report is equivalent to the practical quantitation limit (PQL). This is the minimum concentration that can be reported by the method referenced and the sample matrix. The reporting limit must not be confused with any regulatory limit. Analytical results are reported to three significant figures for quality control and calculation purposes.

The client was advised not to chill the brine sample(s). Chilling such samples alters the chemistries by creating insoluble crystals. The samples were received and stored at ambient temperature for the purpose of gathering accurate and useful data.

6/11/2014: This is a revision to a report originally issued on 6/10/2014. The cover sheet has been updated. Page 1 has been revised.

7/28/2014: Batch QC added by request. All pages updated for pagination.

Thank You,

Approved: Patrick Noteboom — Digitally signed by Patrick Noteboom DN: cn=Patrick Noteboom, o=American West Analytical Laboratories, ou=Senior Chemist, email=pat@awal-labs.com, c=US Date: 2014.07.28 16:31:22 -06'00'

Laboratory Director or designee

All analyses applicable to the CWA, SDWA, and RCRA are performed in accordance to NELAC protocols. Pertinent sampling information is located on the attached COC. Confidential Business Information: This report is provided for the exclusive use of the addressee. Privileges of subsequent use of the name of this company or any member of its staff, or reproduction of this report in connection with the advertisement, promotion or sale of any product or process, or in connection with the re-publication of this report for any purpose other than for the addressee will be granted only on contact. This company accepts no responsibility except for the due performance of inspection and/or analysis in good faith and according to the rules of the trade and of science.

INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-001
Client Sample ID: 8180-1-A
Collection Date: 5/23/2014 1230h
Received Date: 5/27/2014 0924h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1216h	SW6010C	100	**241**	
Magnesium	mg/L	5/27/2014 1555h	6/5/2014 1216h	SW6010C	100	**4,830**	
Potassium	mg/L	5/27/2014 1555h	6/5/2014 1216h	SW6010C	100	**2,820**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1228h	SW6010C	5,000	**46,900**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-002
Client Sample ID: 8180-1-B
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1239h	SW6010C	100	**248**	
Magnesium	mg/L	5/27/2014 1555h	6/5/2014 1239h	SW6010C	100	**5,350**	
Potassium	mg/L	5/27/2014 1555h	6/5/2014 1239h	SW6010C	100	**3,080**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1252h	SW6010C	5,000	**47,600**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-003
Client Sample ID: 8180-2-B
Collection Date: 5/23/2014 0955h
Received Date: 5/27/2014 0924h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1241h	SW6010C	100	**240**	
Magnesium	mg/L	5/27/2014 1555h	6/5/2014 1241h	SW6010C	100	**4,780**	
Potassium	mg/L	5/27/2014 1555h	6/5/2014 1241h	SW6010C	100	**2,770**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1254h	SW6010C	5,000	**53,600**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-004
Client Sample ID: 8180-2-A
Collection Date: 5/23/2014 1015h
Received Date: 5/27/2014 0924h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1243h	SW6010C	100	**236**	
Magnesium	mg/L	5/27/2014 1555h	6/5/2014 1243h	SW6010C	100	**4,740**	
Potassium	mg/L	5/27/2014 1555h	6/5/2014 1243h	SW6010C	100	**2,750**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1256h	SW6010C	5,000	**47,400**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-005
Client Sample ID: 8180-5-A
Collection Date: 5/23/2014 1335h
Received Date: 5/27/2014 0924h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/5/2014 1245h	SW6010C	100	**236**	
Magnesium	mg/L	5/27/2014 1555h	6/5/2014 1245h	SW6010C	100	**4,760**	
Potassium	mg/L	5/27/2014 1555h	6/5/2014 1245h	SW6010C	100	**2,760**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1258h	SW6010C	5,000	**49,100**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-006
Client Sample ID: 8180-5-B
Collection Date: 5/23/2014 1325h
Received Date: 5/27/2014 0924h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/9/2014 1142h	SW6010C	10.0	**242**	
Magnesium	mg/L	5/27/2014 1555h	6/9/2014 1142h	SW6010C	10.0	**4,910**	
Potassium	mg/L	5/27/2014 1555h	6/9/2014 1304h	SW6010C	200	**2,860**	
Sodium	mg/L	5/27/2014 1555h	6/3/2014 1300h	SW6010C	5,000	**52,200**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-027
Client Sample ID: 8180-EB
Collection Date: 5/23/2014 1630h
Received Date: 5/27/2014 0924h

Analytical Results TOTAL METALS

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Calcium	mg/L	5/27/2014 1555h	6/9/2014 0916h	SW6010C	10.0	< 10.0	
Magnesium	mg/L	5/27/2014 1555h	6/9/2014 0916h	SW6010C	10.0	< 10.0	
Potassium	mg/L	5/27/2014 1555h	6/9/2014 0916h	SW6010C	10.0	< 10.0	
Sodium	mg/L	5/27/2014 1555h	6/9/2014 0916h	SW6010C	10.0	< 10.0	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-001
Client Sample ID: 8180-1-A
Collection Date: 5/23/2014 1230h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/29/2014 1100h	SM2320B	50.0	**421**	
Chloride	mg/L		6/5/2014 1552h	E300.0	5,000	**77,000**	
Hardness (as CaCO3)	mg/L		6/9/2014 1503h	SM2340B	10.0	**20,500**	
Sulfate	mg/L		6/5/2014 1948h	E300.0	3,750	**10,900**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-002
Client Sample ID: 8180-1-B
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/29/2014 1100h	SM2320B	50.0	**394**	
Chloride	mg/L		6/5/2014 1608h	E300.0	5,000	**74,200**	
Dissolved Oxygen	mg/L		5/27/2014 1200h	SM4500-O-G	0.500	**1.25**	H
Hardness (as CaCO3)	mg/L		6/9/2014 1503h	SM2340B	10.0	**22,600**	
Sulfate	mg/L		6/5/2014 2004h	E300.0	3,750	**10,600**	

H - Sample was received outside of the holding time.

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-003
Client Sample ID: 8180-2-B
Collection Date: 5/23/2014 0955h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/29/2014 1100h	SM2320B	50.0	**398**	
Chloride	mg/L		6/5/2014 1624h	E300.0	5,000	**89,200**	
Dissolved Oxygen	mg/L		5/27/2014 1200h	SM4500-O-G	0.500	< 0.500	H
Hardness (as CaCO3)	mg/L		6/9/2014 1503h	SM2340B	10.0	**20,300**	
Sulfate	mg/L		6/5/2014 2020h	E300.0	3,750	**12,800**	

H - Sample was received outside of the holding time.

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-004
Client Sample ID: 8180-2-A
Collection Date: 5/23/2014 1015h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/29/2014 1100h	SM2320B	50.0	**412**	
Chloride	mg/L		6/5/2014 1640h	E300.0	5,000	**64,900**	
Hardness (as CaCO3)	mg/L		6/9/2014 1503h	SM2340B	10.0	**20,100**	
Sulfate	mg/L		6/5/2014 2107h	E300.0	3,750	**9,780**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-005
Client Sample ID: 8180-5-A
Collection Date: 5/23/2014 1335h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/29/2014 1100h	SM2320B	50.0	**443**	
Chloride	mg/L		6/5/2014 1655h	E300.0	5,000	**67,500**	
Hardness (as CaCO3)	mg/L		6/9/2014 1503h	SM2340B	10.0	**20,200**	
Sulfate	mg/L		6/5/2014 2123h	E300.0	3,750	**9,560**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-006
Client Sample ID: 8180-5-B
Collection Date: 5/23/2014 1325h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/29/2014 1100h	SM2320B	50.0	**367**	
Chloride	mg/L		6/5/2014 1711h	E300.0	5,000	**71,100**	
Dissolved Oxygen	mg/L		5/27/2014 1200h	SM4500-O-G	0.500	**0.500**	H
Hardness (as CaCO3)	mg/L		6/9/2014 1503h	SM2340B	10.0	**20,800**	
Sulfate	mg/L		6/5/2014 2138h	E300.0	3,750	**10,600**	

H - Sample was received outside of the holding time.

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-007
Client Sample ID: 8180-5-1.5
Collection Date: 5/23/2014 1345h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**65.3**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**157,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-008
Client Sample ID: 8180-5-3.0
Collection Date: 5/23/2014 1345h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**65.3**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**156,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-009
Client Sample ID: 8180-5-4.5
Collection Date: 5/23/2014 1345h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**64.4**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**156,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-010
Client Sample ID: 8180-5-6.0
Collection Date: 5/23/2014 1345h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**66.7**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**150,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-011
Client Sample ID; 8180-5-6.5
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**64.6**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**148,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-012
Client Sample ID: 8180-5-7.0
Collection Date: 5/23/2014 1345h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**66.2**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**211,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-013
Client Sample ID: 8180-5-7.5
Collection Date: 5/23/2014 1345h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**66.4**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**218,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-014
Client Sample ID: 8180-1-1.5
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**65.4**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**167,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-015
Client Sample ID: 8180-1-3.0
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**64.0**	
Total Dissolved Solids	mg/L		5/28/2014 1130h	SM2540C	500	**152,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-016
Client Sample ID: 8180-1-4.5
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**65.9**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**156,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-017
Client Sample ID: 8180-1-6.0
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**65.6**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**147,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-018
Client Sample ID: 8180-1-6.5
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**68.2**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**227,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-019
Client Sample ID: 8180-1-7.0
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**66.3**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**213,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-020
Client Sample ID: 8180-1-7.0-DUP
Collection Date: 5/23/2014 1235h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**68.3**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**222,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-021
Client Sample ID: 8180-1-7.5
Collection Date: 5/23/2014 1020h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**67.0**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**223,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-022
Client Sample ID: 8180-2-1.5
Collection Date: 5/23/2014 1020h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**67.4**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**163,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-023
Client Sample ID: 8180-2-3.0
Collection Date: 5/23/2014 1020h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**67.1**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**156,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-024
Client Sample ID: 8180-2-4.5
Collection Date: 5/23/2014 1020h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**65.6**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**156,000**	

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Jose Rocha
QA Officer

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-025
Client Sample ID: 8180-2-6.0
Collection Date: 5/23/2014 1020h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**66.2**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**152,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-026
Client Sample ID: 8180-7.0
Collection Date: 5/23/2014 1630h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**66.2**	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	500	**168,000**	

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INORGANIC ANALYTICAL REPORT

Client: HDR Engineering **Contact:** Carin Loy
Project: UPRR WQ / 217879
Lab Sample ID: 1405520-027
Client Sample ID: 8180-EB
Collection Date: 5/23/2014 1630h
Received Date: 5/27/2014 0924h

Analytical Results

Compound	Units	Date Prepared	Date Analyzed	Method Used	Reporting Limit	Analytical Result	Qual
Alkalinity (as CaCO3)	mg/L		5/29/2014 1100h	SM2320B	10.0	< 10.0	
Chloride	mg/L		6/9/2014 1904h	E300.0	0.100	**0.898**	
Density	lb/ft³		5/28/2014 0751h	SM2710F	0	**60.3**	
Hardness (as CaCO3)	mg/L		6/9/2014 1503h	SM2340B	10.0	< 10.0	
Sulfate	mg/L		6/9/2014 1904h	E300.0	0.750	< 0.750	
Total Dissolved Solids	mg/L		5/28/2014 1300h	SM2540C	10.0	**26.0**	

American West
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Jose Rocha
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QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: ME
QC Type: LCS

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: LCS-32537	Date Analyzed:	06/03/2014 1140h											
Test Code: 6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium	9.79	mg/L	SW6010C	0.0298	1.00	10.00	0	97.9	80 - 120				
Magnesium	9.46	mg/L	SW6010C	0.0386	1.00	10.00	0	94.6	80 - 120				
Potassium	9.87	mg/L	SW6010C	0.0709	1.00	10.00	0	98.7	80 - 120				
Sodium	9.99	mg/L	SW6010C	0.0287	1.00	10.00	0	99.9	80 - 120				

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Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: ME
QC Type: MBLK

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: MB-32537	Date Analyzed:	06/03/2014 1138h											
Test Code: 6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium	< 1.00	mg/L	SW6010C	0.0298	1.00								
Magnesium	< 1.00	mg/L	SW6010C	0.0386	1.00								
Potassium	< 1.00	mg/L	SW6010C	0.0709	1.00								
Sodium	< 1.00	mg/L	SW6010C	0.0287	1.00								

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QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: ME
QC Type: MS

Analyte		Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID:	**1405501-001HMS**	Date Analyzed:	06/03/2014 1207h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Sodium		546	mg/L	SW6010C	1.44	50.0	10.00	550	-34.3	75 - 125				2
Lab Sample ID:	**1405501-001HMS**	Date Analyzed:	06/05/2014 1159h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium		33.2	mg/L	SW6010C	0.298	10.0	10.00	24.7	84.8	75 - 125				
Magnesium		117	mg/L	SW6010C	0.386	10.0	10.00	109	81.0	75 - 125				
Potassium		37.5	mg/L	SW6010C	0.709	10.0	10.00	29.2	82.8	75 - 125				
Lab Sample ID:	**1405520-027BMS**	Date Analyzed:	06/09/2014 0918h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium		95.3	mg/L	SW6010C	0.298	10.0	100.0	0	95.3	75 - 125				
Magnesium		99.1	mg/L	SW6010C	0.386	10.0	100.0	0	99.1	75 - 125				
Potassium		98.2	mg/L	SW6010C	0.709	10.0	100.0	0	98.2	75 - 125				
Sodium		100	mg/L	SW6010C	0.287	10.0	100.0	1.42	99.0	75 - 125				

[2] - Analyte concentration is too high for accurate matrix spike recovery and/or RPD.
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Jose Rocha
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QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: ME
QC Type: MSD

Analyte		Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID:	**1405501-001HMSD**	Date Analyzed:	06/03/2014 1209h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Sodium		604	mg/L	SW6010C	1.44	50.0	10.00	550	539	75 - 125	546	9.97	20	2
Lab Sample ID:	**1405501-001HMSD**	Date Analyzed:	06/05/2014 1201h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium		34.1	mg/L	SW6010C	0.298	10.0	10.00	24.7	94.0	75 - 125	33.2	2.75	20	
Magnesium		120	mg/L	SW6010C	0.386	10.0	10.00	109	120	75 - 125	117	3.26	20	
Potassium		39.2	mg/L	SW6010C	0.709	10.0	10.00	29.2	99.2	75 - 125	37.5	4.27	20	
Lab Sample ID:	**1405520-027BMSD**	Date Analyzed:	06/09/2014 0920h											
Test Code:	6010C-W	Date Prepared:	05/27/2014 1555h											
Calcium		94.3	mg/L	SW6010C	0.298	10.0	100.0	0	94.3	75 - 125	95.3	1.12	20	
Magnesium		97.2	mg/L	SW6010C	0.386	10.0	100.0	0	97.2	75 - 125	99.1	1.96	20	
Potassium		95.0	mg/L	SW6010C	0.709	10.0	100.0	0	95.0	75 - 125	98.2	3.30	20	
Sodium		101	mg/L	SW6010C	0.287	10.0	100.0	1.42	99.2	75 - 125	100	0.236	20	

[2] - Analyte concentration is too high for accurate matrix spike recovery and/or RPD.
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Laboratory Director

Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: DUP

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: 1405520-009ADUP Date Analyzed: 05/28/2014 0751h													
Test Code: DENSITY-2710F													
Density	64.8	lb/ft³	SM2710F	0	0					64.4	0.526	20	
Lab Sample ID: 1405520-016ADUP Date Analyzed: 05/28/2014 0751h													
Test Code: DENSITY-2710F													
Density	65.5	lb/ft³	SM2710F	0	0					65.9	0.639	20	
Lab Sample ID: 1405520-025ADUP Date Analyzed: 05/28/2014 0751h													
Test Code: DENSITY-2710F													
Density	67.6	lb/ft³	SM2710F	0	0					66.2	2.14	20	
Lab Sample ID: 1405520-027ADUP Date Analyzed: 05/28/2014 0751h													
Test Code: DENSITY-2710F													
Density	61.9	lb/ft³	SM2710F	0	0					60.3	2.59	20	
Lab Sample ID: 1405510-006ADUP Date Analyzed: 05/28/2014 1130h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	324,000	mg/L	SM2540C	108	500					312000	3.86	5	
Lab Sample ID: 1405520-007ADUP Date Analyzed: 05/28/2014 1130h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	157,000	mg/L	SM2540C	108	500					157000	0.0637	5	
Lab Sample ID: 1405520-016ADUP Date Analyzed: 05/28/2014 1300h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	152,000	mg/L	SM2540C	108	500					156000	2.67	5	
Lab Sample ID: 1405555-001CDUP Date Analyzed: 05/28/2014 1300h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	33,600	mg/L	SM2540C	108	500					28700	15.7	5	@

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Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: DUP

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: 1405563-001CDUP Date Analyzed: 05/28/2014 1300h													
Test Code: TDS-W-2540C													
Total Dissolved Solids	3,680	mg/L	SM2540C	4.34	20.0					3530	4.11	5	

@ - High RPD due to suspected sample non-homogeneity or matrix interference.
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QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: LCS

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: LCS-R69927	Date Analyzed:	06/05/2014 1228h											
Test Code: 300.0-W													
Chloride	5.12	mg/L	E300.0	0.00623	0.100	5.000	0	102	90 - 110				
Sulfate	4.99	mg/L	E300.0	0.0331	0.750	5.000	0	99.9	90 - 110				
Lab Sample ID: LCS-R70016	Date Analyzed:	06/09/2014 1730h											
Test Code: 300.0-W													
Chloride	4.72	mg/L	E300.0	0.00623	0.100	5.000	0	94.4	90 - 110				
Sulfate	4.63	mg/L	E300.0	0.0331	0.750	5.000	0	92.7	90 - 110				
Lab Sample ID: LCS-R69513	Date Analyzed:	05/29/2014 1100h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	51,000	mg/L	SM2320B	0.719	10.0	50,000	0	102	90 - 110				
Lab Sample ID: LCS-R69596	Date Analyzed:	05/28/2014 1130h											
Test Code: TDS-W-2540C													
Total Dissolved Solids	208	mg/L	SM2540C	2.17	10.0	205.0	0	101	80 - 120				
Lab Sample ID: LCS-R69598	Date Analyzed:	05/28/2014 1300h											
Test Code: TDS-W-2540C													
Total Dissolved Solids	204	mg/L	SM2540C	2.17	10.0	205.0	0	99.5	80 - 120				

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Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: MBLK

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: MB-R69927	Date Analyzed:	06/05/2014 1141h											
Test Code: 300.0-W													
Chloride	< 0.100	mg/L	E300.0	0.00623	0.100								
Sulfate	< 0.750	mg/L	E300.0	0.0331	0.750								
Lab Sample ID: MB-R70016	Date Analyzed:	06/09/2014 1714h											
Test Code: 300.0-W													
Chloride	< 0.100	mg/L	E300.0	0.00623	0.100								
Sulfate	< 0.750	mg/L	E300.0	0.0331	0.750								
Lab Sample ID: MB-R69513	Date Analyzed:	05/29/2014 1100h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	< 10.0	mg/L	SM2320B	0.719	10.0								
Lab Sample ID: MB-SPLP-32566	Date Analyzed:	05/29/2014 1100h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	18.8	mg/L	SM2320B	0.719	10.0								
Lab Sample ID: MB-R69596	Date Analyzed:	05/28/2014 1130h											
Test Code: TDS-W-2540C													
Total Dissolved Solids	< 10.0	mg/L	SM2540C	2.17	10.0								
Lab Sample ID: MB-R69598	Date Analyzed:	05/28/2014 1300h											
Test Code: TDS-W-2540C													
Total Dissolved Solids	< 10.0	mg/L	SM2540C	2.17	10.0								

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Phone: (801) 263-8686, Toll Free: (888) 263-8686, Fax: (801) 263-8687
e-mail: awal@awal-labs.com, web: www.awal-labs.com

Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: MS

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: 1406076-001AMS	Date Analyzed:	06/05/2014 1243h											
Test Code: 300.0-W													
Chloride	5.40	mg/L	E300.0	0.00623	0.100	5.000	0.405	99.8	90 - 110				
Sulfate	5.31	mg/L	E300.0	0.0331	0.750	5.000	0.116	104	90 - 110				
Lab Sample ID: 1405510-001CMS	Date Analyzed:	06/05/2014 1331h											
Test Code: 300.0-W													
Chloride	378,000	mg/L	E300.0	312	5,000	250,000	128000	100	90 - 110				
Sulfate	268,000	mg/L	E300.0	1,660	37,500	250,000	0	107	90 - 110				
Lab Sample ID: 1405510-011BMS	Date Analyzed:	06/09/2014 1801h											
Test Code: 300.0-W													
Chloride	52.0	mg/L	E300.0	0.0623	1.00	50.00	0.249	104	90 - 110				
Sulfate	56.2	mg/L	E300.0	0.331	7.50	50.00	0.489	111	90 - 110				[1]
Lab Sample ID: 1405608-006BMS	Date Analyzed:	06/09/2014 1952h											
Test Code: 300.0-W													
Chloride	23,700	mg/L	E300.0	31.2	500	25,000	81.2	94.5	90 - 110				
Sulfate	26,900	mg/L	E300.0	166	3,750	25,000	2890	96.0	90 - 110				
Lab Sample ID: 1405366-001EMS	Date Analyzed:	05/29/2014 1100h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	131	mg/L	SM2320B	1.44	20.0	100.0	28.6	102	80 - 120				
Lab Sample ID: 1405520-027CMS	Date Analyzed:	05/29/2014 1100h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	55.5	mg/L	SM2320B	0.719	10.0	50.00	5.4	100	80 - 120				

[1] - Matrix spike recovery indicates matrix interference. The method is in control as indicated by the LCS.
Reissue of a previously generated report. Information has been added. Information herein supersedes that of the previously issued reports.

All analyses applicable to the CWA, SDWA, and RCRA are performed in accordance to NELAC protocols. Pertinent sampling information is located on the attached COC. Confidential Business Information: This report is provided for the exclusive use of the addressee. Privileges of subsequent use of the name of this company or any member of its staff, or reproduction of this report in connection with the advertisement, promotion or sale of any product or process, or in connection with the re-publication of this report for any purpose other than for the addressee will be granted only on contact. This company accepts no responsibility except for the due performance of inspection and/or analysis in good faith and according to the rules of the trade and of science.

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Kyle F. Gross
Laboratory Director

Jose Rocha
QA Officer

QC SUMMARY REPORT

Client: HDR Engineering
Lab Set ID: 1405520
Project: UPRR WQ / 217879

Contact: Carin Loy
Dept: WC
QC Type: MSD

Analyte	Result	Units	Method	MDL	Reporting Limit	Amount Spiked	Spike Ref. Amount	%REC	Limits	RPD Ref. Amt	% RPD	RPD Limit	Qual
Lab Sample ID: 1406076-001AMSD	Date Analyzed:	06/05/2014 1259h											
Test Code: 300.0-W													
Chloride	5.88	mg/L	E300.0	0.00623	0.100	5.000	0.405	109	90 - 110	5.4	8.53	20	
Sulfate	5.85	mg/L	E300.0	0.0331	0.750	5.000	0.116	115	90 - 110	5.31	9.71	20	[1]
Lab Sample ID: 1405510-001CMSD	Date Analyzed:	06/05/2014 1346h											
Test Code: 300.0-W													
Chloride	405,000	mg/L	E300.0	312	5,000	250,000	128000	111	90 - 110	378000	6.91	20	[1]
Sulfate	295,000	mg/L	E300.0	1,660	37,500	250,000	0	118	90 - 110	268000	9.76	20	[1]
Lab Sample ID: 1405510-011BMSD	Date Analyzed:	06/09/2014 1817h											
Test Code: 300.0-W													
Chloride	51.3	mg/L	E300.0	0.0623	1.00	50.00	0.249	102	90 - 110	52	1.30	20	
Sulfate	53.3	mg/L	E300.0	0.331	7.50	50.00	0.489	106	90 - 110	56.2	5.28	20	
Lab Sample ID: 1405608-006BMSD	Date Analyzed:	06/09/2014 2007h											
Test Code: 300.0-W													
Chloride	25,800	mg/L	E300.0	31.2	500	25,000	81.2	103	90 - 110	23700	8.41	20	
Sulfate	28,900	mg/L	E300.0	166	3,750	25,000	2890	104	90 - 110	26900	7.13	20	
Lab Sample ID: 1405366-001EMSD	Date Analyzed:	05/29/2014 1100h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	129	mg/L	SM2320B	1.44	20.0	100.0	28.6	100	80 - 120	131	1.39	10	
Lab Sample ID: 1405520-027CMSD	Date Analyzed:	05/29/2014 1100h											
Test Code: ALK-W-2320B													
Alkalinity (as CaCO3)	58.2	mg/L	SM2320B	0.719	10.0	50.00	5.4	106	80 - 120	55.5	4.75	10	

[1] - Matrix spike recovery indicates matrix interference. The method is in control as indicated by the LCS.
Reissue of a previously generated report. Information has been added. Information herein supersedes that of the previously issued reports.

All analyses applicable to the CWA, SDWA, and RCRA are performed in accordance to NELAC protocols. Pertinent sampling information is located on the attached COC. Confidential Business Information: This report is provided for the exclusive use of the addressee. Privileges of subsequent use of the name of this company or any member of its staff, or reproduction of this report in connection with the advertisement, promotion or sale of any product or process, or in connection with the re-publication of this report for any purpose other than for the addressee will be granted only on contact. This company accepts no responsibility except for the due performance of inspection and/or analysis in good faith and according to the rules of the trade and of science.

D

American West Analytical Laboratories

REVISED: 7-28-14

Batch QC has been added. MH

WORK ORDER Summary

Work Order: **1405520**

Client: HDR Engineering — Due Date: 6/10/2014

Client ID: HDR200 — **Contact:** Carin Loy

Project: UPRR WQ / 217879 — **QC Level:** II — WO Type: Standard

Comments: Email 2 people. Do not refrigerate per Pat. Samples are on check-in shelf by coolers.;

Sample ID	Client Sample ID	Collected Date	Received Date	Test Code	Matrix	Sel	Storage	
1405520-001A	**8180-1-A**	5/23/2014 1230h	5/27/2014 0924h	**300.0-W**	Aqueous	☑	df - wc	I
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405520-001B				**3005A-ICPMS-PR**		☐	df - metals	
				6010C-W		☑	df - metals	
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405520-002A	**8180-1-B**	5/23/2014 1235h	5/27/2014 0924h	**300.0-W**	Aqueous	☑	df - wc	I
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405520-002B				**3005A-ICPMS-PR**		☐	df - metals	
				6010C-W		☑	df - metals	
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405520-002C				**DO-4500OG**		☐	ww - DO	
1405520-003A	**8180-2-B**	5/23/2014 0955h	5/27/2014 0924h	**300.0-W**	Aqueous	☑	df - wc	I
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405520-003B				**3005A-ICPMS-PR**		☐	df - metals	
				6010C-W		☑	df - metals	
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405520-003C				**DO-4500OG**		☐	ww - DO	
1405520-004A	**8180-2-A**	5/23/2014 1015h	5/27/2014 0924h	**300.0-W**	Aqueous	☑	df - wc	I
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405520-004B				**3005A-ICPMS-PR**		☐	df - metals	

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WORK ORDER Summary

Work Order: **1405520**

Client: HDR Engineering — Due Date: 6/10/2014

Sample ID	Client Sample ID	Collected Date	Received Date	Test Code	Matrix	Sel	Storage	
1405520-004B	**8180-2-A**	5/23/2014 1015h	5/27/2014 0924h	**6010C-W**	Aqueous	☑	df - metals	I
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405520-005A	**8180-5-A**	5/23/2014 1335h	5/27/2014 0924h	**300.0-W**	Aqueous	☑	df - wc	I
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405520-005B				**3005A-ICPMS-PR**		☐	df - metals	
				6010C-W		☑	df - metals	
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405520-006A	**8180-5-B**	5/23/2014 1325h	5/27/2014 0924h	**300.0-W**	Aqueous	☑	df - wc	I
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				
1405520-006B				**3005A-ICPMS-PR**		☐	df - metals	
				6010C-W		☑	df - metals	
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405520-006C				**DO-4500OG**		☐	ww - DO	
1405520-007A	**8180-5-1.5**	5/23/2014 1345h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	
1405520-008A	**8180-5-3.0**	5/23/2014 1345h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	
1405520-009A	**8180-5-4.5**	5/23/2014 1345h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	
1405520-010A	**8180-5-6.0**	5/23/2014 1345h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	
1405520-011A	**8180-5-6.5**	5/23/2014 1235h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	
1405520-012A	**8180-5-7.0**	5/23/2014 1345h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	
1405520-013A	**8180-5-7.5**	5/23/2014 1345h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	
1405520-014A	**8180-1-1.5**	5/23/2014 1235h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	
1405520-015A	**8180-1-3.0**	5/23/2014 1235h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	I
				TDS-W-2540C		☐	df - wc / tds	

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WORK ORDER Summary

Work Order: **1405520**

Client: HDR Engineering

Due Date: 6/10/2014

Sample ID	Client Sample ID	Collected Date	Received Date	Test Code	Matrix	Sel	Storage	
1405520-016A	**8180-1-4.5**	5/23/2014 1235h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-017A	**8180-1-6.0**	5/23/2014 1235h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-018A	**8180-1-6.5**	5/23/2014 1235h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-019A	**8180-1-7.0**	5/23/2014 1235h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-020A	**8180-1-7.0-DUP**	5/23/2014 1235h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-021A	**8180-1-7.5**	5/23/2014 1020h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-022A	**8180-2-1.5**	5/23/2014 1020h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-023A	**8180-2-3.0**	5/23/2014 1020h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-024A	**8180-2-4.5**	5/23/2014 1020h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	ww - df / tds	1
				TDS-W-2540C		☐	ww - df / tds	
1405520-025A	**8180-2-6.0**	5/23/2014 1020h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	ww - df / tds	1
				TDS-W-2540C		☐	ww - df / tds	
1405520-026A	**8180-7.0**	5/23/2014 1630h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	ww - df / tds	1
				TDS-W-2540C		☐	ww - df / tds	
1405520-027A	**8180-EB**	5/23/2014 1630h	5/27/2014 0924h	**DENSITY-2710F**	Aqueous	☐	df - wc / tds	1
				TDS-W-2540C		☐	df - wc / tds	
1405520-027B				**3005A-ICPMS-PR**		☐	df - metals	
				6010C-W		☑	df - metals	
				4 SEL Analytes: CA MG K NA				
				HARD-2340B		☐	df - metals	
1405520-027C				**300.0-W**		☑	df - wc	
				2 SEL Analytes: CL SO4				
				ALK-W-2320B		☑	df - wc	
				1 SEL Analytes: ALK				

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American West Analytical Laboratories

Chain of Custody

Lab Sample Set # 1405520

Page 1 of 3

Client: **HDR, Inc.**
Address: 3949 South 700 East, Ste. 500
Salt Lake City, UT 84107

Project Name: **UPRR WQ**
PO#: **217879**

Contact: **Mike Funk** (billing), **Carin Loy** (sampling)
Phone: Funk - 801-743-7818, Loy - 916-679-8737
Fax :
Email: michael.funk@hdrinc.com, carin.loy@hdrinc.com

QC Level: 1
Turn Around Time: Standard

	Sample ID:	Date Sampled	Time	# of Containers	Sample Matrix	SM 2710F, Density	SM 2540 C, TDS		EPA 300.0, Anions (Cl, SO4)	SM2320 B, Alkalinity	EPA 6010B, Cations (NA, K, Mg, CA)	SM 4500, Dissolved Oxygen	SM 2340 C, Hardness					Comments
1	8180-1-A	5/23/14	12:30	1	A				X	X								Please email sample results to Carin Loy carin.loy@hdrinc.com
2	↓	↓	↓	1	A						X		X					
3	8180-1-B	5/23/14	12:35	1	A				X	X								
4	↓	↓	↓	1	↓						X		X					
5	↓	↓	↓	1	↓							X						
6	8180-2-B	5/23/14	09:55	1	1				X	X								For sample collection questions please contact Charles Vertucci charles.vertucci@hdrinc.com
7	↓	↓	↓	↓	↓						X		X					
8	↓	↓	↓	↓	↓							X						
9	8180-2-A	5/23	10:16	1	A				X	X								
10	↓	↓	↓	1	A						X		X					
11	8180-5-A	5/23	13:35	1	A				X	X								Do not refrigerate per Pat - DB 5/27/14
12	~~8180-5-B~~ ↓	↓	↓	1	A						X		X					
13	8180-5-B		13:25	1	A				X	X								
14											X		X					
15		↓	↓	↓	↓							X						

Special Instructions:

Relinquished by: *Signature*	Date: 5/27/14	Received by: *Signature*	Date: 5/27/14
Print Name Nate Nichols	Time: 09:24	*Print Name* Denise Brown	Time: 9:24
Relinquished by: *Signature*	Date:	Received by: *Signature*	Date:
Print Name	Time:	*Print Name*	Time:

American West Analytical Laboratories

Chain of Custody

Lab Sample Set # 1405520

Client: **HDR, Inc.**
Address: 3949 South 700 East, Ste. 500
Salt Lake City, UT 84107

Contact: **Mike Funk** (billing), **Carin Loy** (sampling)
Phone: Funk - 801-743-7818, Loy - 916-679-8737
Fax :
Email: michael.funk@hdrinc.com, carin.loy@hdrinc.com

Page 2 of 3
QC Level: 1
Turn Around Time: Standard

Project Name: **UPRR WQ**
PO#: **217879**

	Sample ID:	Date Sampled	Time	# of Containers	Sample Matrix	SM 2710F, Density	SM 2540 C, TDS	EPA 300.0, Anions (Cl, SO4)	SM2320 B, Alkalinity	EPA 6010B, Cations (NA, K, Mg, CA)	SM 4500, Dissolved Oxygen	SM 2340 C, Hardness				Comments
1	8180-5-1.5	5/23/14	13:45	1	A	X	X									Please email sample results to Carin Loy carin.loy@hdrinc.com
2	8180-5-3.0															
3	8180-5-4.5															
4	" " 6.0															
5	6.5															
6	7.0															For sample collection questions please contact Charles Vertucci charles.vertucci@hdrinc.com
7	7.5															
8	8181-1-1.5	5/23/14	12:35			X	X									
9	" " 3.0															
10	-4.5															
11	-6.0															
12	-6.5															
13	-7.0															
14	-7.0-DUP															
15	-7.5															

Special Instructions:

Relinquished by: Signature	Date: 5/27/14	Received by: Signature Denise Bruun	Date: 5/27/14
Print Name Nate Nichols	Time: 0925	Print Name Denise Bruun	Time: 9:25
Relinquished by: Signature	Date:	Received by: Signature	Date:
Print Name	Time:	Print Name	Time:

American West Analytical Laboratories

Chain of Custody

Lab Sample Set # 1405520

Client: **HDR, Inc.**
Address: 3949 South 700 East, Ste. 500
Salt Lake City, UT 84107

Contact: **Mike Funk** (billing), **Carin Loy** (sampling)
Phone: Funk - 801-743-7818, Loy - 916-679-8737
Fax :
Email: michael.funk@hdrinc.com, carin.loy@hdrinc.com

Page 3 of 3
QC Level: 1
Turn Around Time: Standard

Project Name: **UPRR WQ**
PO#: **217879**

	Sample ID:	Date Sampled	Time	# of Containers	Sample Matrix	SM 2710F, Density	SM 2540 C, TDS	EPA 300.0, Anions (Cl, SO4)	SM2320 B, Alkalinity	EPA 6010B, Cations (NA, K, Mg, CA)	SM 4500, Dissolved Oxygen	SM 2340 C, Hardness				Comments
1	8180-2-1.5	5/23/14	10:20	1	A	X	X									Please email sample results to Carin Loy carin.loy@hdrinc.com
2	" " 3.0															
3	-4.5															
4	-6.0															
5	-7.0															
6	8181-EB	5/23/14	16:30	1	A	X	X									For sample collection questions please contact Charles Vertucci charles.vertucci@hdrinc.com
7										X		X				
8								X	X							
9																
10																
11																
12																
13																
14																
15																

Special Instructions:

Relinquished by: Signature	Date: 5/27/14	Received by: Signature Denise Bruun	Date: 5/27/14
Print Name Nate Nichols	Time: 09:25	Print Name Denise Bruun	Time: 9:25
Relinquished by: Signature	Date:	Received by: Signature	Date:
Print Name	Time:	Print Name	Time:

Lab Set ID: 1405520

Preservation Check Sheet

Sample Set Extension and pH

Analysis	Preservative	-001	-002	-003	-004	-005	-006	-027										
Ammonia	pH <2 H_2SO_4																	
COD	pH <2 H_2SO_4																	
Cyanide	pH >12 NaOH																	
Metals	pH <2 HNO_3	yes	yes	yes	yes	yes	yes	yes										
NO_2 & NO_3	pH <2 H_2SO_4																	
O & G	pH <2 HCL																	
Phenols	pH <2 H_2SO_4																	
Sulfide	pH > 9NaOH, Zn Acetate																	
TKN	pH <2 H_2SO_4																	
T PO_4	pH <2 H_2SO_4																	

Procedure:

1) Pour a small amount of sample in the sample lid
2) Pour sample from **Lid** gently over wide range pH paper
3) **Do Not** dip the pH paper in the sample bottle or lid
4) If sample is not preserved, properly list its extension and receiving pH in the appropriate column above
5) Flag COC, notify client if requested
6) Place client conversation on COC
7) Samples may be adjusted

Frequency: All samples requiring preservation

* The sample required additional preservative upon receipt.

\+ The sample was received unpreserved

▲ The Sample was received unpreserved and therefore preserved upon receipt.

\# The sample pH was unadjustable to a pH < 2 due to the sample matrix

• The sample pH was unadjustable to a pH > ____ due to the sample matrix interference

APPENDIX H

Standard Operating Procedure for Specific Gravity Determinations Using a Hydrometer

Designation: D 1429 – 08

Standard Test Methods for Specific Gravity of Water and Brine[1]

This standard is issued under the fixed designation D 1429; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods cover the determination of the specific gravity of water and brine free of separable oil, as follows:

	Sections
Test Method A—Pycnometer	7 to 11, 21
Test Method B—Balance	12 to 16, 21
Test Method C—Erlenmeyer Flask	17 to 21
Test Method D—Hydrometer	22 to 27

1.2 Test Methods A and B are applicable to clear waters or those containing only a moderate amount of particulate matter. Test Method B is preferred for samples of sea water or brines and is more sensitive than Test Method D which has the same general application. Test Method C is intended for samples of water containing mud or sludge.

1.3 It is the user's responsibility to ensure the validity of these test methods for waters of untested matrices.

1.4 The test method was tested at 22°C over a range, shown in Tables 1-4, of 1.0252 through 1.2299; all data were corrected to 15.6°C (60°F).

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 1066 Practice for Sampling Steam
D 1129 Terminology Relating to Water
D 1193 Specification for Reagent Water
D 2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water
D 3370 Practices for Sampling Water from Closed Conduits
D 5847 Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis
E 1 Specification for ASTM Liquid-in-Glass Thermometers

3. Terminology

3.1 *Definitions:*

3.1.1 *brine*—water that contains dissolved matter at an approximate concentration of more than 30 000 mg/L.

3.1.2 For definitions of terms used in these test methods, refer to Terminology D 1129.

4. Significance and Use

4.1 Specific gravity is an important property of fluids being related to density and viscosity. Knowing the specific gravity will allow determination of a fluid's characteristics compared to a standard, usually water, at a specified temperature. This will allow the user to determine if the test fluid will be heavier or lighter than the standard fluid.

5. Reagents

5.1 *Purity of Water*—Unless otherwise indicated, reference to water shall be understood to mean reagent water conforming to Specification D 1193, Type I. Other reagent water types may be used provided it is first ascertained that the water is of sufficiently high purity to permit its use without adversely affecting the precision and bias of the test method. Type III water was specified at the time of round robin testing of this test method.

6. Sampling

6.1 Collect the samples in accordance with Practices D 3370 and Practice D 1066.

6.2 In view of the lack of a standard test method for sampling mud or sludge, no instructions are given for sampling this type of material.

TEST METHOD A—PYCNOMETER

7. Summary of Test Method

7.1 The sample is introduced into a pycnometer, stabilized at the desired temperature, and weighed. The specific gravity is calculated from this weight and the previously determined

[1] These test methods are under the jurisdiction of ASTM Committee D19 on Water and are the direct responsibility of Subcommittee D19.05 on Inorganic Constituents in Water.

Current edition approved Nov. 15, 2008. Published November 2008. Originally approved in 1956. Last previous edition approved in 2003 as D 1429 – 2003.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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weight of reagent water that is required to fill the pycnometer at the same temperature.

8. Apparatus

8.1 *Bath*—Constant-temperature bath designed to maintain a temperature of 15.6 ± 1°C (60 ± 1.8°F). If any other temperature must be used due to local conditions, appropriate corrections shall be made.

8.2 *Pycnometer*—Cylindrical or conical glass vessel carefully ground to receive an accurately fitting 24/12 standard taper glass stopper provided with a hole approximately 1.0 to 2.0 mm in diameter, centrally located in reference to the vertical axis. The top surface of the stopper shall be smooth and substantially plane, and the lower surface shall be concave in order to allow all air to escape through the bore. The height of the concave section shall be approximately 5 mm at the center. The stoppered pycnometer shall have a capacity of about 24 to 30 mL, and shall weigh not more than 40 g. Suitable pycnometers are shown in Fig. 1.

TABLE 1 Determination of Bias, Pycnometer Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	± %Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0262	−0.049	yes
1.0648	1.0665	+ 0.16	yes
1.1100	1.1119	+ 0.17	yes
1.2299	1.2235	−0.52	yes

TABLE 2 Determination of Bias, Balance Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	± %Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0264	−0.166	yes
1.0648	1.0657	+ 0.084	yes
1.1100	1.1126	+ 0.234	yes
1.2299	1.2233	−0.539	yes

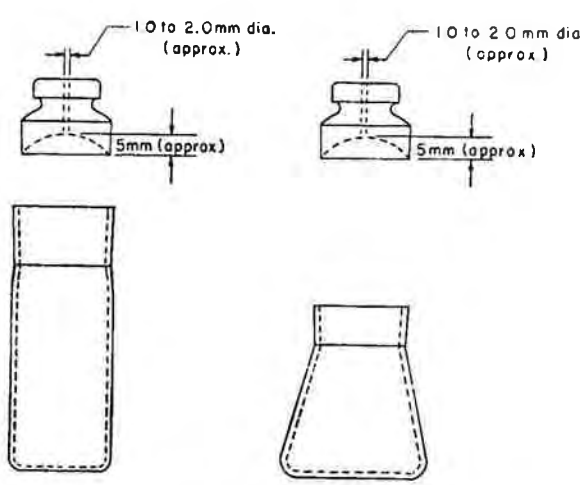

FIG. 1 Suitable Pycnometers

TABLE 3 Determination of Bias, Erlenmeyer Flask Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	± %Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.026	+ 0.126	yes
1.0648	1.066	+ 0.169	yes
1.1100	1.1121	+ 0.74	no
1.2299	1.2225	−0.60	yes

TABLE 4 Determination of Bias, Hydrometer Method

Calculated Specific Gravity	Specific Gravity Experimentally Determined	± %Bias	Statistically Significant (95 % Confidence Level)
1.0247	1.0256	+ 0.088	no
1.0648	1.0647	−0.099	no
1.1100	1.1106	+ 0.054	no
1.2299	1.2207	−0.74	yes

8.3 *Thermometer*—An ASTM Gravity Thermometer having a range from − 20 to + 102°C or − 5 to + 215°F, as specified, and conforming to the requirements for Thermometer 12C or 12F, respectively, as prescribed in Specification E 1.

9. Procedure

9.1 Weigh a clean, dry, calibrated pycnometer, complete with stopper, on an analytical balance, and record this weight to the nearest 0.1 mg, as *P*.

9.2 Remove the stopper and fill the pycnometer with recently boiled reagent water that has been cooled to room temperature, to within several millimetres of the top. Remove the air bubbles. Immerse the unstoppered pycnometer up to the neck in a constant-temperature bath maintained at 15.6 ± 1°C (60 ± 1.8°F). Allow the pycnometer to remain in the bath for a period of time sufficient to establish temperature equilibrium. Twenty minutes is usually sufficient.

9.3 After temperature equilibrium has been established, and before removing from the bath, firmly insert the stopper and remove the excess water from the top of the stopper, taking care to leave the capillary filled. Remove the stoppered pycnometer from the bath and wipe it dry. Immediately weigh the pycnometer, and record this weight to the nearest 0.1 mg, as *W*.

9.4 Empty the reagent water from the pycnometer and dry, or rinse with the sample to be tested.

9.5 Using the sample to be tested, repeat the procedure in accordance with 9.2 and 9.3, recording the weight of the pycnometer containing the sample under test as *S*.

10. Calculation

10.1 Calculate the specific gravity of the sample as follows:

$$\text{Specific gravity} = (S-P)/(W-P)$$

where:

P = weight of the empty pycnometer,
S = weight of the pycnometer and contained sample, and
W = weight of the pycnometer and contained reagent water.

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11. Precision and Bias

11.1 The overall precision (S_t) and single operator precision (S_o) of this test method within their designated ranges vary with quantity being tested in accordance with Fig. 2.

11.2 The bias for this test method, shown in Table 1, was determined from the measurement of a known specific gravity in prepared standards by six laboratories in triplicate for four known specific gravity levels. The known specific gravity range covered was 1.0247 to 1.2299.

11.3 Precision and bias for this test method conforms to Practice D 2777 – 77, which was in place at the time of collaborative testing. Under the allowances made in 1.4 of Practice D 2777 – 06, these precision and bias data do meet existing requirements for interlaboratory studies of Committee D19 test methods.

TEST METHOD B—BALANCE

12. Summary of Test Method

12.1 The specific gravity balance is essentially an analytical balance which uses a plummet to determine the weight of a liquid by displacement. The plummet is calibrated in a standard liquid, usually reagent water, before the determination is made. Any oil present in the sample will interfere with this determination; therefore, only freshly filtered samples should be used.

13. Apparatus

13.1 *Specific Gravity Balance*—A Westphal-type balance or any of several accurate specific gravity balances may be used.

14. Procedure

14.1 Locate the specific gravity balance in a draft-free enclosure. Clean the plummet by immersion in distilled water followed by acetone. Dry with air or a lint-free tissue. Calibrate the plummet by determining its difference in weight in air and in reagent water at 15.6 ± 1°C (60 ± 1.8°F); record this displacement as d_1.

14.2 Immerse the plummet in the sample, which has a stabilized temperature of 15.6 ± 1°C (60 ± 1.8°F). Make certain that the plummet does not touch the bottom or the sides of the container. The liquid displacement, d_2, is the difference between the weight necessary to counterpoise the dry plummet in air and that necessary when the plummet is immersed in the liquid samples.

15. Calculation

15.1 Calculate the specific gravity of the sample as follows:

$$\text{Specific gravity} = \frac{d_2}{d_1}$$

where:

d_1 = difference in weight in air and in reagent water, and
d_2 = difference in weight in air and in the sample.

16. Precision and Bias

16.1 The overall precision (S_t) and single operator precision (S_o) of this test method within their designated ranges vary with quantity being tested in accordance with Fig. 3.

16.2 The bias data for this test method, shown in Table 2, was determined from the measurement of a known specific gravity in prepared standards by five laboratories in triplicate for four known specific gravity levels. The known specific gravity range covered was 1.0247 to 1.2299.

16.3 Precision and bias for this test method conforms to Practice D 2777 – 77, which was in place at the time of collaborative testing. Under the allowances made in 1.4 of

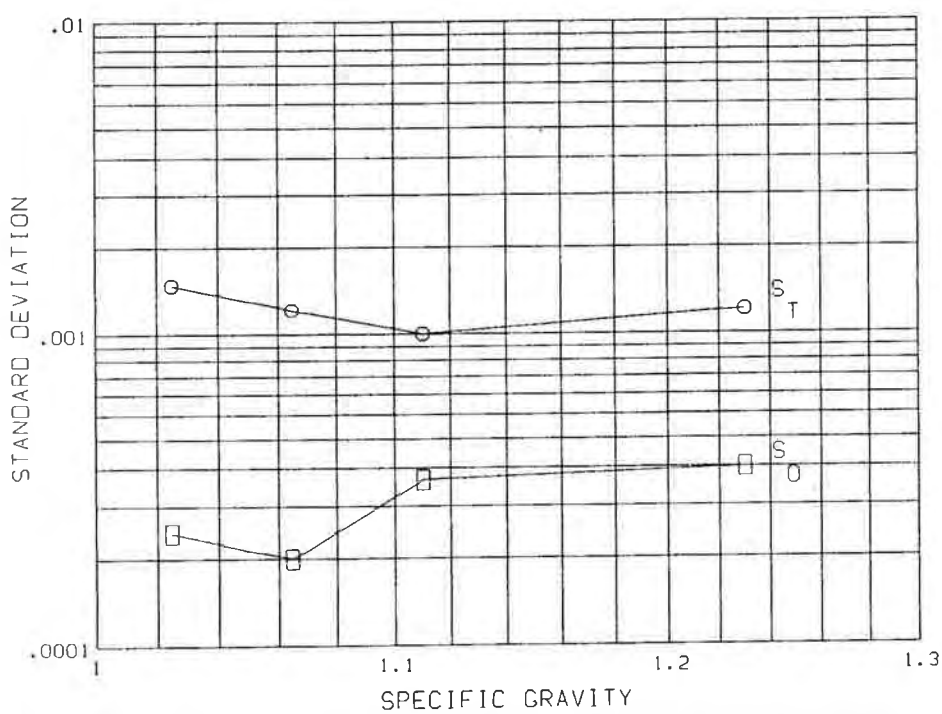

FIG. 2 Interlaboratory Precision for Specific Gravity of Brines by Pycnometer Method

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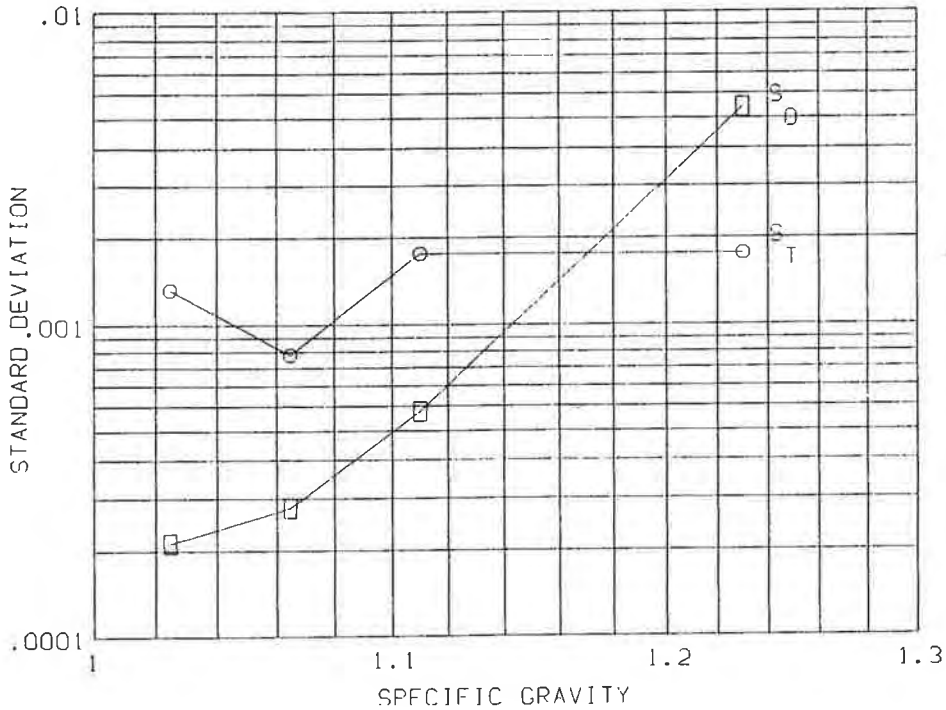

FIG. 3 Interlaboratory Precision for Specific Gravity of Brines by Balance Method

Practice D 2777 – 06, these precision and bias data do meet existing requirements for interlaboratory studies of Committee D19 test methods.

TEST METHOD C—ERLENMEYER FLASK

17. Summary of Test Method

17.1 The sample of mud or sludge is thoroughly stirred and poured into a wide-mouth Erlenmeyer flask until it is somewhat more than level full, the excess being struck off with a spatula blade. The specific gravity is calculated from this weight and the previously determined weight of water required to fill the flask completely.

17.2 If the sample is of a plastic solid consistency, the flask is partly filled with the sample and weighed. Water is then added to fill the flask completely, and the total weight is taken. The specific gravity is calculated from the weight of the volume of water displaced by the sample.

18. Procedure

18.1 Clean, dry, and weigh the Erlenmeyer flask to the nearest 0.1 g, and record this weight as *F*.

18.2 Fill the flask with reagent water or tap water. Both flask and water shall be at temperature equilibrium. Weigh the filled flask and record this weight as *W*. Empty and dry the flask.

18.3 If the sample flows readily, fill the flask completely with the sample, leveling the upper surface with a flat-bladed spatula held at an angle of 45° with the rim of the flask. Weigh, and record this weight as *S*.

18.4 Mix the sample thoroughly by stirring, but do not shake. If the sample does not flow readily, add sufficient sample to approximately half fill the flask, without exerting pressure, and weigh. Record the weight of the flask and sample as *R*. Fill the flask containing the sample completely with reagent water or tap water, whichever was used in accordance with 18.2, taking care to remove all entrained air bubbles, and weigh again. Record this weight at *T*.

19. Calculation

19.1 In the case of free-flowing samples, calculate the specific gravity of the sample as follows:

$$\text{Specific gravity} = \frac{(S - F)}{(W - F)}$$

where:

F = weight of the empty flask,
S = weight of the flask completely filled with sample, and
W = weight of the flask and contained water.

19.2 In the case of samples that do not flow readily, calculate the specific gravity of the sample as follows:

$$\text{Specific gravity} = \frac{(R - F)}{(W - F) - (T - R)}$$

where:

F = weight of the empty flask,
R = weight of the flask partly filled with sample,
T = weight of the flask partly filled with sample, plus water added to fill remaining volume, and
W = weight of the flask and contained water.

20. Precision and Bias

20.1 The overall precision (S_t) and single operator precision (S_o) of this test method within their designated ranges vary with quantity being tested in accordance with Fig. 4.

20.2 The bias data for this test method, shown in Table 3, was determined from the measurement of a known specific gravity in prepared standards by six laboratories in triplicate

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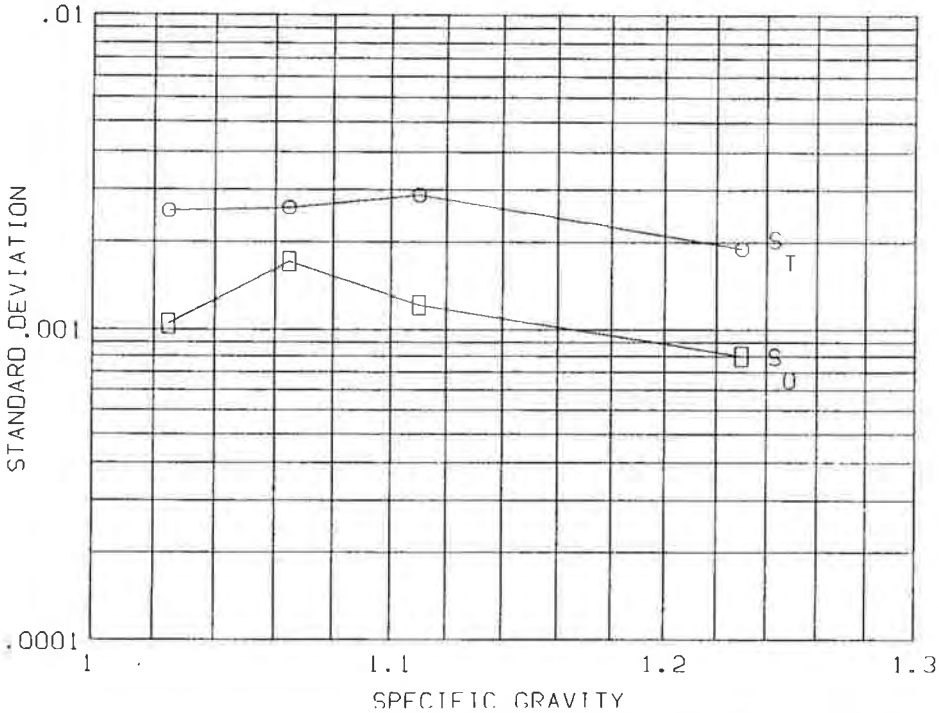

FIG. 4 Interlaboratory Precision for Specific Gravity of Brines by Erlenmeyer Flask Method

for four known specific gravity levels. The known specific gravity range covered was 1.0247 to 1.2299.

20.3 Precision and bias for this test method conforms to Practice D 2777 – 77, which was in place at the time of collaborative testing. Under the allowances made in 1.4 of Practice D 2777 – 06, these precision and bias data do meet existing requirements for interlaboratory studies of Committee D19 test methods.

21. Quality Control

21.1 In order to be certain that analytical values obtained using these test methods are valid and accurate within the confidence limits of the test, the following QC procedures must be followed when analyzing specific gravity.

21.2 *Calibration and Calibration Verification*

21.2.1 Verify the balance calibration by weighing a weight at several weight limits.

21.3 *Initial Demonstration of Laboratory Capability*

21.3.1 If a laboratory has not performed the test before, or if there has been a major change in the measurement system, for example, new analyst, and so forth, a precision and bias study must be performed to demonstrate laboratory capability.

21.3.2 Analyze seven replicates of a solution with a known specific gravity. Each replicate must be taken through the complete analytical test method. The replicates may be interspersed with samples.

21.3.3 Calculate the mean and standard deviation of the seven values and compare to the acceptable ranges of bias in sections 11.1, 16.1, and 20.1. This study should be repeated until the recoveries are within the limits given in sections 11.1, 16.1, and 20.1. If an amount other than the recommended amount is used, refer to Practice D5847 for information on applying the F test and t test in evaluating the acceptability of the mean and standard deviation.

21.4 *Laboratory Control Sample (LCS)*

21.4.1 To ensure that the test method is in control, analyze a LCS having a known specific gravity with each batch or ten samples. If large numbers of samples are analyzed in the batch, analyze the LCS after every ten samples. The LCS must be taken through all of the steps of the analytical method. The result obtained for the LCS shall fall within ±15 % of the known specific gravity.

21.4.2 If the result is not within these limits, analysis of samples is halted until the problem is corrected, and either all the samples in the batch must be reanalyzed, or the results must be qualified with an indication that they do not fall within the performance criteria of the test method.

21.5 *Method Blank*

21.5.1 Analyze a reagent water blank with each batch.

21.6 *Matrix Spike (MS)*

21.6.1 Specific gravity is not an analyte that can be feasibly spiked into samples.

21.7 *Duplicate*

21.7.1 To check the precision of sample analyses, analyze a sample in duplicate with each batch. The value obtained must fall within the control limits established by the laboratory.

21.7.2 Calculate the standard deviation of the duplicate values and compare to the precision in the collaborative study using an F test. Refer to 6.4.4 of Practice D 5847 for information on applying the F test.

21.7.3 If the result exceeds the precision limit, the batch must be reanalyzed or the results must be qualified with an indication that they do not fall within the performance criteria of the test method.

21.8 Independent Reference Material (IRM)

21.8.1 In order to verify the quantitative value produced by the test method, analyze an Independent Reference Material

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(IRM) submitted as a regular sample (if practical) to the laboratory at least once per quarter. The specific gravity of the IRM should be within the control limits established by the laboratory.

TEST METHOD D—HYDROMETER

22. Summary of Test Method

22.1 The hydrometer is a weighted bulb with a graduated stem. The depth to which the hydrometer sinks in a fluid is determined by the density of the fluid. The specific gravity is read directly from the graduated stem. Any oil present in the sample will interfere with the determination; therefore, only freshly filtered samples should be used.

23. Apparatus

23.1 *Hydrometer*—A set of glass hydrometers (equipped with built-in thermometers) covering the range of specific gravities encountered in water and brine analyses. Graduations should not be greater than 0.002.

23.2 *Hydrometer Cylinder* of clear glass, or plastic. For convenience in pouring, the cylinder may have a lip on the rim. The inside diameter of the cylinder shall be at least 25 mm greater than the outside diameter of the hydrometer used. The height of the cylinder shall be such that the hydrometer floats in the sample with at least 25-mm clearance between the bottom of the hydrometer and the bottom of the cylinder.

24. Procedure

24.1 Fill the cylinder with the sample and carefully immerse the hydrometer. The hydrometer must float freely and not touch the sides of the cylinder. Allow the hydrometer to remain in the sample 5 min or until the thermometer establishes equilibrium. Read and record the specific gravity and temperature directly from the hydrometer.

25. Calculation for Correction to 60°F

25.1 The specific gravity may be corrected to 60/60°F by adding 0.0002 for each degree above 60°F. An example is as follows:

Specific gravity at 79°F	1.1225
Correction = (79– 60) 0.0002 =	+ 0.0038
Specific gravity at 60°F	1.1263

26. Precision and Bias

26.1 The overall precision (S_t) and single operator precision (S_o) of this test method within their designated ranges vary with quantity being tested in accordance with Fig. 5.

26.2 The bias data for this test method, shown in Table 4, was determined from the measurement of a known specific gravity in prepared standards by six laboratories in triplicate for four known specific gravity levels. The known specific gravity range covered was 1.0247 to 1.2299.

26.3 Precision and bias for this test method conforms to Practice D 2777 – 77, which was in place at the time of collaborative testing. Under the allowances made in 1.4 of Practice D 2777 – 06, these precision and bias data do meet existing requirements for interlaboratory studies of Committee D19 test methods.

27. Quality Control

27.1 In order to be certain that analytical values obtained using these test methods are valid and accurate within the confidence limits of the test, the following QC procedures must be followed when analyzing specific gravity.

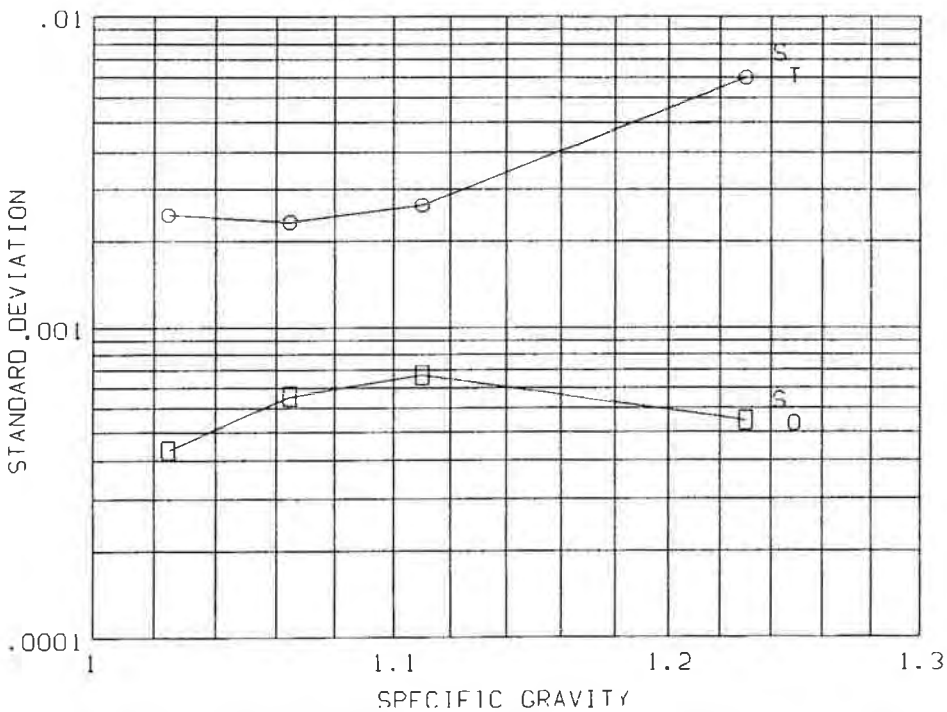

FIG. 5 Interlaboratory Precision for Specific Gravity of Brines by Hydrometer Method

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27.2 *Calibration and Calibration Verification*

27.2.1 Verify the hydrometer by determining the specific gravity on a sample with a known specific gravity.

27.3 *Initial Demonstration of Laboratory Capability*

27.3.1 If a laboratory has not performed the test before, or if there has been a major change in the measurement system, for example, new analyst, and so forth, a precision and bias study must be performed to demonstrate laboratory capability.

27.3.2 Analyze seven replicates of a solution with a known specific gravity. Each replicate must be taken through the complete analytical test method. The replicates may be interspersed with samples.

27.3.3 Calculate the mean and standard deviation of the seven values and compare to the acceptable ranges of bias in section 26.1. This study should be repeated until the recoveries are within the limits given in section 26.1. If an amount other than the recommended amount is used, refer to Practice D5847 for information on applying the F test and t test in evaluating the acceptability of the mean and standard deviation.

27.4 *Laboratory Control Sample (LCS)*

27.4.1 To ensure that the test method is in control, analyze a LCS having a known specific gravity with each batch or ten samples. If large numbers of samples are analyzed in the batch, analyze the LCS after every ten samples. The LCS must be taken through all of the steps of the analytical method. The result obtained for the LCS shall fall within ± 15 % of the known specific gravity.

27.4.2 If the result is not within these limits, analysis of samples is halted until the problem is corrected, and either all the samples in the batch must be reanalyzed, or the results must be qualified with an indication that they do not fall within the performance criteria of the test method.

27.5 *Method Blank*

27.5.1 Analyze a reagent water blank with each batch.

27.6 *Matrix Spike (MS)*

27.6.1 Specific gravity is not an analyte that can be feasibly spiked into samples.

27.7 Duplicate

27.7.1 To check the precision of sample analyses, analyze a sample in duplicate with each batch. The value obtained must fall within the control limits established by the laboratory.

27.7.2 Calculate the standard deviation of the duplicate values and compare to the precision in the collaborative study using an F test. Refer to 6.4.4 of Practice D 5847 for information on applying the F test.

27.7.3 If the result exceeds the precision limit, the batch must be reanalyzed or the results must be qualified with an indication that they do not fall within the performance criteria of the test method.

27.8 *Independent Reference Material (IRM)*

27.8.1 In order to verify the quantitative value produced by the test method, analyze an Independent Reference Material (IRM) submitted as a regular sample (if practical) to the laboratory at least once per quarter. The specific gravity of the IRM should be within the control limits established by the laboratory.

28. Keywords

28.1 brine; hydrometer; pycnometer; specific gravity

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