LMS/RVT/S09799

2012 Enhanced Characterization and Monitoring Report Riverton, Wyoming, Processing Site

June 2013

U.S. DEPARTMENT OF ENERGY | Legacy Management

LMS/RVT/S09799

2012 Enhanced Characterization and Monitoring Report
Riverton, Wyoming, Processing Site

June 2013

Contents

Figures

Tables

Appendixes

Abbreviations

ASW	artificial site water
AWSS	alternate water supply system
bgs	below ground surface
cfs	cubic feet per second
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	foot
ft/s	feet per second
g	grams
GCAP	Groundwater Compliance Action Plan
GV	Groundwater Vistas
IC	institutional control
K_d	distribution coefficient
LM	Office of Legacy Management
LTMP	*Long-Term Management Plan for the Riverton, Wyoming, Processing Site*
MCL	maximum concentration limit
µg/g	micrograms per gram
mg/L	milligrams per liter
mL	milliliters
mL/g	milliliters per gram
mL/min	milliliters per minute
mm	millimeters
NRC	U.S. Nuclear Regulatory Commission
pCi/L	picocuries per liter
PD	percent difference
SOWP	Site Observational Work Plan
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act

This page intentionally left blank

Executive Summary

Verification monitoring in 2012 at the Riverton, Wyoming, Processing Site involved routine sampling of groundwater, surface water, and domestic wells, and a flushing and monitoring program of the alternate water supply system that was reinstituted in late 2011. Concentrations of uranium and molybdenum at the site remained above their respective groundwater standards in surficial aquifer wells; however, concentrations in 2012 decreased to near 2009 levels after spiking following the 2010 flood of the Little Wind River. Sampling results from domestic wells continued to indicate no impact from site-related contaminants, and the flushing program for the alternate water supply system was effective in controlling the buildup of radionuclides in the system.

An enhanced characterization of the surficial aquifer was conducted in 2012, which included installation of 103 boreholes along 9 transects with a Geoprobe, collection of 103 water samples and 65 soil samples, laboratory tests on the soil samples, and additional groundwater modeling. Analysis of groundwater samples resulted in a better understanding of the size and shape of contaminant plumes for manganese, molybdenum, sulfate, and uranium. Laboratory soil testing indicated that there is uranium in the soils above the water table that can be mobilized by flood events; however, the concentration of uranium in unsaturated zone samples alone does not appear to be high enough to have caused the spikes observed in the groundwater after the 2010 flood.

Several types of information, including uranium mobilized by flood events, current plume size and concentration, groundwater modeling results, historical data, and experience at other Uranium Mill Tailings Radiation Control Act (UMTRCA) sites, indicates natural flushing of the surficial aquifer is occurring at the Riverton site, but the rate at which it is occurring might not meet the 100-year regulatory time frame. Additional information will be needed and additional work conducted to gain a better understanding of the site before a final decision can be made regarding the natural flushing compliance strategy or before a selection of an alternate compliance strategy can be made.

This page intentionally left blank

1.0 Introduction

This Riverton, Wyoming, Processing Site enhanced characterization and monitoring report does the following: presents data collected during calendar year 2012, presents and evaluates enhanced characterization efforts to update the site conceptual model, provides an update on the natural flushing compliance strategy, and provides recommendations for future work. Data from 2012 were generated from two routine groundwater and surface water sampling events conducted at the Riverton site during June and December, an enhanced characterization effort with the field investigation conducted in August, a flushing event of the alternate water supply system (AWSS) conducted in October, and soils testing and groundwater modeling in the fall and winter.

2.0 Verification Monitoring

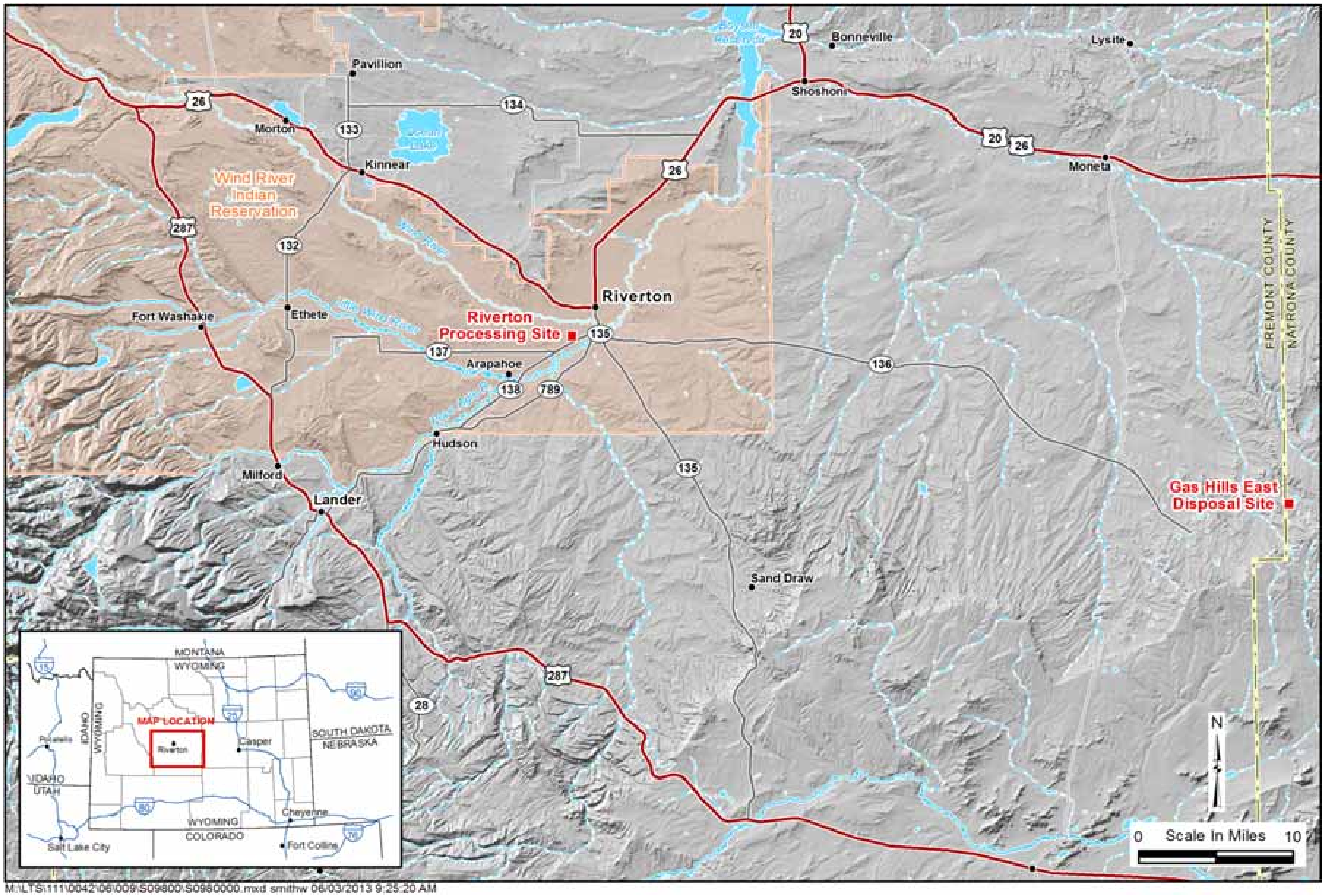
The compliance strategy for the Riverton site is natural flushing in conjunction with institutional controls (ICs) (DOE 1998a). Monitoring required during the natural flushing period is referred to as verification monitoring because the purpose of the monitoring is to verify that the natural flushing strategy is progressing as predicted, and to verify that ICs are in place and functioning as intended. Data collected during verification monitoring are reported annually in a Verification Monitoring Report. These reports have been issued annually since 2001, and the reports from 2005 to 2011can be found on the U. S. Department of Energy's (DOE) Office of Legacy Management (LM) website at http://www.lm.doe.gov/Riverton/Sites.aspx. All water quality data for the Riverton site are archived in the LM's environmental database in Grand Junction, Colorado. Water quality data also are available for viewing with dynamic mapping via the Geospatial Environmental Mapping System (GEMS) website at http://gems.lm.doe.gov/imf/sites/gems_continental_us/jsp/launch.jsp.

The monitoring program at the Riverton site is specified in the *Long-Term Management Plan for the Riverton, Wyoming, Processing Site* (LTMP) (DOE 2009).

2.1 Site Conditions

2.1.1 Uranium Mill Tailings Remedial Action (UMTRA) Site and Surface Remediation

A uranium and vanadium-ore-processing mill operated from1958 to 1963 at the Riverton site. A tailings pile covered about 72 acres of the 140-acre site. In 1988 and 1989, the tailings pile was excavated down to an average depth of 4 feet (ft) below ground surface (bgs) based on a radium-226 soil standard. Surface remediation activities resulted in removal of about 1.8 million cubic yards of tailings and associated materials from the site, which were encapsulated at the Gas Hills East, Wyoming, Disposal Site (Figure 1) (DOE 1998b). Soils at and below the water table with elevated thorium-230 concentrations were left in place on portions of the former mill site by applying supplemental standards. An easement and covenant to restrict land use on the former mill site is in place to prevent exposure to and disturbance of the supplemental-standard areas.



M:\LTS\111\0042\06\009\S09800\S0980000.mxd smithw 06/03/2013 9:25:20 AM

Figure 1. Site Location Map

2.1.2 Hydrogeology

The Riverton site is located on an alluvial terrace between the Wind River and the Little Wind River approximately 2.3 miles southwest of the town of Riverton, Wyoming (Figure 1). Groundwater is in three aquifers beneath the site: (1) a surficial unconfined aquifer (surficial aquifer), (2) a middle semiconfined aquifer, and (3) a deeper confined aquifer (DOE 1998b). The surficial aquifer consists of approximately 15 to 20 ft of unconsolidated alluvial material; the semiconfined and confined aquifers are composed of shales and sandstones of the upper units of the Eocene Wind River Formation, which is over 500 ft thick in the vicinity of the site. Depth to groundwater in the surficial aquifer is generally less than 10 ft bgs. For compliance purposes, the surficial aquifer and semiconfined aquifer comprise the uppermost aquifer, which is the aquifer where compliance with groundwater standards is assessed. Groundwater in the uppermost aquifer flows to the southeast.

Because the Riverton site is located on an alluvial terrace between the Wind River and the Little Wind River, site conditions have been influenced by periodic flooding of these rivers. Influence of river flooding on site conditions includes the following: formation of an oxbow lake in 1995; spikes in groundwater contaminant concentrations; high groundwater levels leaving contaminants in the unsaturated zone; and high groundwater levels that leached contaminants from the former tailings pile (White et al.1984). Significant floods of the Little Wind River that likely affected the site occurred in 1963, 1965, 1967, 1983, 1991, 1995, and 2010 when peak river discharge was greater than 8,000 cubic feet per second (cfs) (USGS 2012a). Significant floods of the Wind River that likely affected the site occurred in 1963, 1967, 1971, 1991, 1997, 1999, and 2011 when peak stream discharge was greater than 8,000 cfs (USGS 2012b). Discharge data and flood data from the Little Wind River are presented in Section 2.3.2.1.

2.1.3 Water Quality

Shallow groundwater beneath and downgradient from the site was contaminated as a result of uranium-processing activities from 1958 through 1963 (DOE 1998b). Contaminants of potential concern (COPCs) in the groundwater beneath the Riverton site are manganese, molybdenum, sulfate, and uranium. COPCs were selected using a screening process that compared contaminant concentrations with the maximum concentration limits (MCLs) in Title 40 *Code of Federal Regulations* Part 192 (40 CFR 192), as appropriate, and evaluated potential human health risks and ecological risks. (Note: The MCLs discussed in this document are not the same as the maximum contaminant levels that the U.S. Environmental Protection Agency (EPA) sets as drinking water standards.) The COPC-selection process is detailed in the *Environmental Assessment of Ground Water Compliance at the Riverton, Wyoming, Uranium Mill Tailings Site* (DOE 1998c). Molybdenum and uranium were selected as indicator contaminants for compliance monitoring in the *Final Ground Water Compliance Action Plan for the Riverton, Wyoming, Title I UMTRA Project Site* (DOE 1998a). These contaminants were selected as indicator contaminants because they are the most widely distributed and because they form significant aqueous plumes in the uppermost aquifer in the vicinity of the site. The MCLs for molybdenum and uranium are 0.10 milligram per liter (mg/L) and 30 picocuries per liter (pCi/L), respectively.

In order to provide a consistent comparison with historical data, uranium concentrations continue to be measured in mg/L; therefore, the uranium standard referenced in this report has been converted from 30 pCi/L to 0.044 mg/L (which assumes secular equilibrium of uranium isotopes) to allow direct comparison of uranium data to the standard.

2.1.4 Institutional Controls

To protect human health and the environment during the natural flushing period, ICs are required to control exposure to contaminated groundwater. An IC boundary has been established at the Riverton site (Figure 2), delineating the area that requires protection. The IC boundary was set to encompass the area of current groundwater contamination and a surrounding buffer zone to account for potential future plume migration.

2.1.4.1 Site Institutional Controls

All IC components have not been finalized, but there is an ongoing cooperative effort among DOE, the Northern Arapaho and Eastern Shoshone Tribes, and the State of Wyoming in order to final additional viable and enforceable ICs at the Riverton site. ICs currently in place include the following components:

- An AWSS, funded by DOE and currently operated by the Great Plains Utility Organization, supplies potable water to residents within the IC boundary to minimize use of groundwater.
- Warning signs installed around the oxbow lake (Figure 3) explain that the contaminated water is not safe for human consumption, with instructions not to drink from, fish in, or swim in the lake.
- A Tribal Ordinance places restrictions on well installation, prohibits surface impoundments, authorizes access to inspect and sample new wells, and provides notification to drilling contractors of the groundwater contamination within the IC boundary. Restrictions on well installation include a minimum depth of 150 ft bgs (approximately 50 ft below the top of the confined aquifer) and installation of surface casing through the contaminated upper aquifer.
- DOE will notify area drilling contractors of the existing groundwater contamination.
- A State of Wyoming Department of Environmental Quality notification of existing groundwater contamination will be provided to persons on privately owned land who apply for a gravel pit permit within the IC boundary.
- A U.S. Bureau of Indian Affairs notification of existing groundwater contamination will be provided to persons on tribal land applying for a surface impoundment within or adjacent to the IC boundary.
- The State of Wyoming State Engineer's Office will inform DOE when permit applications are received for wells or surface impoundments within or adjacent to the IC boundary, provide DOE with a copy of the application (so that DOE may comment on it), and incorporate DOE's comments on the permit, if approved.
- An easement and covenant to restrict land use and well drilling on the former mill site property was finalized on June 29, 2009, and the former mill site was purchased by Chemtrade Refinery Services Inc.

Figure 2. Institutional Control Boundary and 2012 Monitoring Locations at the Riverton Site

This page intentionally left blank

Figure 3. Warning Sign at the Oxbow Lake

ICs that are in progress, but not finalized, include the following:

- A U.S. Bureau of Indian Affairs–provided notification of existing groundwater contamination will be provided to all residents on tribal land within or adjacent to the IC boundary.
- A notification of existing groundwater contamination will be provided to fee-land property owners within the IC boundary every 5 years.

2.1.4.2 Institutional Control Monitoring

The LTMP specifies ongoing IC monitoring to verify that ICs are in place and working, in order to ensure that potential exposure to contaminated groundwater is minimized during the natural flushing period. IC monitoring consists of two components: (1) sampling and (2) land and water use verification. The sampling component consists of sampling of domestic wells and the AWSS. The land and water use verification consists of periodic inspection of lands within the IC boundary to verify and document that no additional land or water uses expose or involve shallow groundwater, such as new wells, gravel pits, and recreational ponds.

All known domestic wells used as a potable water source within the IC boundary were sampled during June and December in 2012, and the results are presented in Section 2.3.1.3 and Appendix C.

The Great Plains Utility Organization is responsible for ensuring that the quality, safety, and quantity of the water in the AWSS are adequate. The Great Plains Utility Organization is also required to maintain compliance with EPA standards that regulate community water systems. To assist in this effort and to maintain the AWSS as a viable IC, DOE has a cooperative agreement with the Northern Arapaho Tribe to ensure cooperative efforts and funding for ongoing maintenance, flushing, sampling, and capital improvements on the AWSS.

An AWSS hydrant flushing program was restarted in October of 2011 as specified in the cooperative agreement with the Northern Arapaho Tribe. As a result of some erroneous laboratory results from the October 2011 hydrant flushing and sampling event that were disclosed to DOE prior to a public meeting on May, 6, 2012, DOE committed to managing the sampling and analysis portion of the hydrant flushing program to ensure samples were analyzed by an accredited and audited analytical laboratory. In 2012, flushing and sampling events were conducted in April and October. The April hydrant flushing event (prior to the public meeting) was conducted by the Great Plains Utility Organization and the Tribal Engineer's Office, and the October hydrant flushing event was conducted as a joint effort among the Great Plains Utility Organization, the Tribal Engineer's Office, and DOE. Results of the October hydrant flushing event are presented in Section 2.3.3 and Appendix E.

Verification that one component of the institutional controls is working as intended was received in 2012. DOE received a letter from the State Engineer's Office on December 18, 2012, requesting comments on a proposed well in the vicinity of the Riverton site. DOE reviewed the application for the well, and determined that the well installation could proceed because the proposed location of the well was outside of the IC boundary. A response letter was drafted and sent to the State Engineer's Office in early 2013.

Sampling crews inspected areas within the IC boundary during each semiannual sampling event and found no evidence of new land or water use that would expose groundwater.

2.2 Monitoring Program

The verification monitoring program for 2012 consisted of 18 monitoring wells, 11 domestic wells, and 9 surface water locations, which are listed in Table 1 and shown in Figure 2. In addition, 7 AWSS hydrant locations and 4 AWSS tap locations were sampled and are listed in Table 1 and discussed in Section 2.3.3. Domestic wells 0838, 0839, and 0840 were sampled only in June at the request of the homeowners; these wells are outside the IC boundary and will not be included in the long-term monitoring program. Water levels were measured at 15 additional monitoring wells. Sampling events were conducted in June (groundwater, surface water, and domestic wells), October (AWSS), and December (groundwater, surface water, and domestic wells). Samples collected in June and December were analyzed for manganese, molybdenum, selenium (June only), sulfate, and uranium, and field measurements of temperature, pH, specific conductance, oxidation-reduction potential, dissolved oxygen, alkalinity, and turbidity were measured at each sampling location. Samples collected in October were analyzed for radium-226, radium-228, and uranium and field measurements of chlorine, temperature, pH, specific conductance, oxidation-reduction potential, dissolved oxygen, alkalinity, and turbidity.

Table 1. 2012 Sampling Network at the Riverton Site

Location ID	Description	Sampling Event	Rationale
DOE Monitoring Wells			
0705	Semiconfined aquifer	June, December	Monitor semiconfined aquifer
0707	Surficial aquifer	June, December	Monitor centroid of plume
0710	Surficial aquifer	June, December	Background location
0716	Surficial aquifer	June, December	Monitor upgradient portion of plume
0717	Semiconfined aquifer	June, December	Monitor semiconfined aquifer
0718	Surficial aquifer	June, December	Monitor lateral plume movement
0719	Semiconfined aquifer	June, December	Monitor semiconfined aquifer
0720	Surficial aquifer	June, December	Monitor lateral plume movement
0721	Semiconfined aquifer	June, December	Monitor semiconfined aquifer
0722R	Surficial aquifer	June, December	Monitor centroid of plume
0723	Semiconfined aquifer	June, December	Monitor semiconfined aquifer
0729	Surficial aquifer	June, December	Monitor lateral plume movement
0730	Semiconfined aquifer	June, December	Monitor semiconfined aquifer
0784	Surficial aquifer	June, December	Monitor lateral plume movement
0788	Surficial aquifer	June, December	Monitor lateral plume movement
0789	Surficial aquifer	June, December	Monitor centroid of plume
0824	Surficial aquifer	June, December	Monitor lateral plume movement
0826	Surficial aquifer	June, December	Monitor lateral plume movement
Domestic Wells[a]			
0405	Private residence	June, December	Potential point of exposure
0422	Private residence	June, December	Potential point of exposure
0430	Private residence	June, December	Potential point of exposure
0436	St Stephens Mission	June, December	Potential point of exposure
0460	Chemtrade Refinery	June, December	Potential point of exposure
0828	St. Stephens Mission	June, December	Potential point of exposure
0838	Private residence	June	Homeowner request
0839	Private residence	June	Homeowner request
0840	Private residence	June	Homeowner request
0841	Private residence	June, December	Potential point of exposure
0842	Private residence	June, December	Potential point of exposure
Surface Water			
0747	Oxbow lake	June, December	Impacted by groundwater discharge
0749	Chemtrade Refinery discharge ditch	June, December	Effluent from sulfuric acid plant
0794	Little Wind River	June, December	Upstream of predicted plume discharge
0796	Little Wind River	June, December	Downstream of predicted plume discharge
0810	Pond—former gravel pit	June, December	Potential for impact—within IC boundary
0811	Little Wind River	June, December	Within area of predicted plume discharge
0812	Little Wind River	June, December	Within area of predicted plume discharge
0822	West side irrigation ditch	June, December	Potential for impact—within IC boundary
0823	Pond—former gravel pit	June, December	Upgradient of plume—within IC area
AWSS Hydrants			
0818	AWSS flushing hydrant	October	Verify effectiveness of flushing program
0819	AWSS flushing hydrant	October	Verify effectiveness of flushing program
0820	AWSS flushing hydrant	October	Verify effectiveness of flushing program
0821	AWSS flushing hydrant	October	Verify effectiveness of flushing program
0829	AWSS flushing hydrant	October	Verify effectiveness of flushing program
0830	AWSS flushing hydrant	October	Verify effectiveness of flushing program
0834	AWSS flushing hydrant	October	Verify effectiveness of flushing program

Table 1 (continued). 2012 Sampling Network at the Riverton Site

Location ID	Description	Sampling Event	Rationale
AWSS Taps			
0813	AWSS tap at house	October	Verify taps unaffected by flushing process
0815	AWSS tap at house	October	Verify taps unaffected by flushing process
0816	AWSS tap at house	October	Verify taps unaffected by flushing process
0837	AWSS tap at house	October	Verify taps unaffected by flushing process

[a] All domestic wells are completed in the confined aquifer, except for well 0841, which might be completed in the semiconfined aquifer

2.3 Results of 2012 Monitoring

2.3.1 Groundwater

2.3.1.1 Groundwater Flow

Water levels were measured at all wells in the monitoring network in June and December in order to verify groundwater flow direction and to assess vertical gradients throughout the IC area. Water level data are included in Appendix A.

Assessment of horizontal groundwater flow direction in the surficial aquifer is required to ensure that the monitoring network is adequate for assessing contaminant plume movement and to ensure that the IC boundary provides a sufficient buffer to prevent access to contaminated groundwater. As shown in Figure 4 and Figure 5, groundwater elevation contours for the surficial aquifer indicate a general flow direction to the southeast in June and December. Water levels have been historically consistent as shown in Figure 5, which compares December 2012 and February 1997 water levels. Contaminant plume configurations tend to have a more southerly axis than the measured groundwater flow direction, which may be explained by different flow patterns during milling operations caused by groundwater mounding in the tailings area coupled by irrigation practices to the east of the site. In addition to water levels measured during each sampling event, continuous water-level measurements recorded by pressure transducers installed in wells along the groundwater flow path demonstrate that, based on groundwater elevations, the groundwater flow does not reverse direction throughout the year (Figure 6).

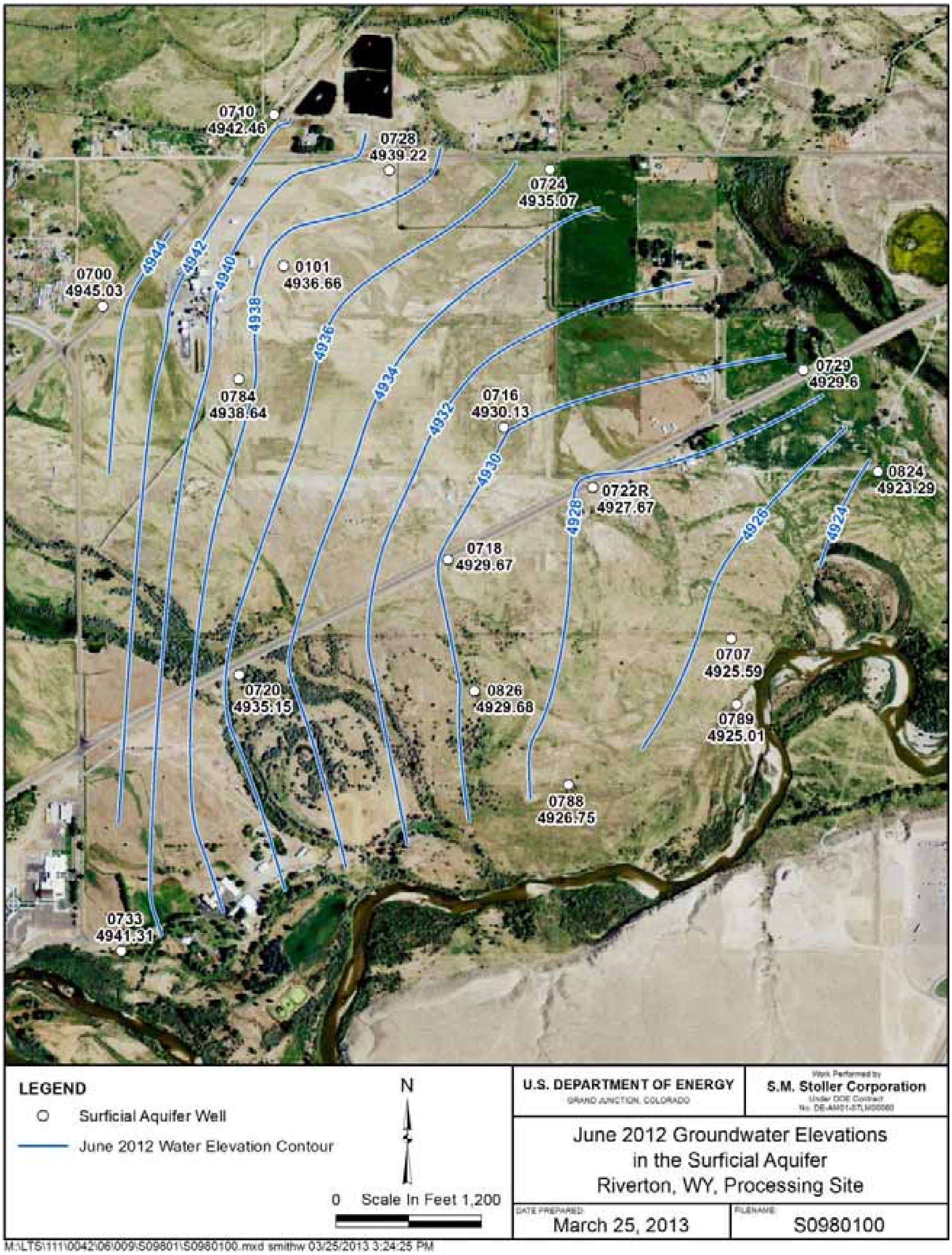
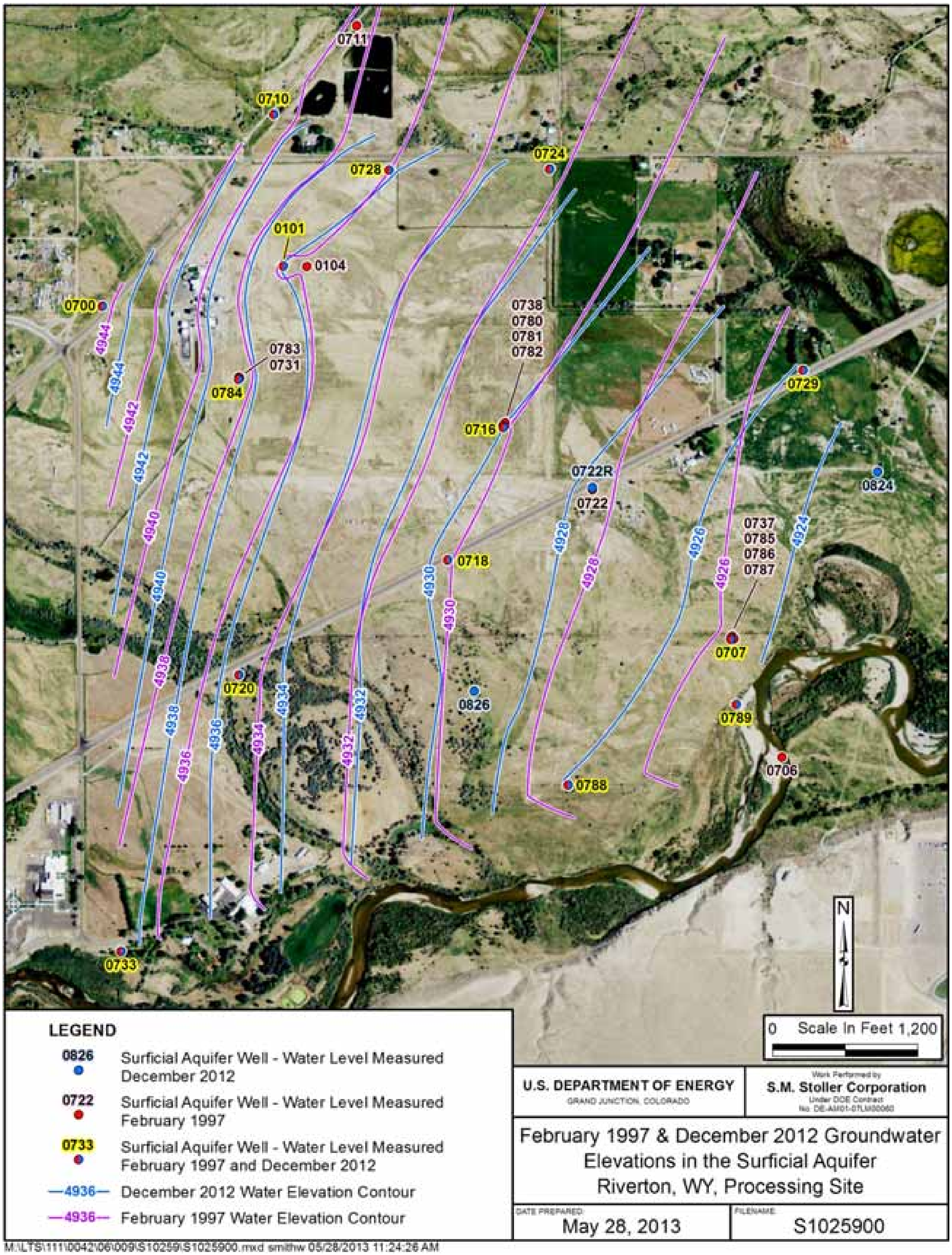


Figure 4. June 2012 Groundwater Elevations in the Surficial Aquifer at the Riverton Site



M:\LTS\111\0042\06\009\S10259\S1025900.mxd smithw 05/28/2013 11:24:26 AM

Figure 5. February 1997 and December 2012 Groundwater Elevations in the Surficial Aquifer at the Riverton Site

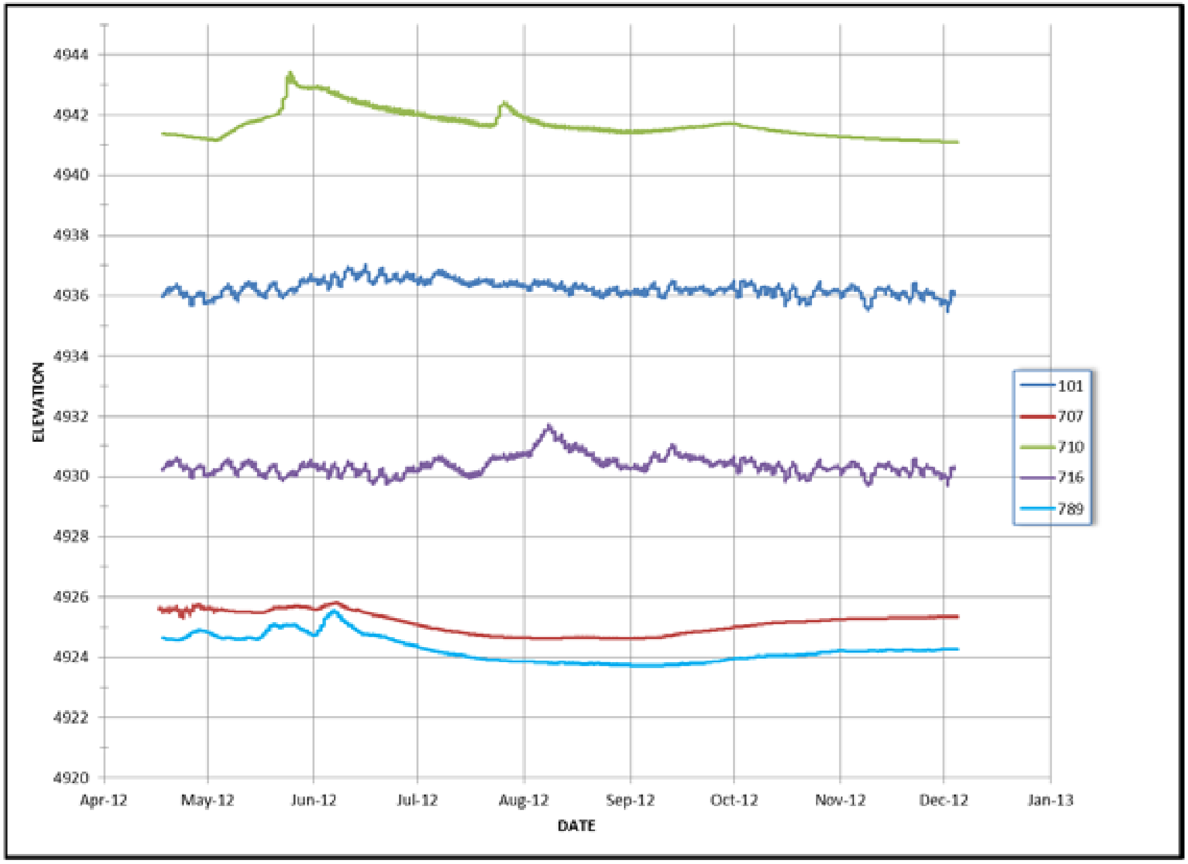


Figure 6. Continuous Water Elevations in Selected Surficial Aquifer Wells

Vertical gradients are used to assess the direction that groundwater will flow vertically. Using the methods that have traditionally been applied to assess vertical flow, a negative gradient indicates potential for upward groundwater flow, and a positive gradient indicates potential for downward groundwater flow. Regardless of the direction indicated by gradient, vertical migration of groundwater between the Riverton site aquifers is expected to be relatively minor because of the low vertical hydraulic conductivities of the confining layers separating aquifers. Vertical gradients are calculated from monitoring wells in an upper aquifer$_1$ and lower aquifer$_2$ using the following formula: $(GE_1\text{-}GE_2) \div (SE_1\text{-}SE_2)$, where GE = groundwater elevation and SE = screen elevation at the midpoint of the screen. Vertical gradients calculated from June and December data from grouped monitoring wells are shown in Table 2. General observations from Table 2 include the following:

- Vertical gradients in the confined aquifer are upward or 0 at two locations and mixed at one location.
- The well cluster adjacent to the sulfuric acid plant (0101, 0111, and 0110) typically shows downward vertical gradient between the confined aquifer and surficial aquifer, which is likely a reflection of continuous long-term pumping of the confined aquifer from the acid-plant production well; in 2012, the gradient was slightly upward in December.
- Although the well cluster adjacent to the sulfuric acid plant typically indicates a downward vertical gradient in the confined aquifer, an upward vertical gradient is indicated in the semiconfined aquifer, which confirms that the semiconfined and confined aquifers are hydrologically isolated.

- Vertical gradients between the surficial and semiconfined aquifer vary but tend to be downward near surface water features, and upward away from surface water features. Surface water is likely recharging the surficial aquifer, causing a localized increase in heads in the surficial aquifer and a resulting downward vertical gradient.

Table 2. Riverton Vertical Gradients

Well ID	Aquifer	Water Elevation June 2012	Water Elevation December 2012	Vertical Gradient[a] June 2012	Vertical Gradient December 2012
0724	Surficial	4935.07	4932.7		
0725	Semiconfined	4935.19	4932.68	-0.007	0.001
0726	Confined	4935.7	4933.83	-0.006	-0.010
0101	Surficial	4936.66	4935.88		
0111	Semiconfined	4937.82	4936	-0.043	-0.004
0110	Confined	4932	4935.99	0.089	-0.002
0784	Surficial	4938.64	4938.73		
0732	Semiconfined	4937.02	4936.84	0.061	0.072
0716	Surficial	4930.13	4929.98		
0717	Semiconfined	4930.17	4929.98	-0.001	0
0707	Surficial	4925.59	4925.25		
0705	Semiconfined	4924.48	4924.06	0.039	0.042
0709	Confined	4927.68	4925.25	-0.027	0
0718	Surficial	4929.67	4929.35		
0719	Semiconfined	4930.05	4929.66	-0.019	-0.016
0722R	Surficial	4927.67	4927.65		
0723	Semiconfined	4927.89	4927.86	-0.007	-0.007
0720	Surficial	4935.15	4935.09		
0721	Semiconfined	4932.56	4932.45	0.072	0.073
0729	Surficial	4929.6	4925.83		
0730	Semiconfined	4928.1	4925.44	0.065	0.017
0733	Surficial	4941.31	4938.52		
0734	Semiconfined	4938.92	4936.76	0.105	0.077

[a] The vertical gradient from the semiconfined aquifer is between the semiconfined aquifer and the surficial aquifer, and the vertical gradient from the confined aquifer is between the confined aquifer and the surficial aquifer. A negative value indicates an upward vertical gradient.

2.3.1.2 Groundwater Quality

Surficial aquifer data from the 2012 sampling events are summarized in the following plots and figures. Time-concentration plots for molybdenum in wells located within contaminant plumes and wells bordering the contaminant plumes in the surficial aquifer are shown in Figure 7 and Figure 8, respectively. The distribution of molybdenum in the surficial aquifer from the June and December 2012 sampling events is shown in Figure 9 and Figure 10, respectively. Time-concentration plots for uranium in wells located within contaminant plumes and wells on the lateral edge of the contaminant plumes in the surficial aquifer are shown in Figure 11 and Figure 12, respectively. The distribution of uranium in the surficial aquifer, based on June and December 2012 sampling results, is shown in Figure 13 and Figure 14, respectively.

As shown in the plots and figures, concentrations of molybdenum and uranium in groundwater in the surficial aquifer are still above their respective MCLs. In June 2010, a dramatic increase in uranium concentrations was observed in wells 0707, 0788, 0789, and 0826 where flooding of the Little Wind River occurred. These increases in uranium concentrations included wells on the western edge of the plume (0788 and 0826), where sample concentrations exceeded the uranium standard, indicating lateral expansion of the plume. In addition, molybdenum concentrations increased dramatically in well 0707 during the June sampling event (Figure 7). In 2012, the concentration of uranium in sample collected from well 0707 in December was back to a pre-flood level.

Concentrations of molybdenum and uranium in groundwater in the semiconfined aquifer are still below corresponding MCLs in areas where the overlying surficial aquifer groundwater is contaminated, which indicate no significant impact from site-related contamination in this unit (Figure 15 and Figure 16).

Groundwater quality data by parameter for monitoring wells in the long-term monitoring network sampled during 2012 are provided in Appendix B.

In response to a review of groundwater quality data that was documented in the *Evaluation of Groundwater Constituents and Seasonal Variation at the Riverton, Wyoming, Processing Site* (DOE 2012a), samples collected from all wells were analyzed for selenium during the June sampling event. All selenium concentrations were one to two orders of magnitude below the selenium MCL of 0.01 mg/L, which confirms that this contaminant is not a concern at the Riverton site and will not be included in the long-term monitoring program. Selenium data are provided in Appendix B.

2.3.1.3 Domestic Wells

Domestic wells at residences within the IC boundary used as a potable water source and three wells outside the IC boundary were sampled in 2012; most of these wells are completed in the confined aquifer with the exception of well 0841, which is likely completed in the semiconfined aquifer. Results from domestic wells did not indicate any impacts from the Riverton site. Concentrations of molybdenum in samples collected from domestic wells were two orders of magnitude below the standard, and concentrations of uranium in samples collected from domestic wells were one to three orders of magnitude below the standard. Time-concentration graphs for molybdenum and uranium are shown in Figure 17 and Figure 18, respectively. Selenium concentrations measured in samples collected in June were low (below or near the detection limit) and two to three orders of magnitude below the MCL. Data obtained from sampling of domestic wells in 2012 are provided in Appendix C.

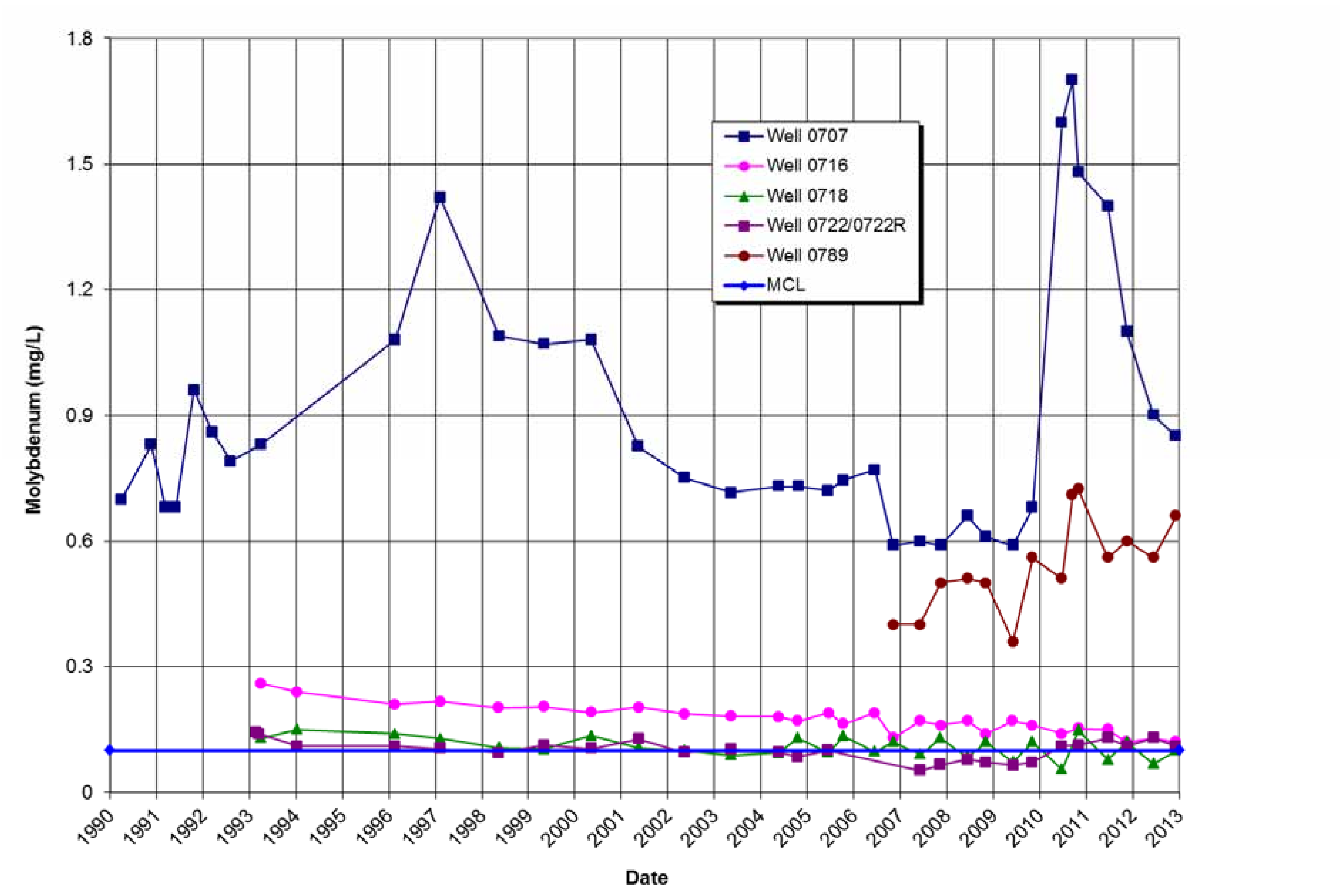
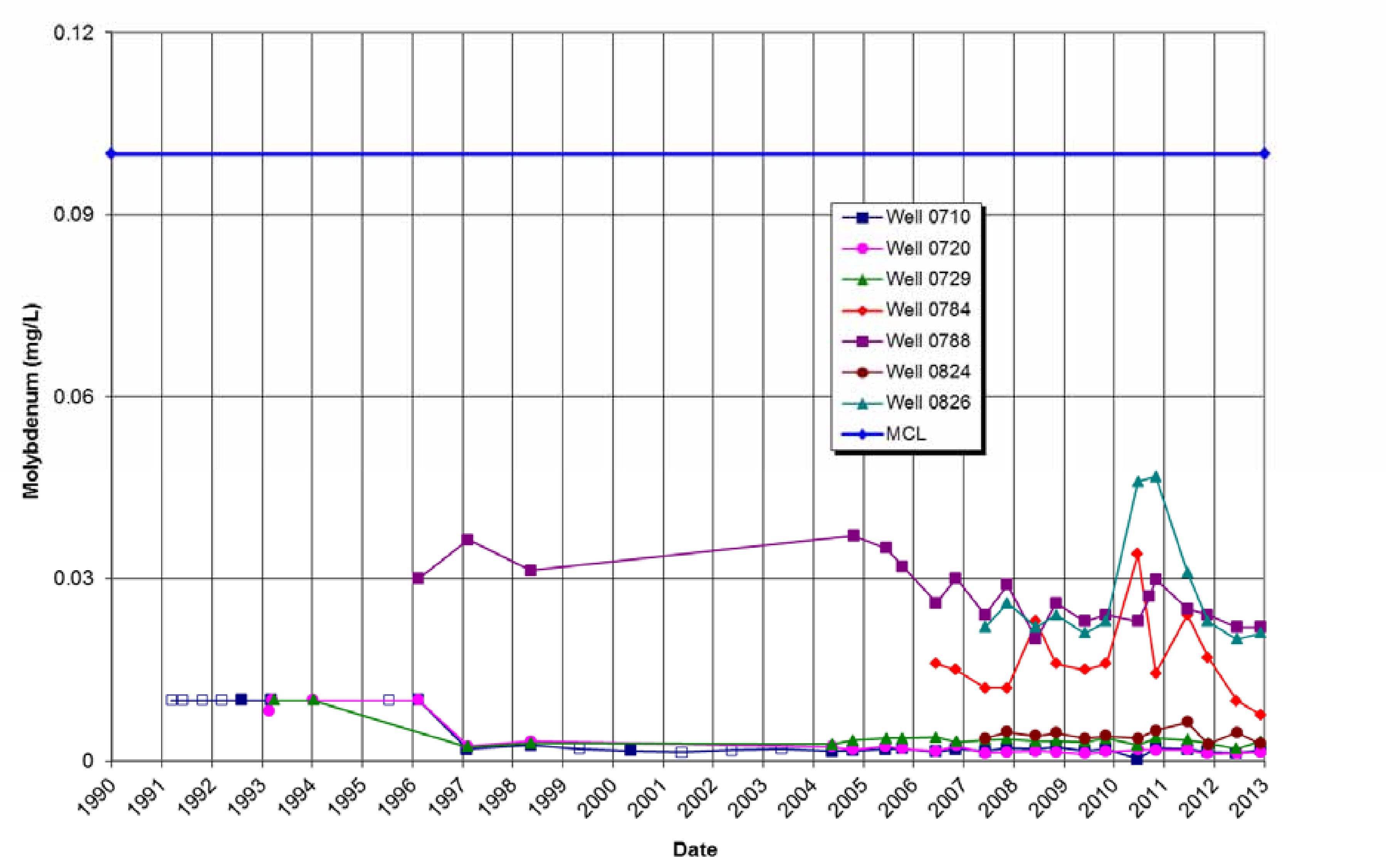
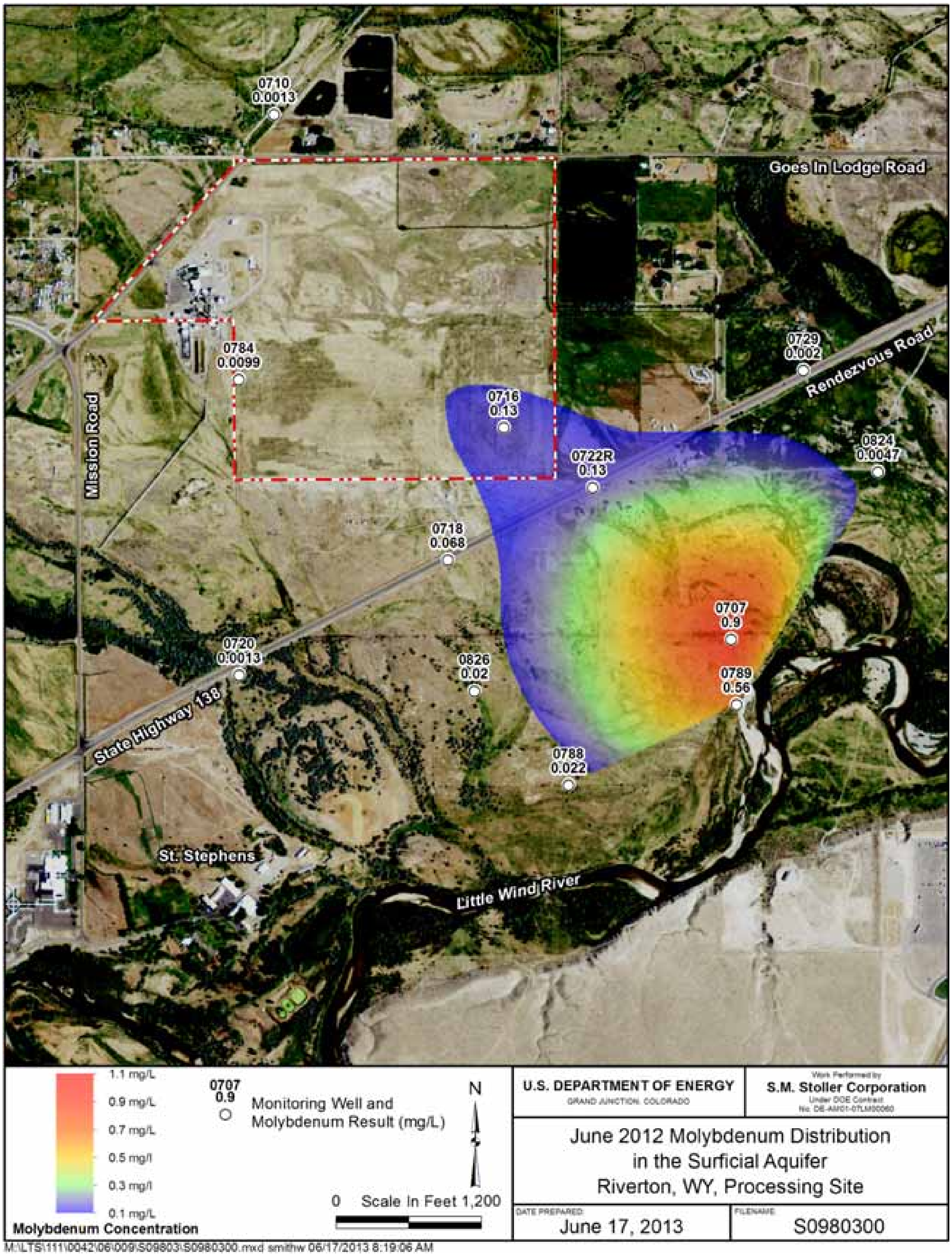


Figure 7. Molybdenum Concentrations in Surficial Aquifer Wells within the Contaminant Plume



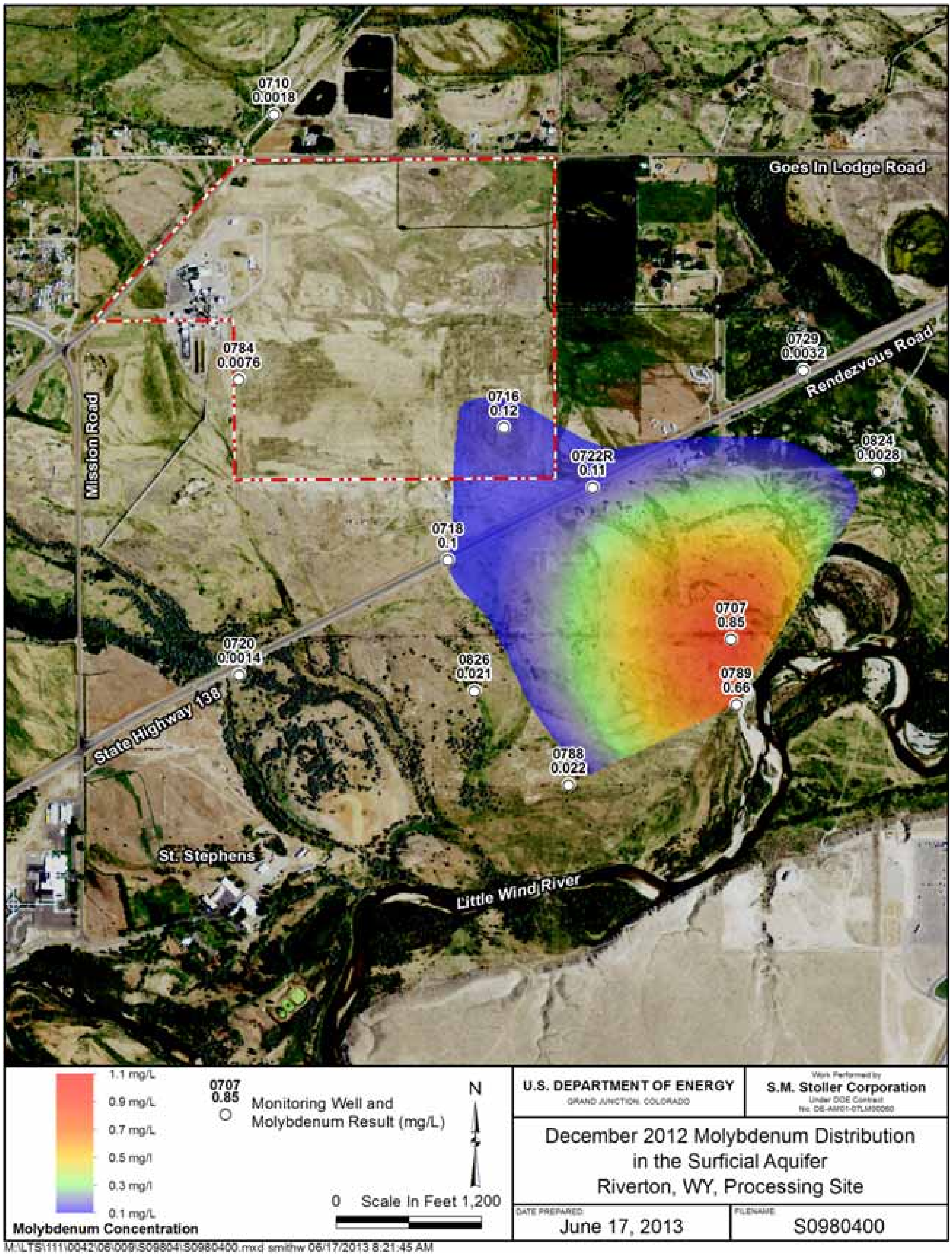
Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 8. Molybdenum Concentrations in Surficial Aquifer Wells on the Edge of the Contaminant Plume



M:\LTS\111\0042\06\009\S09803\S0980300.mxd smithw 06/17/2013 8:19:06 AM

Figure 9. June 2012 Molybdenum Distribution in the Surficial Aquifer at the Riverton Site



M:\LTS\111\0042\06\009\S09804\S0980400.mxd smithw 06/17/2013 8:21:45 AM

Figure 10. December 2012 Molybdenum Distribution in the Surficial Aquifer at the Riverton Site

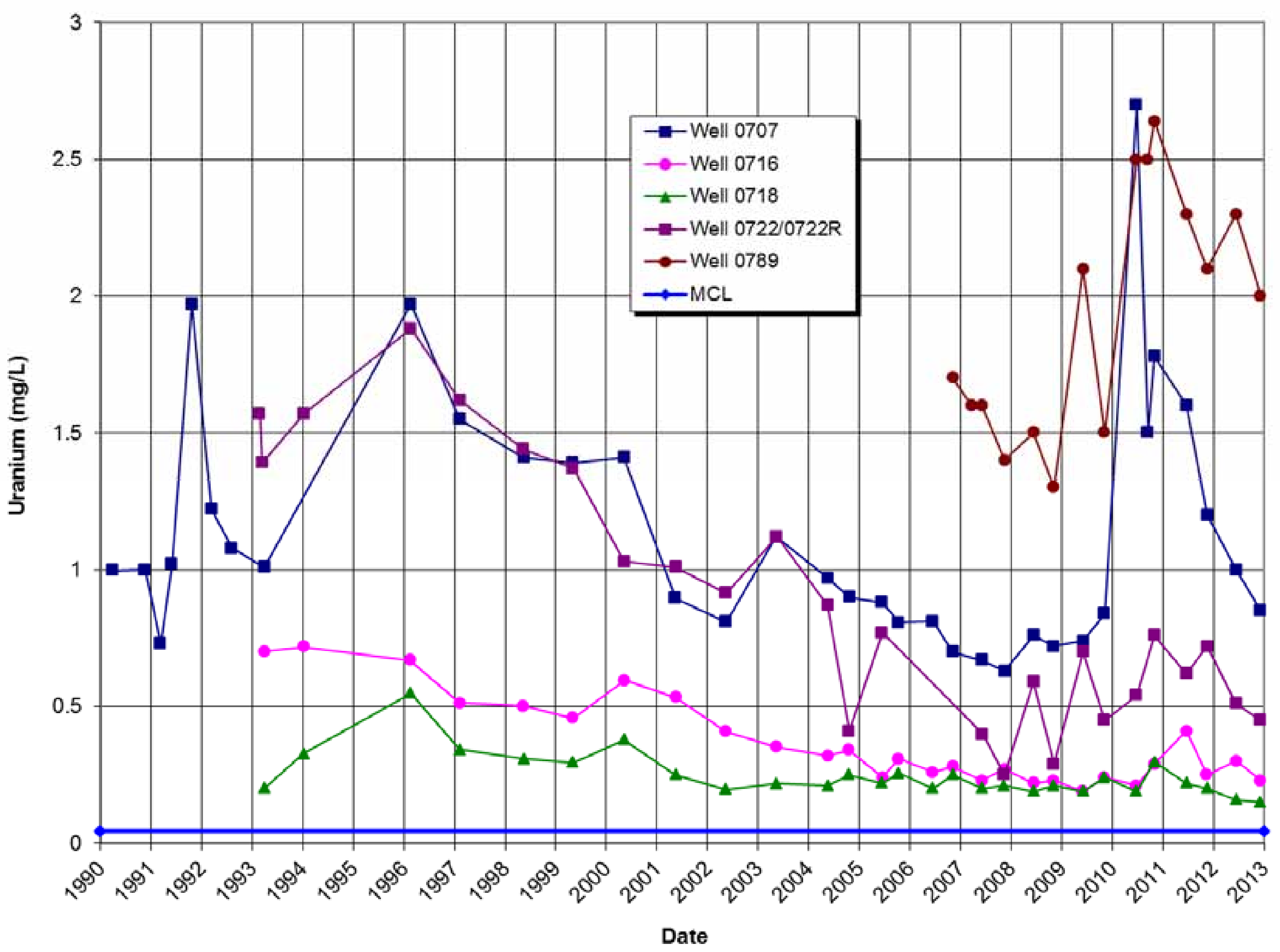
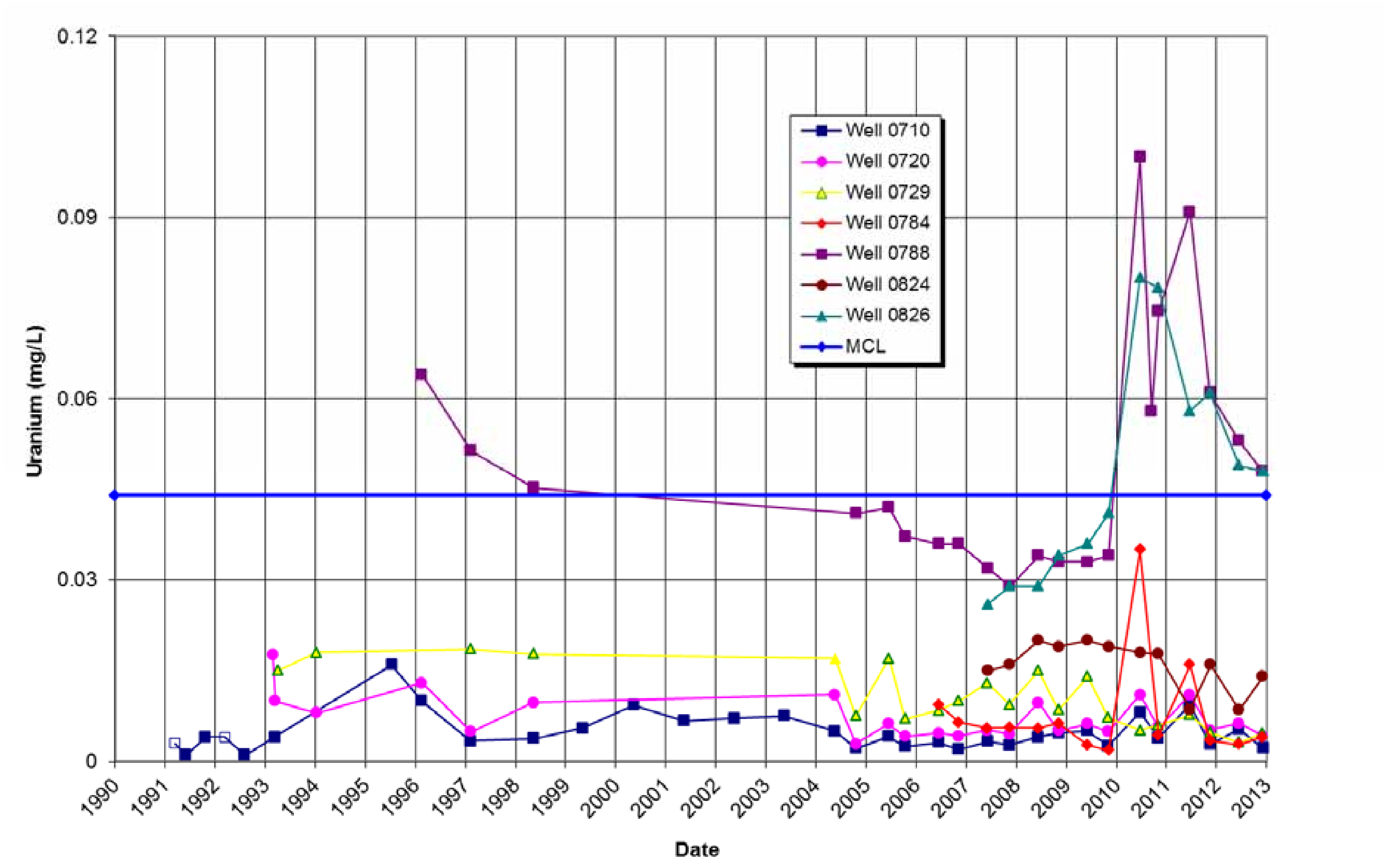
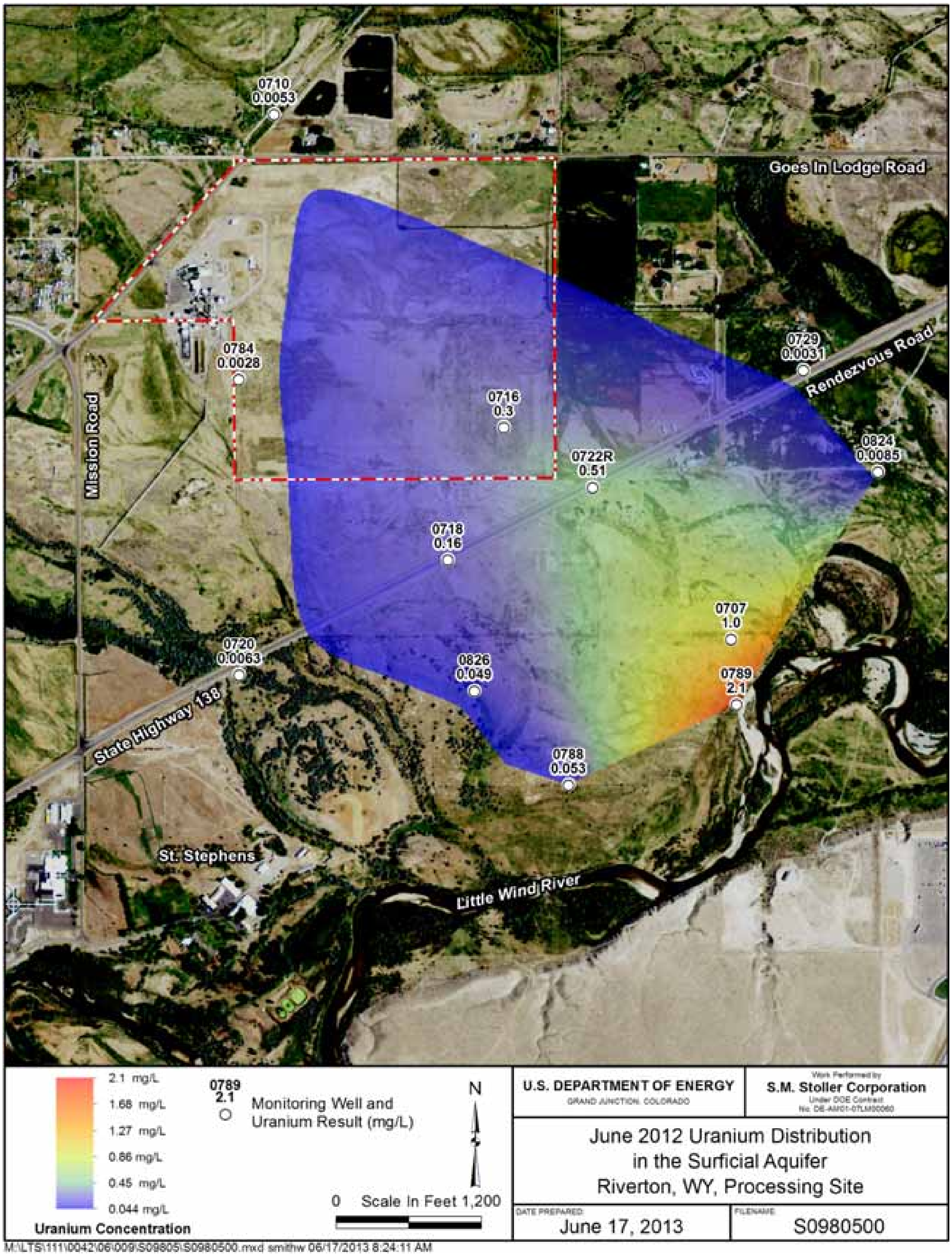


Figure 11. Uranium Concentrations in Surficial Aquifer Wells within the Contaminant Plume



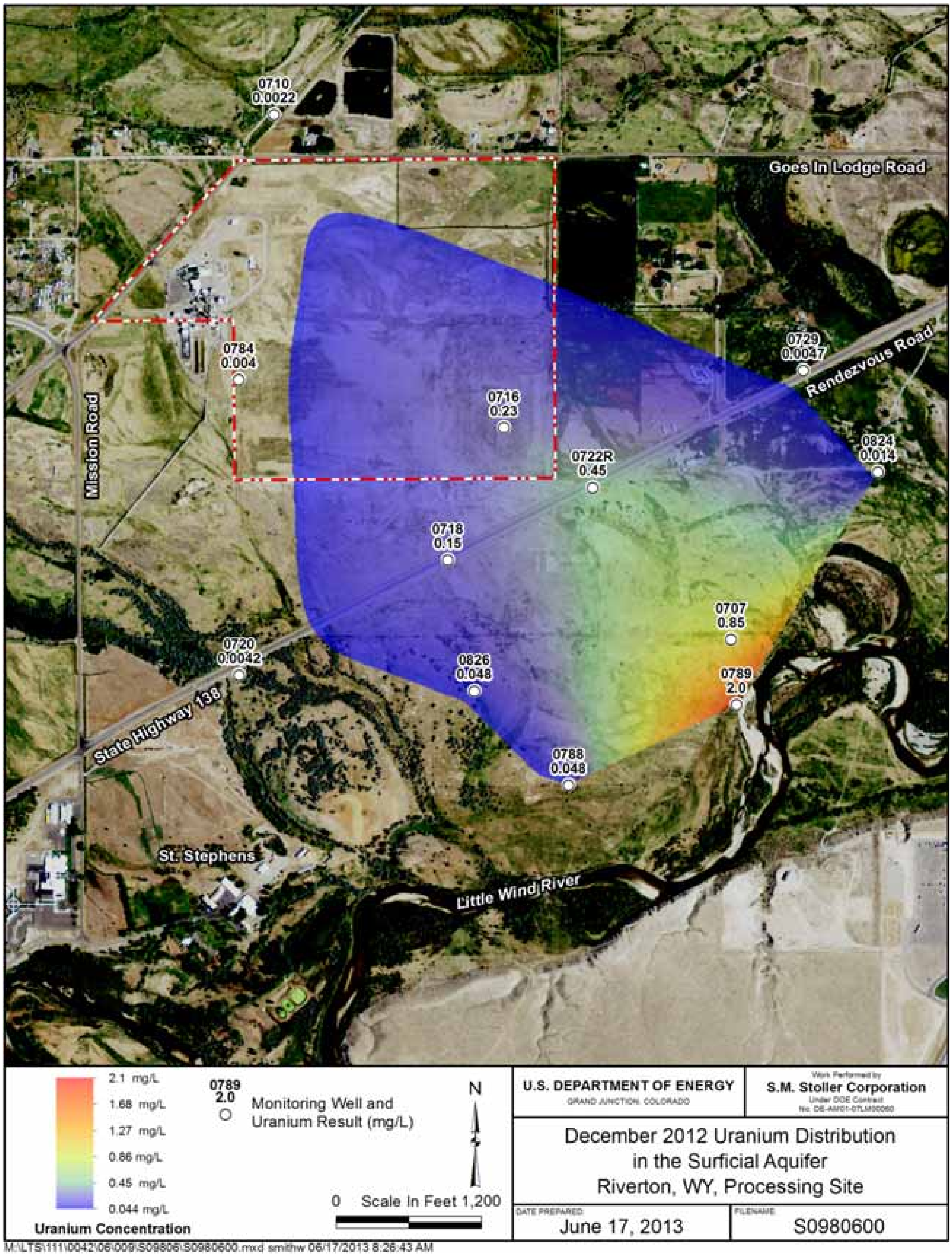
Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 12. Uranium Concentrations in Surficial Aquifer Wells on the Edge of the Contaminant Plume



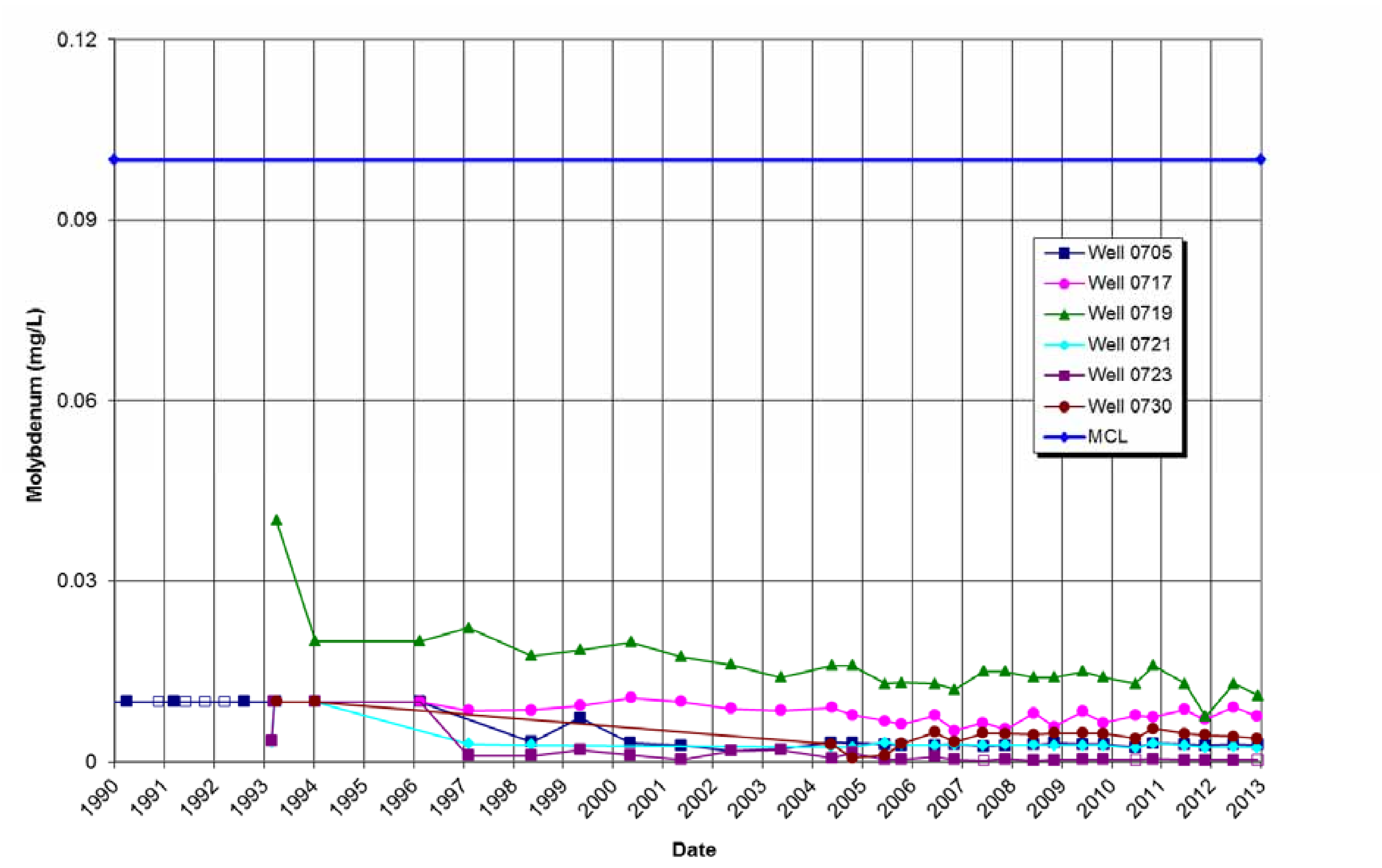
M:\LTS\111\0042\06\009\S09805\S0980500.mxd smithw 06/17/2013 8:24:11 AM

Figure 13. June 2012 Uranium Distribution in the Surficial Aquifer at the Riverton Site



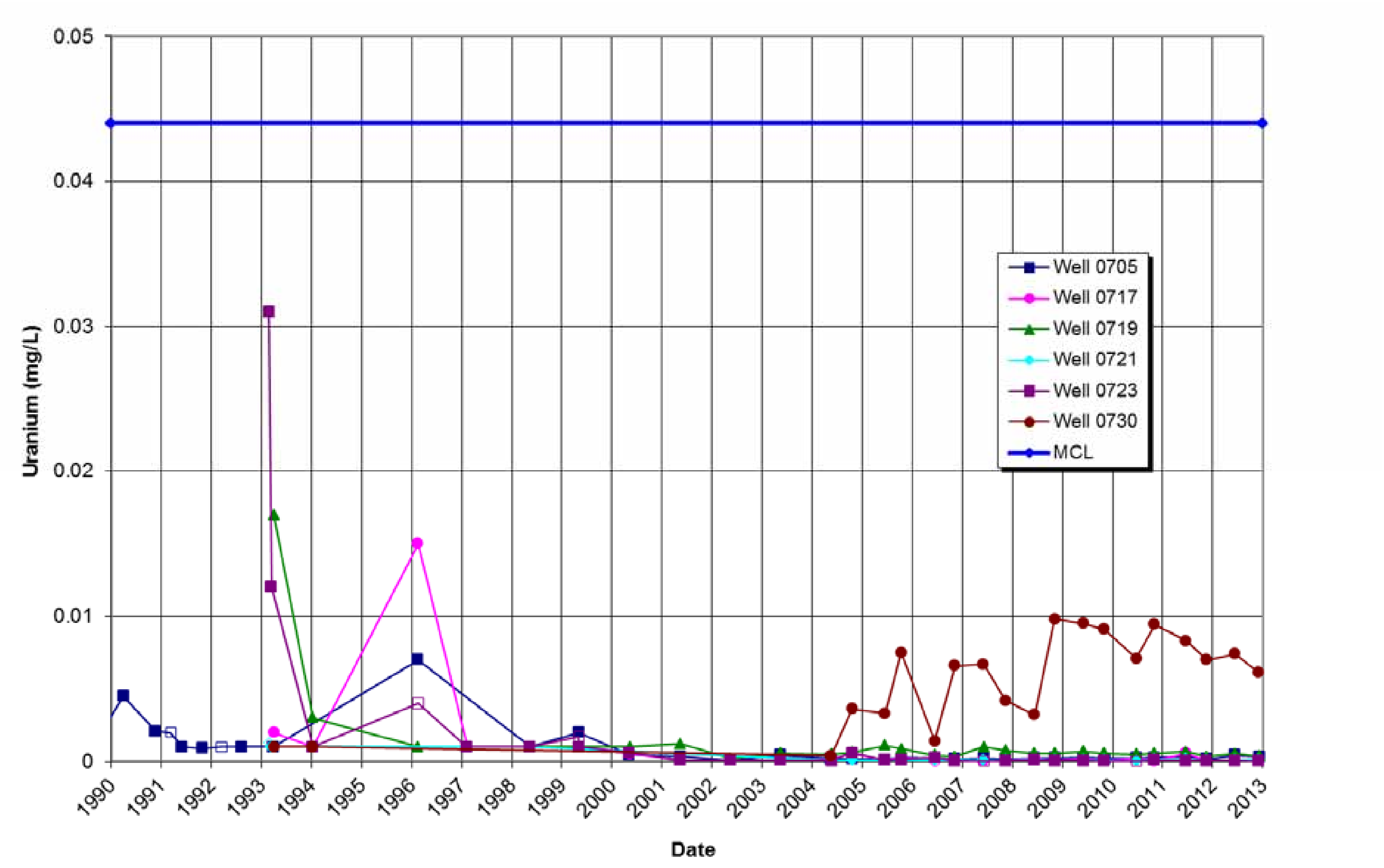
M:\LTS\111\0042\06\009\S09806\S0980600.mxd smithw 06/17/2013 8:26:43 AM

Figure 14. December 2012 Uranium Distribution in the Surficial Aquifer at the Riverton Site



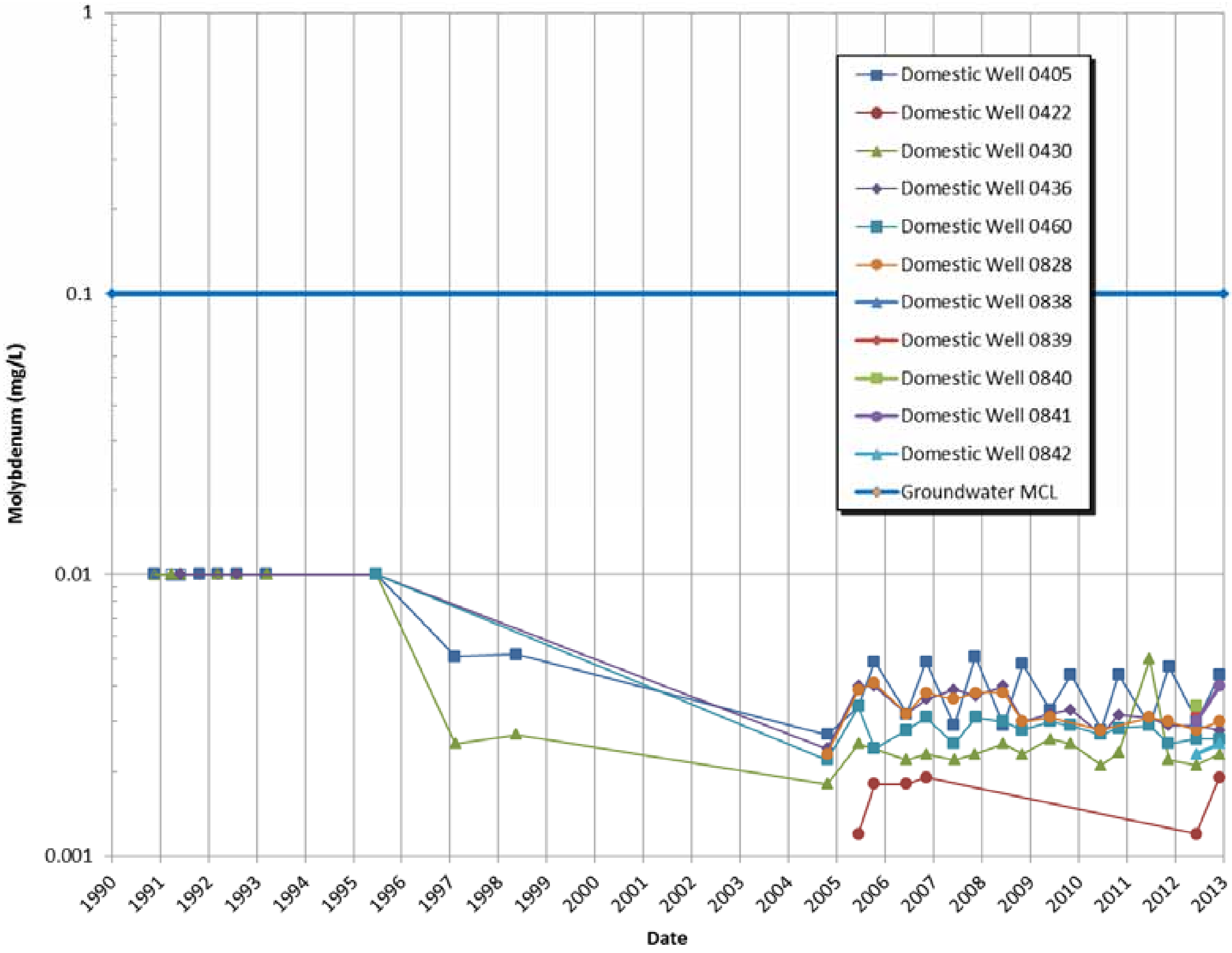
Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 15. Molybdenum Concentrations in Semiconfined Aquifer Wells



Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 16. Uranium Concentrations in Semiconfined Aquifer Wells



Note: Logarithmic scale on Y-axis.

Figure 17. Molybdenum Concentrations in Domestic Wells

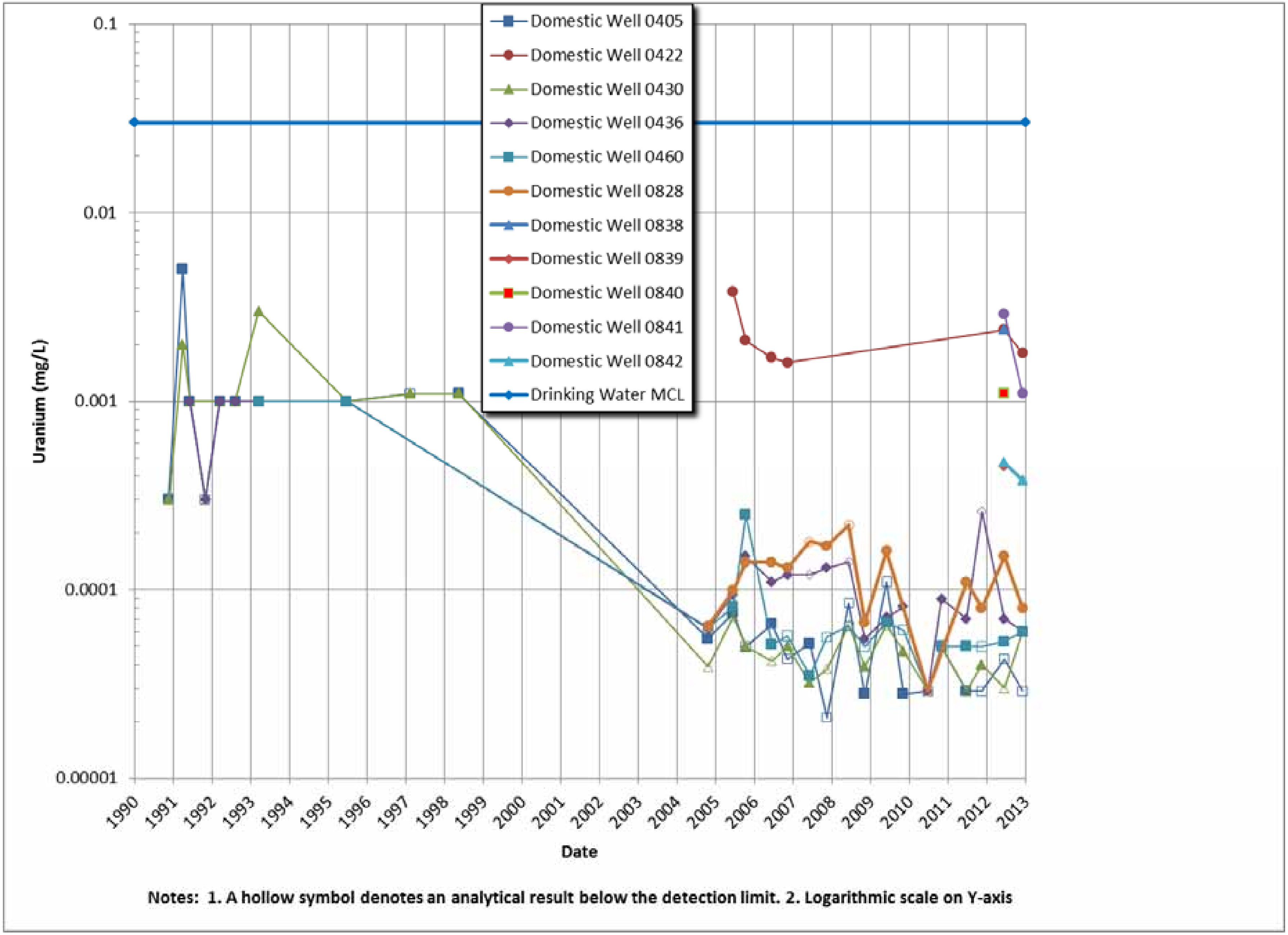


Figure 18. Uranium Concentrations in Domestic Wells

2.3.2 Surface Water

2.3.2.1 *Surface Water Flow*

The 2010 flood of the Little Wind River demonstrated a direct correlation between high discharge in the Little Wind River and increased contaminant concentrations in the surficial aquifer; therefore, it is likely that pre-2010 flooding of the river affected the concentration and configuration of contaminants in the saturated and unsaturated zones of the surficial aquifer. Figure 19 shows the highest peak discharges recorded since the start of milling operations (1958) at the U.S. Geological Survey gaging station (USGS 2012a) located approximately 1.6 miles east of the former mill site (the gaging station location is shown in Figure 2). In 2012, the highest discharge for the year was measured on June 6 at 1,610 cfs and at a river stage of 3.34 feet below flood stage. Discharge in the Little Wind River is statistically the highest in June, which reflects spring runoff from the Wind River Range. Most of the recharge of the alluvial aquifer likely occurs during these higher flows in the river. An assessment of June Little Wind River discharge data indicates that spring runoff/flow in the river was below normal in 2012, after being above normal for the previous three years (Table 3). Prior to 2009, mean spring runoff/flow in the river had been below normal since 2000.

Table 3. Discharge Statistics[a] from the Little Wind River

Year	Mean June Discharge (cfs)	Deviation from Normal[b] June Discharge (cfs)	Maximum Discharge (cfs)
2000	1,089	-1,231	2,720
2001	233.2	-2,087	2,090
2001	740.6	-1,579	1,930
2003	861.7	-1,458	2,490
2004	1,591	-729	4,120
2005	2,272	-48	4,520
2006	642.4	-1,678	1,710
2007	738.9	-1,581	1,910
2008	2,175	-145	3,730
2009	3,012	692	4,190
2010	5,829	3,509	13,300
2011	2,861	541	7,210
2012	594	-1,726	1,610

[a] U.S. Geological Survey gaging station statistics.
[b] Based on a mean June discharge of 2,320 cfs since 1941.

2.3.2.2 *Surface Water Quality*

Samples were collected at four locations on the Little Wind River (Figure 2), which flows generally from the southwest to the northeast adjacent to the site. Contaminated groundwater likely discharges to the Little Wind River, but there is no evidence that it impacts surface water quality in the river. Molybdenum and uranium concentrations measured in samples collected from river locations adjacent to and downstream of the groundwater plume (locations 0811, 0812, and 0796) are comparable to concentrations from river samples collected upstream of the groundwater plume (location 0794), as shown in Figure 20 and Figure 21, respectively.

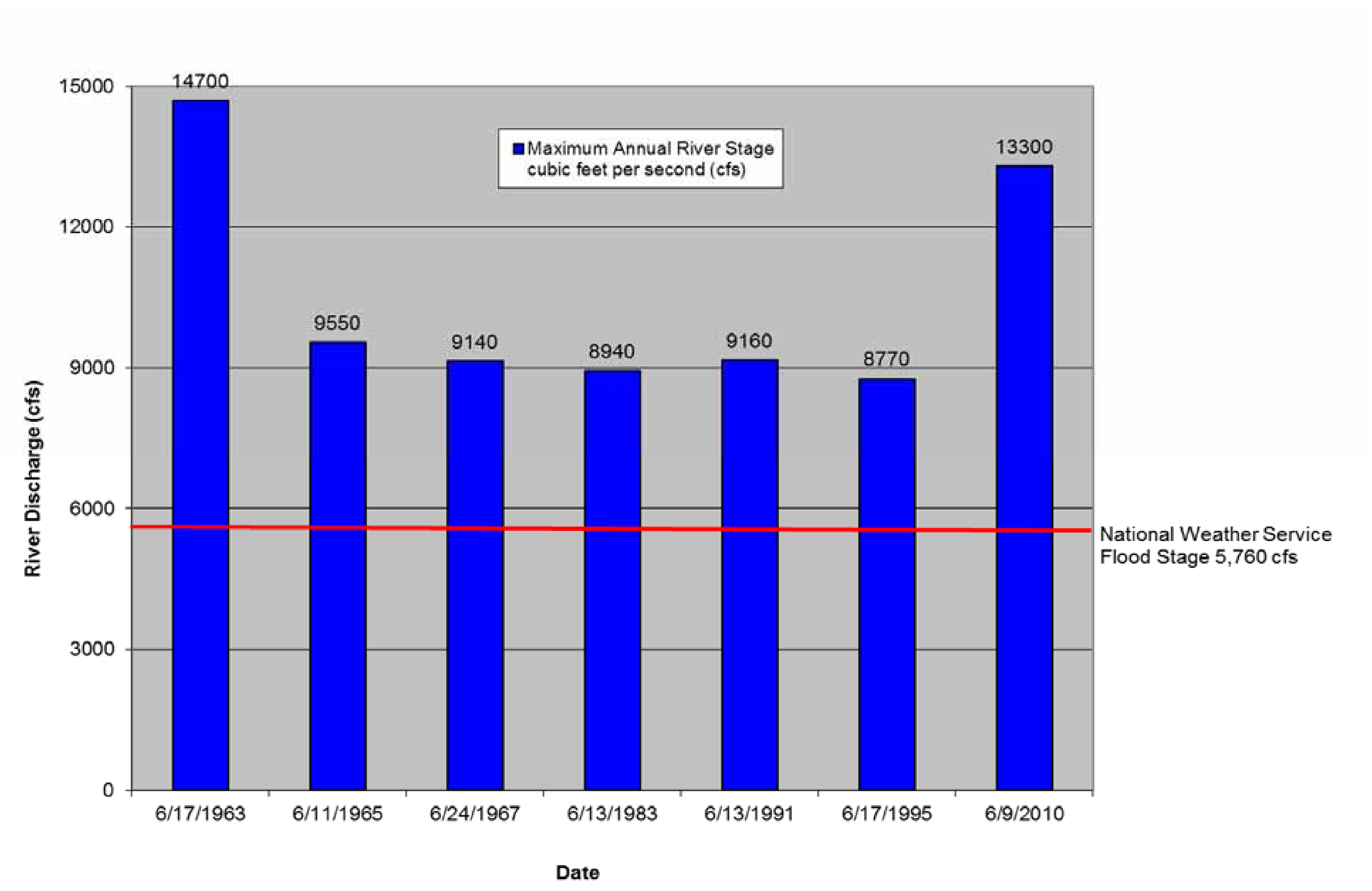
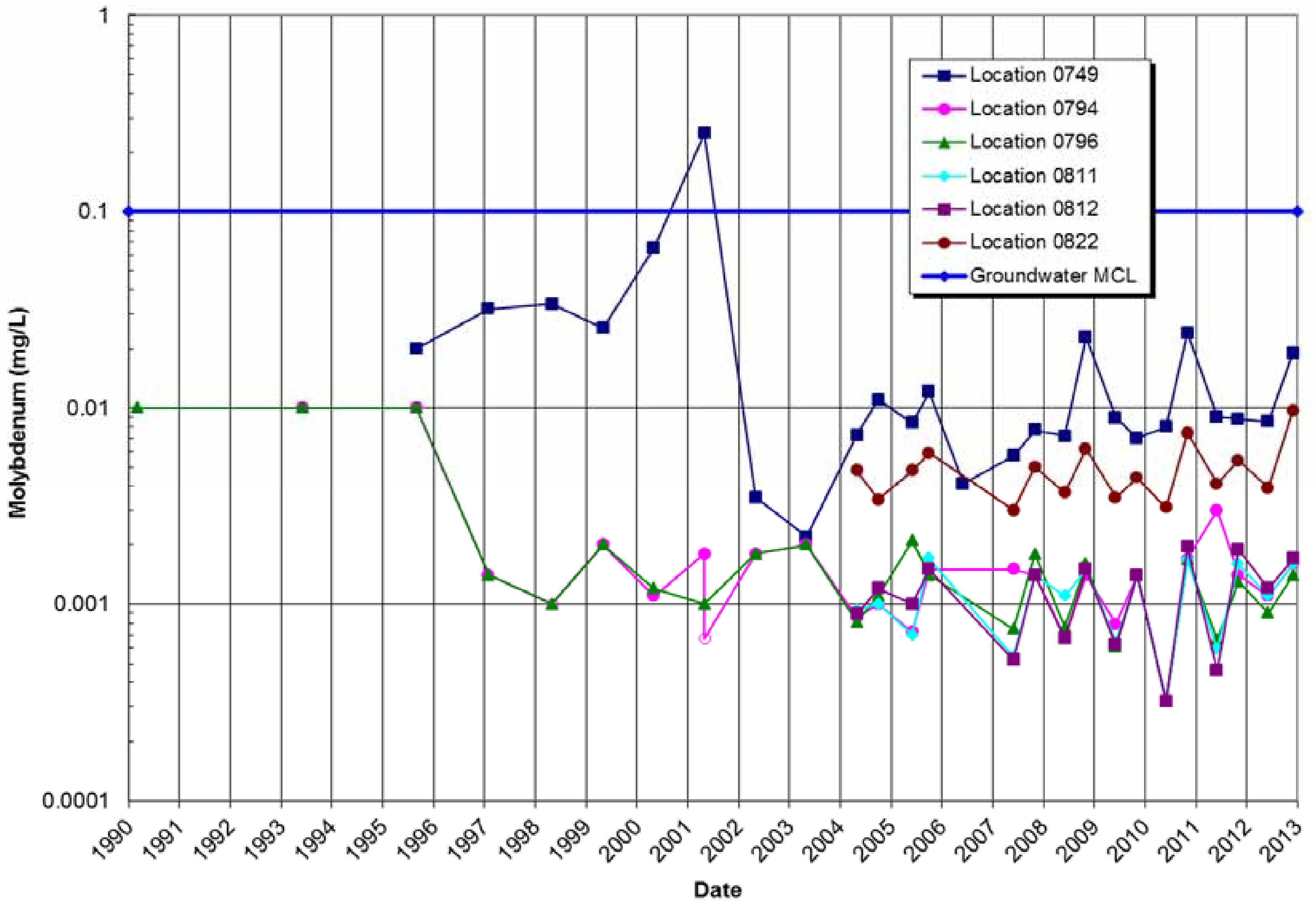
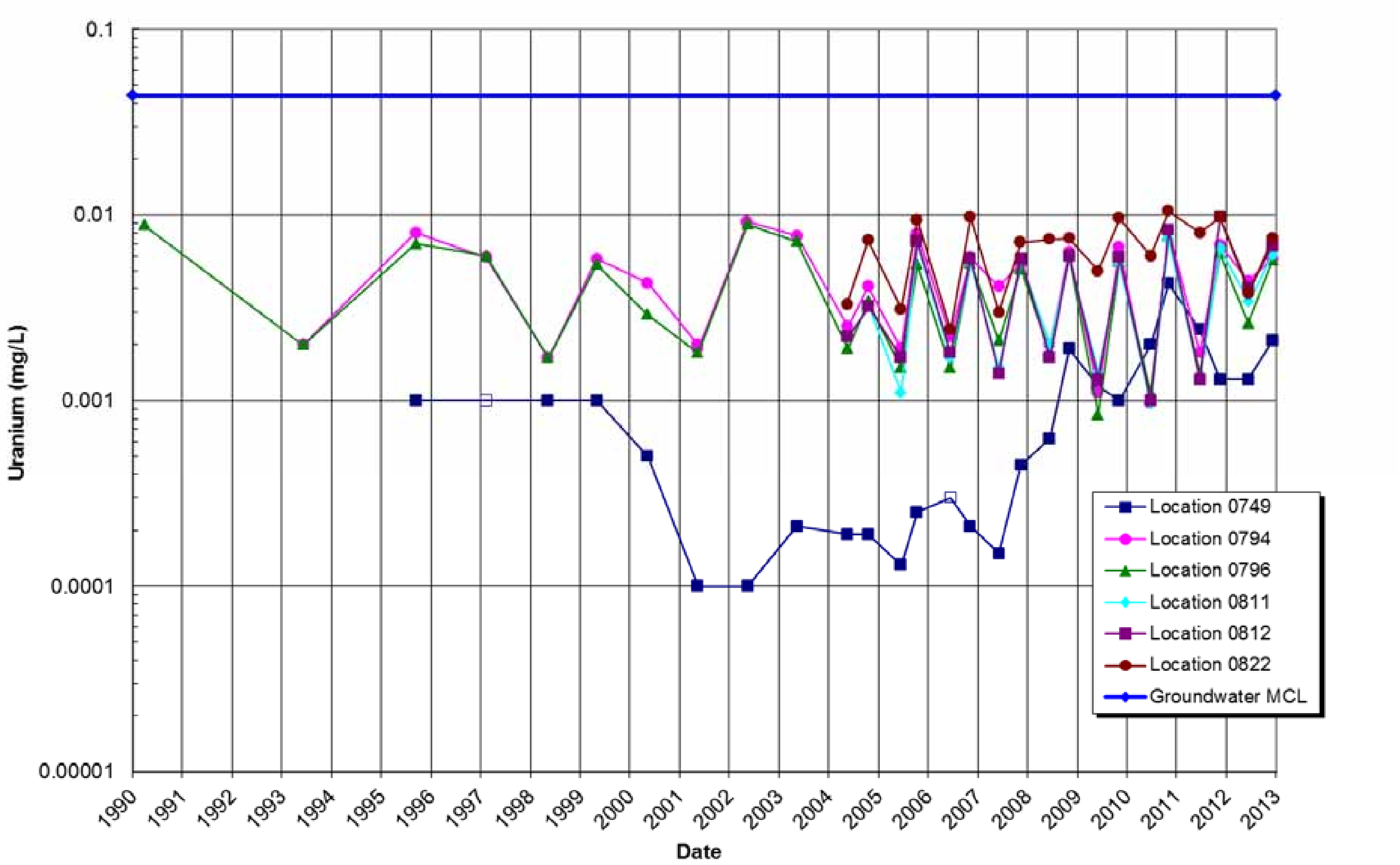


Figure 19. Historical Maximum Stages of the Little Wind River



Notes: 1. A hollow symbol denotes an analytical result below the detection limit. 2. Y-axis is a logarithmic scale.

Figure 20. Molybdenum Concentrations in Creek and River Locations



Notes: 1. A hollow symbol denotes an analytical result below the detection limit. 2. Y-axis is a logarithmic scale.

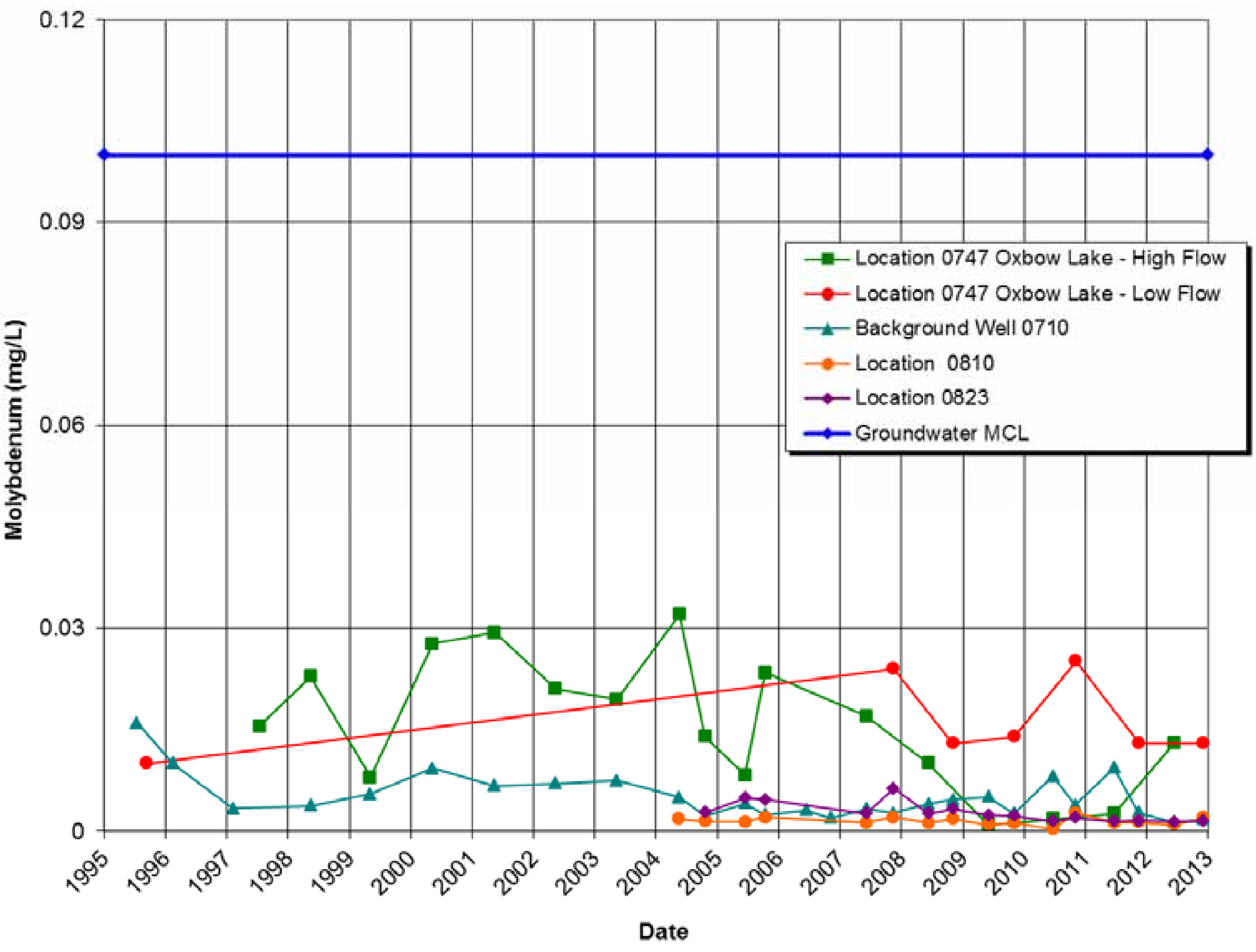
Figure 21. Uranium Concentrations in Creek and River Locations

Two ponds (locations 0810 and 0823) formed from groundwater discharge into former gravel pits were sampled as part of the long-term monitoring network. These ponds are primarily used for fishing and swimming. Samples collected from these ponds had concentrations of molybdenum and uranium that were below their respective groundwater MCLs and comparable to background, which indicates no discernible impacts from the site. Molybdenum and uranium concentrations over time in these pond locations are shown in Figure 22 and Figure 23, respectively.

The sample collected at the ditch that carries discharge water from the Chemtrade sulfuric acid refinery (location 0749) had elevated concentrations of sulfate in 2012 (2,000 mg/L in June). Discharge from the ditch is regulated through a National Pollutant Discharge Elimination System permit issued to Chemtrade and administered by EPA. Sulfate concentrations have been in the 1,800 to 3,000 mg/L range since 2004. The elevated sulfate concentrations in the Chemtrade ditch water have affected sulfate concentrations farther downstream in the west side irrigation ditch (e.g., 960 mg/L at location 0822 in June). Water samples from the west side irrigation ditch also have been analyzed for radium-226 and radium-228 in response to elevated concentrations of these contaminants in the sediments within the ditch. Radium concentrations in water samples collected from the ditch were low (<0.5 pCi/L) and either less than the detections limit (one sample) or near the detection limit (three samples), which indicates minimal impacts to water quality in the ditch from the sediments. Historically, radium concentrations have been below or near the detection limit, indicating no impact to water quality in the ditch. Uranium concentrations in samples collected from the west side irrigation ditch have been within the range of background uranium concentrations and correlate with uranium concentrations in the river (Figure 21), which indicates minimal site impacts to the water quality in the ditch.

Concentrations of molybdenum and uranium in the oxbow lake (location 0747) have varied over time. This variability is attributed to surface inflow (this does not occur every year; it depends on the river stage) to the lake from the Little Wind River during a high river stage, which causes a dilution of uranium concentrations. Hydraulic and water quality data indicate that the oxbow lake is fed by the discharge of contaminated groundwater; therefore, elevated concentrations are expected.

Figure 22 and Figure 23 split oxbow-lake sampling data into high-flow and low-flow events; the high-flow events reflect the potential for river inflow diluting analyte concentrations in the oxbow lake, and the low-flow events reflect a low potential for river inflow diluting analyte concentrations in the oxbow lake. In the June 2012 sampling event, the Little Wind River was not flowing into the oxbow lake and run-off was lower than normal; therefore, the uranium concentration in the sample collected from the oxbow lake was elevated. Uranium concentrations also were elevated in samples collected from the oxbow lake in December, as expected, because the river was not flowing into the lake at that time. Surface water quality data by parameter for locations sampled during 2012 are provided in Appendix D.



Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 22. Molybdenum Concentrations in Ponds

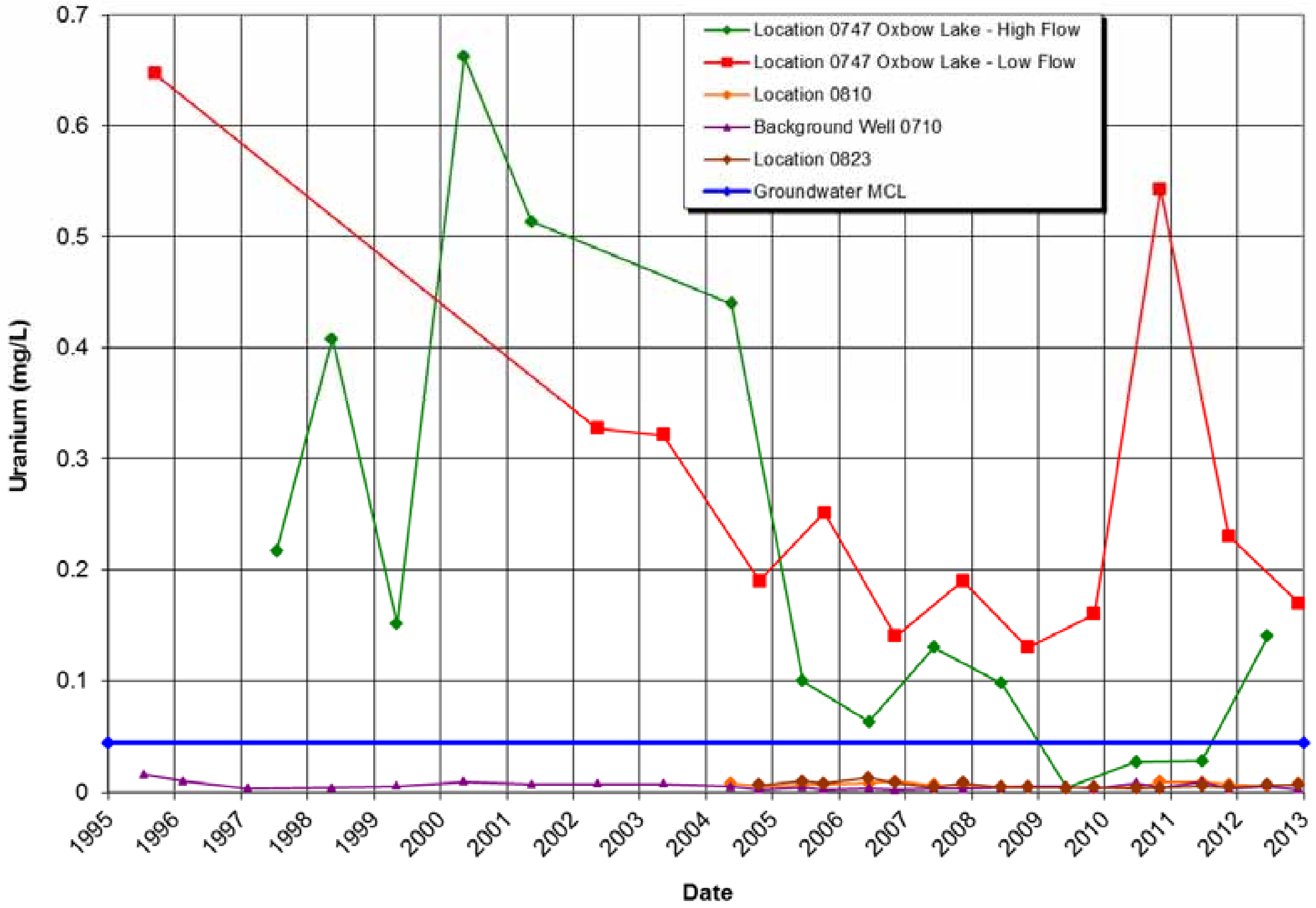


Figure 23. Uranium Concentrations in Ponds

2.3.3 AWSS Monitoring

The AWSS was installed in 1998 by the Indian Health Service. DOE provided $800,000 in funding, which included 25 percent of the cost of a new 1-million-gallon storage tank (Figure 24). As a component of ICs for the Riverton site, the AWSS is designed to supply drinking water to residents within the IC boundary in lieu of drinking groundwater that could potentially be impacted by the contaminated surficial aquifer. The AWSS is an addition to a pre-existing water supply system and consists of 8.5 miles of transmission pipeline running from the 1-million-gallon tank (Figure 25).

Figure 24. AWSS 1-Million-Gallon Tank

Elevated concentrations of radionuclides were identified in the AWSS in 2002 (Babits 2003), and these results were confirmed by DOE in 2004 (DOE 2005). In response to these findings, DOE funded an independent analysis of the AWSS, and the analysis recommended implementation of a flushing program to determine if flushing would reduce the radionuclide concentrations to acceptable levels (ASCG 2005). Based on the recommendation of the independent analysis, DOE implemented a 2-year flushing study to determine if flushing would reduce radionuclide concentrations and control radionuclide buildup in the AWSS (DOE 2006). Results of the study indicated that a unidirectional flushing program be implemented on a 6-month frequency (DOE 2008).

Flushing of the AWSS in 2012 consisted of two semiannual events. One event was conducted by the Great Plains Utility Organization and the Tribal Engineer's Office in April, and a second flushing event was conducted jointly among the Great Plains Utility Organization, the Tribal Engineer's Office, and DOE in October. Sampling was conducted in in accordance with the *Alternate Water Supply System Flushing Plan, Riverton, Wyoming* (DOE 2012b). Seven hydrant locations on the AWSS were flushed and sampled, and four tap locations were sampled. Two samples were collected at each of five hydrant locations – one sample 5 minutes into the flush and one sample at the end of the flush, as specified in the plan. Only end-of-flush samples were collected at hydrant locations 0820 and 0834 because of the short flushing time. A new hydrant (0843) was noted during the flushing event and added to the flushing network for subsequent events; a cursory flush was conducted on this hydrant during the October event, and samples were collected from this hydrant by the Wind River Environmental Quality Commission.

Monitoring of flow during each hydrant flush was required to ensure the calculated water volume of each section of pipe was removed. Flow meters were installed at each hydrant during flushing to measure the volume of water flushed from the pipe. Volume measurements also were used to calculate the velocity of the water moving through the pipe. Velocity data were used to determine if water movement within the pipeline was sufficient to remove sediment and debris, and to scour biofilm from the inside of the pipe. According to the independent analysis (ASCG 2005), flushing velocities of 2 to 3 feet per second (ft/s) are needed to remove sediment and loosely attached particles, while flushing velocities of greater than 5 ft/s are required to scour and remove buildup of biofilm and material adhering to the wall of the pipe. Water volume removed and velocities from each section are shown in Table 4.

Table 4. October 2012 Hydrant Flushing Summary

ID	Calculated Flushing Volume[a]	Section Volume Flushed (gallons)	Section Flush Time (minutes)	Section Average Flow Rate (gallons/minute)	Section Average Velocity (ft/s)
0829	20,252	20,400	41.5	492	3.14
0830	39,554	39,600	70	566	3.61
0818	20,738	20,800	42	495	5.62
0819	43,209	43,200	77	561	3.58
0821	13,973	14,000	33.6	417	4.73
0820	3,139	3,200	6.5	492	5.59
0834	918	1,000	2.13	469	5.33
		Total 142,200	**Total 273**	**Average 499**	**Average 4.51**

[a] Flushing volume calculated as 1.25 x pipe volume.

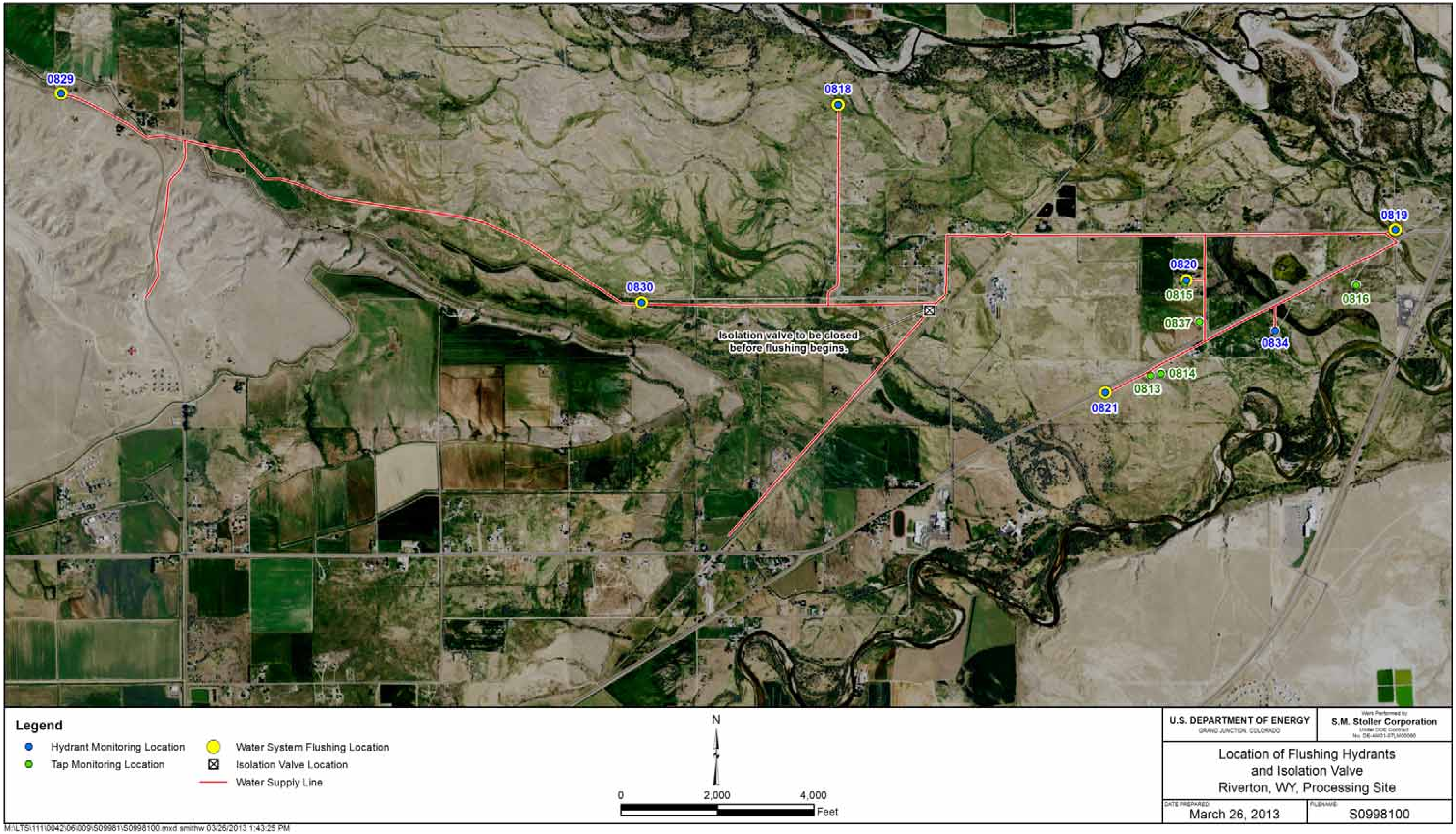


Figure 25. Location of Flushing Hydrants and Tap Monitoring Locations

This page intentionally left blank

Monitoring of hydrant and tap locations was conducted to determine the effectiveness of the flushing program in reducing radionuclide concentrations and maintaining them at acceptable levels. The flushing program is successful when the combined radium-226 and radium-228 concentrations are below the federal drinking water MCL of 5 pCi/L, and the uranium concentrations are below the federal drinking water MCL of 0.03 mg/L. DOE was not involved in the April flushing event, so those results are not presented in this report; however, no issues were identified by the Great Plains Utility Organization or the Tribal Engineer's Office. Effectiveness of the flushing program was demonstrated in October with a maximum-observed combined radium-226 and radium-228 concentration of 2.52 pCi/L, and a maximum observed uranium concentration of 0.00011 mg/L. Results from samples collected from AWSS hydrant and tap locations in October are summarized in Table 5 and provided in Appendix E.

Table 5. Monitoring Results from the October 2012 AWSS Flushing Event

ID	Sample	Radium-226 +Radium-228 (pCi/L)	Radium-226 +Radium-228 MCL	Uranium (mg/L)	Uranium MCL (mg/L)
Hydrant Locations					
0818	5-minute	1.543	5 pCi/L	0.00011	0.03 mg/L
	End of flush	1.364		0.00009	
0819	5-minute	1.943		0.00009	
	End of flush	2.273		0.00009	
0820	5-minute	2.52		0.00011	
0821	5-minute	1.657		0.00008	
	End of flush	2.24		0.0001	
0829	5-minute	1.458		0.00009	
	End of flush	0.939		0.0001	
0830	5-minute	1.44		0.00008	
	End of flush	1.4		0.00008	
0834	5-minute	1.992		0.00008	
Tap Locations					
0813	After completion of flushing	0.776	5 pCi/L	0.0001	0.03 mg/L
0815	After completion of flushing	0.92		0.00009	
0816	After completion of flushing	0.771		0.00008	
0837	After completion of flushing	2.124		0.00009	

This page intentionally left blank

3.0 Enhanced Characterization

3.1 Purpose and Scope

Results of the verification monitoring indicated that natural flushing was generally progressing as expected until June 2010, when significant increases in contaminant concentrations were measured in several wells. The June 2010 sampling event was conducted immediately after record flooding of the Little Wind River. During the flood, overbank flow was observed within a large area downgradient of the former mill site. Significant increases in contaminant concentrations occurred in monitoring wells where the flooding occurred. The spikes in contaminant concentrations were attributed to flood waters mobilizing residual contamination in the unsaturated zone (DOE 2011a).

The observations made in 2010 revealed that the existing site conceptual model and groundwater computer modeling did not account for the spikes in contaminant concentrations observed in the surficial aquifer groundwater. Consequently, the site conceptual model needed to be updated and a new groundwater flow and transport model developed to better simulate natural flushing processes. The enhanced characterization work in 2012 was designed to provide additional data to assist in accomplishing these goals.

The purpose of the enhanced characterization was to obtain additional data to further characterize the surficial aquifer (DOE 2012c). Specific objectives of the investigation were to:

- Provide enhanced definition of contaminant plumes, including the location of the centroid of each plume and the extent of groundwater contamination for each contaminant of concern
- Provide a detailed distribution of contaminants for input into the updated groundwater model.
- Provide data that will guide placement of new monitoring wells outside of the contaminant plumes to monitor lateral plume behavior.
- Provide a detailed and updated baseline of groundwater contamination for tracking plume configuration, movement, and size over time. This will be used to assess the progress of natural flushing if this study is repeated in the future.
- Provide information on soil characteristics, including the leachability of uranium.
- Estimate the mass of uranium remaining in the unsaturated zone of the surficial aquifer, which can be used to develop appropriate contaminant source terms in the transport modeling.

3.2 Fieldwork Summary

Fieldwork was conducted August 20–29, 2012. It was performed in accordance with the *Work Plan for the Enhanced Characterization of the Surficial Aquifer, Riverton, Wyoming, Processing Site* (Work Plan) (DOE 2012c). Fieldwork consisted of installing 103 boreholes along 9 transects (Figure 26) with a Geoprobe, which is equipment that is used to direct-push steel rods into the shallow soils and surficial aquifer material (Figure 27). Water samples were collected at each location, and soil samples were collected at 34 locations. To optimize the mapping of contaminant plumes (which may have a slightly different configuration for each contaminant), transects were oriented northeast and southwest approximately perpendicular to the known southeast direction of groundwater flow and to the axis of the known contaminant plumes. Distance between transects was reduced and sampling density increased in the portion of the aquifer near the expected centroid of the contaminant plumes downgradient of the former mill site. The increase in sampling density was designed to enhance definition of the centroid of the plumes and to provide more soil data from the unsaturated zone above the contaminant plumes in areas where the 2010 flood had the largest effect on groundwater contaminant concentrations. Details of the fieldwork are found in the *Enhanced Characterization of the Surficial Aquifer, Riverton, Wyoming, Processing Site, Data Summary Report* (Data Summary Report) (DOE 2013a).

3.3 Soil Characterization

3.3.1 Summary of Methods

Soil samples were collected at 34 locations (Figure 26). Geoprobe rods were driven to 5 feet bgs at each location, and two soil samples (0–2.5 feet and 2.5–5 feet) were collected at most locations for a total of 65 samples. Soils typically consisted of a dry, pale-yellowish silt in the top 2 to 3 feet with some near-surface roots, and sand and gravels below the silt. Figure 28 (top) displays a typical soil-core retrieved from the Geoprobe with a dry silt at the top that grades to a moist clayey-silt and then to sand and gravel. Figure 28 (bottom) shows another soil sample in the process of being homogenized prior to placement into a sample bag. Full sample recovery was not obtained in any of the 2.5–5-foot samples, with a maximum recovery of 84 percent in that interval. No recovery was obtained, and therefore samples were not collected, from the 2.5–5-foot interval at three locations (T01-07, T04-12, and T08-02). Soil characteristics were described and recorded for each location and are documented in the Data Summary Report.

Soil samples were analyzed by the Grand Junction Environmental Laboratory using three different tests: batch tests, kinetic tests, and column tests. Methods used in the laboratory tests are detailed in the *Laboratory Analysis of Shallow Sediment Near a Former Uranium Mill: Riverton, Wyoming, Site* (DOE 2013b) (Appendix F). Samples were dried in air and weighed several times during drying to determine the rate of water loss. Dried samples were sieved through a 2 millimeter (mm) sieve. The proportion of less-than-2 mm fraction varied from 20.95 percent to 99.98 percent of the sample. Artificial site water (ASW) containing a composition similar to the Little Wind River was prepared in the laboratory and used as the primary leaching solution for the tests.

Kinetic tests were conducted to determine the agitation time required for uranium to reach a steady-state concentration. These tests were conducted on eight samples (from four locations) also using ASW. Ten aliquots from each sample were tested with end-over-end agitation times in the test ASW of 5 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 8 hours, 16 hours, 48 hours, and 96 hours. After agitation of each aliquot, uranium analysis of the test solution was conducted using Environmental Laboratory analytical method AP (U-2), “Uranium Determination by Chemchek” (DOE 2011b). Soil concentrations in micrograms per gram were calculated from the uranium concentration measured in the test solution.

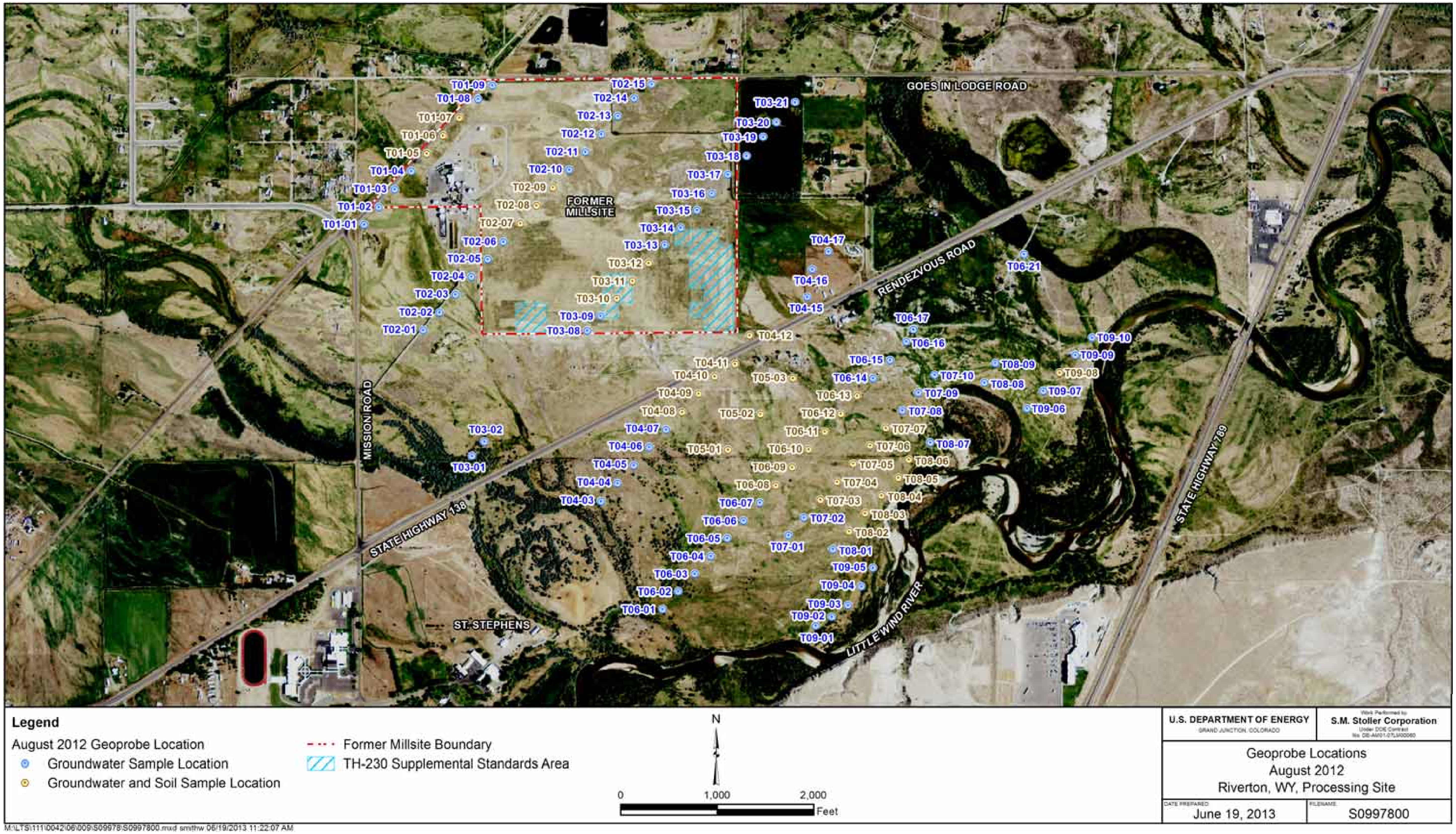


Figure 26. Enhanced Characterization Geoprobe Locations

This page intentionally left blank

Batch tests were conducted on all 65 soil samples by leaching with a high water-to-rock ratio (200 milliliters [mL] of water to 2 grams [g] of soil) using ASW to simulate flood events that would remove uranium. Samples were agitated end-over-end for two separate 24-hour intervals with fresh test solution for each agitation event. Test solutions from the two events were combined and analyzed for uranium using analytical method AP (U-2).

Figure 27. Installing a Borehole with a Geoprobe in August 2012

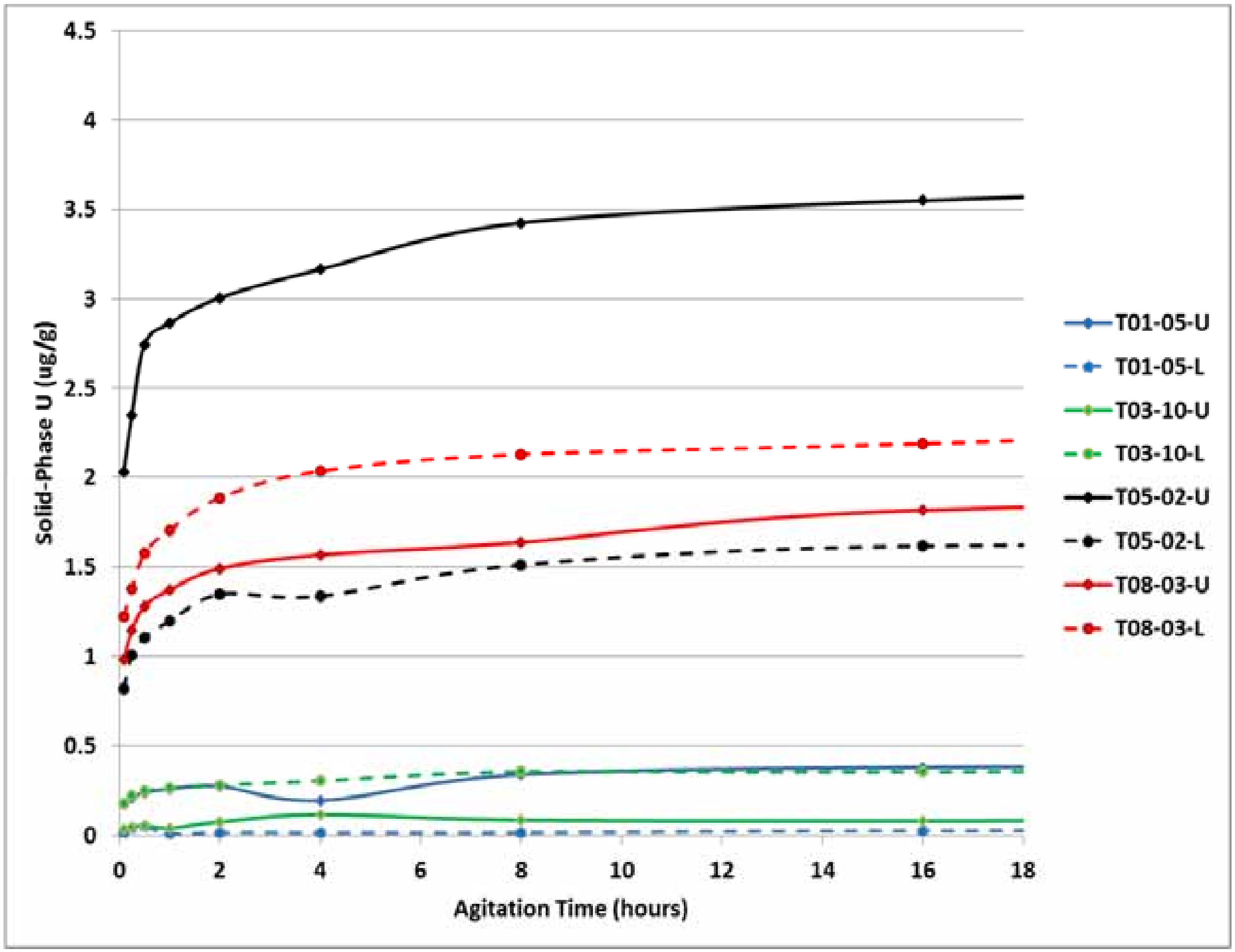
Column tests were conducted on 16 samples (8 locations) to estimate the total uranium source materials remaining in the unsaturated zone. These tests were conducted by pumping ASW through a soil column at a rate of approximately 0.09 milliliters per minute (mL/min) for most columns. Effluent from the column was collected approximately every pore volume and analyzed for uranium using analytical method AP (U-2). Column tests were continued until uranium concentrations in the effluent stabilized, which resulted in completion of tests at various stages ranging from 48 to 93 pore volumes. After the conclusion of the column tests, an extractant solution of sodium bicarbonate ($NaHCO_3$) and sodium carbonate (Na_2CO_3) developed by Kohler et al. (2004) was used to extract the easily removable, or labile, uranium from the column sediments.

Figure 28. Soil Samples Collected Using the Geoprobe

3.3.2 Results and Interpretation

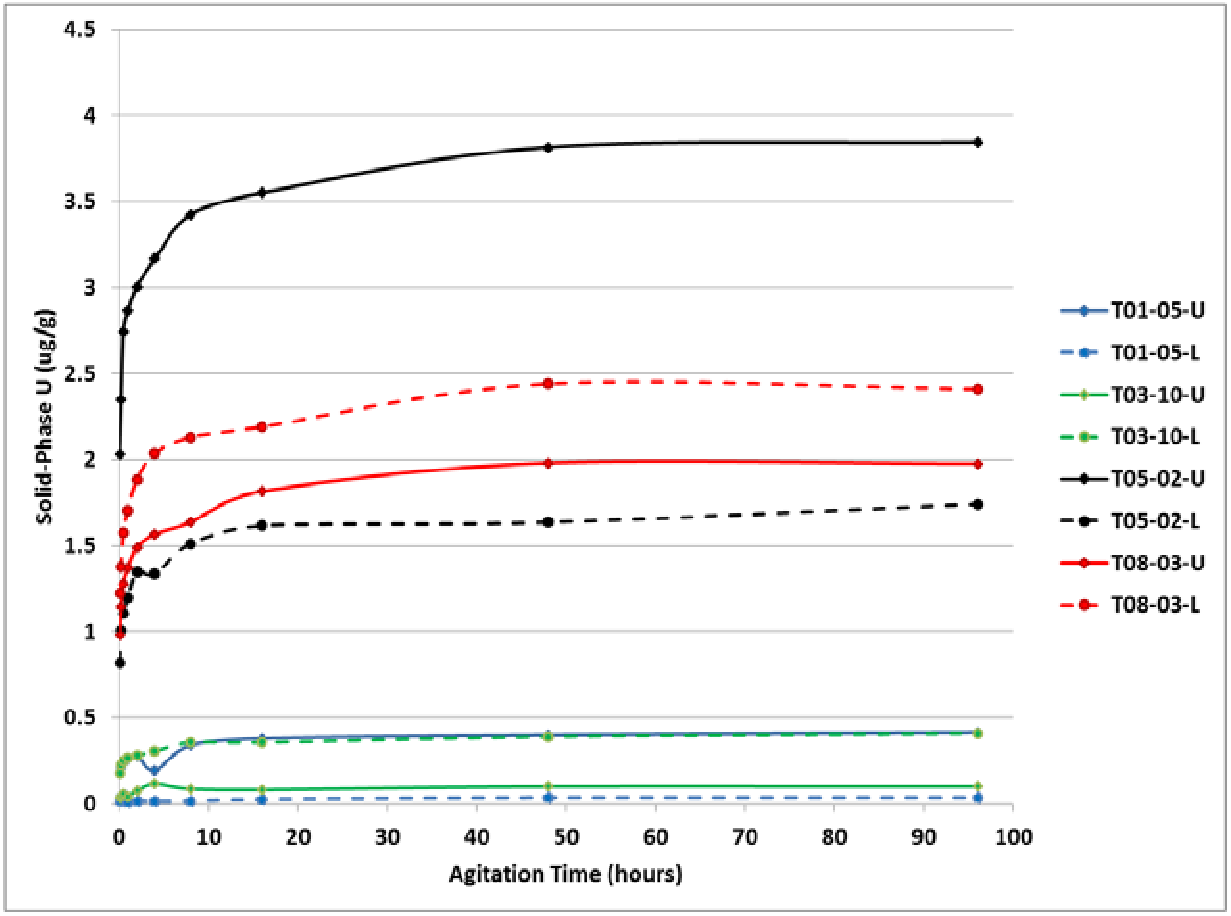
3.3.2.1 Batch Tests

Kinetic test results are shown in Figure 29 and Figure 30. As shown in these figures, the majority of the uranium is removed within the first 8 hours.



Abbreviations:
µg/g = micrograms per gram
U = uranium

Figure 29. Results of Soil Kinetic Tests (0 to 18 Hours)



Abbreviations:
µg/g = micrograms per gram
U = uranium

Figure 30. Results of Soil Kinetic Tests (Full Duration)

Results of the batch tests indicated a positive correlation between the abundance of fine-grained sediment (<2 mm) and the solid-phase uranium concentrations of the soil samples. The labile fraction is generally considered to be the mass that is weakly sorbed to mineral surfaces and is the fraction that most readily participates in interactions with groundwater. The concentrations of labile uranium measured in the soil samples were comparable to abundances of uranium in sedimentary rocks that make up the crust of the earth.

The concentrations of uranium in the <2 mm sediments that were removed by a 48-hour agitation with ASW were variable, ranging from 0.04 to 4.8 micrograms per gram (µg/g) with a median of 0.96 µg/g (Figure 31). In nearly all paired samples, the upper sample had a higher concentration of removable uranium than the lower sample. Median values for the upper and lower units were 2.10 and 0.34 µg/g, respectively (Figure 31). The distribution of soil concentrations at the Riverton site from batch tests are displayed in Figure 32. The concentrations were generally higher in the offsite (transects 04 through 08) samples than in the onsite (transects 01 through 03) samples.

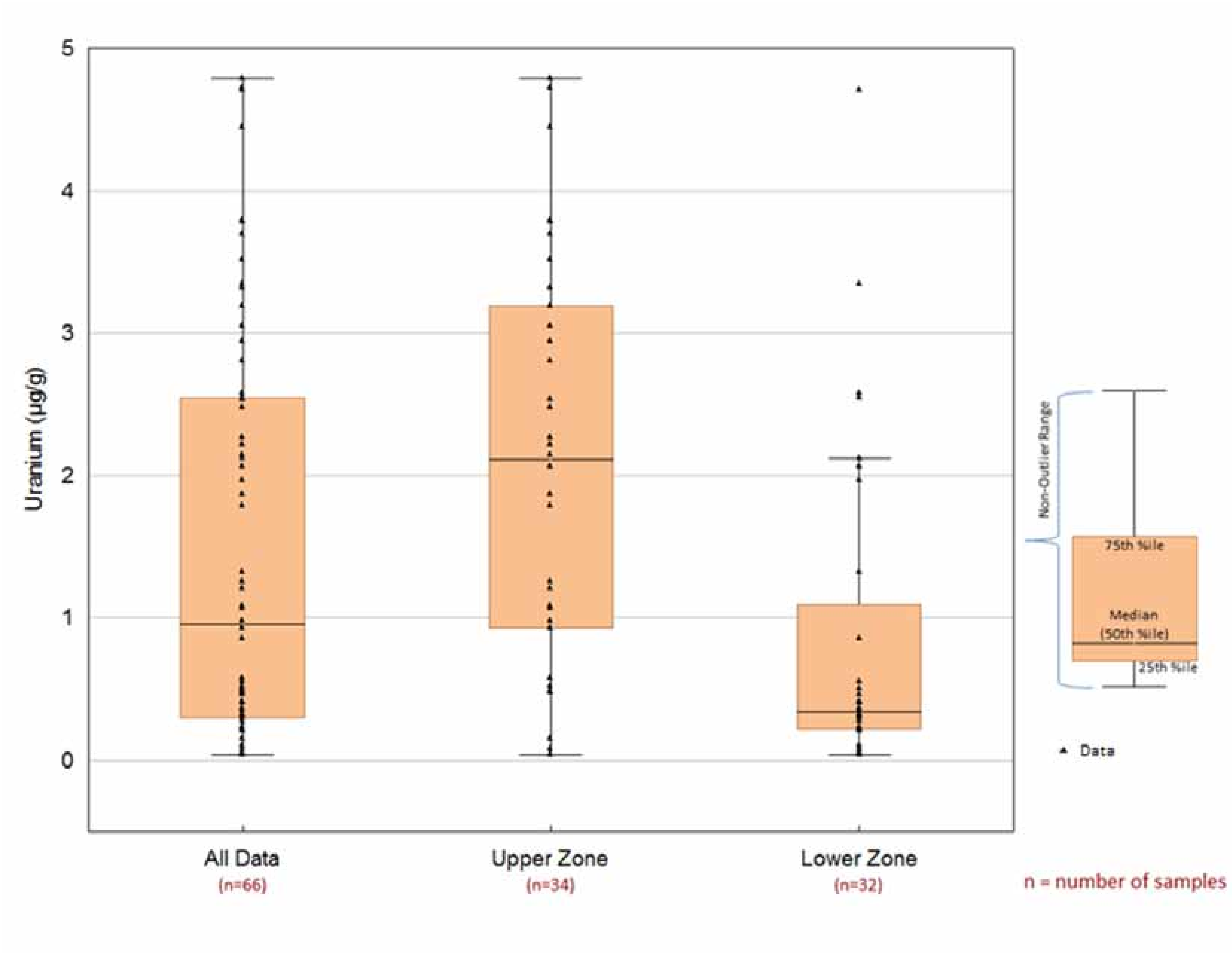


Figure 31. Distribution of Solid-Phase Uranium in Upper Zone (0–2.5 ft) vs. Lower Zone (2.5–5 ft) Samples

3.3.2.2 Distribution Coefficients

The transfer of uranium between sediments and groundwater is often modeled by assuming that the ratio of uranium concentration in the sediment to the concentration in the groundwater is constant. The ratio is called the distribution coefficient (K_d) and it is often used by groundwater modelers, in part because it is easily incorporated into numerical groundwater codes. It is well known that the actual partitioning of uranium concentrations between groundwater and sediment varies with chemical parameters, in particular the concentration of dissolved carbonate and pH. Thus, groundwater aquifers are likely to display variable K_d values over space and time. It is also known that the transfer of mass between aquifer solids and groundwater is controlled to some extent by rate-limited processes, such as slow diffusion from immobile pore fluid. These rate-limited processes are not typically considered in flow and transport models. Despite these uncertainties, it is instructive to examine the range of uranium K_d values that might be observed in the subsurface sediments.

The batch test data collected during the enhanced characterization study were not suitable for determining K_d values on their own because the concentration of labile uranium in the solid phase was not measured. However, assuming that the labile fractions measured on splits of the same samples used in column tests are representative of the labile fractions in the splits used for batch testing, K_d values can be calculated as shown in Table 6. K_d values calculated in this way ranged from 4.30 to 158.75 milliliters per gram (mL/g).

Table 6. Uranium K_d Values Calculated from Batch Test Data and Column Labile Fractions

Sample Number	24 Hour Batch Test Data		Column Labile	After Batch	
	U (µg/L)	U (µg/g)	U (µg/g)	U (µg/g)	K_d (mL/g)
T01-05U	4.8	0.48	0.657	0.177	36.88
T02-07L	0.8	0.08	0.136	0.056	70.00
T03-10U	0.8	0.08	0.207	0.127	158.75
T03-10L	4.7	0.47	0.715	0.245	52.13
T04-10U	25.4	2.54	3.761	1.221	48.07
T04-10L	5.1	0.51	0.729	0.219	42.94
T05-02L	13.2	1.32	1.921	0.601	45.53
T06-10U	17.9	1.79	2.033	0.243	13.58
T06-10L	2.2	0.22	0.329	0.109	49.55
T07-04U	12.1	1.21	1.262	0.052	4.30
T07-04L	2.4	0.24	0.312	0.072	30.00
T08-03U	20.7	2.07	2.265	0.195	9.42
T08-03L	25.8	2.58	2.716	0.136	5.27

µg/L = micrograms per liter

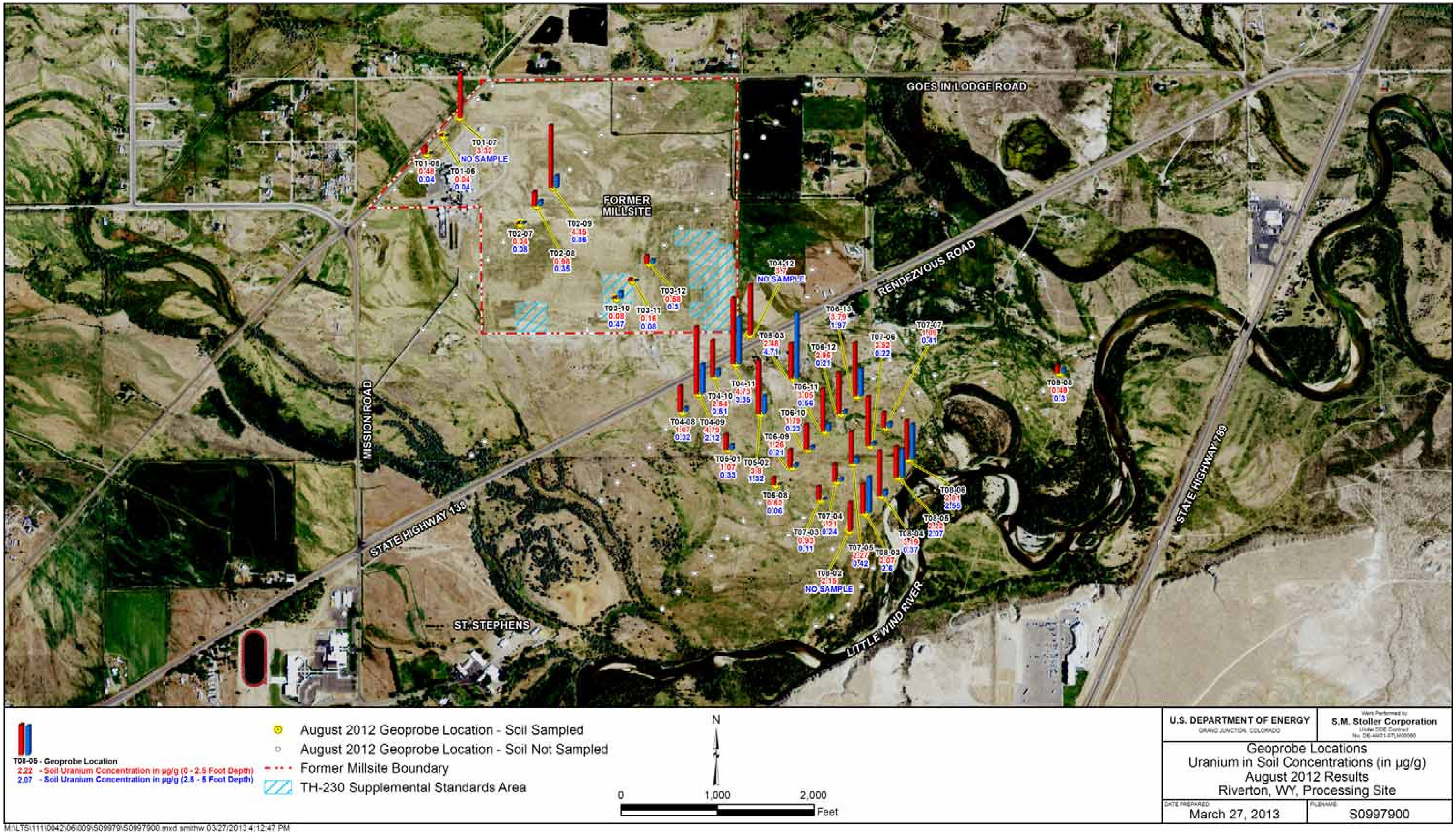


Figure 32. Uranium Distribution from Soil Batch Tests

This page intentionally left blank

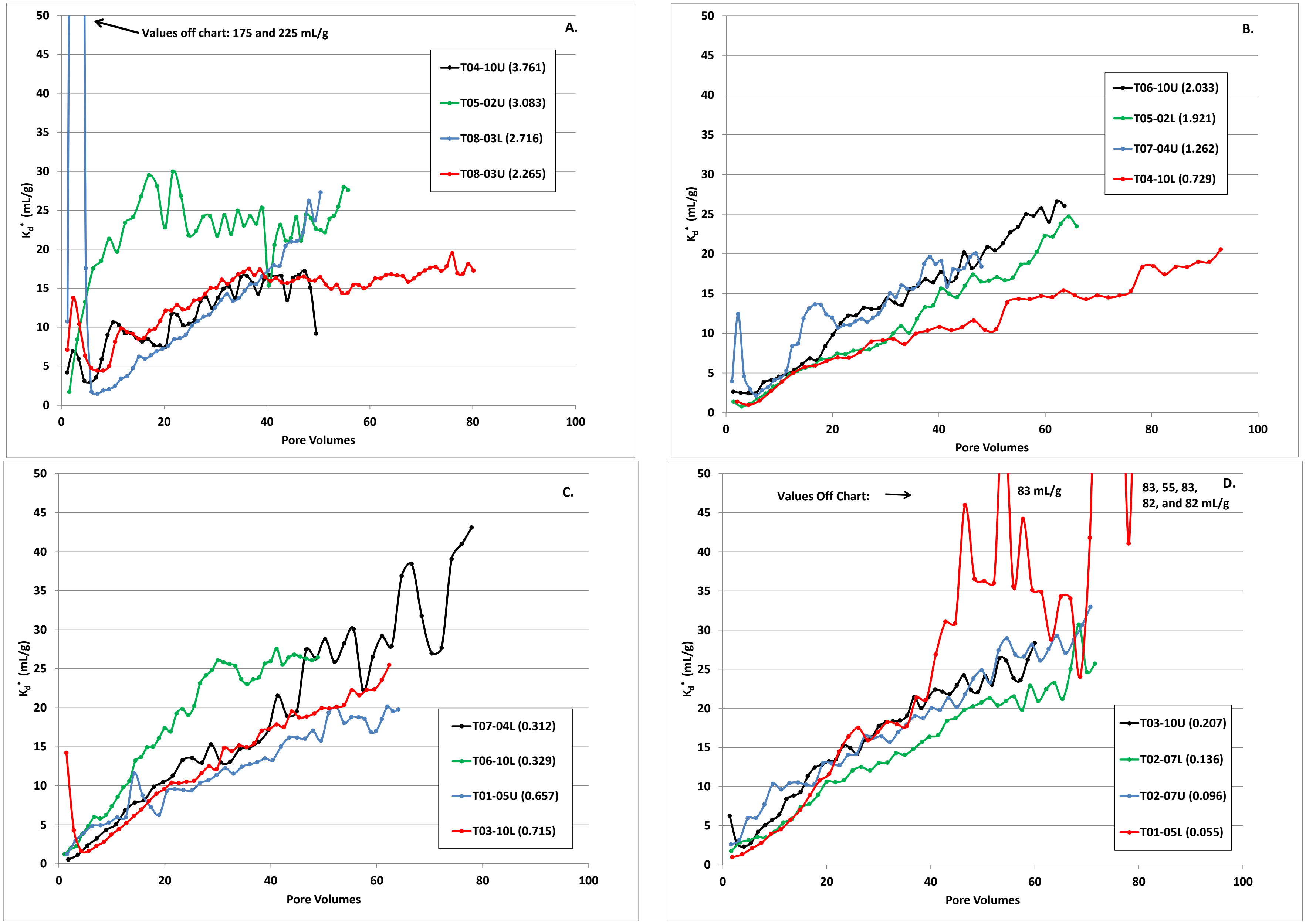
The column data can also be used to estimate K_d values. The apparent uranium distribution coefficient (K_d^*) was determined for each effluent sample collected from the column tests. Because the distribution of uranium in the columns is unknown, K_d^* is the ratio of the concentration of uranium in the effluent sample to the *average* concentration of uranium in the column sediment. To evaluate *true* K_d, the concentration of uranium in the column sediment at the top of the column would need to be used with the effluent dissolved concentration. Residence time also influences the estimated K_d values since the fluid is not in contact with the sediment long enough to come to equilibrium, as is indicated by batch test results measured at variable time intervals.

With the exceptions of fluctuations in the early stages (first 10 pore volumes), the uranium effluent concentrations in the column effluents demonstrated a monotonic decrease throughout the tests. K_d^* values are plotted on Figure 33, arranged in order of their total labile uranium concentrations in µg/g.

With only a few exceptions, the K_d^* values are low early on and gradually trend to higher values as more pore volumes are passed. The fluctuations observed in some columns (e.g., T05-02) during the early stages may be due to fluctuation in the dissolved inorganic and organic carbon concentrations. Some of the fluctuation observed in the later stages (e.g., in T01-05L) are due to imprecision in the uranium concentration analysis at the low dissolved concentrations present in some of the effluent samples.

The early values of K_d^* are typically less than 5 mL/g, with some as low as about 1 mL/g. Most of the K_d^* values observed after more than 40 pore volumes exceed 10 mL/g. Numerical models using K_d values of more than 10 mL/g should result in minimal plume movement (an example is provided in Freeze and Cherry 1979). Because uranium appears to be released and transported by groundwater at the Riverton site, it is likely that the K_d^* values measured in the column tests do not accurately reflect the nature of the uranium partitioning between sediment and groundwater.

Reasons for the wide distribution of K_d^* in the column tests are uncertain. Some of the variation is due to mobilization of organic carbon during the early stages of column operation and the possible influence of pH and dissolved inorganic carbon species. Conceptually, the use of the K_d approach in predictive modeling mandates that the system be maintained at chemical equilibrium. The condition of equilibrium may not be met during the column testing. The residence time of about 1 hour is insufficient for the system to reach an equilibrium state. The condition of equilibrium can be tested using a flow-interruption technique. After a flow-interruption, there should be no change in effluent concentrations if the system is at equilibrium; however, rate-limited reactions are indicated by higher concentrations following column restarts. There are many physical and chemical processes that could cause rate-limited mass transfer. A time lag can occur simply due to slow desorption from mineral surfaces. Slow diffusion from intraparticle pores can also limit uranium transfer. As sediment ages, uranium can migrate to internal portions of mineral crystal structures or to intracrystalline microfractures and pores where it becomes more recalcitrant to re-release. The Riverton sediments have had decades for these types of transformations to occur. Regardless of the exact processes involved, it is reasonable to speculate that the release of contaminants from these sediments is rate controlled.



Note: The labile uranium concentrations in µg/g are given in the parentheses following the sample name—e.g., T03-10U (0.207).

Figure 33. Plot of Apparent Distribution Coefficients (K_d^*)

3.3.2.3 Secondary Source in the Unsaturated Zone

Two scenarios were examined to determine if uranium concentrations measured in soil samples from the 2012 enhanced characterization were high enough to cause the spikes observed in samples collected from monitoring wells in 2010 after flooding of the Little Wind River. These two scenarios were: Scenario 1 – groundwater rising up into the unsaturated zone and mobilizing uranium during flood events, and Scenario 2 – flood waters infiltrating down from the surface and mobilizing uranium. It should be noted that soils collected during the 2012 investigation did not represent the entire unsaturated zone because the samples were only collected from 0 to 5 feet (the unsaturated zone extends deeper most of the year), and recovery ranged from 0 to 85 percent in the 2.5 to 5-foot interval.

Scenario 1 assumes that rising groundwater levels driven by an increasing river stage provide the sole mechanism for leaching of contaminants in the alluvial aquifer's unsaturated zone, and that the resulting leachate was the primary cause of the spikes in concentration observed at near-river wells 0707 and 0789 shortly after a river flood event in June 2010. The viability of this scenario can be assessed by examining flow and advective transport processes associated with this alternative and the results from preliminary modeling of those processes. The observed increase in uranium concentration at well 0707 in response to the 2010 flooding was from about 0.8 mg/L to 2.7 mg/L, and the corresponding increase at well 0789 was from about 1.5 mg/L to 2.64 mg/L (Figure 11).

It is assumed that the rising groundwater elevation was caused by pressure wave transmission inland (toward the Riverton site) from the river, and none of the increase in groundwater level was caused by infiltration of overbank flood water on the floodplain surface. This mechanism had the potential to be most effective at mobilizing contamination if the water table rose as high as the ground surface, so that a maximum amount of sediment was contacted by groundwater. Contaminant mobilization was also likely enhanced by longer contact time between the rising groundwater and the shallow contaminated sediment. The extent of groundwater rise and the contact time depended on aquifer hydraulic conductivity, the specific yield of the aquifer, and the magnitude and duration of the increased river stage during a flood.

Though leaching of uranium from the shallow floodplain sediments apparently increased concentrations in the uppermost part of the saturated zone, additional processes would have been required to transport the newly mobilized uranium to produce the concentrations observed in 2010. Accordingly, it would have been necessary that significant downward flow occurred in the saturated zone as groundwater levels gradually declined upon passage of the flood wave in the river. Downward advective transport of the uranium would have been particularly important for detecting uranium at a concentration of 2.7 mg/L in well 0707, as the top of the 5-foot screened interval for this well is located 9.8 feet bgs, which is about 4.5 feet below the lowest water table levels observed at this well.

Several numerical simulations were performed with a cross-sectional model to assess the likelihood that contaminants mobilized from shallow floodplain sediments in June 2010 migrated as deep as the top of the screened interval in well 0707. The model was designed to account for groundwater flow and advective transport along a 2,100-foot section of the alluvial aquifer aligned with axis of the uranium plume as mapped over the past nine years. The model was constructed using 16 layers, a single row representing a flow path extending northwestward from the river to Rendezvous Road, and 105 columns with a uniform length of 20 feet. Temporally variable, prescribed-head boundary conditions were invoked on the downgradient end of the model to represent changing river levels associated with flows observed at the U.S. Geological Survey gaging station on the river near Riverton during the 2010 flood event. A general head boundary condition was applied to the upgradient boundary to account for groundwater flow in the vicinity of Rendezvous Road, which during non-flood conditions comprises inflows from the northwest. Advective transport was simulated using particle tracking.

Several simulations were conducted with the cross-sectional model, each with a different combination of aquifer hydraulic conductivity and specific yield, with the intent of accounting for a variety of possible groundwater flow conditions. In all cases, the particle tracking indicated that the downward flow associated with a falling water table after the flood event was insufficient for driving leached contamination as deep as the top-of-screen elevation at well 0707. Thus the cross-sectional modeling suggested that, though some mobilization of unsaturated-zone contamination was likely, it was not large enough to produce the spike in uranium concentration observed at well 0707 in 2010.

Scenario 2 invokes the possibility that, during the period of overbank flows that occurred in June 2010, infiltration of surface water on the floodplain augmented downward flow in the aquifer to the extent that uranium was carried as deep as the top-of-screen elevation at well 0707.

Review of principles of contaminant transport associated with this scenario is helpful for assessing its viability. For example, for scenario 2 to be true, it is a requirement that the leaching of shallow floodplain sediments in June 2010 produced aqueous-phase concentrations of uranium that exceeded the 2.7 mg/L peak concentration observed at well 0707, and that such large concentrations were maintained over a several-day period. Otherwise, it would have been impossible for the shallow sediments to be the source of the uranium levels observed at the well. None of the laboratory leach-tests on soil samples produced a dissolved uranium concentration as large as 2.7 mg/L, which raises questions of the viability of this scenario.

The validity of scenario 2 was also analyzed with multiple simulations of two-dimensional groundwater flow and transport in a large area surrounding the former Riverton site over a time period that spanned the 2010 flood event. The numerical model used for this purpose was assigned a single layer intended to represent the entire saturated thickness of the alluvial aquifer, the Little Wind River comprised the southeast boundary of the simulation domain, and the flow portion of the model was automatically calibrated with the pilot-point methods incorporated in PEST software. In simulations aimed at accounting for uranium mass mobilization from shallow floodplain sediments, prescribed hydraulic heads along the model's downgradient border were varied over time to reflect changing river stages associated with river flows in 2010. Thus simulated groundwater levels rose and fell accordingly, due to pressure wave transmission. Mass loading of contamination to the alluvial aquifer was modeled in all cases by simulating recharge with a specified uranium concentration to floodplain areas in the vicinity of and upgradient of wells 0707 and 0789. The recharge represented infiltration of overbank surface water, and was only invoked over the time span when the river apparently overflowed its banks.

Several different combinations of recharge rate and prescribed concentrations were applied in the multiple simulations. One of the findings from the various model runs was that it was necessary to limit the assigned recharge rate so that computed groundwater levels remained within a range that did not exceed the estimated surface-water elevation during the overbank flood stage. In addition, it was necessary to use prescribed uranium concentration in the recharge on the order of

10 mg/L or greater to achieve simulated concentrations in the well 0707 and well 0789 areas that were of the same general magnitude as those measured after passage of the 2010 flood wave. These results suggest it is unlikely that this scenario was the cause of the uranium concentrations spikes observed in wells 0707 and 0789.

3.4 Groundwater Characterization

3.4.1 Summary of Method

Groundwater samples were collected at all 103 borehole locations (Figure 26) according to the procedures specified in the Work Plan. Samples were collected after the Geoprobe rods were driven to 12 feet bgs or until rod refusal (see the Data Summary Report [DOE 2013a] for the locations where Geoprobe rods could not be driven to 12 feet), and 8 liters of water were purged from the rod. The 12-foot depth the Geoprobe rods were driven to approximated the average midpoint of the screened interval for the monitoring wells in the surficial aquifer that comprise the long-term monitoring network. Field measurements of pH, specific conductance, temperature, oxidation-reduction potential, total alkalinity, turbidity, and dissolved oxygen were made at each borehole, and samples were analyzed for the U.S. Nuclear Regulatory Commission (NRC)–approved contaminants of concern (manganese, molybdenum, sulfate, and uranium) (DOE 1998a), major cations (calcium, magnesium, potassium, and sodium), and an additional major anion (chloride). Samples were analyzed by ALS Laboratory Group in Fort Collins, Colorado, using standard EPA methods. Groundwater data were validated according to the "Standard Practice for Validation of Laboratory Data" in the *Environmental Procedures Catalog* (LMS/POL/S04325).

3.4.2 Interpretation and Results

3.4.2.1 Comparability of Data

An assessment of the comparability of the groundwater results obtained during the enhanced characterization to the results from the long-term monitoring network was conducted because sampling methodology was by necessity different for the temporary boreholes sampled during the enhanced characterization (DOE 2013a). The assessment was conducted by comparing (1) molybdenum, sulfate, and uranium results from monitoring well samples collected during the June 2012 routine sampling event with (2) results from the temporary boreholes collected in August 2012, as shown in Table 7. The temporary borehole closest to a monitoring well and within the same contour was used for the comparison.

As shown in Table 7, the mean percent difference (PD) ranged from −31.9 to 3.2 PD. This range of PD indicates good comparability of methods given the following considerations: (1) EPA guidance for acceptable precision for laboratory duplicates is 20 relative percent difference (LMS/POL/S04325), and one third of the comparisons met the laboratory criteria; (2) temporal variability between the June and August events; and (3) distance between the monitoring well and temporary borehole (up to 680 feet). Correlation between enhanced characterization results and long-term monitoring results was exceptional where uranium concentrations were high in monitoring wells 0707 and 0789.

Table 7. Comparison of June 2012 Results with August 2012 Results[a]

Monitoring Well Location	U June	U August	PD[b]	Mo June	Mo August	PD	SO_4 June	SO_4 August	PD
0707	1	1.1	−9.5	0.9	0.53	51.7	3100	2300	29.6
0716	0.3	0.22	30.8	0.13	0.11	16.7	460	440	4.4
0718	0.16	0.42	−89.7	0.068	0.21	−102.2	2600	2600	0.0
0720	0.0063	0.0028	76.9	0.0013	0.0058	−126.8	190	320	−51.0
0722R	0.51	0.18	95.7	0.13	0.15	−14.3	840	130	146.4
0729	0.0031	0.0096	−102.4	0.002	0.0046	−78.8	74	120	−47.4
0784	0.0028	0.0011	87.2	0.0099	0.018	−58.1	2300	2200	4.4
0788	0.053	0.029	58.5	0.022	0.02	9.5	1700	1200	34.5
0789	2.1	2.1	0.0	0.56	0.56	0.0	5900	3900	40.8
0824	0.0085	0.027	−104.2	0.0047	0.0057	−19.2	85	320	−116.0
0826	0.049	0.07	−35.3	0.02	0.027	−29.8	1800	2000	−10.5
		Mean	**0.7**		**Mean**	**−31.9**		**Mean**	**3.2**

[a] Units are in milligrams per liter (mg/L).

[b] Percent difference was calculated as $[(a - b) \div (a + b)/2)] \times 100$, where a = June concentration value from a monitoring well and b = August concentration value from a temporary borehole near the monitoring well.

3.4.2.2 General Water Chemistry

Major anion and cation data are displayed as a Piper diagram in Figure 34. Locations were divided into four areas of the aquifer—upgradient of the uranium plume, within the uranium plume, northeast of the uranium plume, and southwest of the uranium plume—and plotted on the diagram. General water chemistry varies spatially within the aquifer as shown in Figure 34:

- Upgradient locations (green) have no dominant cation type and are distributed between bicarbonate and sulfate types of water for anions.
- Locations within the uranium plume (red) tend to have no dominant cation type and are a sulfate type of water for anions.
- Locations northeast of the uranium plume (blue) are calcium type of water for cations and bicarbonate type of water for anions.
- Locations southwest of the uranium plume (black) are distributed between no dominant type and a sodium/potassium type of water for cations and are generally a sulfate type of water for anions.
- The difference between water types on each side of the uranium plume is likely due to the influence of sulfate in the discharge water from the sulfuric acid plant on the southwest side of the uranium plume that is recharging the surficial aquifer.

Groundwater summary statistics for all results are provided in Table 8, and a complete set of groundwater data collected during this characterization is provided in Appendix G.

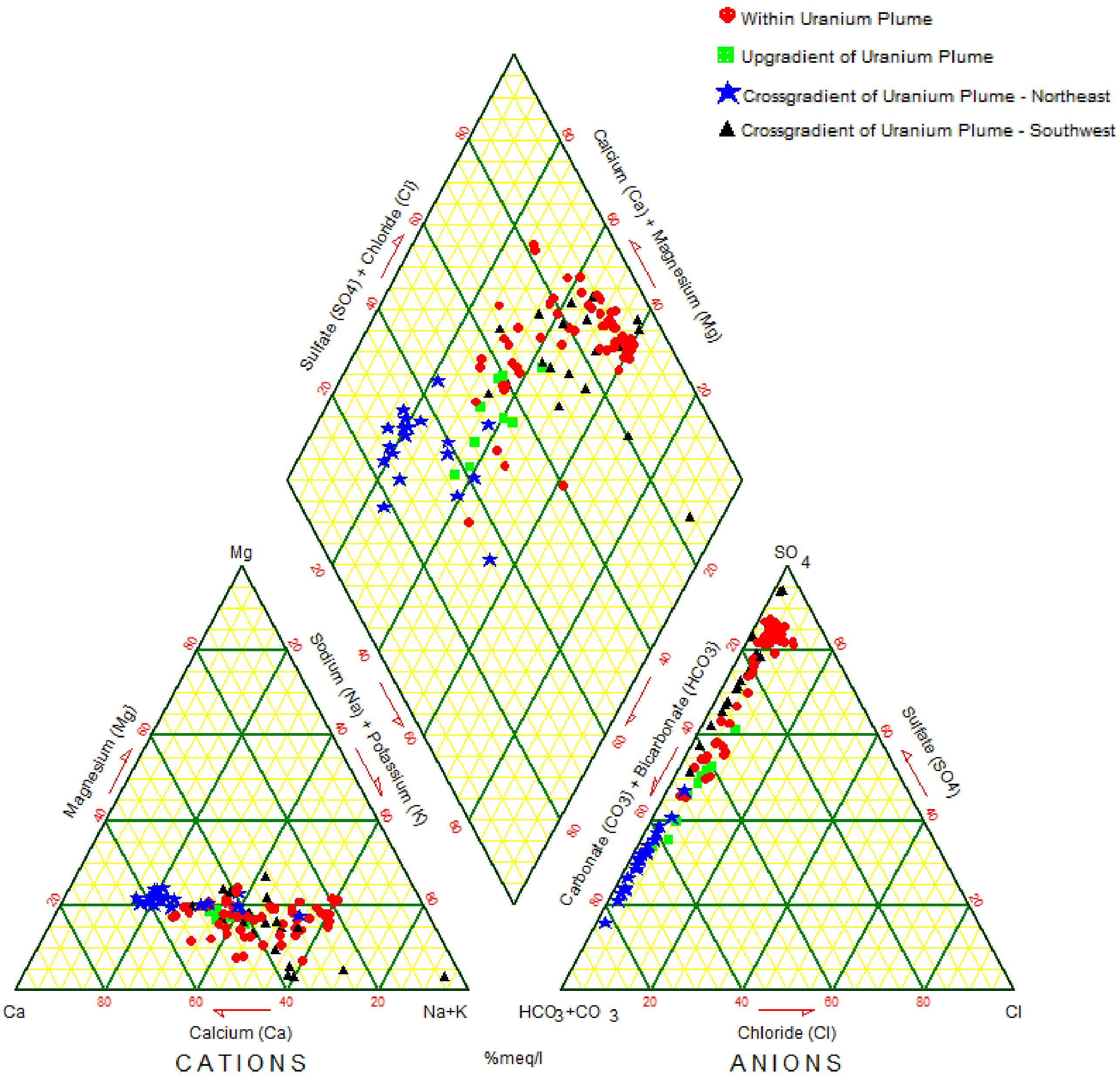


Figure 34. Piper Diagram of Major Anion and Cation Data

Table 8. Summary of Groundwater Results

Analyte	Benchmark[a,b]	Range[b]	Mean[b]	Area of Plume[c] (Acres)
Manganese	2.26	0.012–7.2	0.998	71
Molybdenum	0.1	0.004–1.1	0.165	182
Sulfate	400	39–5,900	1,431	465
Uranium	0.044	0.00081–2.1	0.277	323
Calcium	271	48–760	247	NA
Magnesium	25.5	7.7–390	76.4	NA
Potassium	4.1	2.6–28	8.8	NA
Sodium	167	16–2,000	429	NA
Chloride	73	3.4–570	72	NA

[a] Benchmark is either 40 CFR 192 MCL (molybdenum and uranium) or maximum background concentration (manganese, sulfate, calcium, magnesium, potassium, sodium, and chloride) (DOE 2012a).
[b] Units are in milligrams per liter (mg/L).
[c] Area of plume determined from outer contour of plume using Geographic Information System (GIS) software.

3.4.2.3 Manganese

Manganese concentrations in the surficial aquifer are relatively low, with the maximum concentration approximately four times the background concentration; therefore, manganese does not form a well-defined plume, as shown in Figure 37. Graduated symbol plots and box-and-whisker plots for all groundwater COPCs are shown in Figure 35 and Figure 36, respectively. Those figures show that higher manganese concentrations are skewed to the southwest and occur further upgradient than the molybdenum and uranium plumes.

3.4.2.4 Molybdenum

The molybdenum plume is narrow, well defined, and within the bounds of the long-term monitoring well network as shown in Figure 38. Figure 35 and Figure 36 confirm that elevated molybdenum concentrations occur within the narrow plume area and are evenly distributed along the axis of the plume. The current long-term monitoring network is adequate for monitoring molybdenum.

3.4.2.5 Sulfate

The sulfate plume (Figure 35, Figure 36, and Figure 39) is larger than the other plumes and is skewed upgradient and to the west, which is likely due to infiltration of water from the unlined ditch that carries discharge from the sulfuric acid plant. The outer boundary of the sulfate plume is defined as 400 mg/L, which is the maximum concentration observed in background wells (DOE 2012a). The ditch contained water with sulfate concentrations up to 2,000 milligrams per liter (mg/L) in 2012. Future work may be required to determine the contribution of sulfate to the surficial aquifer from the sulfuric acid plant versus the former mill; however, the high levels of sulfate in the centroid of the plume are likely mill-related.

3.4.2.6 Uranium

In general, the extent of the uranium plume (Figure 40) is similar to previous interpretations using monitoring data from the long-term monitoring program. The centroid of the plume is near the Little Wind River and located near monitoring well 0789, and the maximum uranium concentration found during this investigation is equal to the uranium concentration in monitoring well 0789.

However, two anomalous areas were revealed during the enhanced characterization. First, the uranium concentration measured in the sample collected at location T06-01 (furthest southwest location) was above the MCL in 40 CFR 192, which is anomalous for this area of the aquifer based on plume configurations and groundwater flow direction. This uranium concentration also stands out in Figure 35 and Figure 36. Although anomalous, this uranium concentration is considered valid as it correlates with the elevated sulfate concentration (1,200 mg/L) in T06-01 and elevated uranium concentration (above background) in samples collected from adjacent locations in the same transect (0.024 mg/L in T06-02, 0.02 mg/L in T06-03, and 0.029 mg/L in T06-04). Additional investigation work may be warranted in this area to determine the extent of uranium contamination.

Second, the uranium concentration at T03-08 (1.1 mg/L) on the south edge of the former tailings pile is higher than would be expected 23 years after the completion of surface remediation at the former mill site. This elevated concentration indicates more complex aquifer properties, geochemical controls, and/or additional sources/sinks, which enable recalcitrant uranium concentrations to remain upgradient of the main centroid of the plume. It is unknown if this is an isolated point, because other planned locations to the southwest on Transect 3 were not sampled due to owner access and cultural resource survey issues. Additional investigation work may be warranted in this area to determine the extent and possible causes of this high uranium concentration.

3.5 Site Conceptual Model

Limited empirical data indicates that surprises occur in 20 to 30 percent of conceptual models, with a surprise being defined as new data that renders the site conceptual model invalid (Bredehoeft 2005). The flood of the Little Wind River in 2010 due to rapid snowmelt and rainfall caused increases in dissolved contaminant concentrations in groundwater wells and provided a “surprise” related to the original site conceptual model as detailed in the Site Observational Work Plan (SOWP) (DOE 1998b). An update to the original model is needed. However, there continues to be aspects of the site that are not well understood, so the site conceptual model will continue to evolve as new data are collected (see Section 5.0, “Summary and Recommendations”) and as alternative site conceptual models are tested. This section presents the major aspects of the original site conceptual model presented in the SOWP and presents aspects of an evolving site conceptual model that have been discovered since 2010. A generalized schematic of the original conceptual model and a revised (and evolving) site conceptual model are presented in Figure 41.

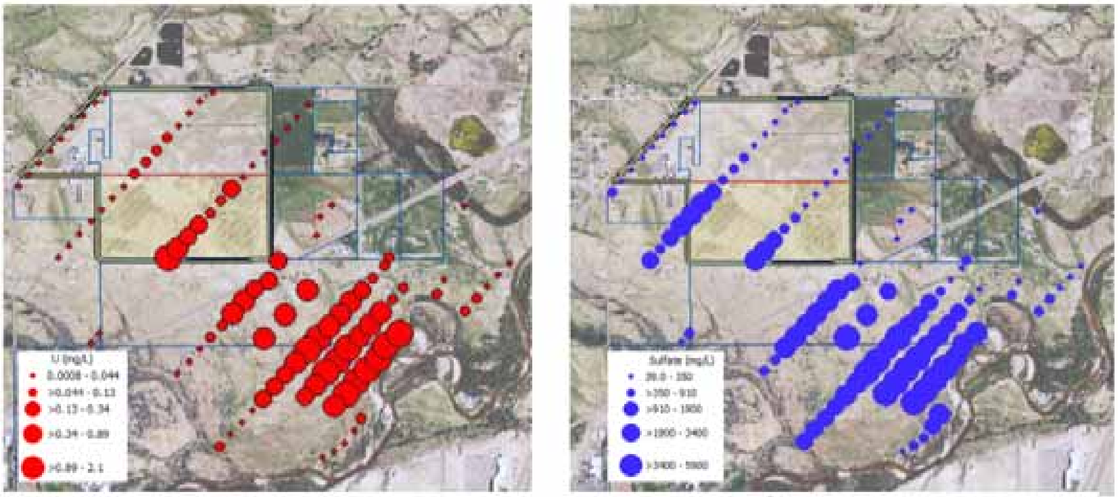


Figure a. Uranium (mg/L)

Figure b. Sulfate (mg/L)

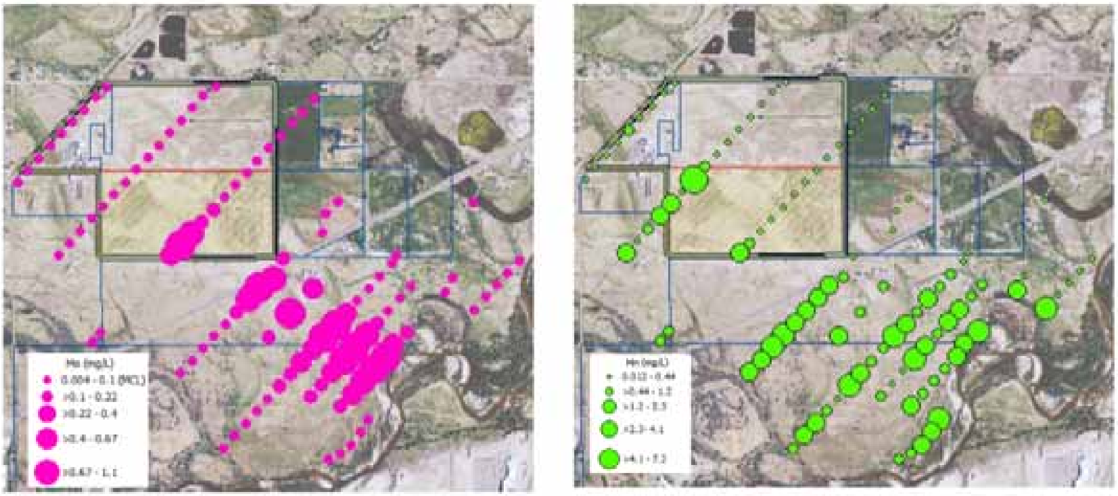


Figure c. Molybdenum (mg/L)

Figure d. Manganese (mg/L)

Symbol (magnitude) categories were established using the Natural Breaks (Jenks) classification method in ArcMap (version 10.0). Exceptions are the first category classes for U and Mo, which were modified slightly to correspond to MCLs (0.044 and 0.1 mg/L). (Initial Jenks-based ranges for these categories were 0.0008–0.037 and 0.004–0.075 mg/L for U and Mo, respectively.)

Figure 35. Graduated Symbol Plots of Manganese, Molybdenum, Sulfate, and Uranium in Groundwater: August 2012

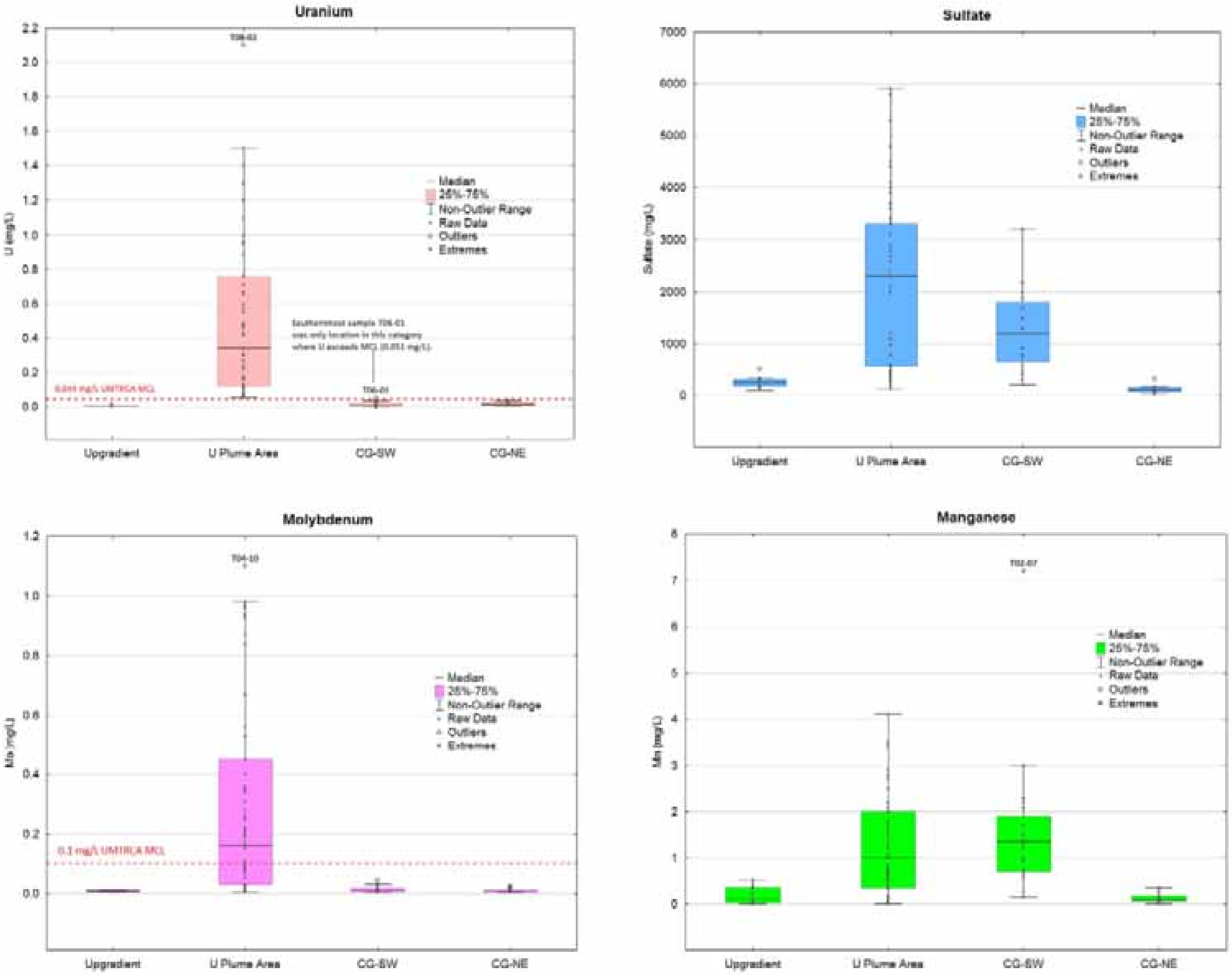


Figure 36. Box-and-Whisker Plots for Manganese, Molybdenum, Sulfate, and Uranium

This page intentionally left blank

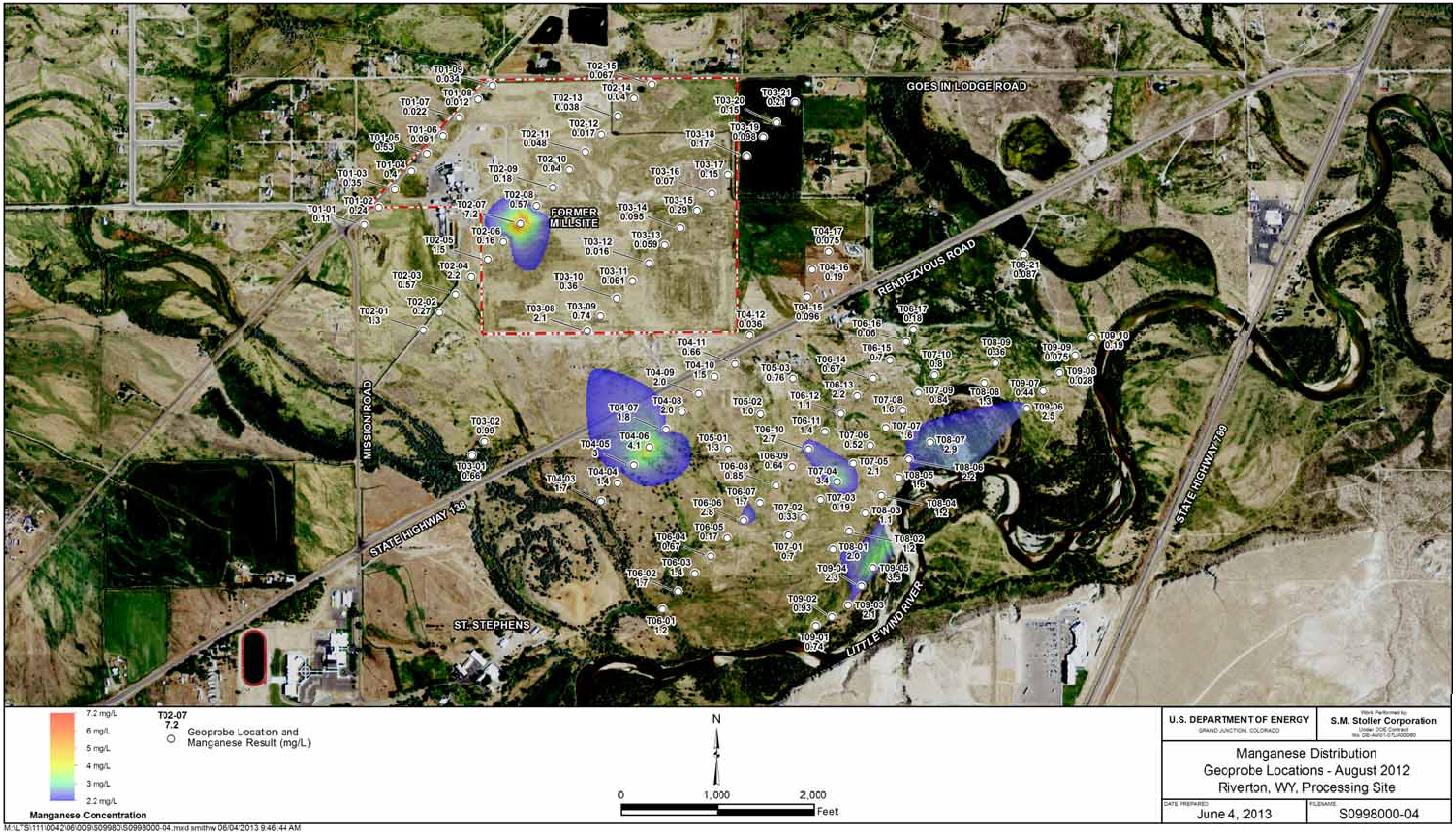


Figure 37. Distribution of Manganese in the Surficial Aquifer: August 2012 Enhanced Characterization

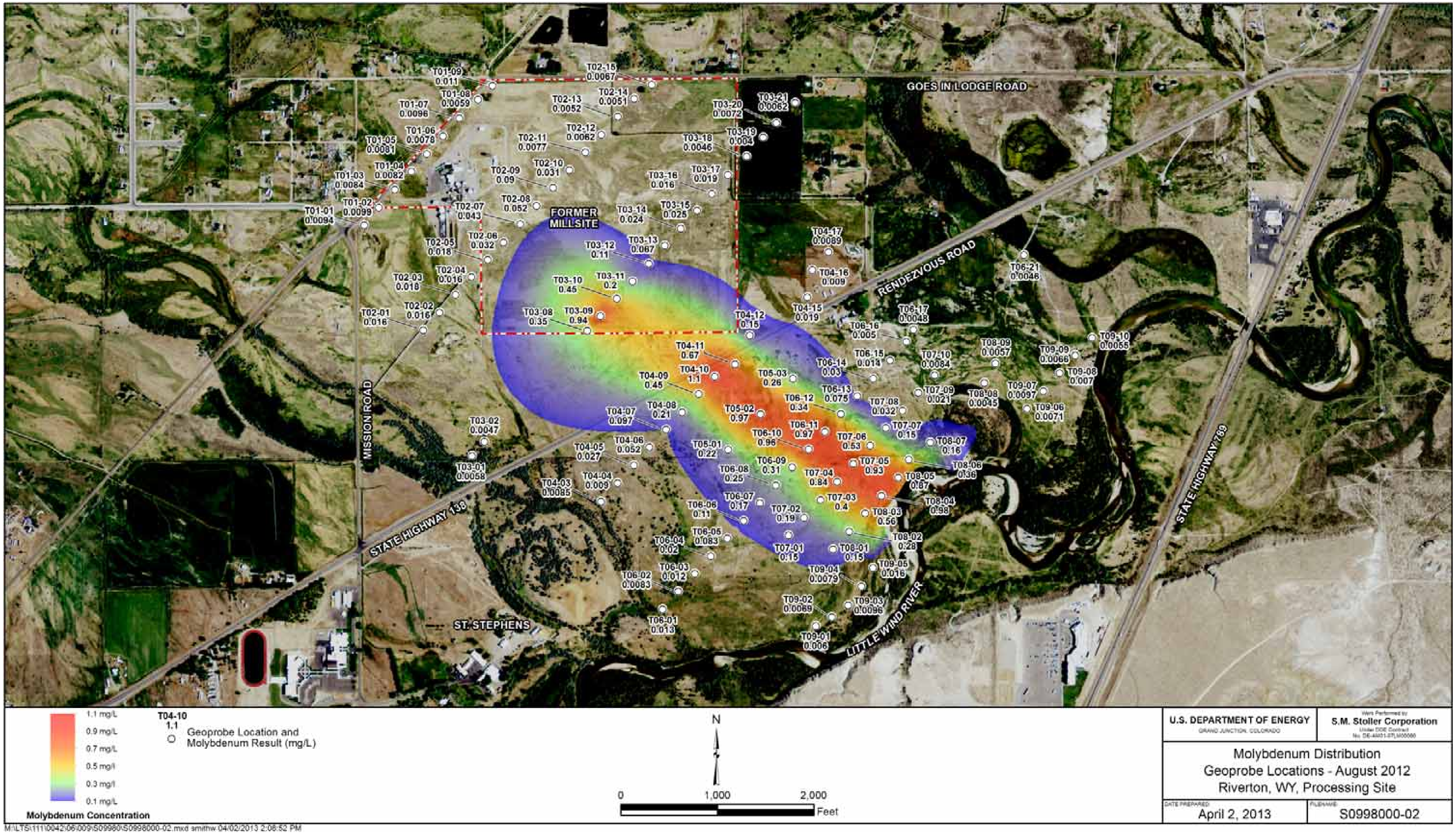


Figure 38. Distribution of Molybdenum in the Surficial Aquifer: August 2012 Enhanced Characterization

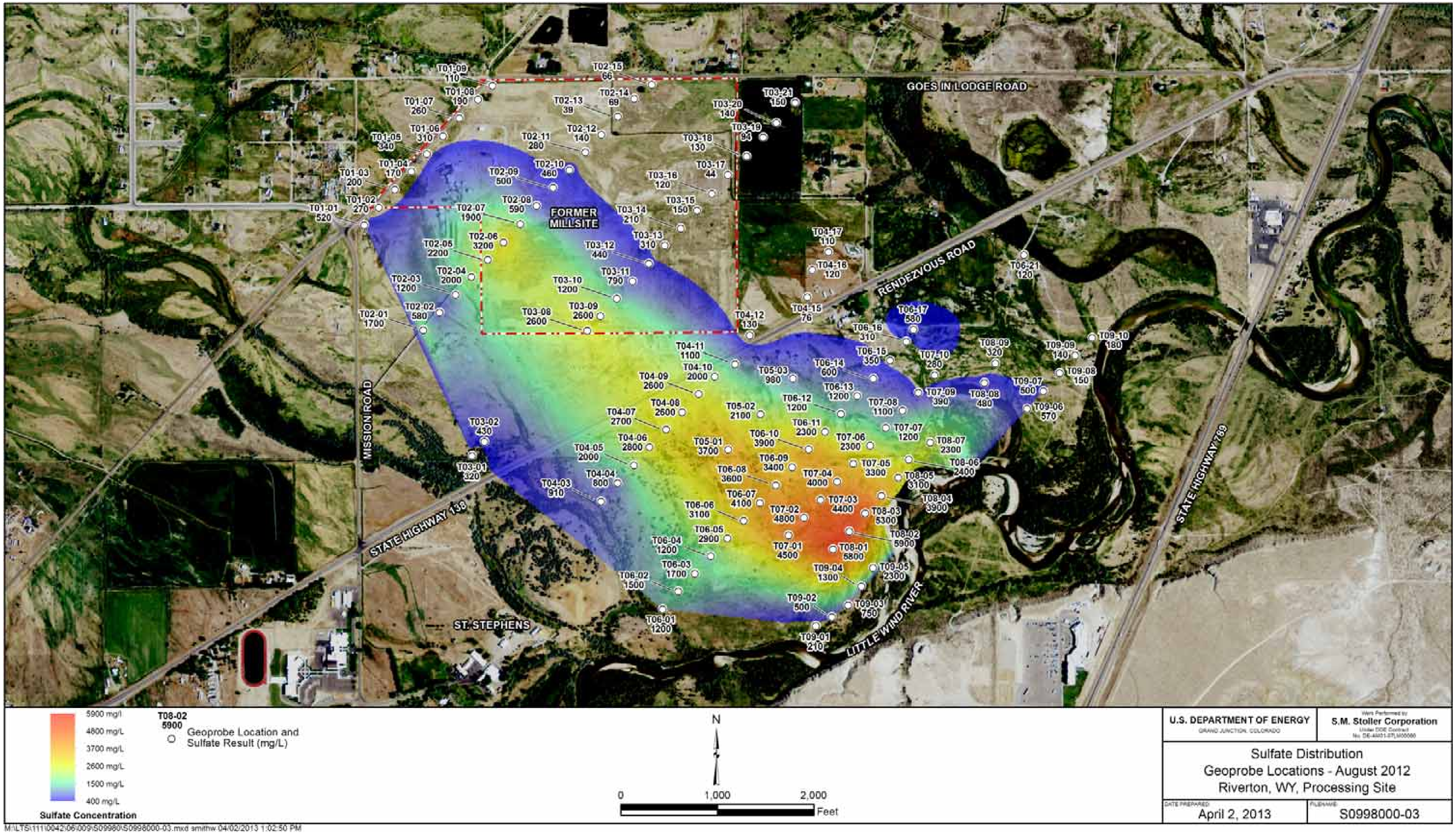
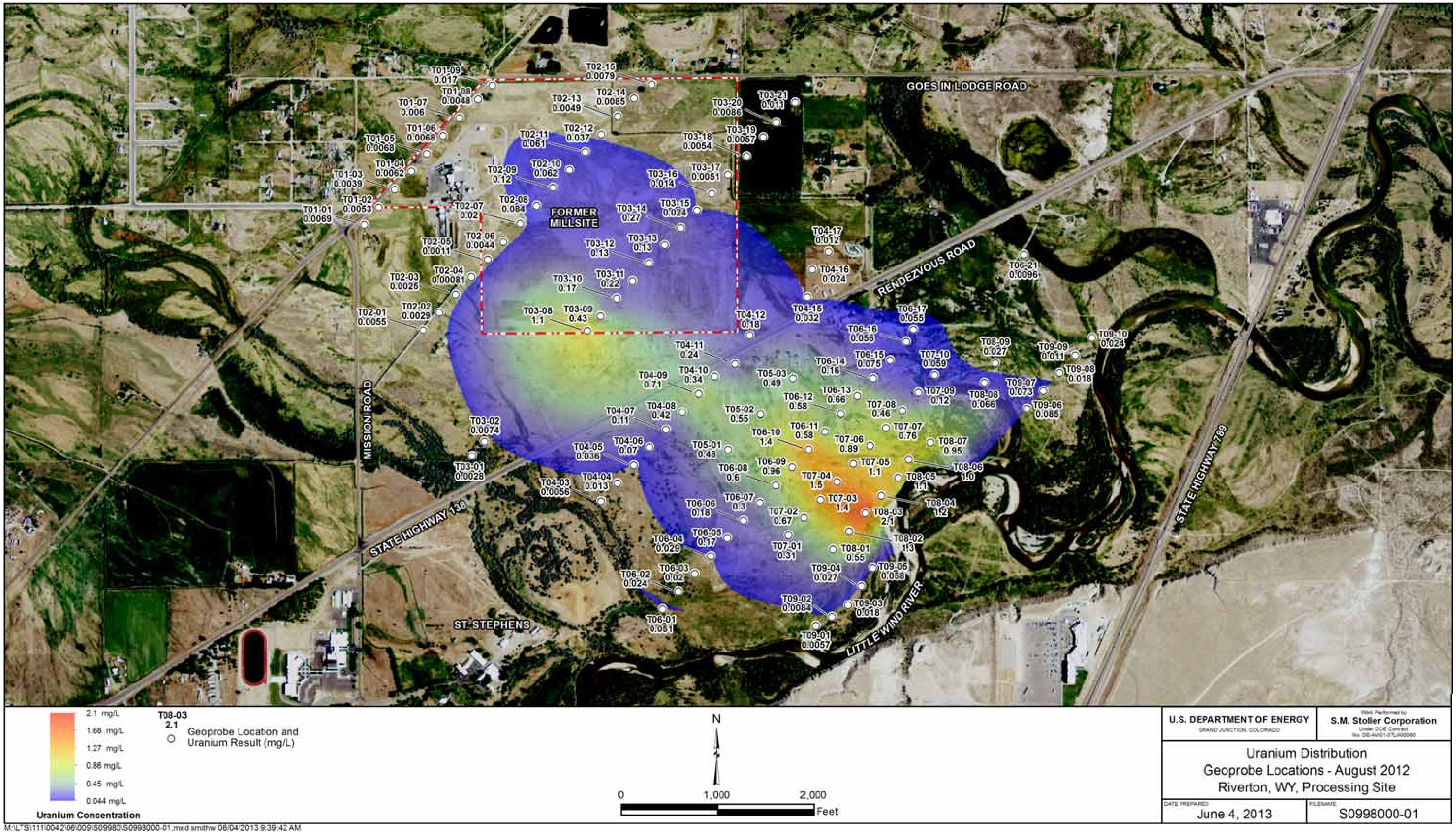
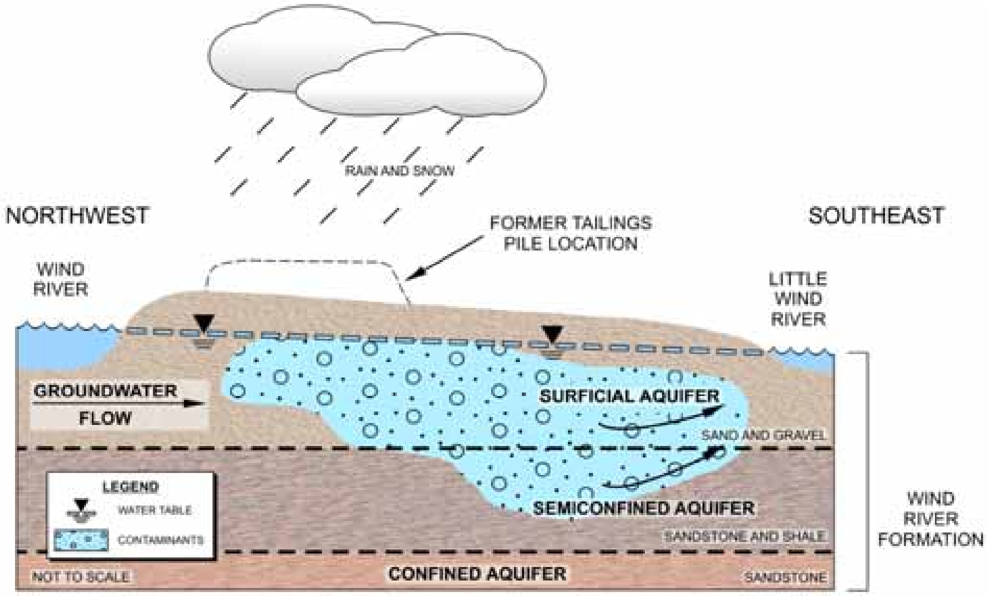


Figure 39. Distribution of Sulfate in the Surficial Aquifer: August 2012 Enhanced Characterization



M:\LTS\111\0042\06\009\S09980\S0998000-01.mxd smithw 06/04/2013 9:39:42 AM

Figure 40. Distribution of Uranium in the Surficial Aquifer; August 2012 Enhanced Characterization



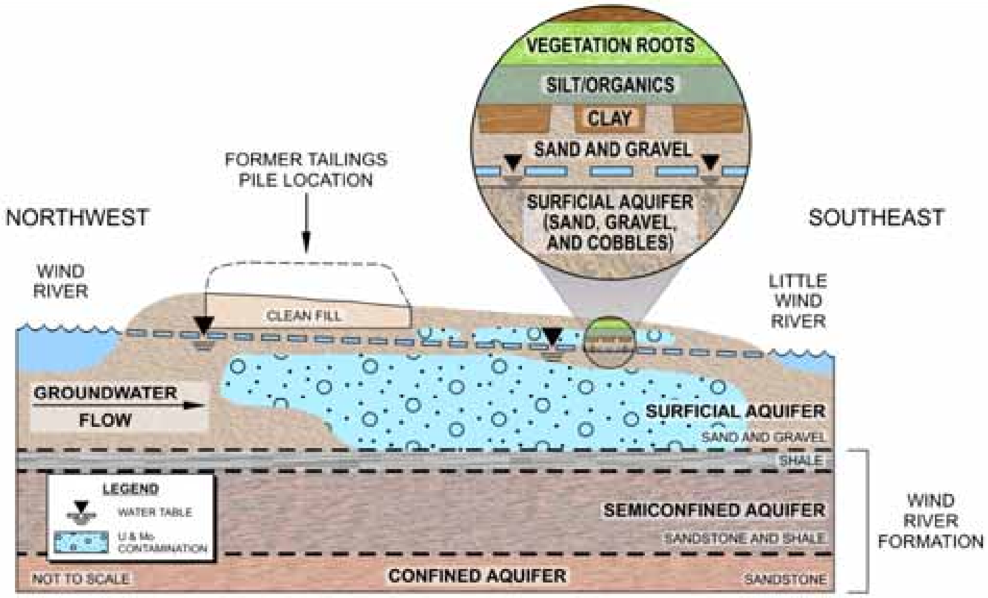
ORIGINAL SITE CONCEPTUAL MODEL (DOE 1998)

BELOW THE SURFACE

Groundwater occurs in an unconfined surficial aquifer, an underlying semiconfined sandstone aquifer, and a deeper confined sandstone aquifer.

Groundwater in the surficial aquifer is the more contaminated, and some contamination exists in the semiconfined aquifer. No contamination has been detected in the deep confined aquifer.

Groundwater from the surficial and semiconfined aquifers is presumed to discharge into the Little Wind River, including the newly formed Oxbow Lake. The river dilutes the discharging groundwater to below concentrations that present risks to human health, wildlife, or the environment.



REVISED SITE CONCEPTUAL MODEL

BELOW THE SURFACE

Groundwater occurs in the shallow sand and gravel, and the deeper rock layers of the Wind River Formation under the site.

The surficial aquifer is contaminated. Neither the underlying sandstone and shale semiconfined aquifer nor the sandstone aquifer is contaminated. Residual contamination remains in the unsaturated zone.

Groundwater from the surficial and semiconfined aquifers discharge to the Oxbow Lake and Little Wind River.

Figure 41. Original and Updated Site Conceptual Models

3.5.1 Original Site Conceptual Model

This section lists the major aspects of the original site conceptual model as described in the SOWP.

3.5.1.1 Original Contaminant Sources

- Groundwater in the surficial aquifer was originally contaminated by downward migration of leachates from the former mill tailing pile as a result of transient drainage from tailings and from infiltration of precipitation on the pile.
- Tailings were not considered a source of continuing contamination, as tailings were excavated down to 4 feet bgs in 1989.
- The excavation also included contaminated surface soils outside the site boundary, which might have resulted from windblown tailings.
- All original sources of groundwater contamination were removed.

3.5.1.2 Groundwater

- Groundwater flows in the surficial aquifer from the Wind River to the Little Wind River. Flow direction can change seasonally – east-southeast in March and south in June.
- The surficial aquifer is unconfined with a geometric mean of saturated hydraulic conductivity of 125 ft/day.
- A discontinuous shale layer separates the sand and gravels of the surficial aquifer from the semiconfined aquifer; the two aquifers are hydrologically connected.
- The surficial aquifer and semiconfined aquifer discharge to the Little Wind River.
- Both the surficial and semiconfined aquifers have been impacted by site contaminants.
- The confined aquifer is hydrologically isolated from the other two aquifers and has not been impacted by site contaminants.

3.5.1.3 Surface Water

- The oxbow lake receives discharge of contaminated groundwater from the surficial aquifer.
- The Little Wind River has not been impacted by site contaminants.
    - Average river flow is 579 ft^3/s and average groundwater discharge to the river 0.28 ft^3/s.

3.5.1.4 Groundwater Modeling/Natural Flushing Assessment

- A GANDT probabilistic groundwater model was used to simulate groundwater flow and transport of uranium and molybdenum, assuming linear, equilibrium sorption (i.e., a K_d approach).
- All of the transport simulations were based on steady-state flow fields under non-flooding conditions.
- Hydraulic conductivity fields were created using geostatistical simulation techniques; hydraulic conductivities were allowed to vary from 1 to 180 ft/day.
- Modeling predicted that molybdenum and uranium levels would be below standards within 75 years of the 1998 starting time.

3.5.2 Revised Site Conceptual Model

This section lists new major concepts derived from additional data collection and evaluation since 2010. These new concepts represent changes and omissions from the original site conceptual model. These new concepts will form the basis for new investigations, data collection, and evaluations that will be used to test alternative site conceptual models and to refine and develop a new site conceptual model.

- Recalcitrant sources of contamination, or secondary sources, remain in the saturated and/or unsaturated zone of the alluvial aquifer.
- Spikes in groundwater contaminant concentrations occur as a result of hydraulic phenomena associated with river flood events that mobilize the secondary sources.
- Magnitudes of the concentration spikes in groundwater vary depending on the peak river flow associated with each high flow event, and may also be dependent on the duration of the event.
- Although the shale layer that separates the sand and gravels of the surficial aquifer from the semiconfined aquifer is discontinuous, there are enough fine-grained sediments in the upper portion of the Wind River Formation to prevent further downward migration of contaminants to more permeable strata within the Wind River Formation. Based on the presence of fine-grained sediments and low concentrations of uranium and molybdenum in the semiconfined aquifer monitoring wells, the semiconfined aquifer has not been impacted by site contaminants.
- Original groundwater modeling (which used steady-state flow fields and linear, equilibrium sorption, or the K_d approach) was too simplistic. It did not account for the effects of transient phenomena, such as changing flow conditions between seasons and the occasional mobilization of contaminants induced by river floods. The original modeling also did not account for additional transport processes that can greatly impact contaminant fate. Such transport phenomena include water chemistry-dependent desorption, rate-limited mass transfer from fine-grained to coarser-grained sediments, preferential flow zones, rate-limited mass transfer from intragrain porosity, and potential redox reactions in near-river areas. The site conceptual model will continue to evolve as these factors are evaluated.
- Hydraulic parameters used to estimate surficial aquifer properties have been updated based on additional site characterization (see Section 3.6 for details).

3.6 Groundwater Modeling

3.6.1 Modeling Approach

Observations in 2010 revealed that the existing numerical groundwater computer modeling did not account for the spikes in contaminant concentrations observed in the surficial aquifer groundwater after flooding of the Little Wind River. Consequently, the Work Plan specified that a new groundwater flow and transport model was needed to better simulate site conditions. Initial efforts were conducted to model flow and uranium source term in the unsaturated zone; however, the complexities of modeling the unsaturated zone, and the limited data for the unsaturated zone, made this impractical. Although this model did not account for additional uranium source term, there are other aspects of the model that were updated from the original SOWP model. These modifications included:

- Extensive initial groundwater-concentration data generated from the enhanced characterization using the Geoprobe.
- An improved accounting for transient conditions and the influence of the Little Wind River flooding on the water levels in the surficial aquifer.
- An improved calculation of hydraulic conductivities using pilot points and PEST software (Doherty 1994).

This new model was intended to be one aspect of assessing the viability of the natural flushing compliance strategy, and so it should be viewed in light of other empirical evidence before a final decision is made. The new flow and transport model was intended to provide a conservative estimate of flushing time because of the following:

- The new model did not account for any additional source mobilized by flood events; therefore, actual flushing time will be longer than predicted by the new model because groundwater concentrations are known to increase after significant flood events.
- The lowest average K_d was selected from the laboratory tests conducted on soils that were similar to surficial aquifer materials. If a higher K_d was selected, flushing time predicted by the model would increase.

Four flow and transport models were developed. Three steady-state flow and transport models were developed to simulate unchanging flow conditions and to assist in development of a fourth model, which was a transient flow and transport model that is presented in this section. The transient model is considered more representative of the Riverton site because it can represent changing flow/stage of the Little Wind River over time.

3.6.2 Input Parameters, Assumptions, and Limitations

Table 9 compares the input parameters in the new flow and transport model with the original GANDT model.

Using a groundwater flow and transport model has significant limitations, and the transport/forecasting aspect of the model should be viewed as a gross estimate, which should be interpreted only in conjunction with other lines of evidence. Data obtained from the enhanced characterization of the surficial aquifer revealed that concentrations of uranium were still high (1.1 mg/L) on the former mill site in 2012. This data, along with experience at similar sites and current literature (Zhu 2003), suggests that groundwater modeling using a linear, equilibrium sorption or K_d approach is too simplistic and does not account for fine-grained sediments and reducing zones (acting as variable sources/sinks in the aquifer) that make transport of contaminants erratic and unpredictable.

Table 9. Groundwater Model Inputs

Parameter	Units	New MODFLOW Model		Original GANDT Model	
		Value	Source	Value	Source
Hydraulic Conductivity	ft/day	6 to 433	Pilot points & PEST	57	DOE 1995, SNL 1996, and model trials
Recharge	ft/day	0.00016	Lasse 1998	0.0002	Expert judgment and general literature
Porosity	Decimal fraction	0.3	Lasse 1998	0.3	DOE 1995 and general literature
Dispersivity	ft	500	Expert judgment and general literature	160–230	Expert judgment and general literature
K_d	mL/g	1.04	Laboratory soil testing	0.1–0.2	DOE 1993 and general literature
Bulk Density	g/cm^3	2.5149	Lasse 1998	1.8	General literature
Initial Uranium Concentration	µg/L	0.81 to 2,100	August 2012 enhanced characterization	Not reported	DOE 1995
Background Uranium Concentration	µg/L	5	Mean from background well data	Not reported	DOE 1995

µg/L = micrograms per liter

3.6.3 Transient Flow Model

The new groundwater flow model is a single-layer, transient flow that was developed using MODFLOW 2000. Groundwater Vistas (GV) was used in conjunction with MODFLOW 2000. GV is a groundwater modeling environment for Microsoft Windows that couples a powerful model design system with comprehensive graphical analysis tools. GV is a model-independent graphical design system that can be used with MODFLOW and other similar models.

3.6.3.1 Model Calibration

This groundwater flow model was calibrated using continuous water level data from 2005 and 2009 obtained from a transducer installed in monitoring well 0707 along with water level data obtained from the monitoring well network during routine sampling events in 2004, 2007, 2009, 2010, and 2011. Model calibration for transducer data is illustrated in Figure 42 and Figure 43 by comparing actual water elevations in monitoring well 0707 with simulated water levels generated by the groundwater model in 2005 and 2009, respectively. Calibration statistics were generated by looking at the difference (residual) between the modeled versus actual water level at 551 targets, which is a substantial number of targets (Table 10). A good “rule of thumb” for model calibration is a sum of squares of residuals per target of 1.0 or less. As shown in Table 10, the sum of squares per target is 0.31, which indicates good model calibration.

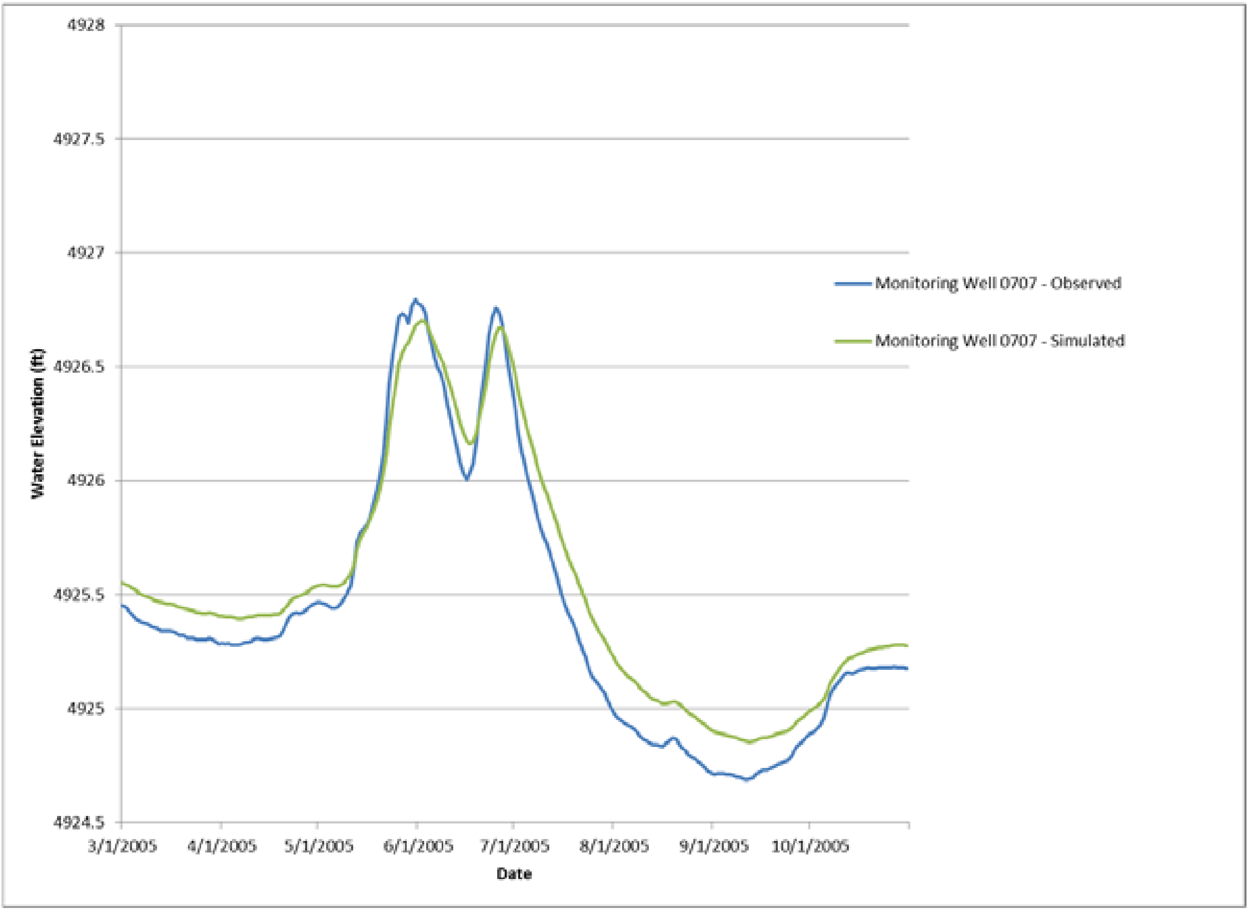


Figure 42. 2005 Water Levels versus Model Simulation: Well 0707

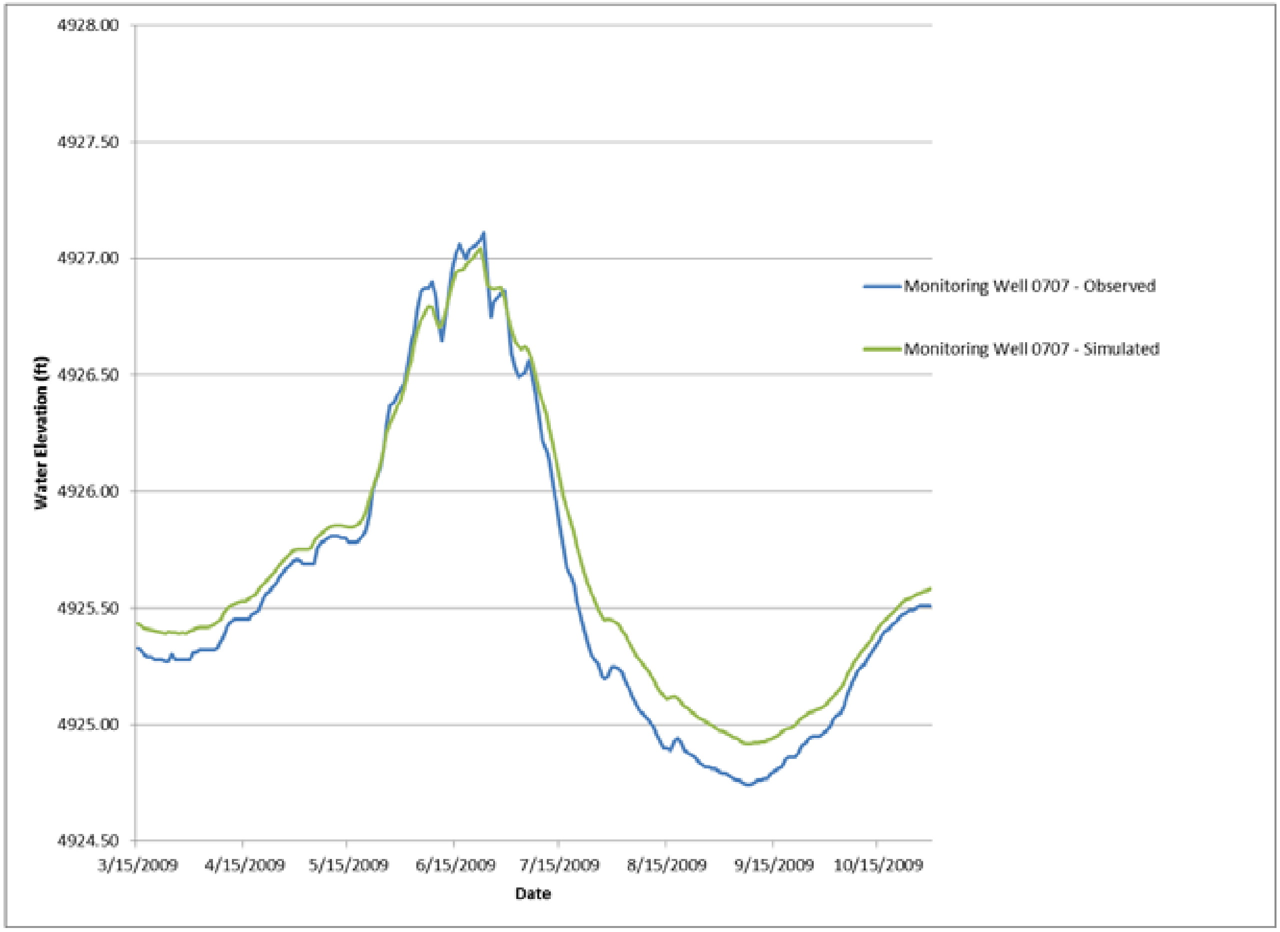


Figure 43. 2009 Water Levels versus Model Simulation: Well 0707

Table 10. Groundwater Model Calibration Statistics

Calibration Statistic	Value
Residual Mean	-0.087
Absolute Residual Mean	0.254
Residual Standard Deviation	0.553
Sum of Squares	172.7
Number of Targets	551
Sum of Squares per Target	0.31
RMS Error	0.560
Minimum Residual	-2.67
Maximum Residual	4.31
Range in Observations	24.15
Scaled Residual Standard Deviation	0.023
Scaled Absolute Residual Mean	0.011
Scaled RMS Error	0.023
Scaled Residual Mean	-0.004

Pilot points can be used for several parameters within GV in calibrating a model, including horizontal hydraulic conductivity (K_x), vertical hydraulic conductivity (K_z) specific storage (S_s) specific yield (S_y) recharge, and porosity. Sensitivity analysis indicated that the model was sensitive only to hydraulic conductivity, so pilot points were used for horizontal hydraulic conductivity to aid in the calibration of the Riverton model.

In conventional model calibration, the calibration process typically involves assigning one overall hydraulic conductivity value (or a separate hydraulic conductivity value to each hydraulic conductivity zone, if there are multiple zones), and adjusting this parameter (these parameters) until the fit between model-predicted and field-observation values is as good as possible. If the fit obtained on the basis of existing zones is not acceptable, then extra zones could be added into the model domain at locations where the modeler felt that they would "do the most good," which is arbitrary. This process would continue until the fit between model predicted and observed values are acceptable. There are a number of shortcomings associated with this approach, which include:

- The process is labor intensive and slow.
- Often there is no geological mapping to provide guidance on where to put additional zones, which makes the process subjective and non-unique.
- Characterization of heterogeneity by zones of piecewise uniformity is not consistent with the nature of geological material, so that any zonation that is finally decided upon is defensible only on the basis that it is better to employ a zonation scheme than to ignore heterogeneity altogether. In addition, piecewise uniformity as a method of characterizing heterogeneity lacks the flexibility required to explore the effects of small-scale variability on model predictive uncertainty.

These problems can be overcome using pilot points and PEST software. PEST is a model-independent calibration tool from Watermark Computing. PEST uses nonlinear least-squares techniques to calibrate virtually any type of model. Special software is included with GV to interface PEST with all models supported by GV.

In the transient flow model (i.e., the new model), the distribution of hydraulic conductivity within the model domain was described by a set of pilot points. Pilot points were located in the model domain, and PEST was used to estimate the hydraulic conductivity of the aquifer at each point. These "point hydraulic conductivities" are then spatially interpolated to all the active cells within the model domain using kriging. In estimating hydraulic conductivity values at pilot points, PEST effectively assigns parameter values to the whole model domain.

A total of 91 pilot points were introduced into the model domain. Pilot points are associated with different site activities (pumping and slug tests) or model features (calibration targets), as shown in the Table 11. Each pilot point is assigned an initial value and a range to restrict hydraulic conductivity to reasonable values. The initial value and range for the pumping and slug tests vary by location and are displayed in Table 12. The hydraulic conductivity field generated using pilot points and PEST is shown in Figure 44.

Table 11. Pilot Points Summary

Parameter	Number of Pilot Points	Description	Initial Value and Range (ft/day)
Pump Tests	3	Pump test locations	Varies (see Table 12)
Slug Tests	5	Slug test locations	Varies (see Table 12)
Calibration Targets	9	Target locations	125.0, 100.0–400.0
Target Triangle	46	Center of each calibration target triangle	125.0, 100.0–400.0
Filler	28	Placed in cells that do not have pilot points within 10 cells	125.0, 100.0–400.0

Table 12. Pilot Points Details

Location	Pilot Point Type	Initial Value (ft/day)	Range (ft/day)
0100	Pumping	104.0	101.0–400.0
0737	Pumping	158.0	155.0–400.0
0738	Pumping	119.0	116.0–400.0
0724	Slug	5.9	4.9–400.0
0728	Slug	16.9	11.9–400.0
0729	Slug	5.4	4.4–400.0
0783	Slug	128.1	74.1–400.0
0788	Slug	7.4	12.4–400.0

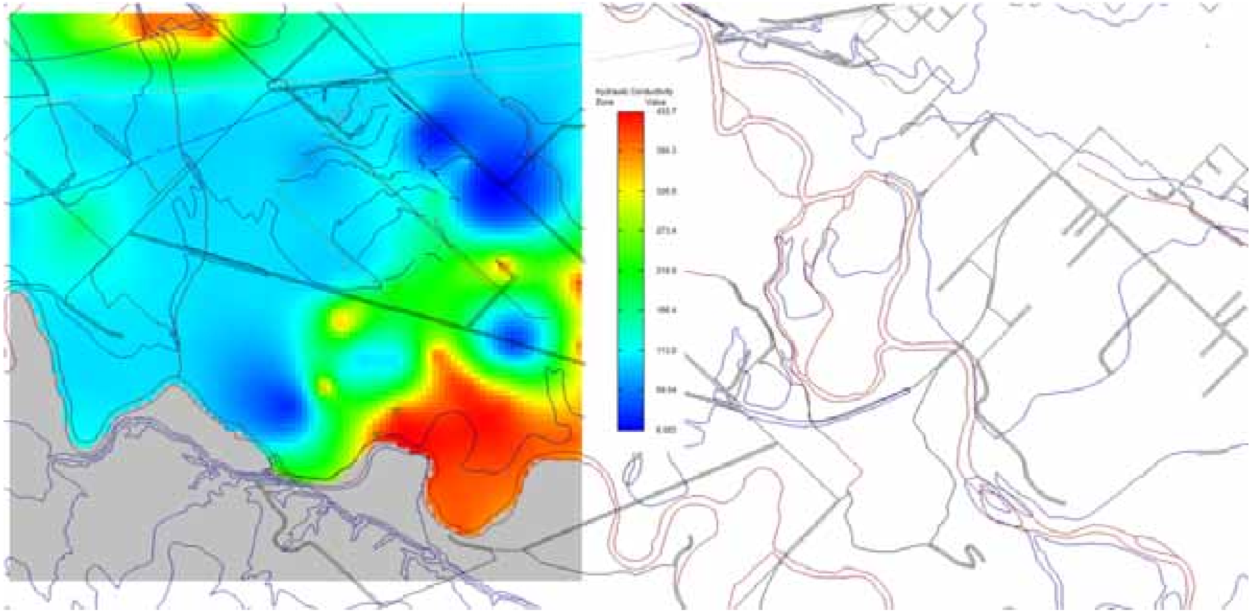


Figure 44. Hydraulic Conductivity Field Calculated Using Pilot Points and PEST

A statistical analysis of annual peak river flows in the Little Wind River was performed to develop perspective regarding the frequency with which the river could be expected to flood and help release contamination. The analysis, based on a record of annual peak flows extending from 1941 to 2011, revealed that the peak river discharge in 2010 (13,300 cfs) was likely to be equaled or exceeded once every 75 years (i.e., a 75-year return period). In addition, analysis of smaller flood events, such as the flood in June of 1965 (peak discharge of 9,550 cfs) had a return period for that peak flow of 15 years. These return periods of 15 and 75 years were used in the new transient flow model. In this model, the typical or average flow years were combined with a higher flow that occurs approximately every 15 years and an extreme flood flow that occurs approximately every 75 years. Constant head (representing river elevation) varies, based on typical or average flow, the 15-year flood event flow, and the 75-year flood event flow. The setup and summary of stress periods using these flood return periods are shown in Table 13 and Table 14, respectively.

Table 13. Stress-Period Setup for the Transient Flow Model

Year Type	Number of Stress-Periods	Stress-Period Length (days)	Cumulative Length (days)
Typical Year	1	90	90
	14	10	230
	1	135	365
15-Year Flood Event	1	125	125
	16	5	205
	1	160	365
75-Year Flood Event	1	125	125
	17	5	210
	1	155	365

Table 14. Transient Flow Model Stress-Period Summary

Flow Type	Number of Years	Date Range	Number of Stress-Periods per Year	Beginning Stress-Period	Ending Stress-Period
Typical	13	2012-2024	16	1	208
15 Yr. Flood	1	2025	18	209	226
Typical	14	2026-2039	16	227	450
15 Yr. Flood	1	2040	18	451	468
Typical	14	2041-2054	16	469	692
15 Yr. Flood	1	2055	18	693	710
Typical	14	2056-2069	16	711	934
15 Yr. Flood	1	2070	18	935	952
Typical	14	2071-2084	16	953	1176
75 Yr. Flood	1	2085	19	1177	1195
Typical	14	2086- 2099	16	1196	1419
15 Yr. Flood	1	2100	18	1420	1437
Typical	14	2101-2114	16	1438	1661
15 Yr. Flood	1	2115	18	1662	1679
Typical	14	2116-2129	16	1680	1903
Total	**118 Total**				

3.6.4 Transport Modeling and Forecasting

Transport simulations were conducted using MT3DMS software. Results of the new flow and transport model are presented below. This model was run for 118 years starting in 2012. Results indicate that the location of higher concentration is further east (downgradient) with increased river elevations during flood events. With higher river elevations, the gradient from the processing area toward the river in the vicinity of well 0707 is decreased. The flow direction likely shifts more to the southeast during 15-year flood and 75-year flood events, causing spreading of contamination in this direction. The change is clearly evident during a 75-year flood event. The initial concentration and transport simulations for 50-year and 100-year time frames are shown in Figure 45, Figure 46, and Figure 47, respectively. As shown in those figures, uranium concentrations are estimated to be above the standard after 100 years (in 2112). That will be 114 years since the Groundwater Compliance Action Plan (GCAP) was finalized in 1998. The GCAP predicted that natural flushing and other natural attenuation processes would reduce contaminant concentrations to MCL or background levels by the year 2098.

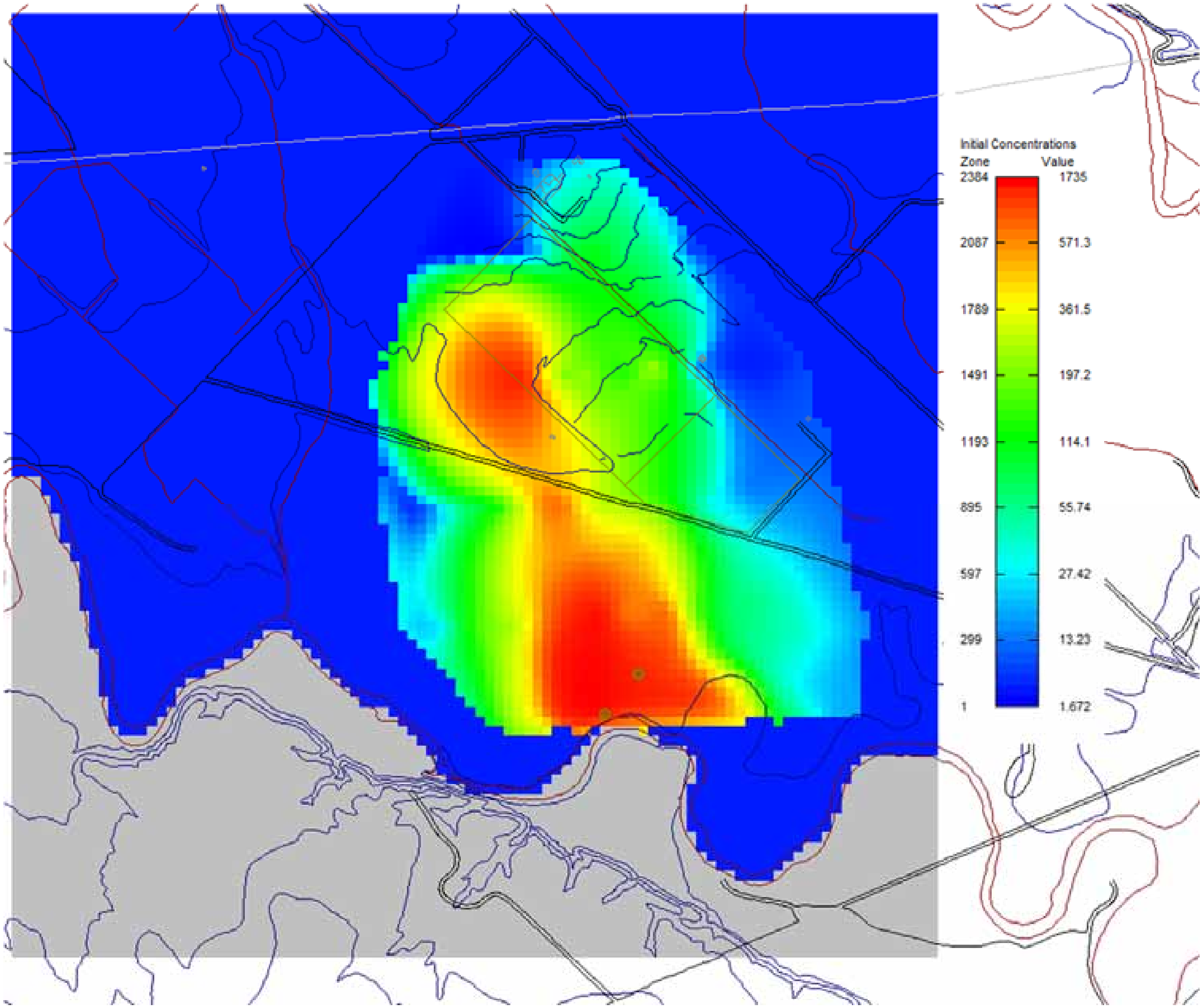


Figure 45. Initial Uranium Concentrations (µg/L) in the Surficial Aquifer from the Enhanced Characterization – August 2012

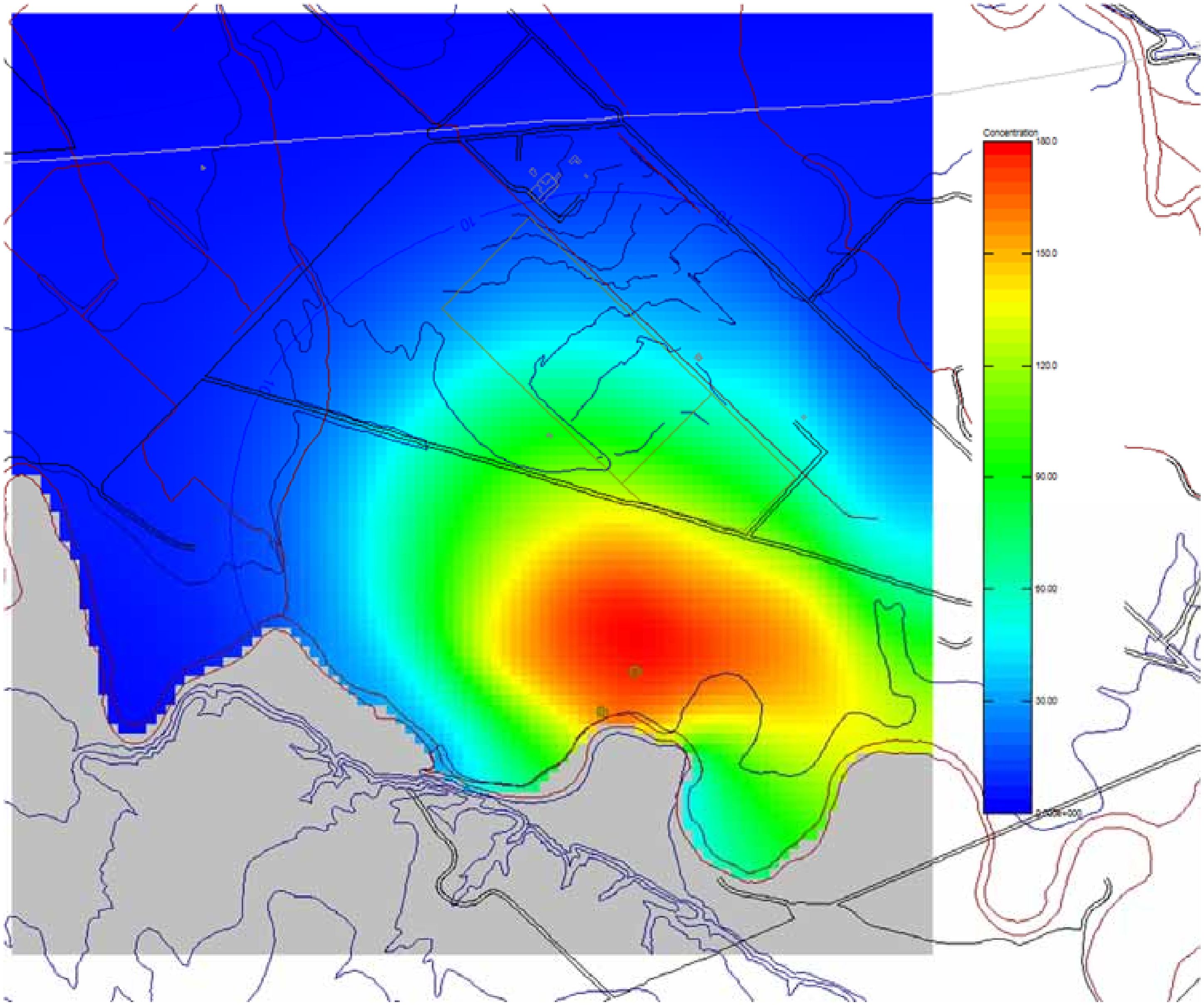


Figure 46. Simulated Uranium Concentrations (µg/L) after 50 Years (i.e., in 2062)

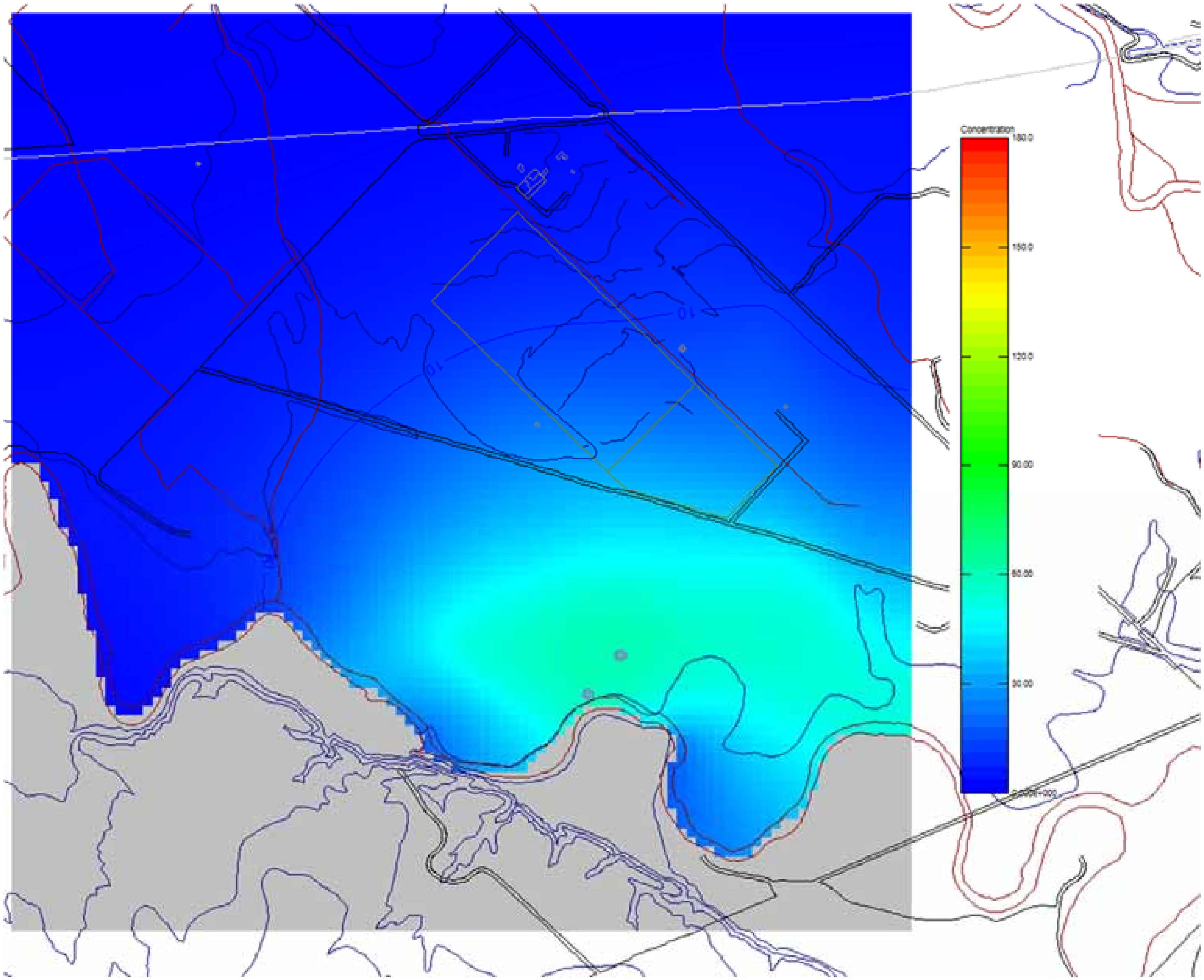


Figure 47. Simulated Uranium Concentrations (µg/L) after 100 Years (i.e., in 2112)

4.0 Compliance Strategy Assessment

After surface remediation was completed, groundwater numerical modeling in 1998 predicted that the alluvial aquifer will naturally flush contaminants to levels below applicable standards within the 100-year regulatory time frame. This modeling formed the basis for the natural flushing strategy that was approved in the *Final Ground Water Compliance Action Plan for the Riverton, Wyoming, Title I UMTRA Project Site* (DOE 1998a) in 1998. In previous years, the progress of natural flushing was assessed using three tools: comparison to hydrogeologic modeling predictions, trend analysis, and curve matching/interpolation techniques applied to temporal plots of contaminant concentrations at individual locations. These techniques were based on a site conceptual model of gradually declining contaminant concentrations after surface remediation of source material on the former mill site. Prior to 2010, these techniques indicated that natural flushing of the surficial aquifer was progressing toward applicable standards.

However, based on observations made in 2010 in context with historical data, the site conceptual model and groundwater computer modeling were too simplistic to account for the spikes in contaminant concentrations in the surficial aquifer groundwater. Spikes in contaminant concentrations are attributed to flooding of the Little Wind River in June 2010, which mobilized contaminants into the saturated zone of the surficial aquifer. Cross correlation of flood events in the Little Wind River with monitoring data reveal that uranium concentrations spiked in monitoring well 0707 in 1991, 1995, and 2010, which followed floods of Little Wind River (Figure 48).

Although the 2010 flood of the Little Wind River caused significant spikes in contaminant concentrations in the surficial aquifer, contaminant concentrations continue to decline and are generally approaching pre-flood levels, as shown in Table 15. Figure 49 shows the average uranium concentration in surficial aquifer wells with a long history that have always been above the MCL (0707, 0716, 0718, and 0722/0722R). As shown in this Figure, the average uranium concentration in these wells was below pre-flood levels in 2012. These data indicate that the effects of 2010 flood are relatively short-lived in context of the 100-year regulatory time frame.

Table 15. Comparison of Pre-Flood, 2010 Flood, and 2012 Results

Well	**Molybdenum**[a]			**Uranium**[a]			**Sulfate**[a]		
	Pre-Flood[b]	***2010 Flood***[c]	***2012***[d]	***Pre-Flood***	***Post-Flood***	***2012***	***Pre-Flood***	***2010 Flood***	***2012***
0707	0.68	1.6	0.85	0.84	2.7	0.85	1900	7000	3000
0788	0.024	0.023	0.022	0.034	0.1	0.048	630	4500	1500
0789	0.56	0.51	0.66	1.5	2.5	2	3900	9400	5300
0826	0.023	0.046	0.021	0.041	0.08	0.048	580	2400	2000

[a] Units are in mg/L.
[b] Pre-flood results are from the November 2009 sampling event.
[c] 2010 flood results from the June 2010 sampling event.
[d] 2012 results are from the December 2012 sampling event.

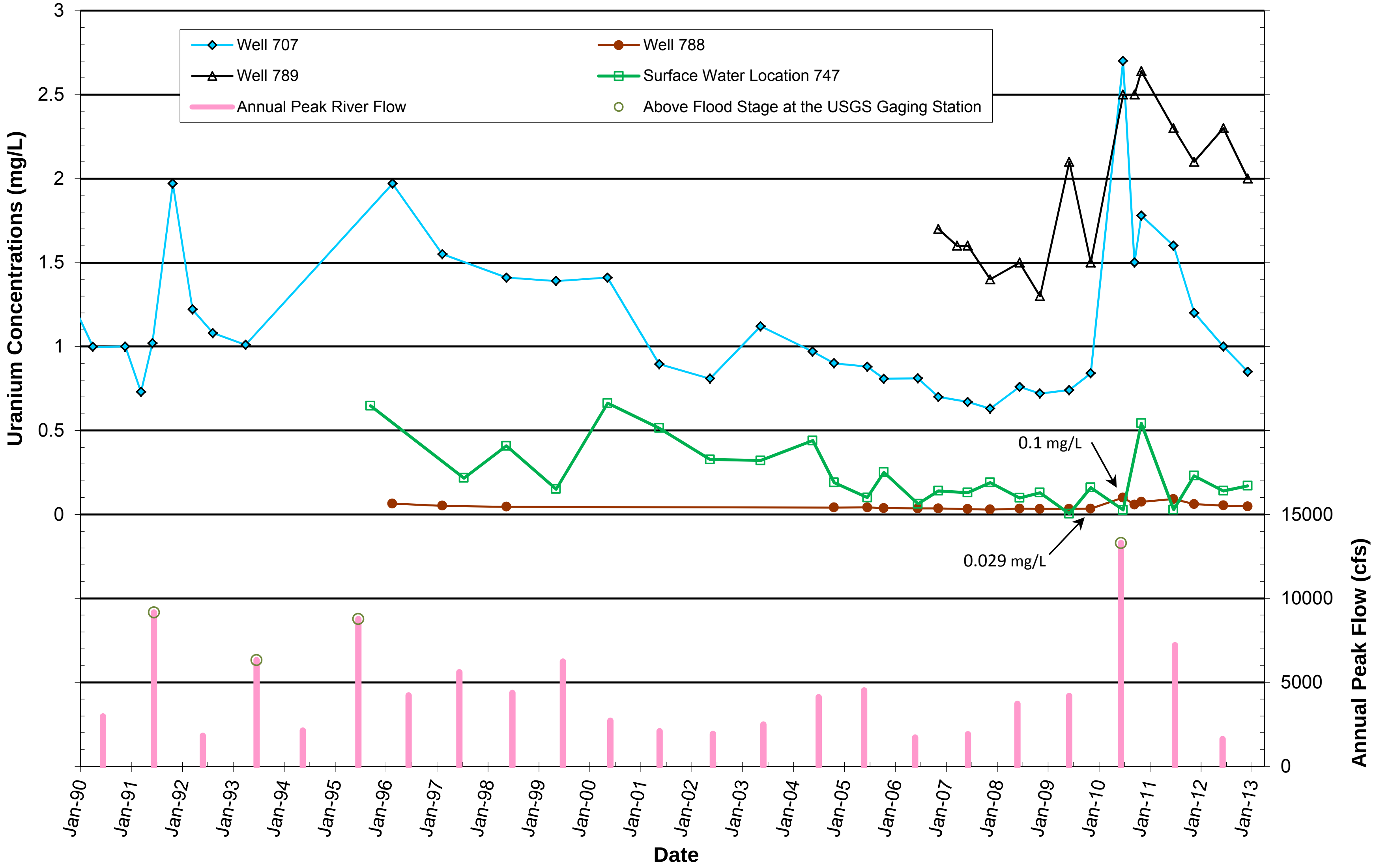


Figure 48. Uranium Concentrations and Maximum Little Wind River Stage

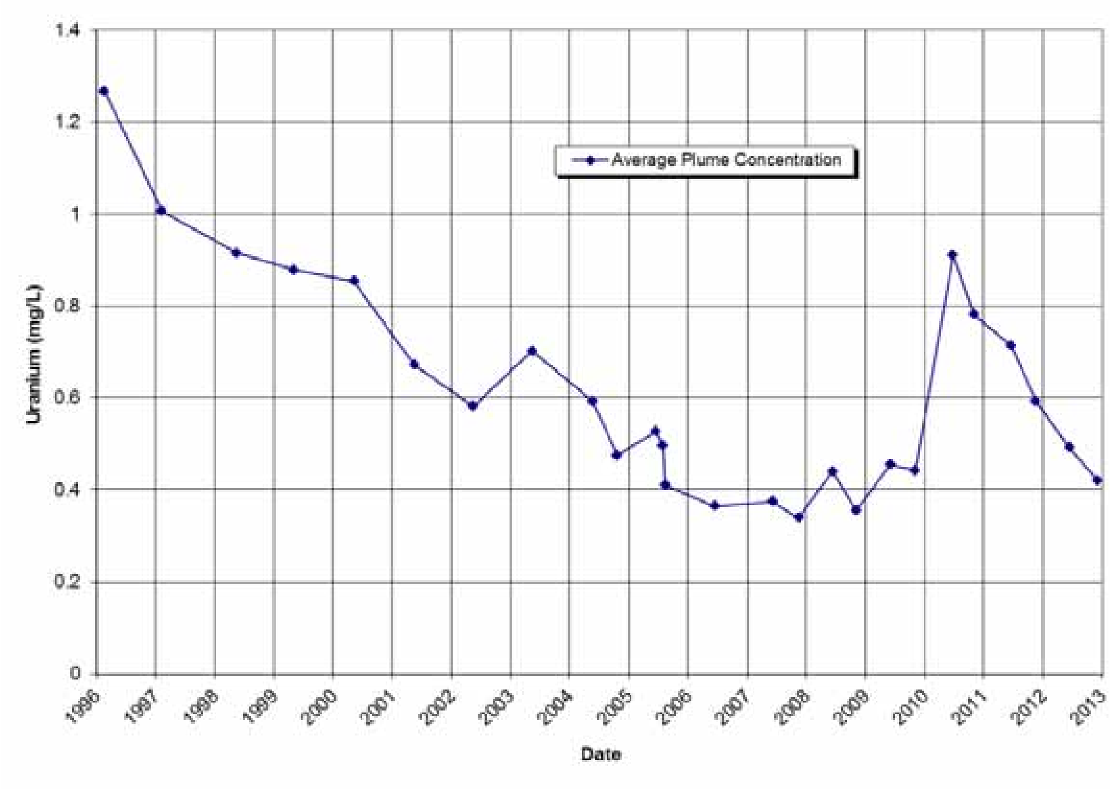


Figure 49. Average Uranium Concentration in Plume Wells

Overall, natural flushing (contaminant movement and removal via groundwater flow) in the surficial aquifer is occurring; however, the rate of flushing does not currently appear to be fast enough to restore the aquifer within the 100-year regulatory time requirement. Several lines of evidence indicate that the natural flushing compliance strategy may not meet the 2089 target date. These include:

- Current plume configurations and magnitude developed from the 2012 enhanced characterization.
    - Uranium concentrations of 1.1 mg/L still exist on the former mill site, which indicates contaminant plume movement is retarded by aquifer properties and/or influenced by additional source.
    - Uranium concentrations in the center of the plume adjacent to the Little Wind River are greater than 2 mg/L, which is very high compared to the uranium standard of 0.044 mg/L.
- Recently completed groundwater modeling indicates aquifer restoration will take longer than 100 years from the present.
- Other UMTRCA former uranium mill-sites with similar geology and contaminants are not cleaning up as predicted by groundwater modeling done to support a natural flushing compliance strategy.

- Time versus concentration graphs for average concentrations and for individual wells show that concentrations of contaminants are not declining as rapidly as in the past and/or have leveled out.
- Future flooding of the Little Wind River will likely cause an increase in contaminant concentrations in groundwater, even if the increase is relatively short-lived.
- Additional contaminants in the saturated and/or unsaturated zone may be acting as additional contaminant sources for elevated concentrations in groundwater.

Although the completion of natural flushing within the 100-year regulatory time frame is uncertain, additional information will be required to make a definitive decision on the natural flushing compliance strategy. A better understanding of the Riverton site, including aquifer properties, geochemistry, and potential additional contaminant sources, will be needed to support the natural flushing compliance strategy or to select a new compliance strategy. Some of this potential future work and information are identified in the Summary and Recommendations Section.

5.0 Summary and Recommendations

Verification monitoring results from 2012 verify that mill-related groundwater contamination continues to impact the surficial aquifer and oxbow lake, but institutional controls are in place and functioning as intended to protect human health and the environment from the groundwater contamination. In addition, verification monitoring results continue to verify that mill-related contamination has not impacted any potable domestic wells within the IC boundary, the semiconfined aquifer, the confined aquifer, the Little Wind River, gravel pit ponds, or the AWSS. Results from the AWSS flushing program provide evidence that the flushing program is effective in controlling the buildup of natural occurring radionuclides found in the source wells for the system.

The enhanced characterization conducted in 2012 resulted in a better understanding of uranium concentrations in the unsaturated zone soils and groundwater contaminant distributions. Uranium is present in higher concentrations in the unsaturated zone soils overlying the uranium plume than in the unsaturated zone soils overlying areas outside the contaminant plume. Although higher in the plume area, the range of labile uranium concentrations measured in the unsaturated soil are comparable to abundances of uranium in sedimentary rocks that make up the crust of the earth and may not be high enough to cause the increases that were observed in groundwater contaminant concentrations after the 2010 flood of the Little Wind River. Enhanced definition of groundwater plumes was obtained from the enhanced characterization effort, which also provided (1) evidence of the influence of the sulfuric acid plant discharge on the sulfate plume and (2) higher-than-expected uranium concentrations in the surficial aquifer on the south edge of the former tailings pile and in an area southwest of the primary uranium plume.

Although still above their respective MCLs, molybdenum and uranium concentrations in the surficial aquifer groundwater have returned to their pre-flood levels after spiking following the 2010 flood of the Little Wind River. However, numerous lines of evidence, including updated groundwater modeling, indicate that the rate of natural flushing is not rapid enough to meet the 100-year regulatory limit.

Although DOE obtained a better understanding of the site conceptual model, contaminant distributions, and properties of the unsaturated zone of the surficial aquifer at the Riverton site in 2012, additional work is needed to further define the conceptual model, to better understand geochemical processes that control contaminant fate and transport, to identify additional sources of uranium that are liberated during flood events, and to understand why uranium concentrations decline relatively quickly after flood events. This additional information will assist in making decisions for a path-forward compliance strategy. Recommendations for potential future work are listed in Table 16. DOE will prioritize the potential future work, will add medium- and high-effort work to future budgets, and will schedule the work. Low-effort work will be conducted under the current budget.

Table 16. Recommendations for Potential Future Work

Work Scope	Effort[a]	Purpose	Comments
Field Investigation			
Field observation of seeps.	Low	Assess groundwater discharge to the Little Wind River in accordance with the current site conceptual model.	Conduct during routine sampling.
Vertical measurements in wells and assessment of screened interval in the monitoring network.	Low	Determine if vertical contamination stratification exists and, if so, what are the impacts to the current understanding of the surficial aquifer contamination.	Vertical measurements of specific conductance can be conducted during routine sampling,
Additional water-level data loggers.	Low	Estimate irrigation infiltration impacts on groundwater flow and contaminant migration.	Wells 0826 and 0722R.
In situ measurements of groundwater flow direction.	Medium	Estimate flow direction in the surficial aquifer based on in situ measurements, and compare that with the flow direction based on water levels.	Research and purchase of equipment needed.
Install stilling well on the Little Wind River adjacent to well 0789.	Medium	Assess groundwater discharge to the Little Wind River in accordance with the current site conceptual model.	
Install stilling well on the Wind River with an adjacent monitoring well.	Medium	Evaluate interaction between the Wind River and the surficial aquifer.	
Additional field characterization with the Geoprobe; additional groundwater sampling around hot spots and the Little Wind River.	High	Better define the extent of groundwater contamination.	Work Plan required to define specific activities, objectives, and scope.
Additional field characterization with a drill rig, including soil/alluvial aquifer sampling below 5 ft, sampling of the clay/shale layer at the base of the alluvium. Perform lab experiments on samples.	High	Estimate the location of the sources of uranium and molybdenum that are mobilized during flood events. Determine the distribution of contaminants in saturated and unsaturated zone sediments.	Work Plan required to define specific activities, objectives, and scope.
Pilot tests or feasibility studies based on potential compliance strategy.	High	Determine feasibility of potential compliance strategies (if active remediation).	Work Plan required to define specific activities, objectives, and scope.
Laboratory Analyses			
Additional groundwater analyses: major cations/anions, total organic carbon, sulfide, and chloride.	Low	Better understand geochemical properties of the aquifers.	Can be conducted during routine sampling; analytical costs only.
Additional lab experiments on fine and coarse sediments in unsaturated zone.	Medium	Estimate source distribution in the unsaturated zone.	Perform tests on soil samples from 2012.
Assessment of sulfate in the semiconfined aquifer, including sulfur isotope analysis, additional chemical analyses.	Medium	Evaluate whether sulfate in the semiconfined aquifer is mill related.	Could be a High effort, depending upon the number and types of analyses.

Table 16 (continued). Recommendations for Potential Future Work

Work Scope	Effort[a]	Purpose	Comments
X-ray diffraction tests.	Medium	Identify clay and mineral types to assist in geochemical modeling, identifying contaminant sources, and assessing contaminant mobility.	Perform tests on soil samples from 2012.
Backscatter electron imaging and spectroscopy for mineralization analysis.	Medium	Identify mineral types to assist in geochemical modeling, identifying contaminant sources, and assessing contaminant mobility.	Perform tests on soil samples from 2012.
Data Evaluation			
Flood frequency analysis of Wind River.	Low	Predict future flooding of the Wind River.	
Assessment of chloride concentrations in groundwater as a conservative tracer.	Low	Estimate irrigation infiltration impact on groundwater flow and contaminant migration.	
White Paper detailing compliance strategy options.	Medium	Present feasibility, requirements, and data gaps for each compliance strategy option under UMTRCA to enhance communications with NRC and stakeholders.	Budgeted in 2013.
Geochemical and reaction path modeling.	High	Better understand geochemical processes that control fate and transport of site contaminants.	Work Plan required to define specific activities, objectives, and scope.
Additional groundwater modeling, coupled with geochemical modeling.	High	Better understand groundwater contaminant transport that includes groundwater flow and geochemical aspects.	Work Plan required to define specific activities, objectives, and scope.

[a] Low = less than 40 hours of labor or less than $1,000 of cost. Medium = between 40 and 160 hours of labor or less than $10,000 of cost. High = greater than 160 hours of labor or greater than $10,000 cost.

This page intentionally left blank

6.0 References

ASCG Inc., 2005. *Evaluation of the Alternate Supply System Riverton, Wyoming*, Project No. 500723, Lakewood, Colorado, July.

Babits, S., 2003. *Wind River Environmental Quality Commission UMTRA Program - Phase II Groundwater/Drinking Water Final Report*, prepared for Wind River Environmental Quality Commission and U.S. Environmental Protection Agency Region VIII, Lander, Wyoming, September.

Bredehoeft, J., 2005. "The conceptual model problem – surprise." Hydrogeo J (2005) 13:37-46.

DOE (U.S. Department of Energy), 1993. *Adsorption Isotherm Special Study*, DOE/AL/62350-162-17F, prepared by Jacobs Engineering Group Inc.

DOE (U.S. Department of Energy), 1995. *Site Observational Work Plan for the UMTRA Project Site at Riverton, Wyoming*, DOE/AL/62350-65, Rev 0, prepared by Jacobs Engineering Group Inc.

DOE (U.S. Department of Energy), 1998a. *Final Ground Water Compliance Action Plan for the Riverton, Wyoming, Title I UMTRA Project Site*, attached to letter from DOE to NRC, U.S. Department of Energy, Grand Junction Office, September 22.

DOE (U.S. Department of Energy), 1998b. *Final Site Observational Work Plan for the UMTRA Project Site at Riverton, Wyoming*, U0013801, U.S. Department of Energy, Grand Junction Office, February.

DOE (U.S. Department of Energy), 1998c. *Environmental Assessment of Ground Water Compliance at the Riverton, Wyoming, Uranium Mill Tailings Site*, DOE/EA–1261, Rev 0, U.S. Department of Energy, Grand Junction Office, September.

DOE (U.S. Department of Energy), 2005. *Verification Monitoring Report for the Riverton, Wyoming, Processing Site, Update for 2004*, DOE–LM/GJ822–2005, U.S. Department of Energy, Grand Junction Office, April.

DOE (U.S. Department of Energy), 2006. *Alternate Water Supply System Flushing Work Plan Riverton, Wyoming, Processing Site*, DOE-LM/GJ1126-2006, U.S. Department of Energy, Grand Junction Office, September.

DOE (U.S. Department of Energy), 2008. *Alternate Water Supply System Flushing Report Riverton, Wyoming, Processing Site*, DOE-LM/1570-2008, U.S. Department of Energy, Grand Junction Office, January.

DOE (U.S. Department of Energy), 2009. *Long-Term Management Plan for the Riverton, Wyoming, Processing Site*, LMS/RVT/S01187, U.S. Department of Energy, Grand Junction, Colorado, September.

DOE (U.S. Department of Energy), 2011a. *Verification Monitoring Report for the Riverton, Wyoming, Processing Site, Update for 2010*, LMS/RVT/S07202, U.S. Department of Energy, Grand Junction, Colorado, February.

DOE (U.S. Department of Energy), 2011b. *Environmental Sciences Laboratory Procedures Manual*, LMS/PRO/S04343-0.0, U.S. Department of Energy, Grand Junction, Colorado, March.

DOE (U.S. Department of Energy), 2012a. *Evaluation of Groundwater Constituents and Seasonal Variation at the Riverton, Wyoming, Processing Site*, LMS/RVT/S08364, U.S. Department of Energy, Grand Junction, Colorado, February.

DOE (U.S. Department of Energy), 2012b. *Alternate Water Supply System Flushing Plan, Riverton, Wyoming, Processing Site*, LMS/RVT/S09423, U.S. Department of Energy, Grand Junction, Colorado, October.

DOE (U.S. Department of Energy), 2012c. *Work Plan for the Enhanced Characterization of the Surficial Aquifer, Riverton, Wyoming Processing Site*, LMS/RVT/S08542, U.S. Department of Energy, Grand Junction, Colorado, June.

DOE (U.S. Department of Energy), 2013a. *Enhanced Characterization of the Surficial Aquifer, Riverton, Wyoming, Processing Site, Data Summary Report*, LMS/RVT/S09545, U.S. Department of Energy, Grand Junction, Colorado, January.

DOE (U.S. Department of Energy), 2013b. *Laboratory Analysis of Shallow Sediment Near a Former Uranium Mill: Riverton, Wyoming, Site*, LMS/RVT/S10066, U.S. Department of Energy, Grand Junction, Colorado, May.

Doherty, J. 1994. "PEST: Model-Independent Parameter Estimation," User Manual: 5th Edition, 2005, Watermark Numerical Computing.

Environmental Procedures Catalog, LMS/POL/S04325, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

Freeze, A. R., and J.A. Cherry, 1979. *Groundwater*, Prentice-Hall Inc., Englewood Cliffs, New Jersey, 604 pp.

Kohler, M., G.P. Curtis, D.E. Meece, and J.A. Davis, 2004. "Methods for estimating adsorbed uranium (VI) and distribution coefficients of contaminated sediments," *Environ. Sci. Technol.*, (38): 240–247.

Lasse, A. D., 1998. Draft *Comparison of GANDT and MODFLOW Groundwater Flow Predictions for the UMTRA Site at Riverton, Wyoming*, prepared by Oak Ridge National Laboratory, Grand Junction, Colorado, April.

SNL (Sandia National Laboratories) 1996. *Hydrological and Geochemical Data Calculation and Analysis Notebook, Riverton, Wyoming*, Site Observational Work Plan Addendum.

USGS (U.S. Geological Survey), 2012a. Gaging station 06235500 Little Wind River near Riverton, Wyoming, http://waterdata.usgs.gov/usa/nwis/uv?site_no=06235500.

USGS (U.S. Geological Survey), 2012b. Gaging station 06228000 Wind River at Riverton, Wyoming, http://nwis.waterdata.usgs.gov/wy/nwis/peak?site_no=06228000&agency_cd=USGS&format=html.

White, A.F., J.M. Delany, T.N. Narasimhan, and A. Smith, 1984. "Groundwater Contamination from an Inactive Mill Tailings Pile, 1. Application of a Chemical Mixing Model," *Water Resources Research* 20(11), p. 1743-1752.

Zhu, C., 2003. "A case against K_d-Based transport models: natural attenuation at a mill tailings site," *Computers and Geosciences*, 29 (2003):351-359.

This page intentionally left blank

Appendix A

Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:09 pm

LOCATION CODE	FLOW CODE	TOP OF CASING ELEVATION (FT)	MEASUREMENT DATE	MEASUREMENT TIME	DEPTH FROM TOP OF CASING (FT)	WATER ELEVATION (FT)	WATER LEVEL FLAG
0101	O	4946.58	06/12/2012	10:11	9.92	4936.66	
		4946.58	12/04/2012	10:27	10.70	4935.88	
0110	O	4950.19	06/12/2012	09:48	12.35	4932.00	
		4950.19	12/04/2012	10:25	14.20	4935.99	
0111	O	4946.87	06/12/2012	09:59	9.05	4937.82	
		4946.87	12/04/2012	10:26	10.87	4936.00	
0700	U	4951.38	06/12/2012	14:18	6.35	4945.03	
		4951.38	12/05/2012	12:38	6.12	4945.26	
0702	D	4931.00	06/13/2012	15:21	6.16	4924.84	
		4931.00	12/05/2012	12:37	6.60	4924.40	
0705	D	4930.80	06/13/2012	15:40	6.32	4924.48	
		4930.80	12/05/2012	12:36	6.74	4924.06	
		4930.80	12/05/2012	13:40	6.74	4924.06	
0707	D	4931.00	06/13/2012	16:00	5.41	4925.59	
		4931.00	12/05/2012	12:35	5.75	4925.25	
		4931.00	12/05/2012	13:30	5.75	4925.25	
0709	D	4930.70	06/12/2012	17:28	3.02	4927.68	
		4930.70	12/05/2012	12:36	5.45	4925.25	
0710	U	4947.90	06/12/2012	16:50	5.44	4942.46	
		4947.90	12/05/2012	09:30	6.80	4941.10	
		4947.90	12/05/2012	12:32	6.80	4941.10	
0716	O	4939.12	06/12/2012	11:55	8.99	4930.13	
		4939.12	12/04/2012	10:30	9.14	4929.98	
		4939.12	12/04/2012	16:05	9.14	4929.98	
0717	O	4938.80	06/12/2012	11:45	8.63	4930.17	
		4938.80	12/04/2012	16:30	8.82	4929.98	
0718	D	4937.60	06/13/2012	13:50	7.93	4929.67	
		4937.60	12/05/2012	10:45	8.25	4929.35	
0719	D	4937.55	06/13/2012	14:10	7.50	4930.05	
		4937.55	12/05/2012	11:00	7.89	4929.66	
0720	C	4940.46	06/13/2012	09:20	5.31	4935.15	
		4940.46	12/04/2012	11:35	5.37	4935.09	
0721	C	4940.47	06/13/2012	09:00	7.91	4932.56	
		4940.47	12/04/2012	11:55	8.02	4932.45	

LOCATION CODE	FLOW CODE	TOP OF CASING ELEVATION (FT)	MEASUREMENT DATE	MEASUREMENT TIME	DEPTH FROM TOP OF CASING (FT)	WATER ELEVATION (FT)	WATER LEVEL FLAG
0722R		4937.06	06/13/2012	17:15	9.39	4927.67	
		4937.06	12/04/2012	09:05	9.41	4927.65	
0723	D	4936.01	06/13/2012	16:55	8.12	4927.89	
		4936.01	12/04/2012	09:20	8.15	4927.86	
0724	U	4941.36	06/12/2012	11:08	6.29	4935.07	
		4941.36	12/04/2012	10:29	8.66	4932.70	
0725	U	4941.66	06/12/2012	11:00	6.47	4935.19	
		4941.66	12/04/2012	10:29	8.98	4932.68	
0726	U	4942.00	06/12/2012	11:07	6.30	4935.70	
		4942.00	12/04/2012	10:30	8.17	4933.83	
0727	U	4951.69	06/12/2012	10:55	9.26	4942.43	
		4951.69	12/04/2012	10:27	11.23	4940.46	
0728	U	4946.01	06/12/2012	10:56	6.79	4939.22	
		4946.01	12/04/2012	10:28	9.82	4936.19	
0729	D	4932.75	06/12/2012	16:00	3.15	4929.60	
		4932.75	12/04/2012	11:00	6.92	4925.83	
0730	D	4933.08	06/12/2012	16:10	4.98	4928.10	
		4933.08	12/04/2012	11:10	7.64	4925.44	
0732	U	4945.07	06/12/2012	11:10	8.05	4937.02	
		4945.07	12/04/2012	10:23	8.23	4936.84	
0733	U	4946.76	06/12/2012	12:31	5.45	4941.31	
		4946.76	12/04/2012	10:25	8.24	4938.52	
0734	U	4946.08	06/12/2012	14:16	7.16	4938.92	
		4946.08	12/04/2012	10:24	9.32	4936.76	
0736	U	4946.00	06/12/2012	16:25	7.14	4938.86	
		4946.00	12/04/2012	10:24	7.90	4938.10	
0784	U	4945.45	06/12/2012	12:45	6.81	4938.64	
		4945.45	12/04/2012	14:40	6.72	4938.73	
0788	C	4935.09	06/13/2012	10:50	8.34	4926.75	
		4935.09	12/05/2012	14:50	9.27	4925.82	
0789	D	4933.66	06/13/2012	11:25	8.65	4925.01	
		4933.66	12/05/2012	12:37	9.31	4924.35	
		4933.66	12/05/2012	14:05	9.31	4924.35	

LOCATION CODE	FLOW CODE	TOP OF CASING ELEVATION (FT)	MEASUREMENT DATE	MEASUREMENT TIME	DEPTH FROM TOP OF CASING (FT)	WATER ELEVATION (FT)	WATER LEVEL FLAG
0824		4928.27	06/13/2012	18:25	4.98	4923.29	
		4928.27	12/04/2012	10:30	5.99	4922.28	
0826		4936.98	06/13/2012	10:20	7.30	4929.68	
		4936.98	12/05/2012	15:15	7.76	4929.22	
T01-01		-	08/24/2012	10:00	8.45	-	
T01-02		-	08/24/2012	09:30	6.92	-	
T01-03		-	08/24/2012	08:50	6.17	-	
T01-04		-	08/24/2012	08:20	6.71	-	
T01-05		-	08/23/2012	17:45	6.65	-	
T01-06		-	08/23/2012	17:05	5.94	-	
T01-07		-	08/23/2012	16:30	8.02	-	
T01-08		-	08/23/2012	15:50	7.92	-	
T01-09		-	08/23/2012	15:20	9.48	-	
T02-01		-	08/22/2012	17:40	8.15	-	
T02-02		-	08/22/2012	15:00	8.39	-	
T02-03		-	08/22/2012	14:05	8.53	-	
T02-04		-	08/22/2012	13:20	5.15	-	
T02-05		-	08/22/2012	12:25	8.40	-	
T02-06		-	08/22/2012	18:30	5.34	-	
T02-07		-	08/23/2012	08:25	8.51	-	
T02-08		-	08/23/2012	09:10	8.21	-	
T02-09		-	08/23/2012	09:40	9.21	-	
T02-10		-	08/23/2012	10:10	9.49	-	
T02-11		-	08/23/2012	10:35	7.38	-	
T02-12		-	08/23/2012	11:00	7.39	-	
T02-13		-	08/23/2012	11:50	8.52	-	
T02-14		-	08/23/2012	12:25	8.40	-	
T02-15		-	08/23/2012	13:40	7.76	-	
T03-01		-	08/22/2012	16:10	5.53	-	
T03-02		-	08/22/2012	16:45	6.10	-	

STATIC WATER LEVELS (USEE700) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:09 pm

LOCATION CODE	FLOW CODE	TOP OF CASING ELEVATION (FT)	MEASUREMENT DATE	MEASUREMENT TIME	DEPTH FROM TOP OF CASING (FT)	WATER ELEVATION (FT)	WATER LEVEL FLAG
T03-08		-	08/21/2012	16:35	10.50	-	
T03-09		-	08/22/2012	09:05	10.30	-	
T03-10		-	08/22/2012	09:45	9.35	-	
T03-11		-	08/22/2012	10:25	8.94	-	
T03-12		-	08/21/2012	15:45	8.10	-	
T03-13		-	08/21/2012	15:00	7.60	-	
T03-14		-	08/21/2012	13:45	5.40	-	
T03-15		-	08/21/2012	12:55	4.00	-	
T03-16		-	08/21/2012	11:55	4.75	-	
T03-18		-	08/24/2012	13:10	6.99	-	
T03-19		-	08/24/2012	12:40	6.29	-	
T03-20		-	08/24/2012	12:15	6.30	-	
T03-21		-	08/24/2012	11:40	6.00	-	
T04-03		-	08/26/2012	15:20	8.99	-	
T04-04		-	08/26/2012	14:30	9.51	-	
T04-05		-	08/26/2012	14:00	8.36	-	
T04-06		-	08/26/2012	16:00	7.20	-	
T04-07		-	08/26/2012	16:30	8.24	-	
T04-08		-	08/27/2012	08:40	7.84	-	
T04-09		-	08/27/2012	09:20	8.05	-	
T04-10		-	08/27/2012	09:50	7.25	-	
T04-11		-	08/27/2012	10:20	7.70	-	
T04-12		-	08/24/2012	17:35	7.95	-	
T04-15		-	08/24/2012	16:15	7.29	-	
T04-16		-	08/24/2012	14:55	5.35	-	
T04-17		-	08/24/2012	15:30	5.71	-	
T05-01		-	08/28/2012	13:00	7.39	-	
T05-02		-	08/29/2012	08:10	9.77	-	
T05-03		-	08/29/2012	08:45	7.82	-	
T06-01		-	08/26/2012	12:30	10.00	-	

STATIC WATER LEVELS (USEE700) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:09 pm

LOCATION CODE	FLOW CODE	TOP OF CASING ELEVATION (FT)	MEASUREMENT DATE	MEASUREMENT TIME	DEPTH FROM TOP OF CASING (FT)	WATER ELEVATION (FT)	WATER LEVEL FLAG
T06-02		-	08/26/2012	12:00	9.59	-	
T06-03		-	08/26/2012	11:25	9.15	-	
T06-04		-	08/26/2012	11:00	9.39	-	
T06-05		-	08/26/2012	10:30	10.30	-	
T06-06		-	08/26/2012	09:55	9.31	-	
T06-07		-	08/26/2012	09:20	9.84	-	
T06-08		-	08/26/2012	08:45	7.72	-	
T06-09		-	08/26/2012	08:15	6.80	-	
T06-10		-	08/27/2012	12:15	7.59	-	
T06-11		-	08/27/2012	12:50	8.39	-	
T06-12		-	08/27/2012	13:30	6.76	-	
T06-13		-	08/27/2012	14:15	7.81	-	
T06-14		-	08/27/2012	14:45	8.44	-	
T06-15		-	08/27/2012	15:10	7.45	-	
T06-16		-	08/27/2012	16:00	7.01	-	
T06-17		-	08/27/2012	16:45	6.67	-	
T06-21		-	08/28/2012	11:40	5.39	-	
T07-01		-	08/25/2012	18:25	8.82	-	
T07-02		-	08/25/2012	17:50	8.72	-	
T07-03		-	08/25/2012	17:20	8.65	-	
T07-04		-	08/25/2012	16:50	8.52	-	
T07-05		-	08/25/2012	16:00	7.21	-	
T07-06		-	08/28/2012	14:15	7.65	-	
T07-07		-	08/29/2012	09:45	7.30	-	
T07-08		-	08/28/2012	17:15	8.03	-	
T07-09		-	08/28/2012	16:50	5.00	-	
T07-10		-	08/28/2012	16:15	5.97	-	
T08-01		-	08/25/2012	10:55	8.72	-	
T08-02		-	08/25/2012	11:40	8.69	-	
T08-03		-	08/25/2012	13:15	10.45	-	

STATIC WATER LEVELS (USEE700) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:09 pm

LOCATION CODE	FLOW CODE	TOP OF CASING ELEVATION (FT)	MEASUREMENT		DEPTH FROM TOP OF CASING (FT)	WATER ELEVATION (FT)	WATER LEVEL FLAG
			DATE	TIME			
T08-04		-	08/25/2012	14:10	9.52	-	
T08-05		-	08/25/2012	14:40	8.96	-	
T08-06		-	08/25/2012	15:15	7.99	-	
T08-07		-	08/27/2012	11:30	7.59	-	
T08-08		-	08/28/2012	15:45	8.61	-	
T08-09		-	08/28/2012	15:15	7.91	-	
T09-01		-	08/25/2012	08:15	8.98	-	
T09-02		-	08/25/2012	08:45	8.89	-	
T09-03		-	08/25/2012	09:20	9.27	-	
T09-04		-	08/25/2012	09:50	9.01	-	
T09-05		-	08/25/2012	10:25	9.49	-	
T09-06		-	08/28/2012	08:25	9.76	-	
T09-07		-	08/28/2012	08:55	8.12	-	
T09-08		-	08/28/2012	11:00	8.31	-	
T09-09		-	08/28/2012	10:10	5.09	-	
T09-10		-	08/28/2012	09:25	7.84	-	

RECORDS: SELECTED FROM USEE700 WHERE site_code='RVT01' AND LOG_DATE between #1/1/2012# and #12/31/2012#

FLOW CODES:

C	CROSS GRADIENT	D	DOWN GRADIENT	O	ON-SITE
U	UPGRADIENT				

WATER LEVEL FLAGS:

Appendix B

Groundwater Quality Data – Verification Monitoring

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 3:00 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	0705	WL	06/13/2012	0001	SE	D	65		FQ	#	-	-
	mg/L	0705	WL	12/05/2012	N001	SE	D	80		FQ	#	-	-
	mg/L	0707	WL	06/13/2012	N001	SF	D	333		F	#	-	-
	mg/L	0707	WL	12/05/2012	N001	SF	D	364		F	#	-	-
	mg/L	0710	WL	06/12/2012	N001	SF	U	197		F	#	-	-
	mg/L	0710	WL	12/05/2012	N001	SF	U	167		F	#	-	-
	mg/L	0716	WL	06/12/2012	N001	SF	O	276		F	#	-	-
	mg/L	0716	WL	12/04/2012	N001	SF	O	281		F	#	-	-
	mg/L	0717	WL	06/12/2012	N001	SE	O	194		F	#	-	-
	mg/L	0717	WL	12/04/2012	N001	SE	O	108		F	#	-	-
	mg/L	0718	WL	06/13/2012	N001	SF	D	349		F	#	-	-
	mg/L	0718	WL	12/05/2012	N001	SF	D	348		F	#	-	-
	mg/L	0719	WL	06/13/2012	N001	SE	D	99		FQ	#	-	-
	mg/L	0719	WL	12/05/2012	N001	SE	D	106		FQ	#	-	-
	mg/L	0720	WL	06/13/2012	N001	SF	C	227		F	#	-	-
	mg/L	0720	WL	12/04/2012	N001	SF	C	196		F	#	-	-
	mg/L	0721	WL	06/13/2012	N001	SE	C	98		F	#	-	-
	mg/L	0721	WL	12/04/2012	N001	SE	C	96		F	#	-	-
	mg/L	0722R	WL	06/13/2012	N001	SF		272		F	#	-	-
	mg/L	0722R	WL	12/04/2012	N001	SF		248		F	#	-	-
	mg/L	0723	WL	06/13/2012	N001	SE	D	263		F	#	-	-
	mg/L	0723	WL	12/04/2012	N001	SE	D	335		F	#	-	-
	mg/L	0729	WL	06/12/2012	N001	SF	D	218		F	#	-	-
	mg/L	0729	WL	12/04/2012	N001	SF	D	340		F	#	-	-
	mg/L	0730	WL	06/12/2012	N001	SE	D	323		FQ	#	-	-
	mg/L	0730	WL	12/04/2012	N001	SE	D	347		FQ	#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 3:00 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	0784	WL	06/12/2012	N001	SF	U	91		F	#	-	-
	mg/L	0784	WL	12/04/2012	N001	SF	U	154		F	#	-	-
	mg/L	0788	WL	06/13/2012	N001	SF	C	433		F	#	-	-
	mg/L	0788	WL	12/05/2012	N001	SF	C	356		F	#	-	-
	mg/L	0789	WL	06/13/2012	N001	SF	D	450		F	#	-	-
	mg/L	0789	WL	12/05/2012	N001	SF	D	493		F	#	-	-
	mg/L	0824	WL	06/13/2012	N001	SF		219		F	#	-	-
	mg/L	0824	WL	12/04/2012	N001	SF		246		F	#	-	-
	mg/L	0826	WL	06/13/2012	N001	SF		382		F	#	-	-
	mg/L	0826	WL	12/05/2012	N001	SF		352		F	#	-	-
Dissolved Oxygen	mg/L	0705	WL	06/13/2012	N001	SE	D	3.21		FQ	#	-	-
	mg/L	0705	WL	12/05/2012	N001	SE	D	2.53		FQ	#	-	-
	mg/L	0707	WL	06/13/2012	N001	SF	D	0.29		F	#	-	-
	mg/L	0707	WL	12/05/2012	N001	SF	D	0.81		F	#	-	-
	mg/L	0710	WL	06/12/2012	N001	SF	U	1.07		F	#	-	-
	mg/L	0710	WL	12/05/2012	N001	SF	U	0.28		F	#	-	-
	mg/L	0716	WL	06/12/2012	N001	SF	O	0.43		F	#	-	-
	mg/L	0716	WL	12/04/2012	N001	SF	O	0.45		F	#	-	-
	mg/L	0717	WL	06/12/2012	N001	SE	O	0.29		F	#	-	-
	mg/L	0717	WL	12/04/2012	N001	SE	O	0.52		F	#	-	-
	mg/L	0718	WL	06/13/2012	N001	SF	D	0.42		F	#	-	-
	mg/L	0718	WL	12/05/2012	N001	SF	D	2.00		F	#	-	-
	mg/L	0719	WL	06/13/2012	N001	SE	D	0.42		FQ	#	-	-
	mg/L	0719	WL	12/05/2012	N001	SE	D	0.92		FQ	#	-	-
	mg/L	0720	WL	06/13/2012	N001	SF	C	0.90		F	#	-	-
	mg/L	0720	WL	12/04/2012	N001	SF	C	1.36		F	#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Dissolved Oxygen	mg/L	0721	WL	06/13/2012	N001	SE	C	0.19		F	#	-	-
	mg/L	0721	WL	12/04/2012	N001	SE	C	0.46		F	#	-	-
	mg/L	0722R	WL	06/13/2012	N001	SF		0.57		F	#	-	-
	mg/L	0722R	WL	12/04/2012	N001	SF		0.82		F	#	-	-
	mg/L	0723	WL	06/13/2012	N001	SE	D	0.31		F	#	-	-
	mg/L	0723	WL	12/04/2012	N001	SE	D	0.55		F	#	-	-
	mg/L	0729	WL	06/12/2012	N001	SF	D	1.02		F	#	-	-
	mg/L	0729	WL	12/04/2012	N001	SF	D	0.36		F	#	-	-
	mg/L	0730	WL	06/12/2012	N001	SE	D	0.58		FQ	#	-	-
	mg/L	0730	WL	12/04/2012	N001	SE	D	1.16		FQ	#	-	-
	mg/L	0784	WL	06/12/2012	N001	SF	U	0.29		F	#	-	-
	mg/L	0784	WL	12/04/2012	N001	SF	U	0.50		F	#	-	-
	mg/L	0788	WL	06/13/2012	N001	SF	C	0.36		F	#	-	-
	mg/L	0788	WL	12/05/2012	N001	SF	C	0.62		F	#	-	-
	mg/L	0789	WL	06/13/2012	N001	SF	D	0.45		F	#	-	-
	mg/L	0789	WL	12/05/2012	N001	SF	D	1.37		F	#	-	-
	mg/L	0824	WL	06/13/2012	N001	SF		3.57		F	#	-	-
	mg/L	0824	WL	12/04/2012	N001	SF		0.36		F	#	-	-
	mg/L	0826	WL	06/13/2012	N001	SF		0.38		F	#	-	-
	mg/L	0826	WL	12/05/2012	N001	SF		0.50		F	#	-	-
Manganese	mg/L	0705	WL	06/13/2012	0001	SE	D	0.00011	U	FQ	#	0.00011	-
	mg/L	0705	WL	12/05/2012	N001	SE	D	0.011		FQJ	#	0.00011	-
	mg/L	0707	WL	06/13/2012	N001	SF	D	1.200		F	#	0.00011	-
	mg/L	0707	WL	12/05/2012	N001	SF	D	1.100		F	#	0.00011	-
	mg/L	0710	WL	06/12/2012	N001	SF	U	0.014		F	#	0.00011	-
	mg/L	0710	WL	12/05/2012	N001	SF	U	0.012		F	#	0.00011	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	0716	WL	06/12/2012	N001	SF	O	0.170		F	#	0.00011	-
	mg/L	0716	WL	12/04/2012	N001	SF	O	0.160		F	#	0.00011	-
	mg/L	0717	WL	06/12/2012	N001	SE	O	0.210		F	#	0.00011	-
	mg/L	0717	WL	12/04/2012	N001	SE	O	0.180		F	#	0.00011	-
	mg/L	0718	WL	06/13/2012	N001	SF	D	0.260		F	#	0.00011	-
	mg/L	0718	WL	12/05/2012	N001	SF	D	0.500		F	#	0.00011	-
	mg/L	0719	WL	06/13/2012	N001	SE	D	0.064		FQ	#	0.00011	-
	mg/L	0719	WL	12/05/2012	N001	SE	D	0.086		FQ	#	0.00011	-
	mg/L	0720	WL	06/13/2012	N001	SF	C	0.0015	B	F	#	0.00011	-
	mg/L	0720	WL	12/04/2012	N001	SF	C	0.0019	B	UF	#	0.00011	-
	mg/L	0721	WL	06/13/2012	N001	SE	C	0.0027	B	F	#	0.00011	-
	mg/L	0721	WL	12/04/2012	N001	SE	C	0.0027	B	UF	#	0.00011	-
	mg/L	0722R	WL	06/13/2012	N001	SF		0.0034	B	F	#	0.00011	-
	mg/L	0722R	WL	12/04/2012	N001	SF		0.0074		F	#	0.00011	-
	mg/L	0723	WL	06/13/2012	N001	SE	D	0.300		F	#	0.00011	-
	mg/L	0723	WL	12/04/2012	N001	SE	D	0.440		F	#	0.00011	-
	mg/L	0729	WL	06/12/2012	N001	SF	D	0.0021	B	F	#	0.00011	-
	mg/L	0729	WL	12/04/2012	N001	SF	D	0.019		F	#	0.00011	-
	mg/L	0730	WL	06/12/2012	N001	SE	D	0.048		FQ	#	0.00011	-
	mg/L	0730	WL	12/04/2012	N001	SE	D	0.039		FQ	#	0.00011	-
	mg/L	0784	WL	06/12/2012	N001	SF	U	0.710				0.00011	-
	mg/L	0784	WL	12/04/2012	N001	SF	U	0.840		F	#	0.00011	-
	mg/L	0788	WL	06/13/2012	N001	SF	C	0.290		F	#	0.00011	-
	mg/L	0788	WL	12/05/2012	N001	SF	C	0.200		F	#	0.00011	-
	mg/L	0789	WL	06/13/2012	N001	SF	D	0.560		F	#	0.00011	-
	mg/L	0789	WL	06/13/2012	N002	SF	D	0.570		F	#	0.00011	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE:		ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS:			DETECTION LIMIT	UN-CERTAINTY
				DATE	ID				LAB	DATA	QA		
Manganese	mg/L	0789	WL	12/05/2012	N001	SF	D	0.750		F	#	0.00011	-
	mg/L	0824	WL	06/13/2012	N001	SF		0.0078		F	#	0.00011	-
	mg/L	0824	WL	12/04/2012	N001	SF		0.0032	B	UF	#	0.00011	-
	mg/L	0826	WL	06/13/2012	N001	SF		2.900		F	#	0.00011	-
	mg/L	0826	WL	12/05/2012	N001	SF		2.900		F	#	0.00011	-
Molybdenum	mg/L	0705	WL	06/13/2012	0001	SE	D	0.0029		FQ	#	3.2E-05	-
	mg/L	0705	WL	12/05/2012	N001	SE	D	0.0028		FQ	#	0.00032	-
	mg/L	0707	WL	06/13/2012	N001	SF	D	0.900		F	#	3.2E-05	-
	mg/L	0707	WL	12/05/2012	N001	SF	D	0.850		F	#	0.0016	-
	mg/L	0710	WL	06/12/2012	N001	SF	U	0.0013		F	#	3.2E-05	-
	mg/L	0710	WL	12/05/2012	N001	SF	U	0.0018		F	#	0.00032	-
	mg/L	0716	WL	06/12/2012	N001	SF	O	0.130		F	#	0.00032	-
	mg/L	0716	WL	12/04/2012	N001	SF	O	0.120		F	#	0.00032	-
	mg/L	0717	WL	06/12/2012	N001	SE	O	0.0091		F	#	3.2E-05	-
	mg/L	0717	WL	12/04/2012	N001	SE	O	0.0075		F	#	0.00032	-
	mg/L	0718	WL	06/13/2012	N001	SF	D	0.068		F	#	0.00016	-
	mg/L	0718	WL	12/05/2012	N001	SF	D	0.100		F	#	0.00032	-
	mg/L	0719	WL	06/13/2012	N001	SE	D	0.013		FQ	#	3.2E-05	-
	mg/L	0719	WL	12/05/2012	N001	SE	D	0.011		FQ	#	0.00032	-
	mg/L	0720	WL	06/13/2012	N001	SF	C	0.0013		F	#	3.2E-05	-
	mg/L	0720	WL	12/04/2012	N001	SF	C	0.0014		F	#	0.00032	-
	mg/L	0721	WL	06/13/2012	N001	SE	C	0.0025		F	#	3.2E-05	-
	mg/L	0721	WL	12/04/2012	N001	SE	C	0.0024		F	#	0.00032	-
	mg/L	0722R	WL	06/13/2012	N001	SF		0.130		F	#	3.2E-05	-
	mg/L	0722R	WL	12/04/2012	N001	SF		0.110		F	#	0.0016	-
	mg/L	0723	WL	06/13/2012	N001	SE	D	0.00029		F	#	3.2E-05	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Molybdenum	mg/L	0723	WL	12/04/2012	N001	SE	D	0.00032	U	F	#	0.00032	-
	mg/L	0729	WL	06/12/2012	N001	SF	D	0.002		F	#	3.2E-05	-
	mg/L	0729	WL	12/04/2012	N001	SF	D	0.0032		F	#	0.00032	-
	mg/L	0730	WL	06/12/2012	N001	SE	D	0.0042		FQ	#	3.2E-05	-
	mg/L	0730	WL	12/04/2012	N001	SE	D	0.0039		FQ	#	0.00032	-
	mg/L	0784	WL	06/12/2012	N001	SF	U	0.0099		F	#	3.2E-05	-
	mg/L	0784	WL	12/04/2012	N001	SF	U	0.0076		F	#	0.00032	-
	mg/L	0788	WL	06/13/2012	N001	SF	C	0.022		F	#	3.2E-05	-
	mg/L	0788	WL	12/05/2012	N001	SF	C	0.022		F	#	0.00032	-
	mg/L	0789	WL	06/13/2012	N001	SF	D	0.560		F	#	3.2E-05	-
	mg/L	0789	WL	06/13/2012	N002	SF	D	0.560		F	#	0.0016	-
	mg/L	0789	WL	12/05/2012	N001	SF	D	0.660		F	#	0.0016	-
	mg/L	0824	WL	06/13/2012	N001	SF		0.0047		F	#	3.2E-05	-
	mg/L	0824	WL	12/04/2012	N001	SF		0.0028		F	#	0.00032	-
	mg/L	0826	WL	06/13/2012	N001	SF		0.020		F	#	3.2E-05	-
	mg/L	0826	WL	12/05/2012	N001	SF		0.021		F	#	0.00032	-
Oxidation Reduction Potential	mV	0705	WL	06/13/2012	N001	SE	D	54.1		FQ	#	-	-
	mV	0705	WL	12/05/2012	N001	SE	D	66.4		FQ	#	-	-
	mV	0707	WL	06/13/2012	N001	SF	D	96.6		F	#	-	-
	mV	0707	WL	12/05/2012	N001	SF	D	95.9		F	#	-	-
	mV	0710	WL	06/12/2012	N001	SF	U	84.7		F	#	-	-
	mV	0710	WL	12/05/2012	N001	SF	U	139.2		F	#	-	-
	mV	0716	WL	06/12/2012	N001	SF	O	36.6		F	#	-	-
	mV	0716	WL	12/04/2012	N001	SF	O	63.4		F	#	-	-
	mV	0717	WL	06/12/2012	N001	SE	O	-71.1		F	#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 3:00 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE:		ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS:			DETECTION LIMIT	UN- CERTAINTY
				DATE	ID				LAB	DATA	QA		
Oxidation Reduction Potential	mV	0717	WL	12/04/2012	N001	SE	O	-90.5		F	#	-	-
	mV	0718	WL	06/13/2012	N001	SF	D	133.5		F	#	-	-
	mV	0718	WL	12/05/2012	N001	SF	D	113.7		F	#	-	-
	mV	0719	WL	06/13/2012	N001	SE	D	-92.4		FQ	#	-	-
	mV	0719	WL	12/05/2012	N001	SE	D	-130.3		FQ	#	-	-
	mV	0720	WL	06/13/2012	N001	SF	C	79.3		F	#	-	-
	mV	0720	WL	12/04/2012	N001	SF	C	25.2		F	#	-	-
	mV	0721	WL	06/13/2012	N001	SE	C	-28.0		F	#	-	-
	mV	0721	WL	12/04/2012	N001	SE	C	-63.5		F	#	-	-
	mV	0722R	WL	06/13/2012	N001	SF		42.6		F	#	-	-
	mV	0722R	WL	12/04/2012	N001	SF		140.7		F	#	-	-
	mV	0723	WL	06/13/2012	N001	SE	D	-60.0		F	#	-	-
	mV	0723	WL	12/04/2012	N001	SE	D	-49		F	#	-	-
	mV	0729	WL	06/12/2012	N001	SF	D	136.2		F	#	-	-
	mV	0729	WL	12/04/2012	N001	SF	D	32.7		F	#	-	-
	mV	0730	WL	06/12/2012	N001	SE	D	-14.2		FQ	#	-	-
	mV	0730	WL	12/04/2012	N001	SE	D	-15.4		FQ	#	-	-
	mV	0784	WL	06/12/2012	N001	SF	U	32.8		F	#	-	-
	mV	0784	WL	12/04/2012	N001	SF	U	8.7		F	#	-	-
	mV	0788	WL	06/13/2012	N001	SF	C	114.5		F	#	-	-
	mV	0788	WL	12/05/2012	N001	SF	C	70.5		F	#	-	-
	mV	0789	WL	06/13/2012	N001	SF	D	134.7		F	#	-	-
	mV	0789	WL	12/05/2012	N001	SF	D	21.6		F	#	-	-
	mV	0824	WL	06/13/2012	N001	SF		118.4		F	#	-	-
	mV	0824	WL	12/04/2012	N001	SF		-61.4		F	#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Oxidation Reduction Potential	mV	0826	WL	06/13/2012	N001	SF		65.4		F	#	-	-
	mV	0826	WL	12/05/2012	N001	SF		18.6		F	#	-	-
pH	s.u.	0705	WL	06/13/2012	N001	SE	D	8.14		FQ	#	-	-
	s.u.	0705	WL	12/05/2012	N001	SE	D	8.24		FQ	#	-	-
	s.u.	0707	WL	06/13/2012	N001	SF	D	6.83		F	#	-	-
	s.u.	0707	WL	12/05/2012	N001	SF	D	7.01		F	#	-	-
	s.u.	0710	WL	06/12/2012	N001	SF	U	7.08		F	#	-	-
	s.u.	0710	WL	12/05/2012	N001	SF	U	7.58		F	#	-	-
	s.u.	0716	WL	06/12/2012	N001	SF	O	6.90		F	#	-	-
	s.u.	0716	WL	12/04/2012	N001	SF	O	7.19		F	#	-	-
	s.u.	0717	WL	06/12/2012	N001	SE	O	7.52		F	#	-	-
	s.u.	0717	WL	12/04/2012	N001	SE	O	7.78		F	#	-	-
	s.u.	0718	WL	06/13/2012	N001	SF	D	6.94		F	#	-	-
	s.u.	0718	WL	12/05/2012	N001	SF	D	7.14		F	#	-	-
	s.u.	0719	WL	06/13/2012	N001	SE	D	7.53		FQ	#	-	-
	s.u.	0719	WL	12/05/2012	N001	SE	D	7.80		FQ	#	-	-
	s.u.	0720	WL	06/13/2012	N001	SF	C	7.08		F	#	-	-
	s.u.	0720	WL	12/04/2012	N001	SF	C	7.37		F	#	-	-
	s.u.	0721	WL	06/13/2012	N001	SE	C	8.53		F	#	-	-
	s.u.	0721	WL	12/04/2012	N001	SE	C	8.85		F	#	-	-
	s.u.	0722R	WL	06/13/2012	N001	SF		6.75		F	#	-	-
	s.u.	0722R	WL	12/04/2012	N001	SF		7.08		F	#	-	-
	s.u.	0723	WL	06/13/2012	N001	SE	D	7.05		F	#	-	-
	s.u.	0723	WL	12/04/2012	N001	SE	D	7.14		F	#	-	-
	s.u.	0729	WL	06/12/2012	N001	SF	D	6.85		F	#	-	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
pH	s.u.	0729	WL	12/04/2012	N001	SF	D	7.20		F	#	-	-
	s.u.	0730	WL	06/12/2012	N001	SE	D	7.15		FQ	#	-	-
	s.u.	0730	WL	12/04/2012	N001	SE	D	7.48		FQ	#	-	-
	s.u.	0784	WL	06/12/2012	N001	SF	U	7.39		F	#	-	-
	s.u.	0784	WL	12/04/2012	N001	SF	U	7.74		F	#	-	-
	s.u.	0788	WL	06/13/2012	N001	SF	C	7.07		F	#	-	-
	s.u.	0788	WL	12/05/2012	N001	SF	C	7.21		F	#	-	-
	s.u.	0789	WL	06/13/2012	N001	SF	D	6.96		F	#	-	-
	s.u.	0789	WL	12/05/2012	N001	SF	D	7.11		F	#	-	-
	s.u.	0824	WL	06/13/2012	N001	SF		7.05		F	#	-	-
	s.u.	0824	WL	12/04/2012	N001	SF		7.16		F	#	-	-
	s.u.	0826	WL	06/13/2012	N001	SF		6.96		F	#	-	-
	s.u.	0826	WL	12/05/2012	N001	SF		7.10		F	#	-	-
Selenium	mg/L	0705	WL	06/13/2012	0001	SE	D	0.00028		FQ	#	3.2E-05	-
	mg/L	0707	WL	06/13/2012	N001	SF	D	0.00087		F	#	3.2E-05	-
	mg/L	0710	WL	06/12/2012	N001	SF	U	0.00034		F	#	3.2E-05	-
	mg/L	0716	WL	06/12/2012	N001	SF	O	0.0015		F	#	0.00032	-
	mg/L	0717	WL	06/12/2012	N001	SE	O	0.0015		F	#	3.2E-05	-
	mg/L	0718	WL	06/13/2012	N001	SF	D	0.005		F	#	0.00016	-
	mg/L	0719	WL	06/13/2012	N001	SE	D	0.00069		FQ	#	3.2E-05	-
	mg/L	0720	WL	06/13/2012	N001	SF	C	0.0012		F	#	3.2E-05	-
	mg/L	0721	WL	06/13/2012	N001	SE	C	0.00003	U	F	#	3.2E-05	-
	mg/L	0722R	WL	06/13/2012	N001	SF		0.0014		F	#	3.2E-05	-
	mg/L	0723	WL	06/13/2012	N001	SE	D	0.0021		F	#	3.2E-05	-
	mg/L	0729	WL	06/12/2012	N001	SF	D	0.00047		F	#	3.2E-05	-
	mg/L	0730	WL	06/12/2012	N001	SE	D	0.00014		FQ	#	3.2E-05	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 3:00 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Selenium	mg/L	0784	WL	06/12/2012	N001	SF	U	0.00048		F	#	3.2E-05	-
	mg/L	0788	WL	06/13/2012	N001	SF	C	0.00026		F	#	3.2E-05	-
	mg/L	0789	WL	06/13/2012	N001	SF	D	0.0019		F	#	3.2E-05	-
	mg/L	0789	WL	06/13/2012	N002	SF	D	0.002		F	#	3.2E-05	-
	mg/L	0824	WL	06/13/2012	N001	SF		0.00093		F	#	3.2E-05	-
	mg/L	0826	WL	06/13/2012	N001	SF		0.00025		F	#	3.2E-05	-
Specific Conductance	umhos/cm	0705	WL	06/13/2012	N001	SE	D	1303		FQ	#	-	-
	umhos/cm	0705	WL	12/05/2012	N001	SE	D	1215		FQ	#	-	-
	umhos/cm	0707	WL	06/13/2012	N001	SF	D	5688		F	#	-	-
	umhos/cm	0707	WL	12/05/2012	N001	SF	D	5032		F	#	-	-
	umhos/cm	0710	WL	06/12/2012	N001	SF	U	908		F	#	-	-
	umhos/cm	0710	WL	12/05/2012	N001	SF	U	473		F	#	-	-
	umhos/cm	0716	WL	06/12/2012	N001	SF	O	1534		F	#	-	-
	umhos/cm	0716	WL	12/04/2012	N001	SF	O	1278		F	#	-	-
	umhos/cm	0717	WL	06/12/2012	N001	SE	O	1927		F	#	-	-
	umhos/cm	0717	WL	12/04/2012	N001	SE	O	1865		F	#	-	-
	umhos/cm	0718	WL	06/13/2012	N001	SF	D	5120		F	#	-	-
	umhos/cm	0718	WL	12/05/2012	N001	SF	D	4734		F	#	-	-
	umhos/cm	0719	WL	06/13/2012	N001	SE	D	1236		FQ	#	-	-
	umhos/cm	0719	WL	12/05/2012	N001	SE	D	1223		FQ	#	-	-
	umhos/cm	0720	WL	06/13/2012	N001	SF	C	812		F	#	-	-
	umhos/cm	0720	WL	12/04/2012	N001	SF	C	589		F	#	-	-
	umhos/cm	0721	WL	06/13/2012	N001	SE	C	895		F	#	-	-
	umhos/cm	0721	WL	12/04/2012	N001	SE	C	865		F	#	-	-
	umhos/cm	0722R	WL	06/13/2012	N001	SF		2072		F	#	-	-
	umhos/cm	0722R	WL	12/04/2012	N001	SF		1486		F	#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 3:00 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Specific Conductance	umhos/cm	0723	WL	06/13/2012	N001	SE	D	3505		F	#	-	-
	umhos/cm	0723	WL	12/04/2012	N001	SE	D	3631		F	#	-	-
	umhos/cm	0729	WL	06/12/2012	N001	SF	D	623		F	#	-	-
	umhos/cm	0729	WL	12/04/2012	N001	SF	D	664		F	#	-	-
	umhos/cm	0730	WL	06/12/2012	N001	SE	D	963		FQ	#	-	-
	umhos/cm	0730	WL	12/04/2012	N001	SE	D	867		FQ	#	-	-
	umhos/cm	0784	WL	06/12/2012	N001	SF	U	4158		F	#	-	-
	umhos/cm	0784	WL	12/04/2012	N001	SF	U	4059		F	#	-	-
	umhos/cm	0788	WL	06/13/2012	N001	SF	C	3708		F	#	-	-
	umhos/cm	0788	WL	12/05/2012	N001	SF	C	3263		F	#	-	-
	umhos/cm	0789	WL	06/13/2012	N001	SF	D	10389		F	#	-	-
	umhos/cm	0789	WL	12/05/2012	N001	SF	D	8911		F	#	-	-
	umhos/cm	0824	WL	06/13/2012	N001	SF		652		F	#	-	-
	umhos/cm	0824	WL	12/04/2012	N001	SF		1014		F	#	-	-
	umhos/cm	0826	WL	06/13/2012	N001	SF		3679		F	#	-	-
	umhos/cm	0826	WL	12/05/2012	N001	SF		3673		F	#	-	-
Sulfate	mg/L	0705	WL	06/13/2012	0001	SE	D	460		FQ	#	10	-
	mg/L	0705	WL	12/05/2012	N001	SE	D	450		FQ	#	5	-
	mg/L	0707	WL	06/13/2012	N001	SF	D	3100		F	#	25	-
	mg/L	0707	WL	12/05/2012	N001	SF	D	3000		F	#	25	-
	mg/L	0710	WL	06/12/2012	N001	SF	U	250		F	#	2.5	-
	mg/L	0710	WL	12/05/2012	N001	SF	U	74		F	#	1	-
	mg/L	0716	WL	06/12/2012	N001	SF	O	460		F	#	10	-
	mg/L	0716	WL	12/04/2012	N001	SF	O	400		F	#	5	-
	mg/L	0717	WL	06/12/2012	N001	SE	O	720		F	#	10	-
	mg/L	0717	WL	12/04/2012	N001	SE	O	760		F	#	10	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Sulfate	mg/L	0718	WL	06/13/2012	N001	SF	D	2600		F	#	25	-
	mg/L	0718	WL	12/05/2012	N001	SF	D	2600		F	#	25	-
	mg/L	0719	WL	06/13/2012	N001	SE	D	450		FQ	#	10	-
	mg/L	0719	WL	12/05/2012	N001	SE	D	480		FQ	#	5	-
	mg/L	0720	WL	06/13/2012	N001	SF	C	190		F	#	2.5	-
	mg/L	0720	WL	12/04/2012	N001	SF	C	100		F	#	2.5	-
	mg/L	0721	WL	06/13/2012	N001	SE	C	280		F	#	2.5	-
	mg/L	0721	WL	12/04/2012	N001	SE	C	280		F	#	2.5	-
	mg/L	0722R	WL	06/13/2012	N001	SF		840		F	#	10	-
	mg/L	0722R	WL	12/04/2012	N001	SF		640		F	#	10	-
	mg/L	0723	WL	06/13/2012	N001	SE	D	1600		F	#	25	-
	mg/L	0723	WL	12/04/2012	N001	SE	D	1700		F	#	25	-
	mg/L	0729	WL	06/12/2012	N001	SF	D	74		F	#	2.5	-
	mg/L	0729	WL	12/04/2012	N001	SF	D	63		F	#	2.5	-
	mg/L	0730	WL	06/12/2012	N001	SE	D	150		FQ	#	2.5	-
	mg/L	0730	WL	12/04/2012	N001	SE	D	140		FQ	#	2.5	-
	mg/L	0784	WL	06/12/2012	N001	SF	U	2300		F	#	25	-
	mg/L	0784	WL	12/04/2012	N001	SF	U	2500		F	#	25	-
	mg/L	0788	WL	06/13/2012	N001	SF	C	1700		F	#	25	-
	mg/L	0788	WL	12/05/2012	N001	SF	C	1500		F	#	25	-
	mg/L	0789	WL	06/13/2012	N001	SF	D	5900		F	#	50	-
	mg/L	0789	WL	06/13/2012	N002	SF	D	5800		F	#	50	-
	mg/L	0789	WL	12/05/2012	N001	SF	D	5300		F	#	50	-
	mg/L	0824	WL	06/13/2012	N001	SF		85		F	#	2.5	-
	mg/L	0824	WL	12/04/2012	N001	SF		220		F	#	5	-
	mg/L	0826	WL	06/13/2012	N001	SF		1800		F	#	25	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Sulfate	mg/L	0826	WL	12/05/2012	N001	SF		2000		F	#	25	-
Temperature	C	0705	WL	06/13/2012	N001	SE	D	11.40		FQ	#	-	-
	C	0705	WL	12/05/2012	N001	SE	D	9.06		FQ	#	-	-
	C	0707	WL	06/13/2012	N001	SF	D	10.76		F	#	-	-
	C	0707	WL	12/05/2012	N001	SF	D	9.65		F	#	-	-
	C	0710	WL	06/12/2012	N001	SF	U	10.07		F	#	-	-
	C	0710	WL	12/05/2012	N001	SF	U	11.58		F	#	-	-
	C	0716	WL	06/12/2012	N001	SF	O	12.90		F	#	-	-
	C	0716	WL	12/04/2012	N001	SF	O	10.51		F	#	-	-
	C	0717	WL	06/12/2012	N001	SE	O	12.70		F	#	-	-
	C	0717	WL	12/04/2012	N001	SE	O	9.57		F	#	-	-
	C	0718	WL	06/13/2012	N001	SF	D	15.04		F	#	-	-
	C	0718	WL	12/05/2012	N001	SF	D	13.07		F	#	-	-
	C	0719	WL	06/13/2012	N001	SE	D	14.89		FQ	#	-	-
	C	0719	WL	12/05/2012	N001	SE	D	11.79		FQ	#	-	-
	C	0720	WL	06/13/2012	N001	SF	C	10.57		F	#	-	-
	C	0720	WL	12/04/2012	N001	SF	C	9.31		F	#	-	-
	C	0721	WL	06/13/2012	N001	SE	C	10.14		F	#	-	-
	C	0721	WL	12/04/2012	N001	SE	C	9.55		F	#	-	-
	C	0722R	WL	06/13/2012	N001	SF		13.44		F	#	-	-
	C	0722R	WL	12/04/2012	N001	SF		11.99		F	#	-	-
	C	0723	WL	06/13/2012	N001	SE	D	13.20		F	#	-	-
	C	0723	WL	12/04/2012	N001	SE	D	10.73		F	#	-	-
	C	0729	WL	06/12/2012	N001	SF	D	13.77		F	#	-	-
	C	0729	WL	12/04/2012	N001	SF	D	11.57		F	#	-	-
	C	0730	WL	06/12/2012	N001	SE	D	13.07		FQ	#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 3:00 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Temperature	C	0730	WL	12/04/2012	N001	SE	D	11.21		FQ	#	-	-
	C	0784	WL	06/12/2012	N001	SF	U	13.69		F	#	-	-
	C	0784	WL	12/04/2012	N001	SF	U	10.79		F	#	-	-
	C	0788	WL	06/13/2012	N001	SF	C	10.29		F	#	-	-
	C	0788	WL	12/05/2012	N001	SF	C	10.41		F	#	-	-
	C	0789	WL	06/13/2012	N001	SF	D	11.62		F	#	-	-
	C	0789	WL	12/05/2012	N001	SF	D	10.10		F	#	-	-
	C	0824	WL	06/13/2012	N001	SF		12.00		F	#	-	-
	C	0824	WL	12/04/2012	N001	SF		10.00		F	#	-	-
	C	0826	WL	06/13/2012	N001	SF		9.98		F	#	-	-
	C	0826	WL	12/05/2012	N001	SF		9.22		F	#	-	-
Turbidity	NTU	0705	WL	06/13/2012	N001	SE	D	67.1		FQ	#	-	-
	NTU	0705	WL	12/05/2012	N001	SE	D	8.4		FQ	#	-	-
	NTU	0707	WL	06/13/2012	N001	SF	D	6.37		F	#	-	-
	NTU	0707	WL	12/05/2012	N001	SF	D	3.42		F	#	-	-
	NTU	0710	WL	06/12/2012	N001	SF	U	5.90		F	#	-	-
	NTU	0710	WL	12/05/2012	N001	SF	U	1.45		F	#	-	-
	NTU	0716	WL	06/12/2012	N001	SF	O	5.34		F	#	-	-
	NTU	0716	WL	12/04/2012	N001	SF	O	0.88		F	#	-	-
	NTU	0717	WL	06/12/2012	N001	SE	O	5.58		F	#	-	-
	NTU	0717	WL	12/04/2012	N001	SE	O	1.17		F	#	-	-
	NTU	0718	WL	06/13/2012	N001	SF	D	6.57		F	#	-	-
	NTU	0718	WL	12/05/2012	N001	SF	D	2.94		F	#	-	-
	NTU	0719	WL	06/13/2012	N001	SE	D	7.56		FQ	#	-	-
	NTU	0719	WL	12/05/2012	N001	SE	D	5.01		FQ	#	-	-
	NTU	0720	WL	06/13/2012	N001	SF	C	1.74		F	#	-	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Turbidity	NTU	0720	WL	12/04/2012	N001	SF	C	2.27		F	#	-	-
	NTU	0721	WL	06/13/2012	N001	SE	C	2.12		F	#	-	-
	NTU	0721	WL	12/04/2012	N001	SE	C	0.8		F	#	-	-
	NTU	0722R	WL	06/13/2012	N001	SF		1.17		F	#	-	-
	NTU	0722R	WL	12/04/2012	N001	SF		0.84		F	#	-	-
	NTU	0723	WL	06/13/2012	N001	SE	D	1.45		F	#	-	-
	NTU	0723	WL	12/04/2012	N001	SE	D	1.15		F	#	-	-
	NTU	0729	WL	06/12/2012	N001	SF	D	2.18		F	#	-	-
	NTU	0729	WL	12/04/2012	N001	SF	D	9.23		F	#	-	-
	NTU	0730	WL	06/12/2012	N001	SE	D	5.74		FQ	#	-	-
	NTU	0730	WL	12/04/2012	N001	SE	D	1.99		FQ	#	-	-
	NTU	0784	WL	06/12/2012	N001	SF	U	3.20		F	#	-	-
	NTU	0784	WL	12/04/2012	N001	SF	U	2.38		F	#	-	-
	NTU	0788	WL	06/13/2012	N001	SF	C	5.74		F	#	-	-
	NTU	0788	WL	12/05/2012	N001	SF	C	6.29		F	#	-	-
	NTU	0789	WL	06/13/2012	N001	SF	D	4.02		F	#	-	-
	NTU	0789	WL	12/05/2012	N001	SF	D	1.76		F	#	-	-
	NTU	0824	WL	06/13/2012	N001	SF		8.17		F	#	-	-
	NTU	0824	WL	12/04/2012	N001	SF		2.06		F	#	-	-
	NTU	0826	WL	06/13/2012	N001	SF		4.25		F	#	-	-
	NTU	0826	WL	12/05/2012	N001	SF		4.45		F	#	-	-
Uranium	mg/L	0705	WL	06/13/2012	0001	SE	D	0.00044		FQ	#	2.9E-06	-
	mg/L	0705	WL	12/05/2012	N001	SE	D	0.00032		FQ	#	2.9E-05	-
	mg/L	0707	WL	06/13/2012	N001	SF	D	1.000		F	#	2.9E-06	-
	mg/L	0707	WL	12/05/2012	N001	SF	D	0.850		F	#	0.00015	-
	mg/L	0710	WL	06/12/2012	N001	SF	U	0.0053		F	#	2.9E-06	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 3:00 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	0710	WL	12/05/2012	N001	SF	U	0.0022		F	#	2.9E-05	-
	mg/L	0716	WL	06/12/2012	N001	SF	O	0.300		F	#	2.9E-05	-
	mg/L	0716	WL	12/04/2012	N001	SF	O	0.230		F	#	2.9E-05	-
	mg/L	0717	WL	06/12/2012	N001	SE	O	0.00006		F	#	2.9E-06	-
	mg/L	0717	WL	12/04/2012	N001	SE	O	0.00004	B	F	#	2.9E-05	-
	mg/L	0718	WL	06/13/2012	N001	SF	D	0.160		F	#	1.5E-05	-
	mg/L	0718	WL	12/05/2012	N001	SF	D	0.150		F	#	2.9E-05	-
	mg/L	0719	WL	06/13/2012	N001	SE	D	0.00054		FQ	#	2.9E-06	-
	mg/L	0719	WL	12/05/2012	N001	SE	D	0.00035		FQ	#	2.9E-05	-
	mg/L	0720	WL	06/13/2012	N001	SF	C	0.0063		F	#	2.9E-06	-
	mg/L	0720	WL	12/04/2012	N001	SF	C	0.0042		F	#	2.9E-05	-
	mg/L	0721	WL	06/13/2012	N001	SE	C	0.00009		F	#	2.9E-06	-
	mg/L	0721	WL	12/04/2012	N001	SE	C	0.00012		F	#	2.9E-05	-
	mg/L	0722R	WL	06/13/2012	N001	SF		0.510		F	#	2.9E-06	-
	mg/L	0722R	WL	12/04/2012	N001	SF		0.450		F	#	0.00015	-
	mg/L	0723	WL	06/13/2012	N001	SE	D	0.00004		F	#	2.9E-06	-
	mg/L	0723	WL	12/04/2012	N001	SE	D	0.00003	B	F	#	2.9E-05	-
	mg/L	0729	WL	06/12/2012	N001	SF	D	0.0031		F	#	2.9E-06	-
	mg/L	0729	WL	12/04/2012	N001	SF	D	0.0047		F	#	2.9E-05	-
	mg/L	0730	WL	06/12/2012	N001	SE	D	0.0074		FQ	#	2.9E-06	-
	mg/L	0730	WL	12/04/2012	N001	SE	D	0.0061		FQ	#	2.9E-05	-
	mg/L	0784	WL	06/12/2012	N001	SF	U	0.0028		F	#	2.9E-06	-
	mg/L	0784	WL	12/04/2012	N001	SF	U	0.004		F	#	2.9E-05	-
	mg/L	0788	WL	06/13/2012	N001	SF	C	0.053		F	#	2.9E-06	-
	mg/L	0788	WL	12/05/2012	N001	SF	C	0.048		F	#	2.9E-05	-
	mg/L	0789	WL	06/13/2012	N001	SF	D	2.100		F	#	2.9E-06	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	0789	WL	06/13/2012	N002	SF	D	2.300		F	#	0.00015	-
	mg/L	0789	WL	12/05/2012	N001	SF	D	2.000		F	#	0.00015	-
	mg/L	0824	WL	06/13/2012	N001	SF		0.0085		F	#	2.9E-06	-
	mg/L	0824	WL	12/04/2012	N001	SF		0.014		F	#	2.9E-05	-
	mg/L	0826	WL	06/13/2012	N001	SF		0.049		F	#	2.9E-06	-
	mg/L	0826	WL	12/05/2012	N001	SF		0.048		F	#	2.9E-05	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 3:00 pm

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY

RECORDS: SELECTED FROM USEE200 WHERE site_code='RVT01' AND location_code in('0705','0707','0710','0716','0717','0718','0719','0720','0721','0722R','0723','0729','0730','0784','0788','0789','0824','0826') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2012# and #12/31/2012#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LOCATION TYPES: WL WELL

ZONES OF COMPLETION: a zone of completion with a "-" is cross-screened and, therefore, has two zones of completion (1st zone - 2nd zone).

SE SEMICONFINED SANDSTONE SF SURFICIAL

FLOW CODES: C CROSS GRADIENT D DOWN GRADIENT O ON-SITE U UPGRADIENT

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

Appendix C

Domestic Well Data

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:01 pm

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	0405	WL	06/13/2012	N001	NR	N	113			#	-	-
	mg/L	0405	WL	12/03/2012	N001	NR	N	38			#	-	-
	mg/L	0422	WL	06/12/2012	N001	NR	N	168			#	-	-
	mg/L	0422	WL	12/03/2012	N001	NR	N	150			#	-	-
	mg/L	0430	WL	06/12/2012	N001	NR	N	147			#	-	-
	mg/L	0430	WL	12/03/2012	N001	NR	N	196			#	-	-
	mg/L	0436	WL	06/12/2012	N001	NR	N	167			#	-	-
	mg/L	0436	WL	12/03/2012	N001	NR	N	163			#	-	-
	mg/L	0460	WL	06/12/2012	N001	NR	N	149			#	-	-
	mg/L	0460	WL	12/03/2012	N001	NR	N	65			#	-	-
	mg/L	0828	WL	06/12/2012	N001		O	145			#	-	-
	mg/L	0828	WL	12/03/2012	N001		O	154			#	-	-
	mg/L	0838	WL	06/11/2012	N001			152			#	-	-
	mg/L	0839	WL	06/11/2012	N001			173			#	-	-
	mg/L	0840	WL	06/11/2012	N001			180			#	-	-
	mg/L	0841	WL	06/12/2012	N001			185			#	-	-
	mg/L	0841	WL	12/03/2012	N001			198			#	-	-
	mg/L	0842	WL	06/12/2012	N001			138			#	-	-
	mg/L	0842	WL	12/03/2012	N001			164			#	-	-
Dissolved Oxygen	mg/L	0405	WL	06/13/2012	N001	NR	N	5.57			#	-	-
	mg/L	0405	WL	12/03/2012	N001	NR	N	0.61			#	-	-
	mg/L	0422	WL	06/12/2012	N001	NR	N	5.31			#	-	-
	mg/L	0422	WL	12/03/2012	N001	NR	N	2.17			#	-	-
	mg/L	0430	WL	06/12/2012	N001	NR	N	3.33			#	-	-
	mg/L	0430	WL	12/03/2012	N001	NR	N	0.60			#	-	-
	mg/L	0436	WL	06/12/2012	N001	NR	N	2.54			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Dissolved Oxygen	mg/L	0436	WL	12/03/2012	N001	NR	N	6.21			#	-	-
	mg/L	0460	WL	06/12/2012	N001	NR	N	3.05			#	-	-
	mg/L	0460	WL	12/03/2012	N001	NR	N	2.50			#	-	-
	mg/L	0828	WL	06/12/2012	N001		O	4.56			#	-	-
	mg/L	0828	WL	12/03/2012	N001		O	2.0			#	-	-
	mg/L	0838	WL	06/11/2012	N001			10.29			#	-	-
	mg/L	0839	WL	06/11/2012	N001			6.42			#	-	-
	mg/L	0840	WL	06/11/2012	N001			11.38			#	-	-
	mg/L	0841	WL	06/12/2012	N001			4.46			#	-	-
	mg/L	0841	WL	12/03/2012	N001			0.95			#	-	-
	mg/L	0842	WL	06/12/2012	N001			4.53			#	-	-
	mg/L	0842	WL	12/03/2012	N001			2.08			#	-	-
Manganese	mg/L	0405	WL	06/13/2012	N001	NR	N	0.0029	B		#	0.00011	-
	mg/L	0405	WL	12/03/2012	N001	NR	N	0.00061	B	U	#	0.00011	-
	mg/L	0422	WL	06/12/2012	N001	NR	N	0.00011	U			0.00011	-
	mg/L	0422	WL	12/03/2012	N001	NR	N	0.00061	B	U	#	0.00011	-
	mg/L	0430	WL	06/12/2012	N001	NR	N	0.0027	B		#	0.00011	-
	mg/L	0430	WL	12/03/2012	N001	NR	N	0.0083		J	#	0.00011	-
	mg/L	0430	WL	12/03/2012	N002	NR	N	0.0061			#	0.00011	-
	mg/L	0436	WL	06/12/2012	N001	NR	N	0.0018	B		#	0.00011	-
	mg/L	0436	WL	12/03/2012	N001	NR	N	0.00054	B	U	#	0.00011	-
	mg/L	0460	WL	06/12/2012	N001	NR	N	0.00084	B		#	0.00011	-
	mg/L	0460	WL	12/03/2012	N001	NR	N	0.0011	B	U	#	0.00011	-
	mg/L	0828	WL	06/12/2012	N001		O	0.00011	U		#	0.00011	-
	mg/L	0828	WL	12/03/2012	N001		O	0.001	B	U	#	0.00011	-
	mg/L	0838	WL	06/11/2012	N001			0.240			#	0.00011	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	0839	WL	06/11/2012	N001			0.160			#	0.00011	-
	mg/L	0840	WL	06/11/2012	N001			0.079			#	0.00011	-
	mg/L	0841	WL	06/12/2012	N001			0.110			#	0.00011	-
	mg/L	0841	WL	12/03/2012	N001			0.110			#	0.00011	-
	mg/L	0842	WL	06/12/2012	N001			0.056			#	0.00011	-
	mg/L	0842	WL	12/03/2012	N001			0.060			#	0.00011	-
Molybdenum	mg/L	0405	WL	06/13/2012	N001	NR	N	0.003			#	3.2E-05	-
	mg/L	0405	WL	12/03/2012	N001	NR	N	0.0044			#	0.00032	-
	mg/L	0422	WL	06/12/2012	N001	NR	N	0.0012			#	3.2E-05	-
	mg/L	0422	WL	12/03/2012	N001	NR	N	0.0019			#	0.00032	-
	mg/L	0430	WL	06/12/2012	N001	NR	N	0.0021			#	3.2E-05	-
	mg/L	0430	WL	12/03/2012	N001	NR	N	0.0023			#	0.00032	-
	mg/L	0430	WL	12/03/2012	N002	NR	N	0.0022			#	0.00032	-
	mg/L	0436	WL	06/12/2012	N001	NR	N	0.0029			#	3.2E-05	-
	mg/L	0436	WL	12/03/2012	N001	NR	N	0.0028			#	0.00032	-
	mg/L	0460	WL	06/12/2012	N001	NR	N	0.0026			#	3.2E-05	-
	mg/L	0460	WL	12/03/2012	N001	NR	N	0.0026			#	0.00032	-
	mg/L	0828	WL	06/12/2012	N001		O	0.0028			#	3.2E-05	-
	mg/L	0828	WL	12/03/2012	N001		O	0.003			#	0.00032	-
	mg/L	0838	WL	06/11/2012	N001			0.003			#	3.2E-05	-
	mg/L	0839	WL	06/11/2012	N001			0.0032			#	3.2E-05	-
	mg/L	0840	WL	06/11/2012	N001			0.0034			#	3.2E-05	-
	mg/L	0841	WL	06/12/2012	N001			0.003			#	3.2E-05	-
	mg/L	0841	WL	12/03/2012	N001			0.004			#	0.00032	-
	mg/L	0842	WL	06/12/2012	N001			0.0023			#	3.2E-05	-
	mg/L	0842	WL	12/03/2012	N001			0.0025			#	0.00032	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Oxidation Reduction Potential	mV	0405	WL	06/13/2012	N001	NR	N	166.3			#	-	-
	mV	0405	WL	12/03/2012	N001	NR	N	84.8			#	-	-
	mV	0422	WL	06/12/2012	N001	NR	N	91.3			#	-	-
	mV	0422	WL	12/03/2012	N001	NR	N	122			#	-	-
	mV	0430	WL	06/12/2012	N001	NR	N	35.6			#	-	-
	mV	0430	WL	12/03/2012	N001	NR	N	88.7			#	-	-
	mV	0436	WL	06/12/2012	N001	NR	N	106.7			#	-	-
	mV	0436	WL	12/03/2012	N001	NR	N	198.6			#	-	-
	mV	0460	WL	06/12/2012	N001	NR	N	136.4			#	-	-
	mV	0460	WL	12/03/2012	N001	NR	N	132.2			#	-	-
	mV	0828	WL	06/12/2012	N001		O	94.2			#	-	-
	mV	0828	WL	12/03/2012	N001		O	149.7			#	-	-
	mV	0838	WL	06/11/2012	N001			237.9			#	-	-
	mV	0839	WL	06/11/2012	N001			57.3			#	-	-
	mV	0840	WL	06/11/2012	N001			119.4			#	-	-
	mV	0841	WL	06/12/2012	N001			105.4			#	-	-
	mV	0841	WL	12/03/2012	N001			92.7			#	-	-
	mV	0842	WL	06/12/2012	N001			-8.2			#	-	-
	mV	0842	WL	12/03/2012	N001			124.9			#	-	-
pH	s.u.	0405	WL	06/13/2012	N001	NR	N	8.55			#	-	-
	s.u.	0405	WL	12/03/2012	N001	NR	N	9.35			#	-	-
	s.u.	0422	WL	06/12/2012	N001	NR	N	7.60			#	-	-
	s.u.	0422	WL	12/03/2012	N001	NR	N	7.85			#	-	-
	s.u.	0430	WL	06/12/2012	N001	NR	N	8.60			#	-	-
	s.u.	0430	WL	12/03/2012	N001	NR	N	8.72			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
pH	s.u.	0436	WL	06/12/2012	N001	NR	N	8.35			#	-	-
	s.u.	0436	WL	12/03/2012	N001	NR	N	8.42			#	-	-
	s.u.	0460	WL	06/12/2012	N001	NR	N	8.77			#	-	-
	s.u.	0460	WL	12/03/2012	N001	NR	N	8.90			#	-	-
	s.u.	0828	WL	06/12/2012	N001		O	8.64			#	-	-
	s.u.	0828	WL	12/03/2012	N001		O	8.7			#	-	-
	s.u.	0838	WL	06/11/2012	N001			7.41			#	-	-
	s.u.	0839	WL	06/11/2012	N001			7.73			#	-	-
	s.u.	0840	WL	06/11/2012	N001			7.74			#	-	-
	s.u.	0841	WL	06/12/2012	N001			7.49			#	-	-
	s.u.	0841	WL	12/03/2012	N001			7.83			#	-	-
	s.u.	0842	WL	06/12/2012	N001			7.69			#	-	-
	s.u.	0842	WL	12/03/2012	N001			7.94			#	-	-
Selenium	mg/L	0405	WL	06/13/2012	N001	NR	N	0.00003	U		#	3.2E-05	-
	mg/L	0422	WL	06/12/2012	N001	NR	N	0.00035			#	3.2E-05	-
	mg/L	0430	WL	06/12/2012	N001	NR	N	0.00003	U		#	3.2E-05	-
	mg/L	0436	WL	06/12/2012	N001	NR	N	0.00003	U		#	3.2E-05	-
	mg/L	0460	WL	06/12/2012	N001	NR	N	0.00003	U		#	3.2E-05	-
	mg/L	0828	WL	06/12/2012	N001		O	0.00003	U		#	3.2E-05	-
	mg/L	0838	WL	06/11/2012	N001			0.00004	B		#	3.2E-05	-
	mg/L	0839	WL	06/11/2012	N001			0.00004	B		#	3.2E-05	-
	mg/L	0840	WL	06/11/2012	N001			0.00003	U		#	3.2E-05	-
	mg/L	0841	WL	06/12/2012	N001			0.00014			#	3.2E-05	-
	mg/L	0842	WL	06/12/2012	N001			0.00003	U		#	3.2E-05	-
Specific Conductance	umhos/cm	0405	WL	06/13/2012	N001	NR	N	912			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Specific Conductance	umhos/cm	0405	WL	12/03/2012	N001	NR	N	969			#	-	-
	umhos/cm	0422	WL	06/12/2012	N001	NR	N	524			#	-	-
	umhos/cm	0422	WL	12/03/2012	N001	NR	N	435			#	-	-
	umhos/cm	0430	WL	06/12/2012	N001	NR	N	781			#	-	-
	umhos/cm	0430	WL	12/03/2012	N001	NR	N	734			#	-	-
	umhos/cm	0436	WL	06/12/2012	N001	NR	N	832			#	-	-
	umhos/cm	0436	WL	12/03/2012	N001	NR	N	796			#	-	-
	umhos/cm	0460	WL	06/12/2012	N001	NR	N	747			#	-	-
	umhos/cm	0460	WL	12/03/2012	N001	NR	N	725			#	-	-
	umhos/cm	0828	WL	06/12/2012	N001		O	837			#	-	-
	umhos/cm	0828	WL	12/03/2012	N001		O	850			#	-	-
	umhos/cm	0838	WL	06/11/2012	N001			855			#	-	-
	umhos/cm	0839	WL	06/11/2012	N001			1400			#	-	-
	umhos/cm	0840	WL	06/11/2012	N001			833			#	-	-
	umhos/cm	0841	WL	06/12/2012	N001			900			#	-	-
	umhos/cm	0841	WL	12/03/2012	N001			831			#	-	-
	umhos/cm	0842	WL	06/12/2012	N001			728			#	-	-
	umhos/cm	0842	WL	12/03/2012	N001			675			#	-	-
Sulfate	mg/L	0405	WL	06/13/2012	N001	NR	N	300			#	5	-
	mg/L	0405	WL	12/03/2012	N001	NR	N	380			#	5	-
	mg/L	0422	WL	06/12/2012	N001	NR	N	89			#	2.5	-
	mg/L	0422	WL	12/03/2012	N001	NR	N	64			#	1	-
	mg/L	0430	WL	06/12/2012	N001	NR	N	180			#	2.5	-
	mg/L	0430	WL	12/03/2012	N001	NR	N	190			#	2.5	-
	mg/L	0430	WL	12/03/2012	N002	NR	N	180			#	2.5	-
	mg/L	0436	WL	06/12/2012	N001	NR	N	210			#	2.5	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:01 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Sulfate	mg/L	0436	WL	12/03/2012	N001	NR	N	200			#	2.5	-
	mg/L	0460	WL	06/12/2012	N001	NR	N	160			#	2.5	-
	mg/L	0460	WL	12/03/2012	N001	NR	N	170			#	2.5	-
	mg/L	0828	WL	06/12/2012	N001		O	210			#	2.5	-
	mg/L	0828	WL	12/03/2012	N001		O	230			#	2.5	-
	mg/L	0838	WL	06/11/2012	N001			220			#	2.5	-
	mg/L	0839	WL	06/11/2012	N001			460			#	10	-
	mg/L	0840	WL	06/11/2012	N001			220			#	2.5	-
	mg/L	0841	WL	06/12/2012	N001			240			#	2.5	-
	mg/L	0841	WL	12/03/2012	N001			240			#	2.5	-
	mg/L	0842	WL	06/12/2012	N001			170			#	2.5	-
	mg/L	0842	WL	12/03/2012	N001			170			#	2.5	-
Temperature	C	0405	WL	06/13/2012	N001	NR	N	13.21			#	-	-
	C	0405	WL	12/03/2012	N001	NR	N	8.73			#	-	-
	C	0422	WL	06/12/2012	N001	NR	N	14.58			#	-	-
	C	0422	WL	12/03/2012	N001	NR	N	13.70			#	-	-
	C	0430	WL	06/12/2012	N001	NR	N	14.26			#	-	-
	C	0430	WL	12/03/2012	N001	NR	N	7.76			#	-	-
	C	0436	WL	06/12/2012	N001	NR	N	23.13			#	-	-
	C	0436	WL	12/03/2012	N001	NR	N	10.82			#	-	-
	C	0460	WL	06/12/2012	N001	NR	N	20.39			#	-	-
	C	0460	WL	12/03/2012	N001	NR	N	17.93			#	-	-
	C	0828	WL	06/12/2012	N001		O	18.08			#	-	-
	C	0828	WL	12/03/2012	N001		O	9.65			#	-	-
	C	0838	WL	06/11/2012	N001			13.11			#	-	-
	C	0839	WL	06/11/2012	N001			12.71			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Temperature	C	0840	WL	06/11/2012	N001			14.39			#	-	-
	C	0841	WL	06/12/2012	N001			14.91			#	-	-
	C	0841	WL	12/03/2012	N001			12.10			#	-	-
	C	0842	WL	06/12/2012	N001			13.94			#	-	-
	C	0842	WL	12/03/2012	N001			10.77			#	-	-
Turbidity	NTU	0405	WL	06/13/2012	N001	NR	N	3.70			#	-	-
	NTU	0405	WL	12/03/2012	N001	NR	N	1.10			#	-	-
	NTU	0422	WL	06/12/2012	N001	NR	N	2.68			#	-	-
	NTU	0422	WL	12/03/2012	N001	NR	N	3.20			#	-	-
	NTU	0430	WL	06/12/2012	N001	NR	N	7.55			#	-	-
	NTU	0430	WL	12/03/2012	N001	NR	N	1.86			#	-	-
	NTU	0436	WL	06/12/2012	N001	NR	N	4.50			#	-	-
	NTU	0436	WL	12/03/2012	N001	NR	N	0.63			#	-	-
	NTU	0460	WL	06/12/2012	N001	NR	N	2.97			#	-	-
	NTU	0460	WL	12/03/2012	N001	NR	N	0.80			#	-	-
	NTU	0828	WL	06/12/2012	N001		O	4.30			#	-	-
	NTU	0828	WL	12/03/2012	N001		O	0.50			#	-	-
	NTU	0838	WL	06/11/2012	N001			4.66			#	-	-
	NTU	0839	WL	06/11/2012	N001			1.75			#	-	-
	NTU	0840	WL	06/11/2012	N001			3.34			#	-	-
	NTU	0841	WL	06/12/2012	N001			1.78			#	-	-
	NTU	0841	WL	12/03/2012	N001			0.31			#	-	-
	NTU	0842	WL	06/12/2012	N001			1.84			#	-	-
	NTU	0842	WL	12/03/2012	N001			1.27			#	-	-
Uranium	mg/L	0405	WL	06/13/2012	N001	NR	N	0.00004			#	2.9E-06	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	0405	WL	12/03/2012	N001	NR	N	0.00002	U		#	2.9E-05	-
	mg/L	0422	WL	06/12/2012	N001	NR	N	0.0024			#	2.9E-06	-
	mg/L	0422	WL	12/03/2012	N001	NR	N	0.0018			#	2.9E-05	-
	mg/L	0430	WL	06/12/2012	N001	NR	N	0.00003			#	2.9E-06	-
	mg/L	0430	WL	12/03/2012	N001	NR	N	0.00002	U		#	2.9E-05	-
	mg/L	0430	WL	12/03/2012	N002	NR	N	0.00006	B		#	2.9E-05	-
	mg/L	0436	WL	06/12/2012	N001	NR	N	0.00007			#	2.9E-06	-
	mg/L	0436	WL	12/03/2012	N001	NR	N	0.00006	B		#	2.9E-05	-
	mg/L	0460	WL	06/12/2012	N001	NR	N	0.00005			#	2.9E-06	-
	mg/L	0460	WL	12/03/2012	N001	NR	N	0.00006	B		#	2.9E-05	-
	mg/L	0828	WL	06/12/2012	N001		O	0.00015			#	2.9E-06	-
	mg/L	0828	WL	12/03/2012	N001		O	0.00008	B		#	2.9E-05	-
	mg/L	0838	WL	06/11/2012	N001			0.0024			#	2.9E-06	-
	mg/L	0839	WL	06/11/2012	N001			0.00045			#	2.9E-06	-
	mg/L	0840	WL	06/11/2012	N001			0.0011			#	2.9E-06	-
	mg/L	0841	WL	06/12/2012	N001			0.0029			#	2.9E-06	-
	mg/L	0841	WL	12/03/2012	N001			0.0011			#	2.9E-05	-
	mg/L	0842	WL	06/12/2012	N001			0.00047			#	2.9E-06	-
	mg/L	0842	WL	12/03/2012	N001			0.00038			#	2.9E-05	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:01 pm

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY

RECORDS: SELECTED FROM USEE200 WHERE site_code='RVT01' AND location_code in('0405','0422','0430','0436','0460','0828','0838','0839','0840','0841','0842') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2012# and #12/31/2012#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LOCATION TYPES: WL WELL

ZONES OF COMPLETION: a zone of completion with a "-" is cross-screened and, therefore, has two zones of completion (1st zone - 2nd zone).

NR NO RECOVERY OF DATA FOR CLASSIFYING

FLOW CODES: N UNKNOWN O ON-SITE

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

Appendix D

Surface Water Quality Data

This page intentionally left blank

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:06 pm

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	0747	06/13/2012	0001	311			#	-	-
	mg/L	0747	12/05/2012	N001	339			#	-	-
	mg/L	0749	06/12/2012	N001	37			#	-	-
	mg/L	0749	12/04/2012	N001	138			#	-	-
	mg/L	0794	06/12/2012	0001	116			#	-	-
	mg/L	0794	12/04/2012	N001	88			#	-	-
	mg/L	0796	06/12/2012	0001	102			#	-	-
	mg/L	0796	12/05/2012	N001	189			#	-	-
	mg/L	0810	06/12/2012	0001	370			#	-	-
	mg/L	0810	12/04/2012	N001	536			#	-	-
	mg/L	0811	06/13/2012	0001	108			#	-	-
	mg/L	0811	12/05/2012	N001	198			#	-	-
	mg/L	0812	06/13/2012	0001	108			#	-	-
	mg/L	0812	12/05/2012	N001	190			#	-	-
	mg/L	0822	06/13/2012	N001	154			#	-	-
	mg/L	0822	12/04/2012	N001	203			#	-	-
	mg/L	0823	06/12/2012	0001	108			#	-	-
	mg/L	0823	12/04/2012	N001	41			#	-	-
Calcium	mg/L	0794	06/12/2012	0001	48.000			#	0.012	-
Chloride	mg/L	0794	06/12/2012	0001	3.8			#	1	-
Dissolved Oxygen	mg/L	0747	06/13/2012	N001	8.12			#	-	-
	mg/L	0747	12/05/2012	N001	11.43			#	-	-
	mg/L	0749	06/12/2012	N001	6.76			#	-	-
	mg/L	0749	12/04/2012	N001	6.10			#	-	-
	mg/L	0794	06/12/2012	N001	8.97			#	-	-
	mg/L	0794	12/04/2012	N001	12.74			#	-	-
	mg/L	0796	06/12/2012	N001	7.73			#	-	-
	mg/L	0796	12/05/2012	N001	12.80			#	-	-
	mg/L	0810	06/12/2012	N001	9.22			#	-	-
	mg/L	0810	12/04/2012	N001	11.14			#	-	-
	mg/L	0811	06/13/2012	N001	8.53			#	-	-
	mg/L	0811	12/05/2012	N001	13.78			#	-	-
	mg/L	0812	06/13/2012	N001	8.90			#	-	-
	mg/L	0812	12/05/2012	N001	13.68			#	-	-
	mg/L	0822	06/13/2012	N001	8.97			#	-	-
	mg/L	0822	12/04/2012	N001	11.87			#	-	-
	mg/L	0823	06/12/2012	N001	8.85			#	-	-

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:06 pm

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	SAMPLE: ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Dissolved Oxygen	mg/L	0823	12/04/2012	N001	11 .69			#	-	-
Magnesium	mg/L	0794	06/12/2012	0001	16 .000			#	0.013	-
Manganese	mg/L	0747	06/13/2012	0001	0 .150			#	0.00011	-
	mg/L	0747	12/05/2012	0001	0 .460			#	0.00011	-
	mg/L	0747	12/05/2012	0002	0 .470			#	0.00011	-
	mg/L	0749	06/12/2012	N001	0 .085			#	0.00011	-
	mg/L	0749	12/04/2012	0001	0 .084			#	0.00011	-
	mg/L	0794	06/12/2012	0001	0 .016	E	J	#	0.00011	-
	mg/L	0794	12/04/2012	N001	0 .037			#	0.00011	-
	mg/L	0796	06/12/2012	0001	0 .014			#	0.00011	-
	mg/L	0796	12/05/2012	N001	0 .038			#	0.00011	-
	mg/L	0810	06/12/2012	0001	0 .037			#	0.00011	-
	mg/L	0810	12/04/2012	N001	0 .300			#	0.00011	-
	mg/L	0811	06/13/2012	0001	0 .053			#	0.00011	-
	mg/L	0811	12/05/2012	N001	0 .038			#	0.00011	-
	mg/L	0812	06/13/2012	0001	0 .024			#	0.00011	-
	mg/L	0812	12/05/2012	N001	0 .045			#	0.00011	-
	mg/L	0822	06/13/2012	N001	0 .014			#	0.00011	-
	mg/L	0822	12/04/2012	N001	0 .065			#	0.00011	-
	mg/L	0823	06/12/2012	0001	0 .170			#	0.00011	-
	mg/L	0823	12/04/2012	N001	0 .028			#	0.00011	-
Molybdenum	mg/L	0747	06/13/2012	0001	0 .013			#	0.00032	-
	mg/L	0747	12/05/2012	0001	0 .013			#	0.00032	-
	mg/L	0747	12/05/2012	0002	0 .013			#	0.00032	-
	mg/L	0749	06/12/2012	N001	0 .0085			#	0.00032	-
	mg/L	0749	12/04/2012	0001	0 .019			#	0.00032	-
	mg/L	0794	06/12/2012	0001	0 .0011			#	0.00032	-
	mg/L	0794	12/04/2012	N001	0 .0016			#	0.00032	-
	mg/L	0796	06/12/2012	0001	0 .0009	B		#	0.00032	-
	mg/L	0796	12/05/2012	N001	0 .0014			#	0.00032	-
	mg/L	0810	06/12/2012	0001	0 .001			#	0.00032	-
	mg/L	0810	12/04/2012	N001	0 .002			#	0.00032	-
	mg/L	0811	06/13/2012	0001	0 .0011			#	0.00032	-
	mg/L	0811	12/05/2012	N001	0 .0016			#	0.00032	-
	mg/L	0812	06/13/2012	0001	0 .0012			#	0.00032	-
	mg/L	0812	12/05/2012	N001	0 .0017			#	0.00032	-
	mg/L	0822	06/13/2012	N001	0 .0039			#	0.00032	-

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Molybdenum	mg/L	0822	12/04/2012	N001	0 .0097			#	0.00032	-
	mg/L	0823	06/12/2012	0001	0 .0014			#	0.00032	-
	mg/L	0823	12/04/2012	N001	0 .0015			#	0.00032	-
Nitrate + Nitrite as Nitrogen	mg/L	0794	06/12/2012	0001	0 .014			#	0.01	-
Oxidation Reduction Potential	mV	0747	06/13/2012	N001	-6 .3			#	-	-
	mV	0747	12/05/2012	N001	84 .4			#	-	-
	mV	0749	06/12/2012	N001	74 .5			#	-	-
	mV	0749	12/04/2012	N001	67 .9			#	-	-
	mV	0794	06/12/2012	N001	101 .9			#	-	-
	mV	0794	12/04/2012	N001	52 .7			#	-	-
	mV	0796	06/12/2012	N001	225 .3			#	-	-
	mV	0796	12/05/2012	N001	15			#	-	-
	mV	0810	06/12/2012	N001	98 .1			#	-	-
	mV	0810	12/04/2012	N001	243 .6			#	-	-
	mV	0811	06/13/2012	N001	84 .0			#	-	-
	mV	0811	12/05/2012	N001	57 .8			#	-	-
	mV	0812	06/13/2012	N001	24 .4			#	-	-
	mV	0812	12/05/2012	N001	141 .1			#	-	-
	mV	0822	06/13/2012	N001	79 .2			#	-	-
	mV	0822	12/04/2012	N001	37 .4			#	-	-
	mV	0823	06/12/2012	N001	-77 .1			#	-	-
	mV	0823	12/04/2012	N001	107 .5			#	-	-
pH	s.u.	0747	06/13/2012	N001	8 .03			#	-	-
	s.u.	0747	12/05/2012	N001	7 .62			#	-	-
	s.u.	0749	06/12/2012	N001	7 .33			#	-	-
	s.u.	0749	12/04/2012	N001	8 .12			#	-	-
	s.u.	0794	06/12/2012	N001	7 .99			#	-	-
	s.u.	0794	12/04/2012	N001	8 .43			#	-	-
	s.u.	0796	06/12/2012	N001	8 .13			#	-	-
	s.u.	0796	12/05/2012	N001	8 .37			#	-	-
	s.u.	0810	06/12/2012	N001	8 .83			#	-	-
	s.u.	0810	12/04/2012	N001	8 .15			#	-	-
	s.u.	0811	06/13/2012	N001	8 .34			#	-	-
	s.u.	0811	12/05/2012	N001	8 .4			#	-	-
	s.u.	0812	06/13/2012	N001	8 .58			#	-	-
	s.u.	0812	12/05/2012	N001	8 .39			#	-	-
	s.u.	0822	06/13/2012	N001	7 .87			#	-	-

		LOCATION	SAMPLE:			QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	DATE	ID	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
pH	s.u.	0822	12/04/2012	N001	8 .13			#	-	-
	s.u.	0823	06/12/2012	N001	7 .97			#	-	-
	s.u.	0823	12/04/2012	N001	8 .11			#	-	-
Potassium	mg/L	0794	06/12/2012	0001	1 .700			#	0.11	-
Radium-226	pCi/L	0822	06/13/2012	N001	0 .25	U		#	0.25	± 0.19
	pCi/L	0822	12/04/2012	N001	0 .437		J	#	0.18	± 0.23
Radium-228	pCi/L	0822	06/13/2012	N001	0 .443		J	#	0.32	± 0.23
	pCi/L	0822	12/04/2012	N001	0 .455		J	#	0.41	± 0.28
Selenium	mg/L	0794	06/12/2012	N001	0 .0004	B		#	0.00032	-
Sodium	mg/L	0794	06/12/2012	0001	24 .000	E	J	#	0.0066	-
Specific Conductance	umhos/cm	0747	06/13/2012	N001	2658			#	-	-
	umhos/cm	0747	12/05/2012	N001	1498			#	-	-
	umhos/cm	0749	06/12/2012	N001	3536			#	-	-
	umhos/cm	0749	12/04/2012	N001	3332			#	-	-
	umhos/cm	0794	06/12/2012	N001	481			#	-	-
	umhos/cm	0794	12/04/2012	N001	794			#	-	-
	umhos/cm	0796	06/12/2012	N001	435			#	-	-
	umhos/cm	0796	12/05/2012	N001	833			#	-	-
	umhos/cm	0810	06/12/2012	N001	1694			#	-	-
	umhos/cm	0810	12/04/2012	N001	1915			#	-	-
	umhos/cm	0811	06/13/2012	N001	504			#	-	-
	umhos/cm	0811	12/05/2012	N001	828			#	-	-
	umhos/cm	0812	06/13/2012	N001	418			#	-	-
	umhos/cm	0812	12/05/2012	N001	820			#	-	-
	umhos/cm	0822	06/13/2012	N001	2021			#	-	-
	umhos/cm	0822	12/04/2012	N001	2115			#	-	-
	umhos/cm	0823	06/12/2012	N001	2751			#	-	-
	umhos/cm	0823	12/04/2012	N001	2939			#	-	-
Sulfate	mg/L	0747	06/13/2012	0001	1100			#	25	-
	mg/L	0747	12/05/2012	0001	520			#	10	-
	mg/L	0747	12/05/2012	0002	540	N		#	10	-
	mg/L	0749	06/12/2012	N001	2000			#	25	-
	mg/L	0749	12/04/2012	0001	1900	N		#	25	-
	mg/L	0794	06/12/2012	0001	120			#	2.5	-
	mg/L	0794	12/04/2012	N001	250			#	2.5	-
	mg/L	0796	06/12/2012	0001	110			#	1	-

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Sulfate	mg/L	0796	12/05/2012	N001	250			#	2.5	-
	mg/L	0810	06/12/2012	0001	480			#	10	-
	mg/L	0810	12/04/2012	N001	550			#	10	-
	mg/L	0811	06/13/2012	0001	130			#	2.5	-
	mg/L	0811	12/05/2012	N001	250			#	2.5	-
	mg/L	0812	06/13/2012	0001	130			#	2.5	-
	mg/L	0812	12/05/2012	N001	260			#	2.5	-
	mg/L	0822	06/13/2012	N001	960			#	10	-
	mg/L	0822	12/04/2012	N001	1100			#	10	-
	mg/L	0823	06/12/2012	0001	1100			#	25	-
	mg/L	0823	12/04/2012	N001	1200			#	25	-
Temperature	C	0747	06/13/2012	N001	29.52			#	-	-
	C	0747	12/05/2012	N001	6.42			#	-	-
	C	0749	06/12/2012	N001	24.85			#	-	-
	C	0749	12/04/2012	N001	15.42			#	-	-
	C	0794	06/12/2012	N001	19.71			#	-	-
	C	0794	12/04/2012	N001	1.79			#	-	-
	C	0796	06/12/2012	N001	14.53			#	-	-
	C	0796	12/05/2012	N001	1.37			#	-	-
	C	0810	06/12/2012	N001	23.70			#	-	-
	C	0810	12/04/2012	N001	-0.5			#	-	-
	C	0811	06/13/2012	N001	21.54			#	-	-
	C	0811	12/05/2012	N001	2.47			#	-	-
	C	0812	06/13/2012	N001	25.62			#	-	-
	C	0812	12/05/2012	N001	0.92			#	-	-
	C	0822	06/13/2012	N001	16.26			#	-	-
	C	0822	12/04/2012	N001	4.93			#	-	-
	C	0823	06/12/2012	N001	21.33			#	-	-
	C	0823	12/04/2012	N001	2.55			#	-	-
Turbidity	NTU	0747	06/13/2012	N001	79.1			#	-	-
	NTU	0747	12/05/2012	N001	14.9			#	-	-
	NTU	0749	06/12/2012	N001	9.98			#	-	-
	NTU	0749	12/04/2012	N001	16.7			#	-	-
	NTU	0794	06/12/2012	N001	17.9			#	-	-
	NTU	0794	12/04/2012	N001	5.97			#	-	-
	NTU	0796	06/12/2012	N001	25.8			#	-	-
	NTU	0796	12/05/2012	N001	6.60			#	-	-
	NTU	0810	06/12/2012	N001	16.4			#	-	-

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	SAMPLE: ID	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Turbidity	NTU	0810	12/04/2012	N001	3.68			#	-	-
	NTU	0811	06/13/2012	N001	89.7			#	-	-
	NTU	0811	12/05/2012	N001	6.69			#	-	-
	NTU	0812	06/13/2012	N001	51.4			#	-	-
	NTU	0812	12/05/2012	N001	6.0			#	-	-
	NTU	0822	06/13/2012	N001	2.76			#	-	-
	NTU	0822	12/04/2012	N001	4.61			#	-	-
	NTU	0823	06/12/2012	N001	62.3			#	-	-
	NTU	0823	12/04/2012	N001	1.83			#	-	-
Uranium	mg/L	0747	06/13/2012	0001	0.140			#	2.9E-05	-
	mg/L	0747	12/05/2012	0001	0.170			#	2.9E-05	-
	mg/L	0747	12/05/2012	0002	0.170			#	2.9E-05	-
	mg/L	0749	06/12/2012	N001	0.0013			#	2.9E-05	-
	mg/L	0749	12/04/2012	0001	0.0021			#	2.9E-05	-
	mg/L	0794	06/12/2012	0001	0.0044			#	2.9E-05	-
	mg/L	0794	12/04/2012	N001	0.0058			#	2.9E-05	-
	mg/L	0796	06/12/2012	0001	0.0026			#	2.9E-05	-
	mg/L	0796	12/05/2012	N001	0.0057			#	2.9E-05	-
	mg/L	0810	06/12/2012	0001	0.0051			#	2.9E-05	-
	mg/L	0810	12/04/2012	N001	0.0075			#	2.9E-05	-
	mg/L	0811	06/13/2012	0001	0.0034			#	2.9E-05	-
	mg/L	0811	12/05/2012	N001	0.0061			#	2.9E-05	-
	mg/L	0812	06/13/2012	0001	0.004			#	2.9E-05	-
	mg/L	0812	12/05/2012	N001	0.0068			#	2.9E-05	-
	mg/L	0822	06/13/2012	N001	0.0038			#	2.9E-05	-
	mg/L	0822	12/04/2012	N001	0.0075			#	2.9E-05	-
	mg/L	0823	06/12/2012	0001	0.0061			#	2.9E-05	-
	mg/L	0823	12/04/2012	N001	0.0062			#	2.9E-05	-

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY

RECORDS: SELECTED FROM USEE800 WHERE site_code='RVT01' AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2012# and #12/31/2012#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.
J	Estimated value.
N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".
R	Unusable result.
X	Location is undefined.
G	Possible grout contamination, pH > 9.
L	Less than 3 bore volumes purged prior to sampling.
Q	Qualitative result due to sampling technique
U	Parameter analyzed for but was not detected.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

Appendix E

AWSS Data

GENERAL WATER QUALITY DATA BY PARAMETER (USEE205) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 4/17/2013 2:30 pm

PARAMETER	UNITS	LOCATION CODE	LOC TYPE, SUBTYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Chlorine, Total Residual	mg/L	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.48			#	-	-
	mg/L	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.43			#	-	-
	mg/L	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.42			#	-	-
	mg/L	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.03			#	-	-
	mg/L	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.51			#	-	-
	mg/L	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.34			#	-	-
	mg/L	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.53			#	-	-
	mg/L	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.66			#	-	-
	mg/L	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.29			#	-	-
	mg/L	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.38			#	-	-
	mg/L	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.21			#	-	-
	mg/L	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.29			#	-	-
	mg/L	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.38			#	-	-
	mg/L	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.31			#	-	-
	mg/L	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.53			#	-	-
	mg/L	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.51			#	-	-
Dissolved Oxygen	mg/L	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	5.25			#	-	-
	mg/L	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	5.83			#	-	-
	mg/L	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	3.33			#	-	-
	mg/L	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	5.37			#	-	-
	mg/L	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	5.77			#	-	-
	mg/L	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	6.54			#	-	-
	mg/L	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	5.86			#	-	-
	mg/L	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	6.06			#	-	-
	mg/L	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	6.00			#	-	-
	mg/L	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	6.54			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOC TYPE, SUBTYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Dissolved Oxygen	mg/L	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	5.44			#	-	-
	mg/L	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	4.39			#	-	-
	mg/L	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	7.07			#	-	-
	mg/L	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	5.08			#	-	-
	mg/L	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	8.04			#	-	-
	mg/L	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	6.96			#	-	-
Oxidation Reduction Potential	mV	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	143.0			#	-	-
	mV	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	348.4			#	-	-
	mV	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	351.4			#	-	-
	mV	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	354.0			#	-	-
	mV	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	319.0			#	-	-
	mV	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	353.6			#	-	-
	mV	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	379.4			#	-	-
	mV	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	461.3			#	-	-
	mV	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	448.8			#	-	-
	mV	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	453.0			#	-	-
	mV	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	126.6			#	-	-
	mV	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	225.1			#	-	-
	mV	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	181.2			#	-	-
	mV	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	332.1			#	-	-
	mV	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	488.8			#	-	-
	mV	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	355.1			#	-	-
pH	s.u.	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	7.32			#	-	-
	s.u.	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	8.53			#	-	-
	s.u.	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	8.70			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOC TYPE, SUBTYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
pH	s.u.	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	8.68			#	-	-
	s.u.	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	8.63			#	-	-
	s.u.	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	8.50			#	-	-
	s.u.	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	8.65			#	-	-
	s.u.	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	8.61			#	-	-
	s.u.	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	8.35			#	-	-
	s.u.	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	8.51			#	-	-
	s.u.	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	8.05			#	-	-
	s.u.	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	8.51			#	-	-
	s.u.	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	8.48			#	-	-
	s.u.	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	8.56			#	-	-
	s.u.	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	8.68			#	-	-
	s.u.	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	8.22			#	-	-
Radium-226	pCi/L	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.456		J	#	0.18	± 0.23
	pCi/L	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.385		J	#	0.2	± 0.22
	pCi/L	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.433		J	#	0.2	± 0.24
	pCi/L	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.961			#	0.18	± 0.38
	pCi/L	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.593		J	#	0.21	± 0.29
	pCi/L	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	1.03			#	0.2	± 0.40
	pCi/L	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	1.58			#	0.2	± 0.55
	pCi/L	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	1.09			#	0.2	± 0.42
	pCi/L	0820	DS, HDRT	10/23/2012	N002	0.00 - 0.00	1.4			#	0.21	± 0.51
	pCi/L	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.726			#	0.2	± 0.32
	pCi/L	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.91			#	0.2	± 0.37
	pCi/L	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.693			#	0.18	± 0.31
	pCi/L	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.469		J	#	0.22	± 0.26

PARAMETER	UNITS	LOCATION CODE	LOC TYPE, SUBTYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Radium-226	pCi/L	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.569		J	#	0.2	± 0.28
	pCi/L	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.545		J	#	0.19	± 0.27
	pCi/L	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	1.18			#	0.19	± 0.43
	pCi/L	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	1.37			#	0.21	± 0.50
Radium-228	pCi/L	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.32	U		#	0.32	± 0.21
	pCi/L	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.535		J	#	0.33	± 0.25
	pCi/L	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.338		U	#	0.34	± 0.23
	pCi/L	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.582		J	#	0.31	± 0.25
	pCi/L	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.771		J	#	0.34	± 0.30
	pCi/L	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.913		J	#	0.34	± 0.32
	pCi/L	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.693		J	#	0.32	± 0.27
	pCi/L	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	1.43		J	#	0.39	± 0.44
	pCi/L	0820	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.541		J	#	0.31	± 0.25
	pCi/L	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.931		J	#	0.38	± 0.34
	pCi/L	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	1.33			#	0.38	± 0.41
	pCi/L	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.765		J	#	0.33	± 0.29
	pCi/L	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.47		J	#	0.38	± 0.27
	pCi/L	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.871		J	#	0.39	± 0.34
	pCi/L	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.855		J	#	0.35	± 0.31
	pCi/L	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.812		J	#	0.37	± 0.32
	pCi/L	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.754		J	#	0.37	± 0.30
Specific Conductance	umhos/cm	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	684			#	-	-
	umhos/cm	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	638			#	-	-
	umhos/cm	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	651			#	-	-
	umhos/cm	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	629			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOC TYPE, SUBTYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Specific Conductance	umhos/cm	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	650			#	-	-
	umhos/cm	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	643			#	-	-
	umhos/cm	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	647			#	-	-
	umhos/cm	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	644			#	-	-
	umhos/cm	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	651			#	-	-
	umhos/cm	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	667			#	-	-
	umhos/cm	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	663			#	-	-
	umhos/cm	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	655			#	-	-
	umhos/cm	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	650			#	-	-
	umhos/cm	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	652			#	-	-
	umhos/cm	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	642			#	-	-
	umhos/cm	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	646			#	-	-
Temperature	C	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	15.01			#	-	-
	C	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	13.80			#	-	-
	C	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	16.23			#	-	-
	C	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	14.25			#	-	-
	C	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	13.16			#	-	-
	C	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	13.57			#	-	-
	C	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	14.37			#	-	-
	C	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	12.94			#	-	-
	C	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	13.71			#	-	-
	C	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	13.52			#	-	-
	C	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	16.41			#	-	-
	C	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	14.13			#	-	-
	C	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	13.05			#	-	-
	C	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	13.75			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOC TYPE, SUBTYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Temperature	C	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	13.56			#	-	-
	C	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	11.23			#	-	-
Turbidity	NTU	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.87			#	-	-
	NTU	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.27			#	-	-
	NTU	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.28			#	-	-
	NTU	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	1.49			#	-	-
	NTU	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.75			#	-	-
	NTU	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.97			#	-	-
	NTU	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	1.16			#	-	-
	NTU	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	1.80			#	-	-
	NTU	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	1.43			#	-	-
	NTU	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	1.32			#	-	-
	NTU	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.48			#	-	-
	NTU	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.34			#	-	-
	NTU	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.31			#	-	-
	NTU	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.86			#	-	-
	NTU	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	1.36			#	-	-
	NTU	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.62			#	-	-
Uranium	mg/L	0813	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.0001			#	2.9E-05	-
	mg/L	0815	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.00009	B		#	2.9E-05	-
	mg/L	0816	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.00008	B		#	2.9E-05	-
	mg/L	0818	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.00011			#	2.9E-05	-
	mg/L	0818	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.00009	B		#	2.9E-05	-
	mg/L	0819	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.00009	B		#	2.9E-05	-
	mg/L	0819	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.00009	B		#	2.9E-05	-

PARAMETER	UNITS	LOCATION CODE	LOC TYPE, SUBTYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	0820	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.00011			#	2.9E-05	-
	mg/L	0820	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.00009	B		#	2.9E-05	-
	mg/L	0821	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.00008	B		#	2.9E-05	-
	mg/L	0821	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.0001			#	2.9E-05	-
	mg/L	0829	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.00009	B		#	2.9E-05	-
	mg/L	0829	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.0001			#	2.9E-05	-
	mg/L	0830	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.00008	B		#	2.9E-05	-
	mg/L	0830	DS, HDRT	10/23/2012	N002	0.00 - 0.00	0.00008	B		#	2.9E-05	-
	mg/L	0834	DS, HDRT	10/23/2012	N001	0.00 - 0.00	0.00008	B		#	2.9E-05	-
	mg/L	0837	DS, TAP	10/24/2012	N001	0.00 - 0.00	0.00009	B		#	2.9E-05	-

PARAMETER	UNITS	LOCATION CODE	LOC TYPE, SUBTYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY

RECORDS: SELECTED FROM USEE200 WHERE site_code='RVT01' AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #10/1/2012# and #10/31/2012#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LOCATION TYPES: DS DOMESTIC SUPPLY

LOCATION SUBTYPES: HDRT Hydrant TAP Tap in Domestic Supply Syste

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

Appendix F

Laboratory Analysis of Shallow Sediment Near a Former Uranium Mill: Riverton, Wyoming, Site

LMS/RVT/S10066

Laboratory Analysis of Shallow Sediment Near a Former Uranium Mill: Riverton, Wyoming, Site

May 2013

U.S. DEPARTMENT OF ENERGY | Legacy Management

This page intentionally left blank

LMS/RVT/S10066

Laboratory Analysis of Shallow Sediment Near a Former Uranium Mill: Riverton, Wyoming, Site

May 2013

Contents

Figures

Tables

Appendixes

Abbreviations

ASW	artificial site water
CARB	carbonate extractant
DOE	U.S. Department of Energy
ft	feet
g	gram
K_d	distribution coefficient
K_d^*	apparent distribution coefficient
LM	Office of Legacy Management
LOD	loss-on-drying
µg/g	micrograms per gram
µg/L	micrograms per liter
µL	microliter
µm	micrometer
mL	milliliter
mL/g	milliliters per gram
mm	millimeter
N	normality (equivalent weight of a solute per liter of solution)
PV	pore volume
rpm	revolutions per minute

This page intentionally left blank

1.0 Introduction

A uranium and vanadium ore-processing mill operated at a site 2 miles from the city of Riverton, Wyoming, from 1958 to 1963 (DOE 2011). Surface restoration, which included removal of the mill tailings from the site, was completed in 1989. The milling operation resulted in contamination of groundwater with uranium and other constituents. The site is now managed by the U.S. Department of Energy Office of Legacy Management (LM).

In June 2010, following a record flooding of the adjacent Little Wind River, uranium concentrations in groundwater monitoring well 0707 increased by three times their previous values (DOE 2012a). This observation led to the hypothesis that shallow sediments were contaminated with uranium, which was released as water from the flooding passed through the sediments (DOE 2012b). A workplan was developed to investigate this concept (DOE 2012c). As stated by DOE (2012c), the purpose of the investigation was to “obtain additional data to further characterize the surficial aquifer. Specific objectives of the investigation were to:

- Provide enhanced definition of contaminant plumes including the location of the centroid of each plume and the extent of groundwater contamination for each constituent of concern (COC).
- Provide a detailed distribution of contaminants for input into the updated groundwater computer model.
- Provide data that will guide placement of new monitoring wells outside of the contaminant plumes to monitor lateral plume behavior.
- Provide a detailed and updated baseline of groundwater contamination for tracking plume configuration, movement, and size over time. This will be used to assess the progress of natural flushing if this study is repeated in the future.
- Provide information on soil characteristics including leachability of uranium.
- Estimate the masses of uranium remaining in the unsaturated zone of the surficial aquifer, to gather data that can be used to develop appropriate contaminant source terms in the transport modeling. The resulting computer model will be capable of simulating the effects of periodic flooding of the Little Wind River.”

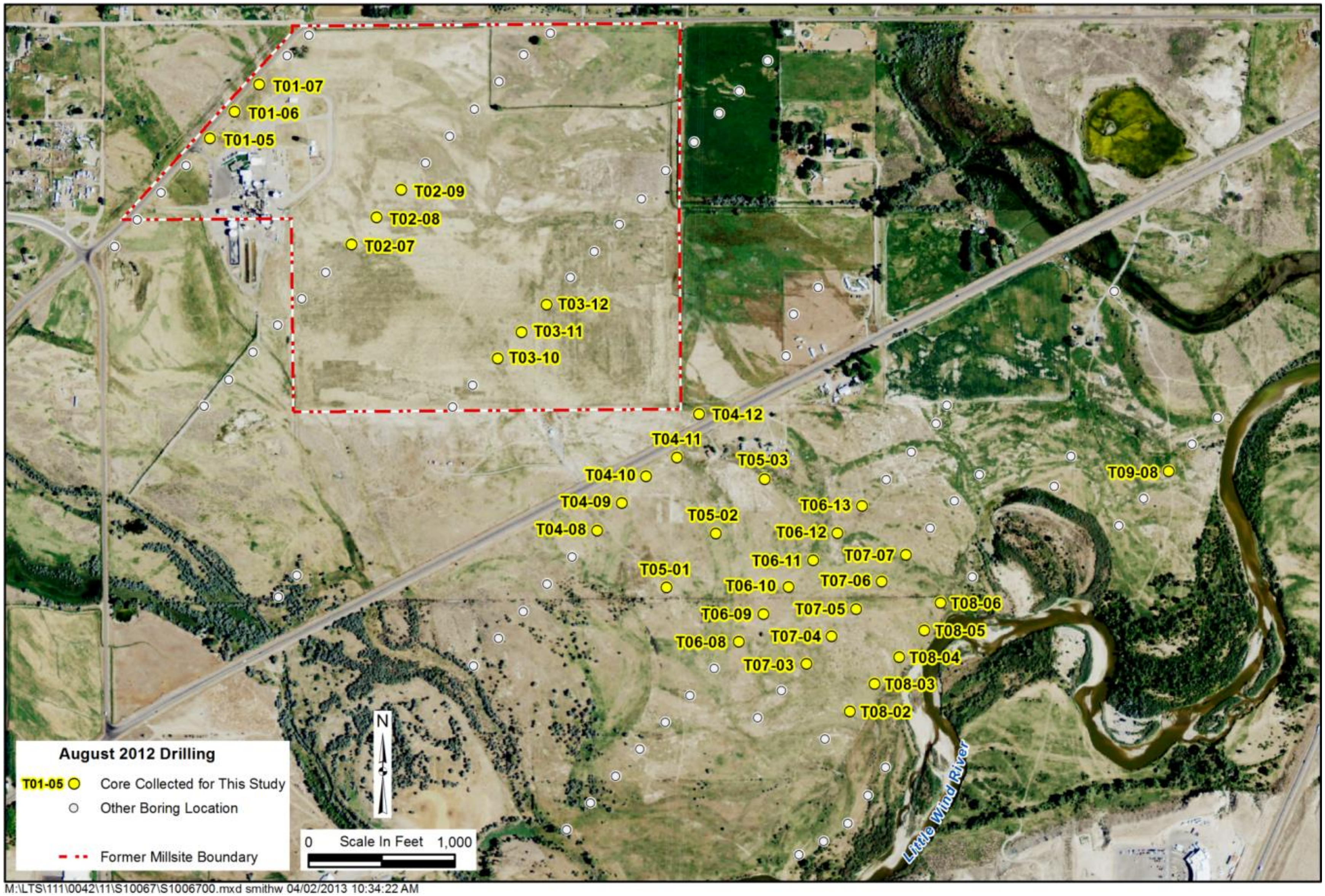
To satisfy a portion of these objectives, core samples from the upper 5 feet (ft) of sediment were collected at 34 locations in August 2012 (Figure 1). The core samples were subjected to laboratory batch and column testing over the period September through December 2012. LM prepared a report that summarizes the coring and groundwater sampling activities conducted during the August 2012 field episode, and the subsequent laboratory analysis (DOE 2013). The purpose of the current report is to document, in more detail, the methods used and results of the laboratory analyses of the core material.

2.0 Methods

2.1 Sample Preparation

Samples were collected from August 21 through 28, 2012, by pushing a core barrel vertically to 5 ft using a Geoprobe drilling rig. Sampling locations were arranged along nine transects denoted T01 through T09 (Figure 1). Samples were composited from two intervals, 0 to 2.5 ft and 2.5 to 5 ft. Core recovery ranged from 2.24 ft (44 percent) to 4.6 ft (92 percent). In borings where core recovery was less than the full 5 ft, it was assumed that the bottom portion of the core was lost. For example, if the recovered core was 3 ft long, the upper 2.5 ft represented the 0−2.5 ft interval, and the lower 0.5 ft represented the 2.5–5 ft interval. Sample numbers are designated by the boring location and upper (U) or lower (L) interval; thus, T01-05U and T01-05L are samples from the 0–2.5 ft and 2.5–5 ft intervals, respectively, of a boring on transect T01at location T01-05. Appendix A contains core descriptions provided by field personnel.

Samples were received at the laboratory on August 30, 2012, in plastic zip-lock bags. Laboratory personnel made some additional sample descriptions during sample processing. In particular, it was noted that roots were present in many of the samples, particularly in those collected from the upper zone. These descriptions are included in Appendix A. Laboratory notes are provided as Appendix B.



M:\LTS\111\0042\11\S10067\S1006700.mxd smithw 04/02/2013 10:34:22 AM

Figure 1. Location Map, Riverton, Wyoming, Site

2.2 Loss-on-Drying and Sieving

The sample bags were opened on August 31, 2012, and weighed to the nearest 0.1 gram (g). The samples were air dried in aluminum pans (Figure 2) for 17 days. Samples were weighed several times during drying to determine the rate of water loss. Because moisture content in a sample can be affected by moisture in the air, relative humidity in the drying room was recorded on 7 days during drying. Relative humidity was reasonably consistent throughout the drying, averaging 42 percent with standard deviation 8 percent. No attempt was made to adjust loss-on-drying (LOD) results for relative humidity. LOD was calculated by subtracting the weight following the drying period from the initial weight.

Figure 2. Air Drying of Samples

Dried samples were sieved through a 2 millimeter (mm) (#10) sieve on a Rotap table (Gilson model SS-15) for 5 minutes. In some samples, clumps of dirt remained after the Rotap agitation; however, no additional effort was made to break these apart. Disaggregating these clumps by aggressive actions such as grinding might have broken up intact shale grains and was avoided. Therefore, some of the fraction retained by the 2 mm sieve is actually finer grained. Splits were weighed to determine the fraction of the sample that was less than 2 mm (<2 mm).

2.3 Preparation of Artificial Site Water

Some of the tests used a water composition containing major ion concentrations similar to those in a sample of Little Wind River water collected on June 12, 2012. This artificial site water (ASW) was made by adding stock solutions of reagent grade chemicals to laboratory water that was deionized to 18.2 megaohms per centimeter (Table 1). Two trials at making the artificial Little Wind River water indicated that the solution equilibrated with the atmosphere, and pH gradually increased as carbon dioxide (CO_2) was lost. Nitric acid (HNO_3) was added to maintain pH but resulted in additional CO_2 release. As a result, the alkalinity of the ASW was lower than the value measured on the Little Wind River sample. Since a goal of this project was to examine uranium mobility, and because it is well known that uranium mobility is affected by the dissolved carbonate concentration, a third recipe was developed that maintained the dissolved carbonate at a level near that of the Little Wind River analysis by adjusting pH with gaseous CO_2 rather than HNO_3. The composition of major ions in this ASW is compared to the analysis of the Little Wind River sample in Table 2. The slight differences between ASW and the Little Wind River analysis are not likely to significantly influence the results of the study. Alkalinity and pH of the ASW solutions were checked regularly during the testing to ensure that these parameters remained at the desired levels. A chemical analysis was conducted on the ASW solution and indicated that all of the constituents had the expected concentrations, verifying the methodology and the purity of the source chemicals.

Table 1. Recipe for Artificial Little Wind River Site Water (ASW)

Stock	Stock Concentration (g/L)	Stock Volume (mL/L)
K_2CO_3	10	0.30
$NaHCO_3$	50	5.0
$CaSO_4{\bullet}2H_2O$	1.5	140
$MgSO_4{\bullet}7H_2O$	200	0.04
$MgCl_2{\bullet}6H_2O$	100	0.11

g/L = grams per liter
mL/L = milliliters per liter

Table 2. Composition of Artificial Little Wind River Water (ASW) Compared to the June 12, 2012, Analysis

	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	SO_4 (mg/L)	Cl (mg/L)	C (mg/L)	Alk[a]
ASW	68.5	1.7	48.9	2.1	120	3.8	36.0	~130
Measured	24.0	1.7	48.0	16.0	120	3.8	27.8	116

mg/L = milligrams per liter
[a] alkalinity as $CaCO_3$ (mg/L)

2.4 Batch Testing Methods

All batch tests were conducted on dried samples that had been sieved to <2 mm. Care was taken to obtain a representative sample by mixing the sample and minimizing gravity separation. A weighed mass of sample was placed in a 50 milliliter (mL) plastic centrifuge tube, a known volume of ASW was added, and the tubes were agitated on an end-over-end shaker at 8 revolutions per minute (rpm) (Figure 3). After agitation, samples were centrifuged for 10 minutes at 3500 rpm, decanted, and syringe filtered through 0.45 micrometer (µm) nylon Acrodisk filters. The filtered solutions were brought to 50 mL in a glass volumetric flask by adding ASW. They were then acidified with 100 microliters (µL) of concentrated nitric acid and analyzed for uranium.

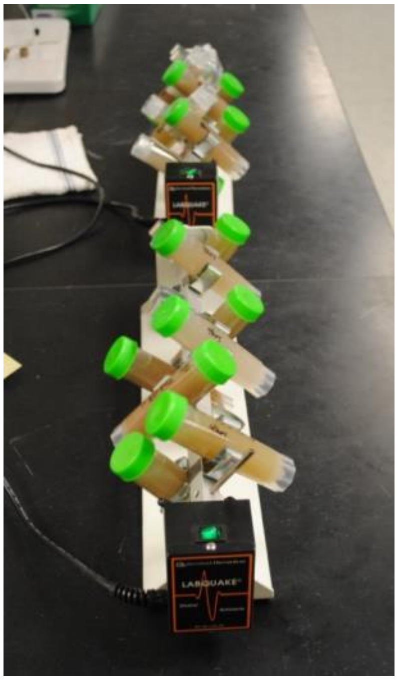


Figure 3. End-Over-End Agitation of Batch Test Samples

2.5 Column Test Methods

All column tests were conducted on dried samples that had been sieved to <2 mm. A weighed mass of sample was placed in an Omnifit glass chromatography column. Care was taken to obtain a representative sample by mixing the sample and minimizing gravity separation. Sediment was placed in each column in approximately 1 centimeter (cm) lifts with gentle tapping between lifts. The volume of the columns is about 21 mL. Volumes of sediment ranged from 20.68 to 20.85 mL, as determined from the column area (1.7671 cm^2) and measured length of the sediment column. The pore volume (PV) in each column was determined from the flow rate and the length of time required to fill the column with ASW.

A fraction collector was used to collect column effluent in glass test tubes (Figure 4). A Masterflex peristaltic pump with number 13 nylon tubing was used to pump ASW through the column from bottom to top. The ASW was kept in a collapsible plastic container to minimize exposure to air. Flow rate was set on the pump but was accurately determined from the volume collected during each collection period. The actual flow rate was generally within 10 percent of the pump setting. Residence time (RT) was calculated as:

RT = (PV/60)/AFR

where
RT = residence time, hours (h)
PV = pore volume, mL
AFR = average flow rate, mL per minute

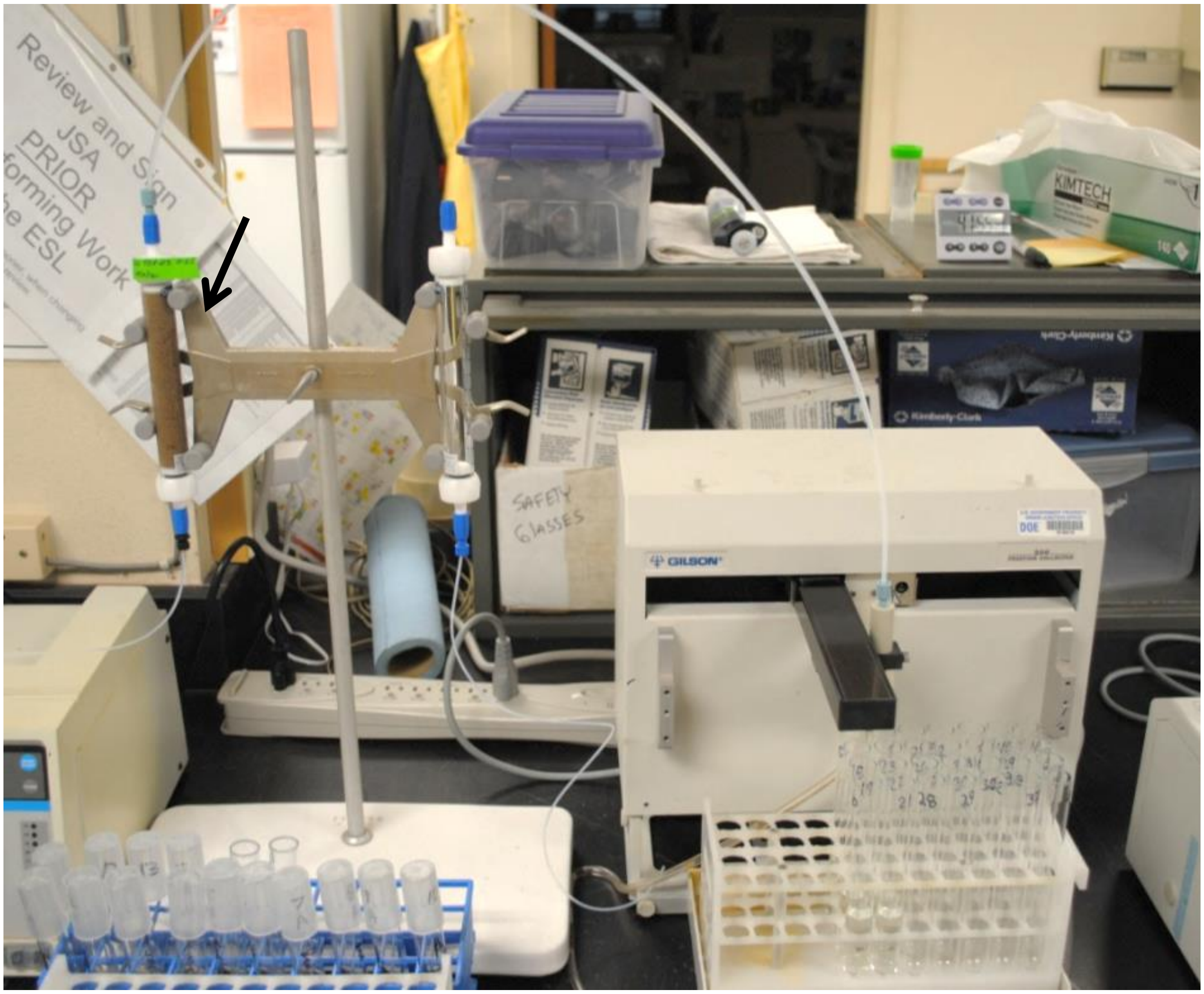


Figure 4. Column with Auto Sampler
Arrow points to sediment-filled column. In one column (sample T05-02U), flow could not be established because the sediment was too fine grained, and this sample was mixed with a 50% volume of high silica sand (Unimin Corp. #2075).

2.6 CARB Extractions

An extractant solution of sodium bicarbonate ($NaHCO_3$) and sodium carbonate (Na_2CO_3) was developed by Kohler et al. (2004) as an inexpensive method to determine the amount of adsorbed and other lightly held uranium (labile uranium) in solid samples. The solution was prepared by dissolving 1.2097 g of $NaHCO_3$ and 0.2968 g of $NaCO_3$ in deionized water and bringing to a volume of 1 L with deionized water. pH was adjusted to 9.5 with 100 to 150 µL of 10 N sodium hydroxide (Murray et al. 2012). The solution has a carbonate concentration of 17.2 millimol per liter and is referred to here as CARB.

Following each column test, all of the sediment was removed from the column and placed in a 500 mL glass Erlenmeyer flask. A predetermined volume of CARB solution ranging from 522 to 547 mL was added to each flask. The CARB volume was selected to approximate a solid-to-solution ratio of 50 g/L as was used by Kohler et al. (2004); however, volume was limited by the flask size, and the actual solid-to-solution ratios ranged from 51.71 to 71.32 g/L. The variations in solid-to-solution ratios should not affect the resulting determination of labile uranium. The flasks were stoppered, placed on an orbital shaker table, and agitated for 3 weeks (Figure 5). Following the agitation period, a 30 mL sample of the solution was removed by pipette from the center of the flask. The sample was syringe filtered through a 0.45 µm nylon Acrodisk filter. The samples sometimes had a yellow color after filtering. The filtered samples were acidified to pH <2 using 200 µL of concentrated nitric acid (HNO_3) and analyzed for uranium. The labile uranium fraction was calculated as:

$$U^{solid}_{labile} = (U^{CARB}_{labile}/1000) \times (V^{CARB}/M^{solid})$$

where

U^{solid}_{labile} = labile U in solids, µg/g

U^{CARB}_{labile} = labile U measured in the CARB solution, micrograms per liter (µg/L)

V^{CARB} = volume of the CARB solution, mL

M^{solid} = mass of the solids, g

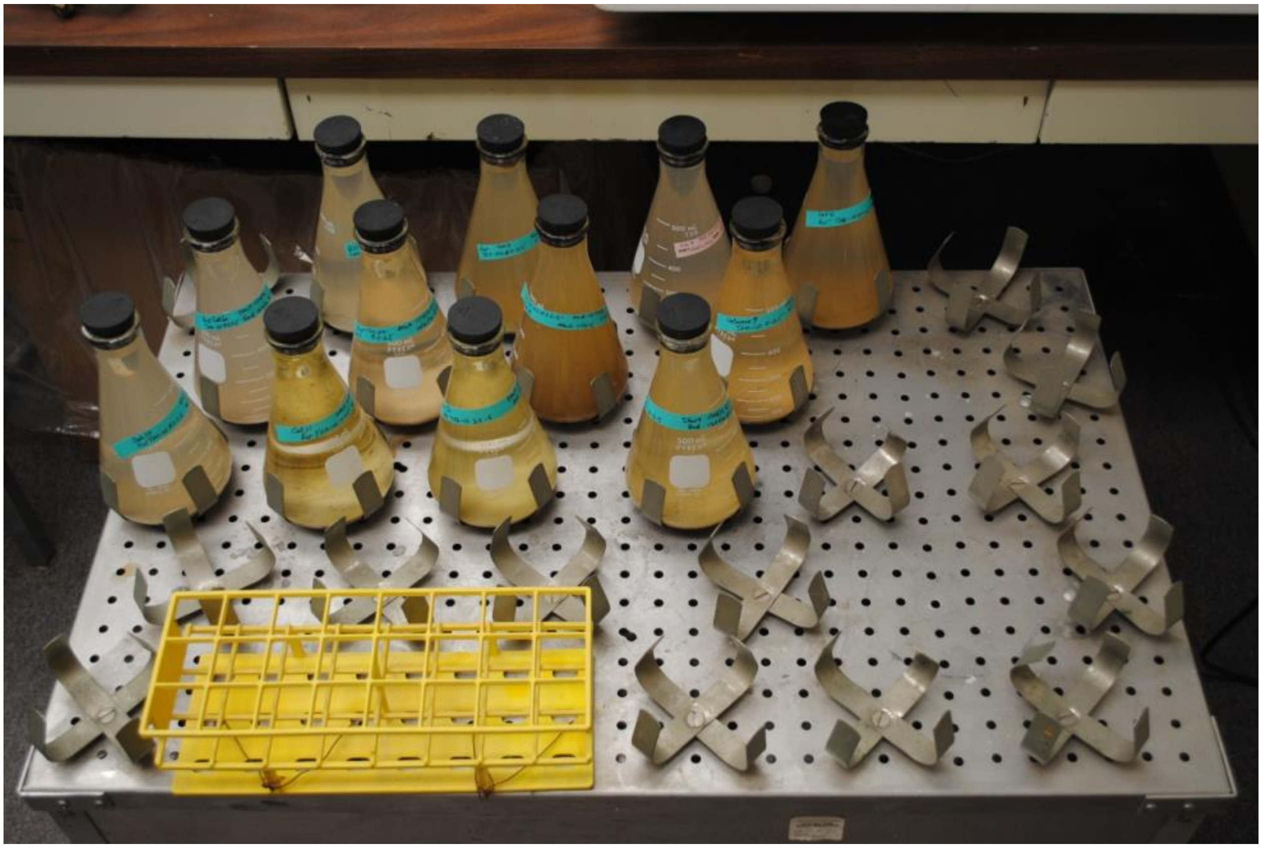


Figure 5. CARB Extractions on Orbital Shaker Table

2.7 Analytical Methods

Alkalinity was determined by titration with 1.6 N sulfuric acid using a Hach model 16900 digital titrator. pH was determined with a gel-filled glass electrode (Cole-Parmer model U59001) and calibrated with buffer solutions at the same temperature as the samples. Dissolved carbon concentrations were estimated from alkalinity and pH using equations in the U.S. Geological

Survey Alkalinity Calculator (USGS 2011). Uranium was analyzed by laser-induced kinetic phosphorescence on a Chemchek model KPA-11. Standard additions were run on every 10th sample, and recoveries were generally 95 to 100 percent.

3.0 Results

The samples varied considerably in texture, grain size, and visible properties. Many of the samples contained roots and other plant matter, particularly in samples collected from the upper zone (Appendix A).

3.1 Loss-on-Drying and Sieving

LOD ranged from 0.42 to 20.67 percent (Table 3). Sample weight loss was rapid over the first few days and more gradual thereafter (Figure 6). The 17-day period was sufficient to dry the samples to near equilibrium with the moisture of the laboratory atmosphere. All weights reported in the batch and column testing were the air-dried samples weights.

Table 3. Loss-on-Drying (LOD) and <2 mm Fractions

	LOD	<2mm		LOD	<2mm		LOD	<2mm
Sample	**%**	**%**	**Sample**	**%**	**%**	**Sample**	**%**	**%**
T01-05U	2.28	46.14	T04-10L	0.76	32.91	T07-03U	1.18	65.14
T01-05L	2.55	23.40	T04-11U	11.82	79.80	T07-03L	0.68	30.56
T01-06U	1.40	55.21	T04-11L	9.48	83.14	T07-04U	1.35	54.11
T01-06L	4.47	26.99	T04-12U	10.09	78.81	T07-04L	0.40	22.72
T01-07U	9.36	76.07	T05-01U	2.88	97.35	T07-05U	2.23	70.94
T02-07U	1.16	50.69	T05-01L	1.68	99.57	T07-05L	0.97	27.00
T02-07L	1.58	25.13	T05-02U	16.03	99.79	T07-06U	2.90	83.61
T02-08U	10.84	70.79	T05-02L	2.77	22.75	T07-06L	0.87	33.45
T02-08L	20.67	91.31	T05-03U	6.59	92.63	T07-07U	1.15	47.51
T02-09U	3.48	99.67	T05-03L	10.61	89.50	T07-07L	1.68	25.36
T02-09L	1.70	47.83	T06-08U	0.85	47.45	T08-02U	14.83	67.37
T03-10U	6.24	80.39	T06-08L	0.95	26.62	T08-03U	6.18	95.80
T03-10L	9.78	74.15	T06-09U	0.83	56.76	T08-03L	3.99	99.95
T03-11U	2.40	79.47	T06-09L	0.42	20.95	T08-04U	5.91	86.26
T03-11L	0.57	25.51	T06-10U	0.96	51.55	T08-04L	0.90	55.61
T03-12U	8.38	78.43	T06-10L	1.30	27.89	T08-05U	6.06	81.26
T03-12L	11.95	71.05	T06-11U	10.04	90.10	T08-05L	1.21	36.79
T04-08U	3.36	99.98	T06-11L	3.50	93.28	T08-06U	6.96	86.65
T04-08L	1.04	51.70	T06-12U	7.67	66.60	T08-06L	3.46	70.15
T04-09U	7.30	92.77	T06-12L	0.78	27.44	T09-08U	4.98	97.69
T04-09L	2.96	55.18	T06-13U	3.08	98.41	T09-08L	9.71	92.99
T04-10U	3.21	66.43	T06-13L	1.55	83.90			

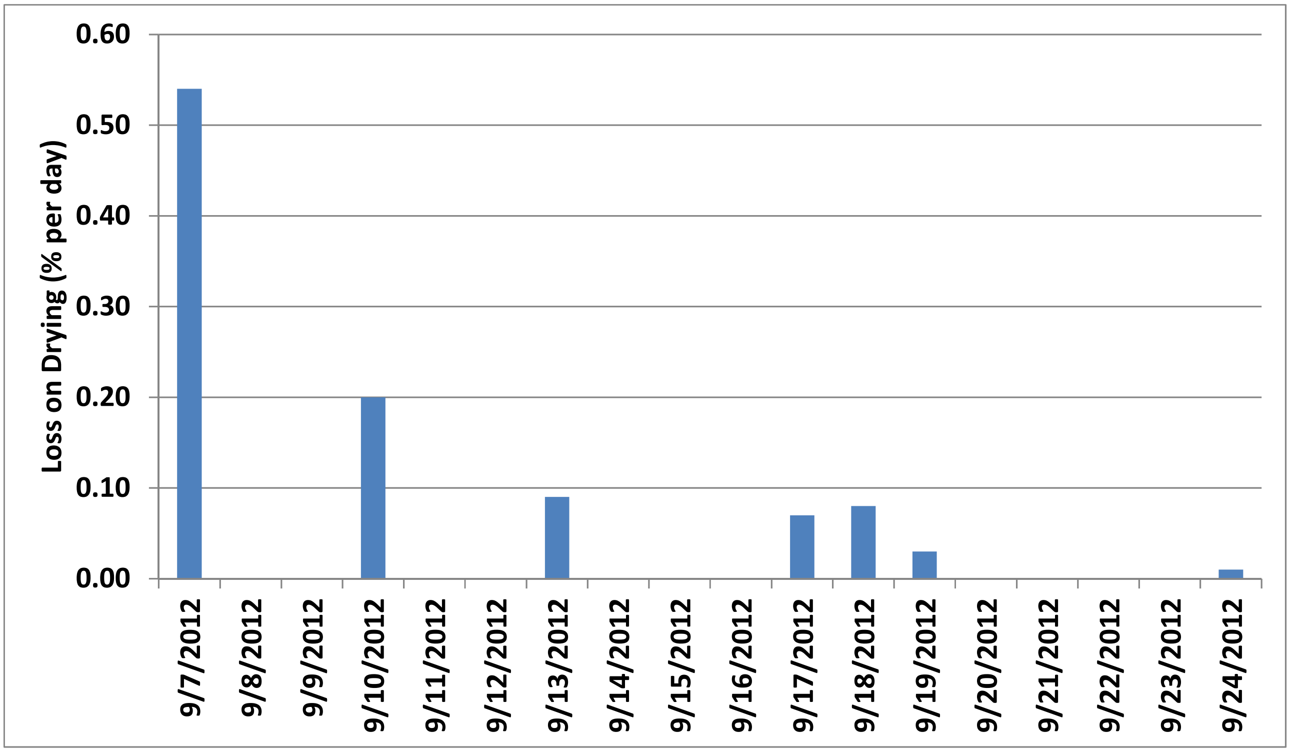


Figure 6. Rate of Loss-on-Drying in Percent of Sample Weight per Day (Average of 65 Samples)

Moisture content varied spatially but did not noticeably correlate with distance along the sampled profile (Figure 7). Within a single boring, both upper and lower samples usually had similar relative moisture contents, as seen by comparing paired samples in Figure 7.

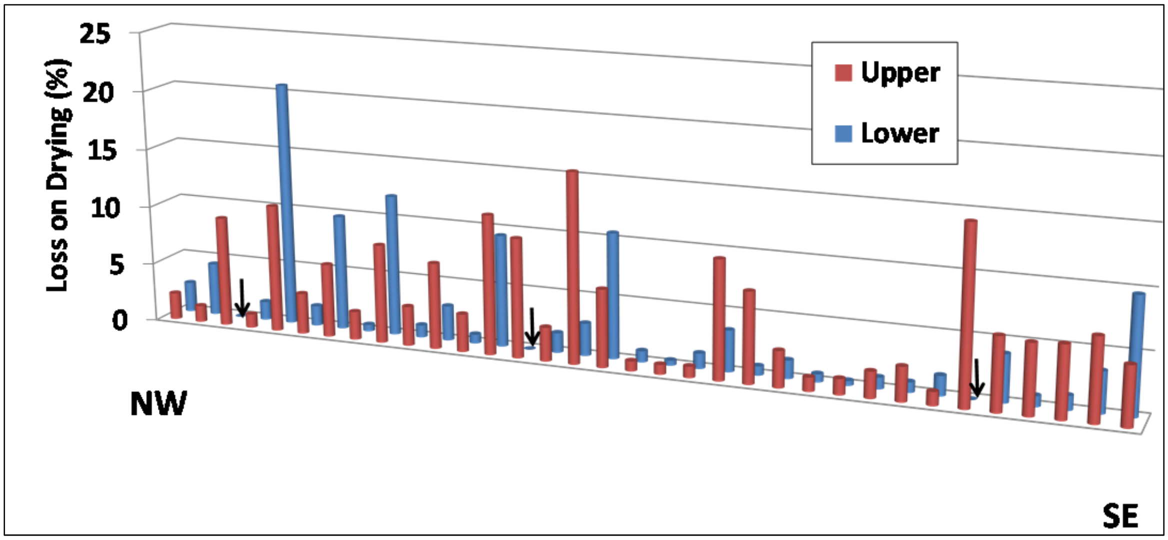


Figure 7. Distribution of Moisture Content from NW (near the Former Mill) to the SE (near the Little Wind River). Values for the upper zone samples are in red and the lower zone in blue. Arrows indicate missing samples.

The grain-size distribution varied substantially among the samples, with the <2 mm fractions comprising 20.95 to 99.98 percent of the sample (Table 3). Figure 8 shows a histogram indicating that the distribution of the <2 mm fraction is not a normal distribution. Instead, the distribution is broad based with peaks at about 27 and 98 percent <2 mm fraction. The cluster around the 27 percent peak is dominated by sandy gravel textures, and every sample with a <2 mm fraction of less than 40 percent contained pebbles with diameters more than 1 inch. The group of samples with <2 mm fractions of more than 90 percent had a powdery consistency and contained more roots than the coarser samples.

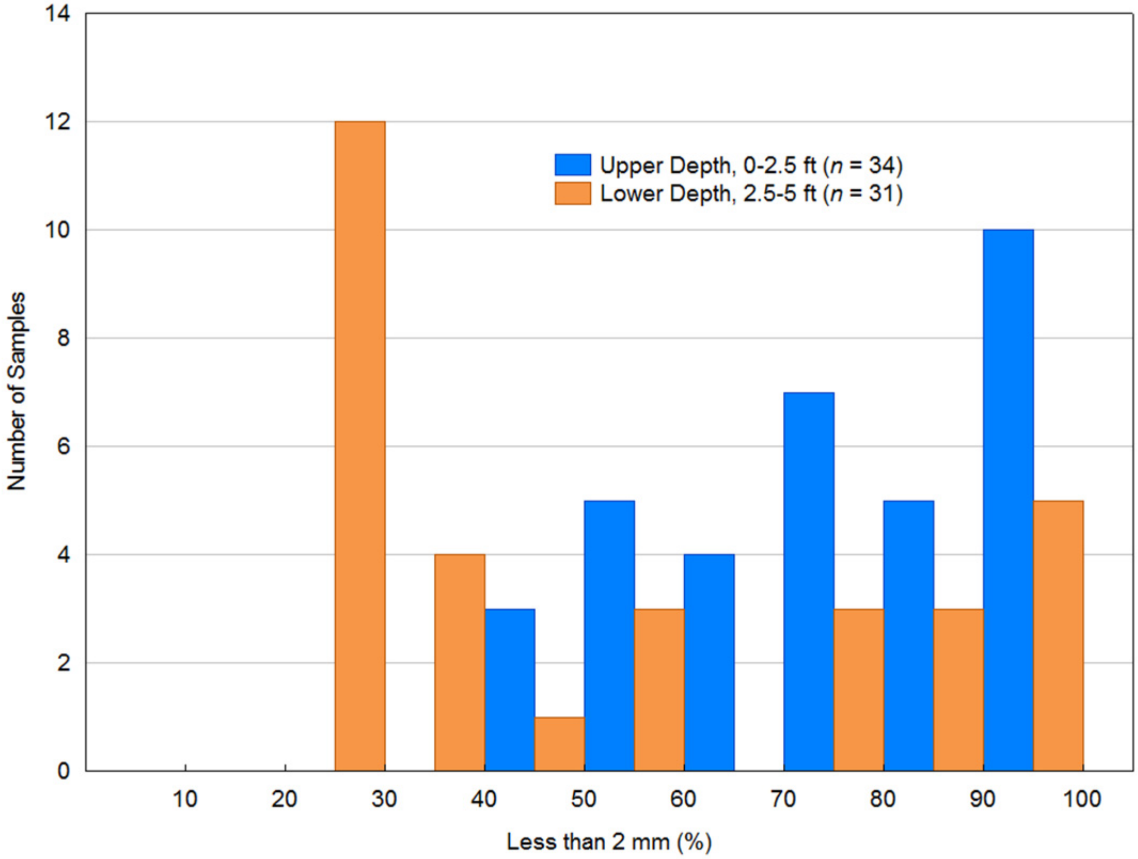


Figure 8. Distribution of Grain Size (percent of sample that is <2 mm)

3.2 Batch Test Results

Batch tests using variable agitation times were conducted to determine the length of time required for uranium to reach a steady-state, solid-phase concentration. Eight samples from locations throughout the study area were agitated for 10 different time periods (0.08, 0.25, 0.50, 1, 2, 4, 8, 16, 48, and 96 hours). In all tests, uranium concentrations increased relatively fast for about the first 24 hours, after which less increase was observed (Figure 9). Based on these results, a 24-hour agitation time was used to determine the distribution of uranium removal by ASW.

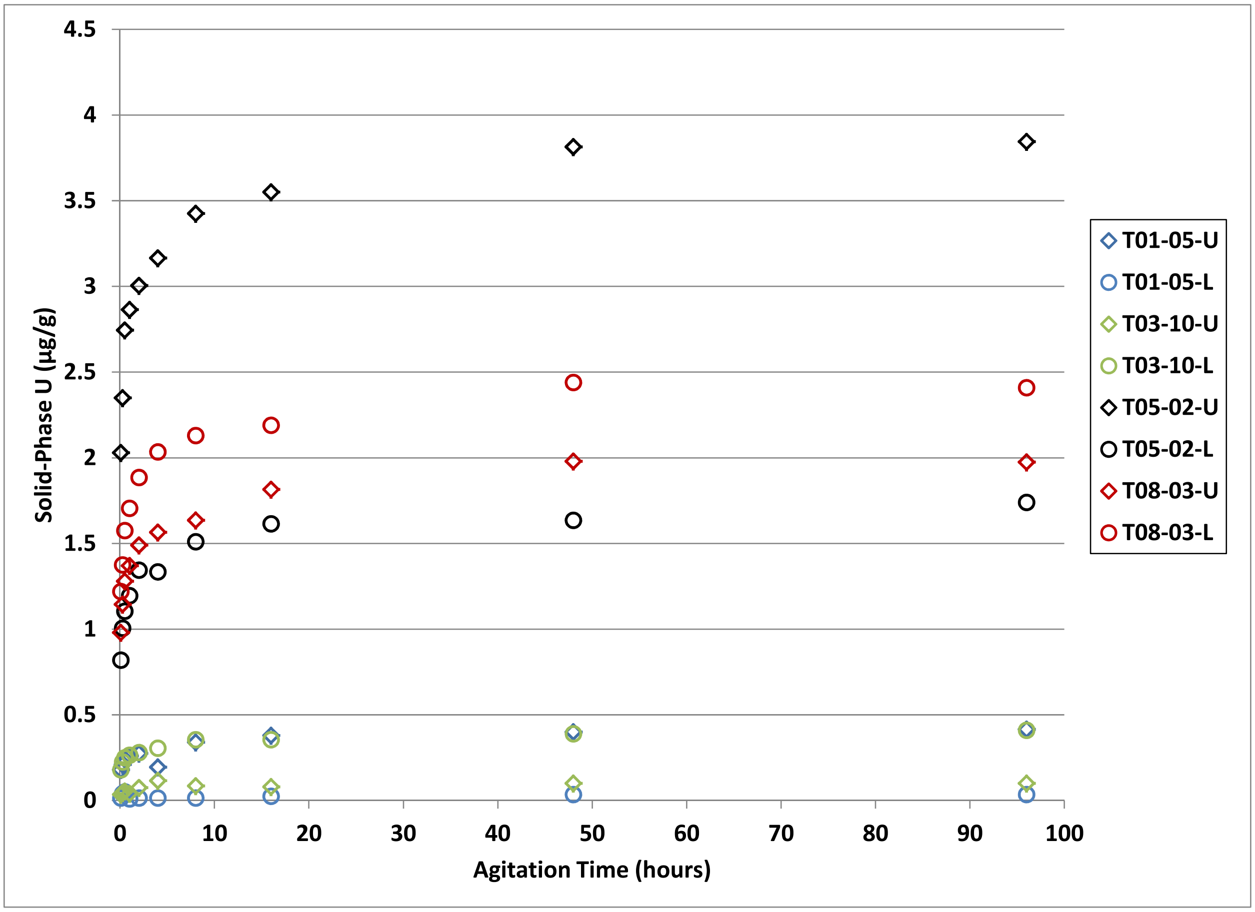


Figure 9. Effect of Agitation Time on Batch Test Results

The concentrations of uranium in the <2 mm sediments that was removed by a 24-hour agitation with ASW were variable, ranging from 0.04 to 4.8 µg/g with an average of 1.5 µg/g and standard deviation of 1.4 µg/g (Figure 10). The concentrations were generally higher in the offsite (transects 04 through 08) samples than in the onsite (transects 01 through 03) samples (Figure 11). Removable uranium concentrations were low in the upper (0.49 µg/g) and lower (0.3 µg/g) samples collected at location T09-08. In nearly all paired samples, the upper sample had a higher concentration of removable uranium than the lower sample (Figure 11).

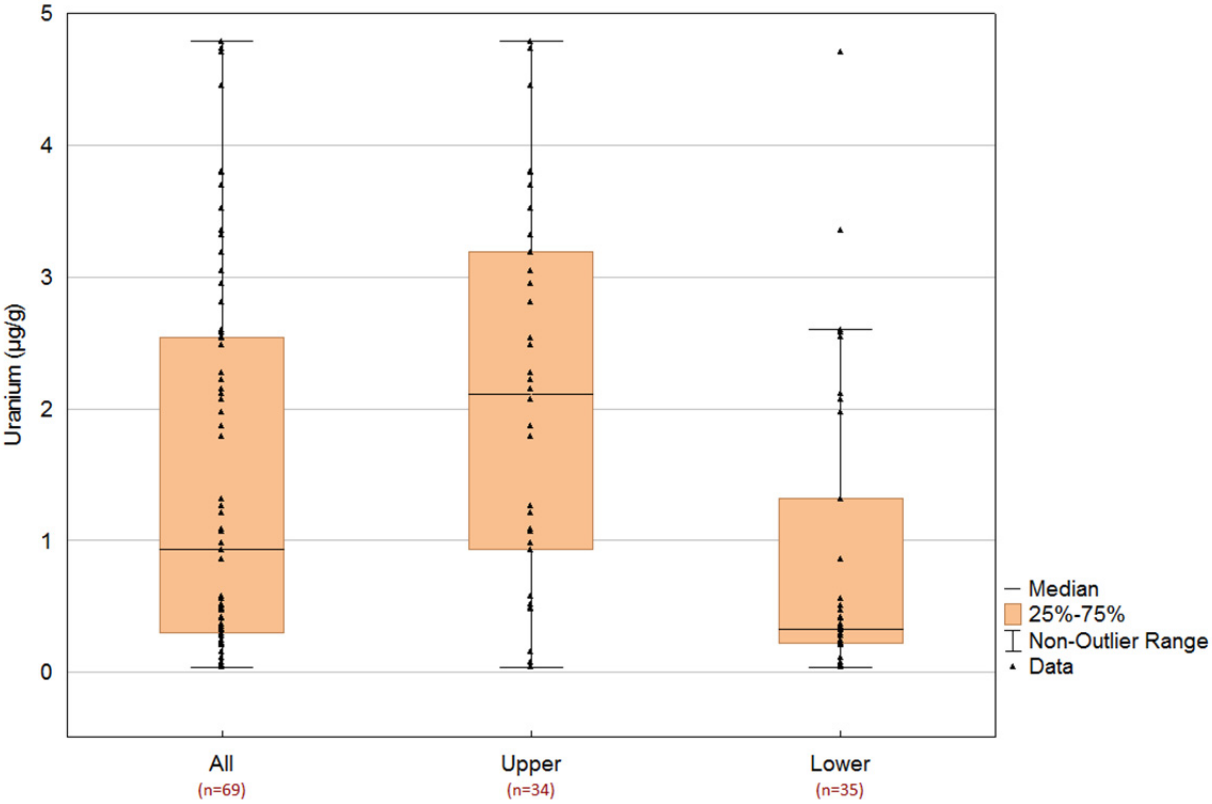
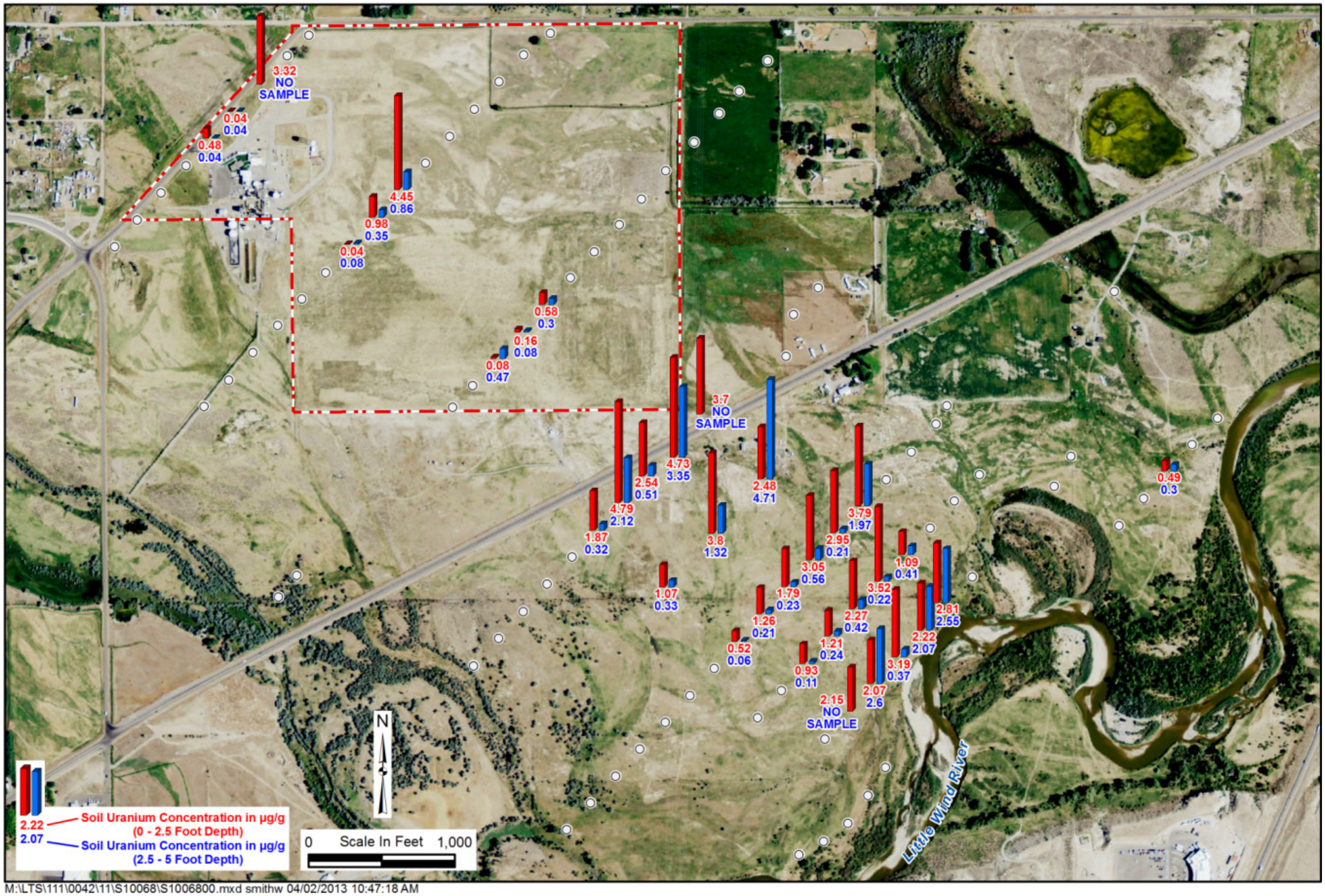


Figure 10. Distribution of Solid-Phase Uranium in Upper Zone (0 – 2.5 ft) vs. Lower Zone (2.5 – 5 ft) Samples. Batch test data using ASW and 24-hour agitation time.



M:\LTS\111\0042\11\S10068\S1006800.mxd smithw 04/02/2013 10:47:18 AM

Figure 11. Distribution of Solid-Phase Uranium Concentrations Removed by 24-Hour Batch Tests with ASW

Solid-phase uranium concentrations in contaminated sediments are often higher in the fine-grained fraction than in the coarse-grained fraction. This relationship is thought to occur largely because uranium is complexed at grain surfaces, and fine-grained sediment has more surface area per unit weight than does coarse sediment. A positive correlation appears to exist between the abundance of fine-grained sediment (<2 mm) and the solid-phase uranium concentrations of the Riverton sample (Figure 12). All samples with solid-phase uranium concentrations of more than 3 µg/g have more than 78 percent of the sample in the <2 mm size fraction (Figure 12).

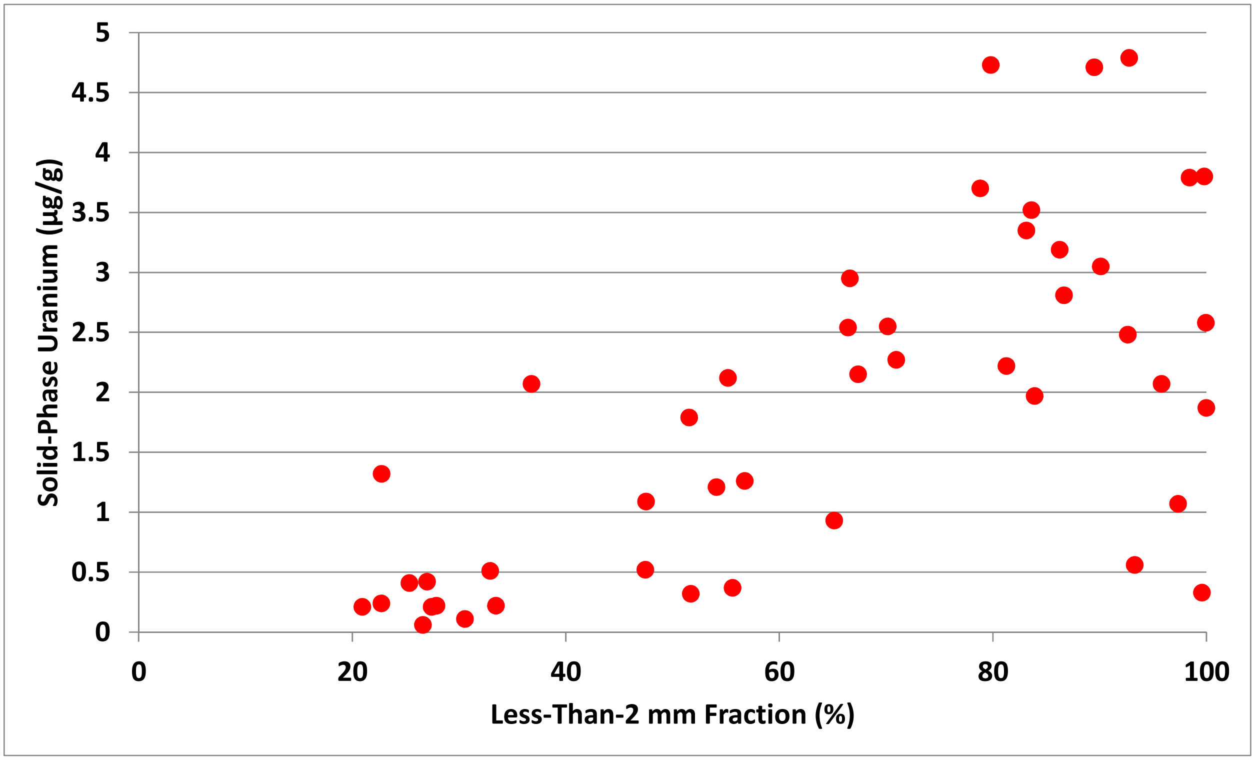


Figure 12. Relationship of Solid-Phase Uranium Removed by ASW to the Percent of <2 mm Grain Size for Offsite (Transects 04 Through 08) Samples

3.3 Column Test Results

Column tests were conducted on samples from one location in each of the eight transects. Two tests were run for each location, one each from the upper and lower sediment samples. Column properties were relatively constant for each test; Table 4 provides specifications for each column test.

Table 4. Column Properties

Sample	Sediment Volume (mL)	Sediment Dry Weight (g)	Pore Volume (mL)	Average Flow Rate (mL/min)	Residence Time (h)	Pore-Water Velocity (cm/d)	Type[a]
T01-05U	20.85	33.62	5.7	0.0831	1.14	247.7	A
T01-05L	20.85	35.99	5.1	0.0948	0.90	315.9	A
T02-07U	20.85	33.89	5.6	0.0900	1.04	273.1	A
T02-07L	20.85	35.14	4.5	0.0732	1.02	276.4	A
T03-10U	20.85	30.52	6.6	0.0900	1.22	231.7	B
T03-10L	20.85	30.16	6.7	0.0950	1.18	240.9	B
T04-10U	20.85	30.28	8.0	0.0901	1.48	191.4	C
T04-10L	20.85	37.94	4.5	0.0951	0.79	359.1	B
T05-02U[b]	20.32	34.75	5.8	0.0735	1.32	209.9	A
T05-02L	20.85	32.14	6.0	0.0899	1.11	254.6	B
T06-10U	20.85	32.17	6.2	0.0897	1.15	245.8	A
T06-10L	20.85	37.42	8.1	0.0900	1.50	188.8	A
T07-04U	20.85	31.98	8.4	0.0917	1.53	185.5	C
T07-04L	20.85	36.35	5.3	0.0960	0.92	307.8	A
T08-03U	20.68	27.51	8.6	0.0932	1.54	182.6	C
T08-03L	20.85	29.28	7.9	0.0906	1.45	194.9	C

h = hours
cm/d = centimeters per day
[a] Curve type (see text).
[b] 50% sand mix

3.3.1 Effluent Uranium Concentrations

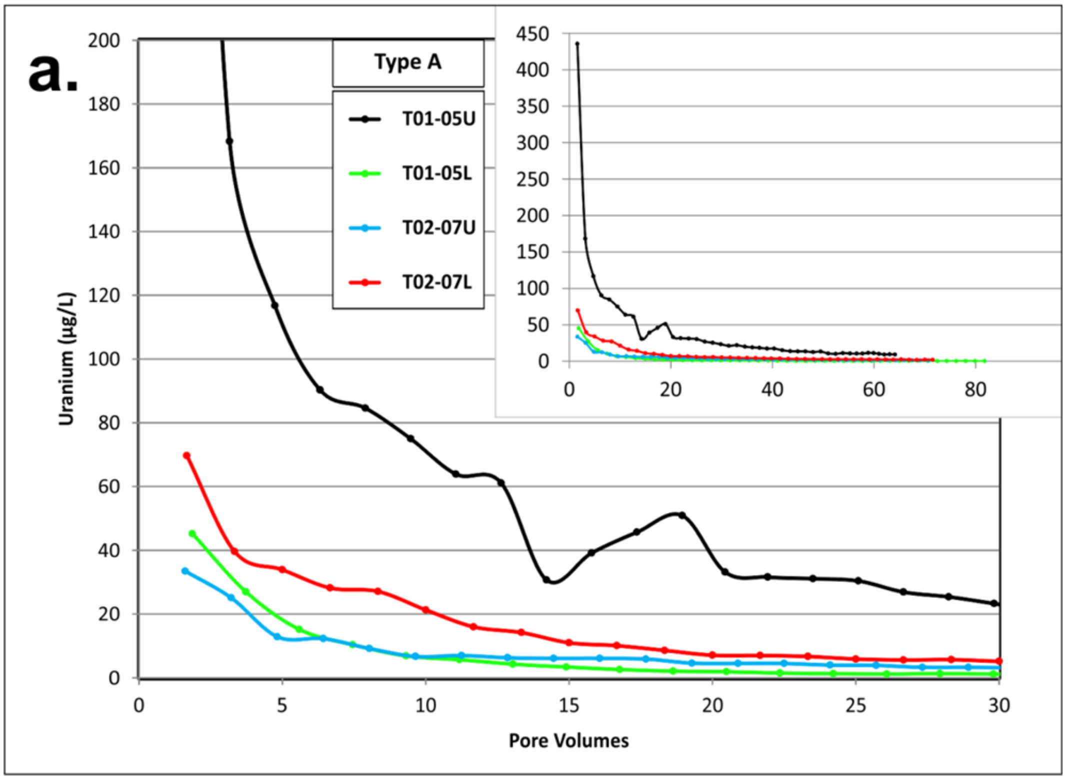
Effluent uranium concentrations were variable among the columns. With exceptions of the unanticipated fluctuations in the early stages, the uranium concentrations demonstrated a monotonic decrease throughout the tests. The uranium concentrations displayed three distinct profiles in the early stages, referred to as profile types A, B, and C, described as follows (Figure 13):

Type A: Uranium concentrations have a monotonic decrease throughout the test.

Type B: Uranium concentrations are low initially, then increase before finally having a monotonic decrease.

Type C: Uranium concentrations are initially high, then decrease, then increase again before finally having a monotonic decrease.

All four profiles from the two farthest upgradient transects (T01 and T02) were Type A and had relatively low effluent uranium concentrations (Figure 13). In contrast, three of the four samples from the two farthest downgradient transects (T07 and T08) had Type C profiles. Samples from the intermediate transects (T03, T04, T05, and T06) had mostly Type A and Type B profiles. Both samples from the T05-02 location had the highest peak uranium concentrations of any of the samples.



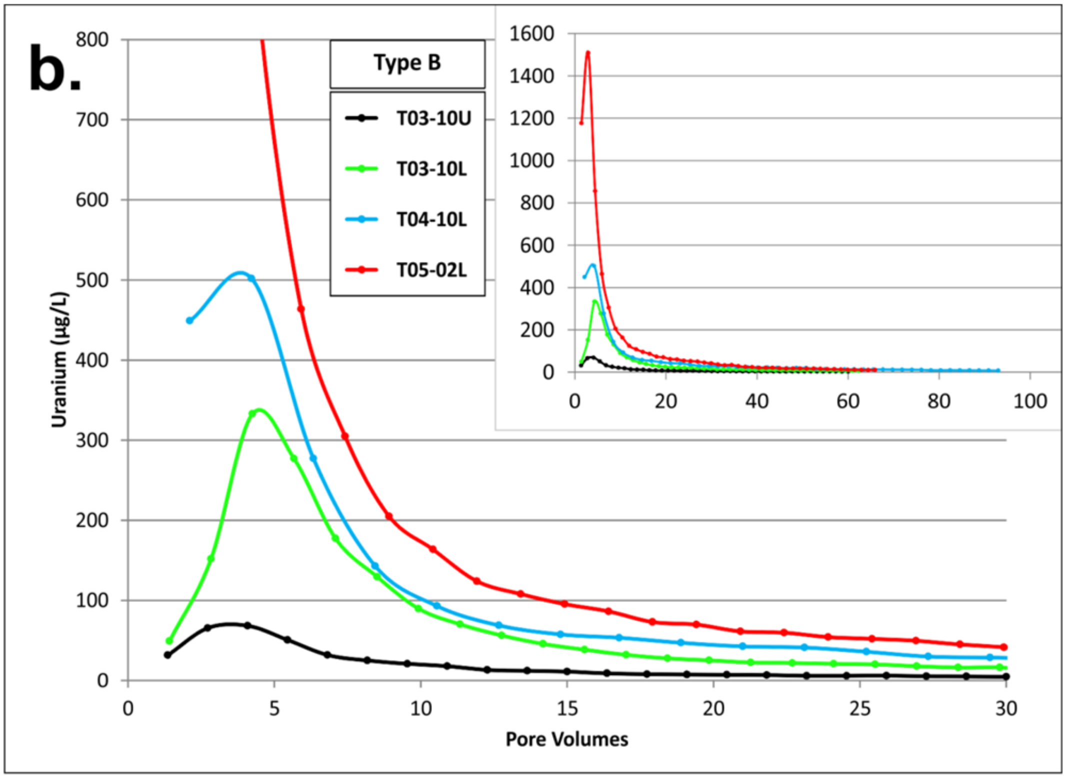
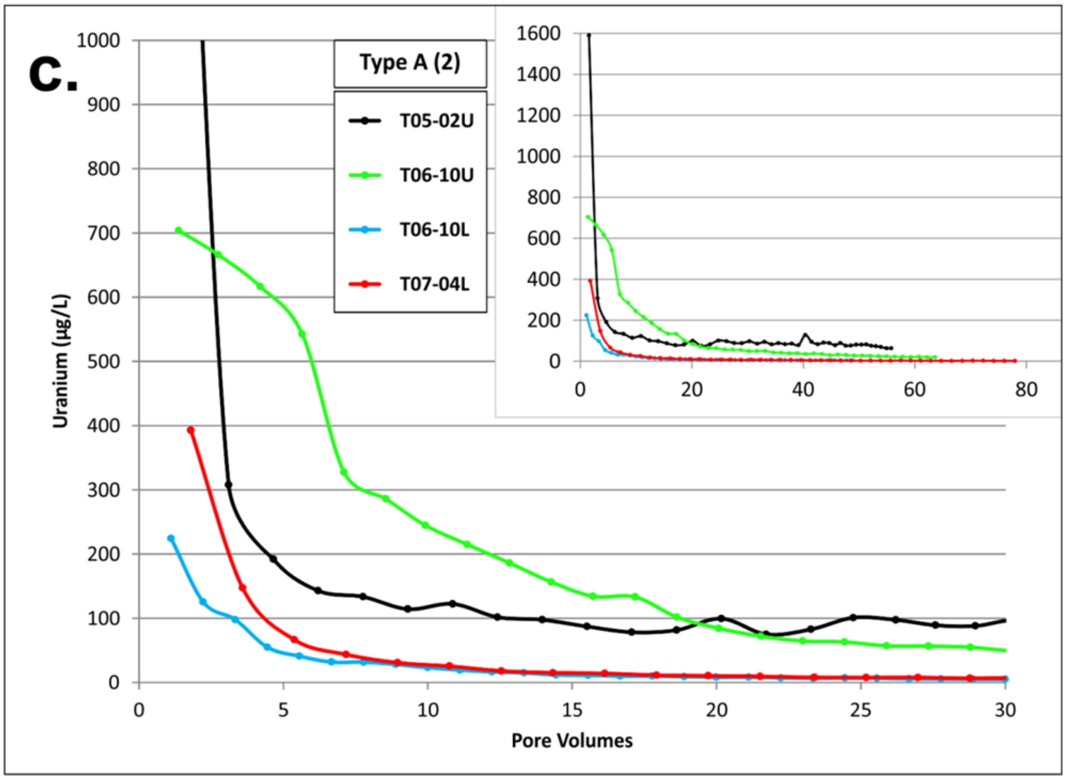


Figure 13. Uranium Concentrations in Column Effluents Arranged by Profile Type



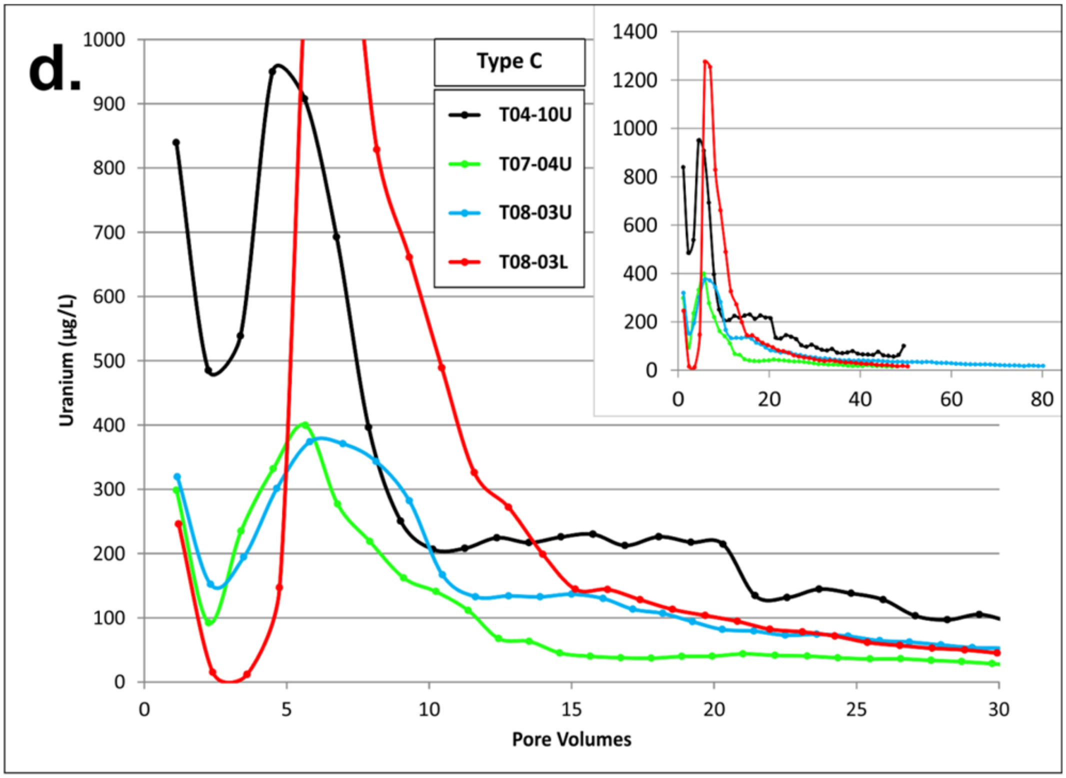


Figure 13 (continued). Uranium Concentrations in Column Effluents Arranged by Profile Type

The first effluent samples from many of the columns had a pale yellow to deep yellow-brown color that may be caused by dissolved organic acids. As indicated by descriptions in the laboratory notes (Appendix B), coloration in the Type C effluents was the deepest yellow-brown of all column effluents. Organics may be derived from the roots or other organic matter contained in the sediment. The first effluent samples from the columns may also be affected by the initial wetting of the column. As the columns wet up, water gradually seeps into immobile pores and as the pores become saturated, outward diffusion rates of uranium may increase.

3.3.2 Labile Fractions

The easily removable mass of uranium from a sediment is called the labile fraction. The labile fraction is generally considered to be the mass that is weakly sorbed to mineral surfaces and is the fraction that most readily participates in interactions with groundwater. Isotope exchange methods are used to provide a rigorous assessment of the uranium in the labile fraction; however, Kohler et al. (2004) developed an extraction technique that is simpler to perform and provides estimates of the uranium labile fraction that are comparable to isotopic exchange methods. The Kohler et al. (2004) method, which was used in this study, uses a carbonate solution (CARB) as the extraction medium.

The labile fractions were determined as the sum of the uranium mass removed by ASW during column operation and the mass subsequently removed by CARB extraction on the column sediment. The labile fractions in the Riverton sediment samples used for column testing ranged from 0.055 to 3.761 µg/g (Table 5). ASW removed between 58 and 87 percent of the labile fraction during column operation (Table 5). The concentrations of labile uranium are comparable to abundances of uranium in sedimentary rocks that make up the crust of the earth. For example, Rogers and Adams (1974) provide a compilation of data on average uranium concentrations in common sedimentary rocks as follows: sandstone (0.5 to 3.2 µg/g), shale (2 to 8 µg/g), Mancos Shale (3.7 µg/g), black shale (8 µg/g), bentonite (5 µg/g), and limestone (0.4 to 2.3 µg/g).

Table 5. Uranium Removed by ASW and by Subsequent CARB Digestion. The total labile fraction is the sum of the ASW and CARB extractions

Sample	**ASW Removed (µg/g) (%)[a]**	**CARB Removed (µg/g)**	**Total Labile (µg/g)**
T01-05U	0.473 (72 %)	0.184	0.657
T01-05L	0.039 (71 %)	0.016	0.055
T02-07U	0.056 (58 %)	0.040	0.096
T02-07L	0.085 (63 %)	0.051	0.136
T03-10U	0.145 (70 %)	0.062	0.207
T03-10L	0.580 (81 %)	0.135	0.715
T04-10U	2.840 (76 %)	0.921	3.761
T04-10L	0.579 (79 %)	0.150	0.729
T05-02U	1.325 (43 %)	1.758	3.083
T05-02L	1.677 (87 %)	0.244	1.921
T06-10U	1.523 (75 %)	0.510	2.033
T06-10L	0.218 (66 %)	0.111	0.329
T07-04U	0.968 (77 %)	0.294	1.262
T07-04L	0.239 (77 %)	0.073	0.312
T08-03U	1.959 (86 %)	0.306	2.265
T08-03L	2.301 (85 %)	0.415	2.716

[a] Percent of labile fraction removed by ASW.

4.0 References

DOE (U.S. Department of Energy), 2011. *Riverton, Wyoming, Processing Site Fact Sheet*, Office of Legacy Management, Grand Junction, Colorado, December 15. Available at http://www.lm.doe.gov/riverton/Documents.aspx.

DOE (U.S. Department of Energy), 2012a. *Verification Monitoring Report for the Riverton, Wyoming, Processing Site, Update for 2011*, LMS/RVT/S08569, U.S. Department of Energy, Grand Junction, Colorado, April.

DOE (U.S. Department of Energy), 2012b. *Enhanced Characterization of the Surficial Aquifer Riverton, Wyoming, Processing Site Fact Sheet*, Office of Legacy Management, Grand Junction, Colorado, August 8. Available at http://www.lm.doe.gov/riverton/Documents.aspx.

DOE (U.S. Department of Energy), 2012c. *Work Plan for the Enhanced Characterization of the Surficial Aquifer, Riverton, Wyoming Processing Site*, LMS/RVT/S08542, U.S. Department of Energy, Grand Junction, Colorado, June.

DOE (U.S. Department of Energy), 2013. *Enhanced Characterization of the Surficial Aquifer Riverton, Wyoming, Processing Site Data Summary Report*, LMS/RVT/S09545, Office of Legacy Management, Grand Junction, Colorado, January.

Kohler, M., G.P. Curtis, D.E. Meece, and J.A. Davis, 2004. "Methods for estimating adsorbed uranium(VI) and distribution coefficients of contaminated sediments," *Environ. Sci. Technol.*, (38): 240–247.

Murray, C.J., J.M. Zachara, J.P. McKinley, A. Ward, Y. Bott, K. Draper, and D. Moore, 2012 (accepted for publication). "Establishing a geochemical heterogeneity model for a contaminated vadose zone – aquifer system," *J. Contam. Hydrol.*

Rogers, J.J.W., and J.A.S. Adams, 1974. "Uranium," *in* Wedepohl, K.H. (ed.) *Handbook of Geochemistry*, Springer Verlag, Berlin, p. 92-1 to 92-O-1.

USGS (U.S. Geological Survey), 2011. Alkalinity calculation methods, available at http://or.water.usgs.gov/alk/methods.html, accessed 15 April 2013.

This page intentionally left blank

Appendix A

Field Logs for Sample Cores Used in This Study

Location	Core Recovery (%)	Depth Interval (ft.)	Core Description
T01-05	70	0-2.5	Pale yellowish-brown silt with rock fragments; dry. Roots in sample.
		2.5-3.5	Brownish-gray sand and gravel (5YR 4/1); moist (not wet).
T01-06	72	0-2.5	0–1 feet, pale yellowish-brown silt grades to light gray sand and gravel; dry. A few roots in sample.
		2.5-3.6	Medium dark gray (N4) sand and gravel; very wet.
T01-07	44	0-2.2	Pale yellowish-brown (10YR 6/2) silt; dry, well consolidated core. Abundant roots in sample.
T02-07	66	0-2.5	Moderate yellowish-brown (10YR 5/4) silt with roots. At 1.5 feet grades to sand and gravel—light gray (N7); dry. Abundant roots in sample.
		2.5-3.3	Well-rounded to angular rock fragments up to 1 inch and smaller pebbles and sand. Increase in moisture content 2.5-3.3 feet.
T02-08	82	0-2.5	Top 6 inches root fragments in silt becomes partially saturated from 2.4 to 2.7 feet (inside core); core well consolidated, moderate yellowish-brown (10YR 5/4). Abundant roots in sample.
		2.5-4.1	Very moist silt (no sand or clay observed); core stuck inside tube; difficult to remove. Dark yellowish brown (10YR 4/2); no rock fragments.
T02-09	78	0-2.5	Pale yellowish-brown (10YR 6/2) silt (no sand, clay, or rock); very dry. Some roots in sample.
		2.5-3.9	Light-gray sand and gravel; very dry; rock fragments up to 0.2 feet.
T03-10	78	0-2.5	Moderate yellowish-brown (10YR 5/4) silt (no sand and clay). Root in sample.
		2.5-3.9	Grades into dark yellow-brown (10YR 4/2) silty clay with orange (oxidized) minerals; dry to slightly moist.
T03-11	72	0-2.5	Pale yellow-brown (10YR 6/2) silt becomes rocky fill fragments at 2 feet. Angular to rounded rocks up to 1 inch; dry. Abundant roots in sample.
		2.5-3.6	Very light gray (N8) rock fragments and sand—fill material; dry.
T03-12	82	0-2.5	0–3 inches, roots; pale yellowish brown (10YR 6/2) pure silt, no sand or clay; dry. Occasional orange oxidized grains. A few roots in sample.
		2.5-4.1	Increasing clay content with depth and color change at 32 inches to dark yellowish brown; mottled clay with black-gray zones. No alluvium observed, slightly moist.
T04-08	86	0-2.5	Pale yellowish-brown silt; dry. Abundant roots in sample.
		2.5-4.3	2.5–2.8 feet, silt as above. 2.8–4.0 feet, pale brown (10YR 5/2) medium grained sand and gravel. 4.0–4.3 feet, light-medium gray/black medium grain sand and gravel. A few roots in sample.
T04-09	76	0-2.5	Pale yellowish silt; dry.
		2.5-3.8	2.5–3.0 feet, silt, gray sand and gravel; dry. 3.0–3.8 feet, light gray-black sand and gravel; dry.
T04-10	62	0-2.5	0–1.4 feet, silt (as above); dry. 1.4–2.5 feet, light gray sand and gravel; dry.
		2.5-3.1	2.5–3.1 feet, light gray sand and gravel, pebbles well rounded to angular; dry.
T04-11	74	0-2.5	0–1.7 feet, pale yellowish-brown silt (soft); dry. 1.7–2.5 feet, moderate brown (5YR 4/4) silt (hard); dry. Abundant roots in sample.
		2.5-3.7	2.5–3.5 feet, same as above. 3.5–3.7 feet, coarse sand (light gray) with subrounded pebbles. Abundant roots in sample.
T04-12	50	0-2.5	0–0.9 feet, pale yellowish-brown (10YR 6/2) silt; dry. 0.9-2.5 feet, dark yellowish brown (10YR 4/2); slightly moist, rocky at 2.4-2.5 feet. Abundant roots in sample.
T05-01	76	0-2.5	Pale yellowish-brown silt; dry. Abundant roots in sample.
		2.5-3.8	Pale yellowish-brown silt; dry. A few roots in sample.

Location	Core Recovery (%)	Depth Interval (ft.)	Core Description
T05-02	58	0-2.5	0–1.4 feet, moderate yellowish brown silt; dry. 1.4–2.4 feet, moderate yellowish-brown clayey silt; moist. Many roots in sample.
		2.5-2.9	2.4–2.9 feet, light gray gravel and dark yellowish brown (10YR 4/2) sand, fine-grained; dry.
T05-03	92	0-2.5	0–2.5 feet, pale yellowish brown silt; dry. Top 0.5 feet, crusty/hard, weathered; dry. 0.5–2.5 feet, soft silt; dry. Abundant roots in sample.
		2.5-4.6	2.4–4.4 feet, soft silt; dry. 4.4–4.6 feet, silty sand, pale yellowish-brown; dry. Some roots in sample.
T06-08	62	0-2.5	0–0.8 feet, pale yellowish-brown silt; dry. 0.8–2.5 feet, gravel and sand, light gray and black. Some roots in sample.
		2.5-3.1	2.5–3.1 feet, gravel and sand, light gray and black.
T06-09	68	0-2.5	0–0.5 feet, pale yellowish-brown silt; dry. 0.5–2.5 feet, gravel with minor sand, light gray; dry. Some roots in sample.
		2.5-3.4	2.5–3.0 feet, gravel and light gravelly sand, angular gravel. 3.0–3.4 feet, black sand and light gray gravel.
T06-10	70	0-2.5	0–0.9 feet, pale yellowish-brown silt; dry. 0.9–2.5 feet, brown sand (10YR 6/2) and pebbles, rounded. Abundant roots in sample.
		2.5-3.5	2.5–3.5 feet, brown sand and gravel grading to light gray sand and gravel; dry.
T06-11	76	0-2.5	0–2.5 feet, moderate brown (10YR 4/4) silt; dry and hard. Abundant roots in sample.
		2.5-3.8	2.5–2.7 feet, same as above; dry. 2.7–3.8 feet, silt and very fine grained sand (no gravel). A few roots in sample.
T06-12	66	0-2.5	0–2.1 feet, moderate brown silt; dry and hard. 2.1–2.5 feet, light gray sand and gravel; dry. Some roots in sample.
		2.5-3.3	2.5–3.3 feet, light gray sand and gravel; dry.
T06-13	82	0-2.5	Pale yellowish-brown silt; dry and soft. Abundant roots in sample.
		2.5-4.1	2.5–3.8 feet, same as above. 3.8–4.1 feet, light gray sand and gravel; dry. A few roots in sample.
T07-03	72	0-2.5	0–2.2 feet, pale yellowish-brown silt; dry. 2.2 to 2.5 feet, sand and gravel; dry.
		2.5-3.6	2.5–3.6 feet, sand and gravel, light gray, pebbles and gravel subangular to round, fine to medium grain sand; dry. Abundant roots in sample.
T07-04	62	0-2.5	0–1.5 feet, pale yellowish-brown silt; dry. 1.5–2.5 feet, sand and gravel, light gray; dry. Some roots in sample.
		2.5-3.1	1.5–3.1 feet, sand and gravel, light gray; dry.
T07-05	72	0-2.5	0–2.0 feet, pale yellowish-brown silt; dry. 2.0–2.5 feet, sand and gravel, poorly sorted, light gray; dry. Abundant roots in sample.
		2.5-3.6	2.5–3.6 feet, sand and gravel, light gray and black pebbles and sand, subangular gravel; dry.
T07-06	80	0-2.5	0–2.3 feet, pale yellowish-brown silt; dry. 2.3–2.5 feet, light gray-black fine to medium grained sand and well rounded pebbles. Abundant roots in sample.
		2.5-4	Same as above to 4.0 feet.
T07-07	58	0-2.5	0–1.0 feet, pale yellowish-brown silt; dry. 1.0–1.7 feet, light gray sand and well rounded pebbles, very fine grained sand.
		2.5-2.9	1.7–2.9 feet, dark gray medium grained sand and gray gravel (angular) and well rounded black pebbles. Abundant roots in sample.
T08-02	48	0-2.4	Pale yellowish-brown silt; dry. A few roots in sample.
T08-03	86	0-2.5	Pale yellowish-brown silt; dry. Many roots in sample. Organic sediment.
		2.5-4.3	2.5–4.3 feet, pale yellowish-brown silt; dry with roots observed to bottom of core.

Location	Core Recovery (%)	Depth Interval (ft.)	Core Description
T08-04	80	0-2.5	0–2.0 feet, pale yellowish-brown silt. 2.0–2.5 feet, grades to river sand and gravel. Many roots in sample. A few roots in sample.
		2.5-4.0	2.5–4.0 feet, river sand, medium light gray (N6) with well-rounded pebbles/gravel.
T08-05	86	0-2.5	Pale yellowish-brown silt; dry to 2.8 feet. Abundant roots in sample.
		2.5-4.3	2.8–4.3 feet, river sand and gravel, medium light gray; dry. Some roots in sample.
T08-06	82	0-2.5	Pale yellowish-brown silt; dry. Abundant roots in sample.
		2.5-4.1	2.5–3.3 feet, same as above. 3.3–4.1 feet, river sand and gravel; dry. Some roots in sample.
T09-08	82	0-2.5	Pale yellowish-brown silt; dry. Abundant roots in sample.
		2.5-4.1	2.5–3.3 feet, same as above. 3.3–3.5 feet, light gray fine sand; dry. 3.5−4.1 feet, moderate brown clay and silt; dry. (Additional location that was not in the plan.) Abundant roots in sample.

This page intentionally left blank

Appendix B

Copies of Laboratory Notes

RIVERTON "CARB" Extractions (Kohler et al 2004; we are using slight modification as per Murray et al 2012)

p1

Solution Composition

	1 M	2 mM	3 g/L	4 g/2L
$NaHCO_3$	1.44×10^{-2}	14.4	1.2097	2.4194
Na_2CO_3	2.80×10^{-3}	2.8	0.2968	0.5935

Adjusted to pH 9.5 using NaOH

Formula wgts (From Reagent bottles):
Fisher $NaHCO_3$ (S233-B, Lot 028924) = 84.01 g/mol
Fisher Na_2CO_3 (S263-500, Lot 915501A) = 105.99 g/mol

$NaHCO_3$ 0.0144 mol/L × 84.01 g/mol = 1.2097 g/L
Na_2CO_3 0.0028 mol/L × 105.99 g/mol = 0.2968 g/L

CARB BATCH #	Solutions DATE made	10N NaOH (or Eq) (μL) used
1	9/5/12	140 μL

GOAL was to use 50 g/L but limited by 500 mL VOL flasks (which fit well on orbital shaker table) – so slightly higher ratios were used

Used ORBITAL (FLOOR-MODEL Eberback) shaker at Low Setting

Column No	Sample	DRY Weight	(50 g/L) Desired CARB Vol (mL)	Actual CARB Vol (mL)	Actual Wgt/Vol RATIO (g/L)	START DATE/Time	END DATE/Time	U (μg/L)	U (μg/g)
1	T08-034	27.51 g	550 mL	532 mL	51.71 g/L	11/5/12 18:18	11/26/12 18:18	15.8	0.306
2	T08-036	29.280	586 mL	547 mL	53.53 g/L	11/9/12 12:38	11/30/12 12:38	22.2	0.415
3	T07-04 0-2.5	31.98	640 mL	538 mL	59.44 g/L	11/9/12 17:35	11/30/12 17:35	17.5	0.294
4	T07-04 2.5-5	36.35	727 mL	522 mL	69.64 g/L	11/10/12 10:10	12/1/12 10:10	5.1	0.073
5	T06-10 0-2.5	32.17	643 mL	542 mL	59.35 g/L	11/12/12 17:10	12/3/12 17:10	30.3	0.510
6	T06-10 2.5-5	37.42	748 mL	533 mL	70.21 g/L	11/13/12 16:30	12/4/12 16:30	7.8	0.111
7	T05-02 0-2.5	~~29.91~~ 34.75 5mL	695 ~~598~~ mL	531 mL	56.33 g/L	11/15/12 12:40	12/6/12 12:40	57.5	1.758
8	T05-02 2.5-5	32.14 5mL	643 mL	538 mL	59.74	11/16/12 15:45	12/7/12 @ 15:45	14.6 45.1	0.755
9	T04-10 0-2.5	30.28	60 606 mL	533 mL	56.81 g/L	11/17/12 17:45	12/8/12 @ 17:45	52.3	0.923
10	T04-10 2.5-5	37.94	758 mL	532 mL	71.32 g/L	11/18/12 15:15	12/9/12 @ 15:15	10.7	0.150
11	T03-10 0-2.5	30.52	610	543 mL	56.21 g/L	11/19/12 16:25	12/10/12 @ 1625	3.5	0.062
12	T03-10 2.5-5	30.16	603	529 mL	57.01 g/L	11/23/12 11:18	12/14/12 11:18	7.7	0.135
13	T02-01 0-2.5	33.89	678	536 mL	63.23 g/L	11/23/12 11:40	12/14/12 11:40	2.5	0.040

31.25
30.28

Riverton Carb Extractions

p2

Col		Sample	2 Dry Weight (g)	Desired Carb Vol (ml)(50g/L)	Actual Carb Vol (ml)	Actual Wgt/Vol Ratio	6	7 Start Date/Time	8 End Date/Time	9	10 U (ug/L)	11 U (ug/g)	12	13
14	4	T02-07255	35.14	702.8	531	66.18		11/29/12 13:20	12/20/12 08:10		3.4	0.051		
15	5	T01-05 0-25	33.62	672.4	537	62.61		11/29/12 13:40	12/30/12 08:10		11.5	0.184	* carb soln on 15 is	
16	6	T01-05 255	35.99	719.8	534	67.40		11/29/12 13:30	12/30/12 08:10		1.1	0.016	mix 280 rec/320 new	

Riverton Carb Extractions

11/8/12

Preparing 8L of "CARB" solution as referenced in Kohler et al 2004. Will prepare in 2L batches.

Final concentrations should be 0.0144M $NaHCO_3$ and 0.0028M Na_2CO_3. pH should be 9.45 ± 0.05 and alkalinity should be 20 meq/L.

$NaHCO_3$ = 2.419g /2L Na_2CO_3 = 0.594 g /2L

Batch 1 $NaHCO_3$ = 2.418 g
Na_2CO_3 = 0.595 g

Batch 2 $NaHCO_3$ = 2.419g
Na_2CO_3 = 0.594

Batch 3 $NaHCO_3$ = 2.420
Na_2CO_3 = 0.594

Batch 4 $NaHCO_3$ = 2.420
Na_2CO_3 = 0.594

Check pH stds. 4=4.03 7=7.01 10=9.99

Measure pH of CARB solution
14:13 pH = 9.26
14:20 pH = 9.32

Using 10N and 1N NaOH adjust pH to 9.45 ± 0.05. After addition pH allowed to stabilize 1min. before reading taken

10N	1N	pH	10N	1N	pH
100µL		9.34		200µL	9.44
100µL		9.37		100µL	9.45
200µL		9.40	200µL		9.48
100µL ~~200µL~~		9.42	100µL		9.50
100µL		9.44			
	100µL	9.44			
	200µL	9.44			

— talked w/ Stan he wants pH = 7.50

960µL of 10N NaOH equiv.

11/8/12

Measure alkalinity of CARB solution using 1.6N H_2SO_4 and ~~100mL sample~~ 50mL sample diluted to 100mL. (DF2)

Final pH = 4.49 Digits = 455 Alk = 455 × 2 × 0.02 = 18.2 meq/L

pH slowly climbed back up in alk. solution will add more acid until pH remains steady @ 4.5.

6 more digits added final pH = 4.47 Total digits = 461 Alk = 461 × 2 × 0.02 = 18.4 meq/L

11/13/12 Measured sodium on CARB solution. Measured value was 492 mg/L. Theoretical Na concentration is ~~487.47 mg/L.~~ 487.4 mg/L. 0.94% high.

$NaHCO_3$ 0.0144 M $\frac{0.0144\,mol}{L} \cdot \frac{22.99\,g}{mol} \cdot \frac{1000\,mg}{g} = 331.06$

Na_2CO_3 0.0028 M $\frac{0.0028\,mol}{L} \cdot \frac{22.99\,g}{mol} \cdot 2 \cdot \frac{1000\,mg}{g} = 128.74$

10N NaOH $\frac{0.00096\,L}{1} \cdot \frac{10\,mol}{L} \cdot \frac{22.99\,g}{mol} \cdot \frac{1000\,mg}{g} \cdot \frac{1}{8\,L} = 27.59$

$\}$ 487.4

Riverton CARB Extractions

11/26/12	13:15 col 1	Removed sample from Column #1 T08-03 0-2.5' from shaker table. Using a 15mL fixed volume pipet took 15mL from middle of erlynmeyer flask and pipetted into an Open 30mL syringe w/ a 0.45 μm nylon acrodisk filter on it. Put the syringe plunger back into the syringe and filtered sample into a 50mL centrifuge tube. It was hard to push the last 1-2mL through filter. Sample had very light yellow color to it. Acidified w/ 200 μL HNO_3 and checked pH to ensure it was <2. The rest of the sample is retained for later use. Color remained even after acidification.
11/30/12	12:35 col 2	Removed the next sample T08-03 2.5-5' from shaker table. Using same procedure as above filtered sample into 50mL centrifuge tube. It required 2 filters to filter sample. It got very difficult to filter after ~10mL. Filtered sample has no noticible color. Acidified w/ 200μL HNO_3.
	12:45 col 3	Removed the next sample T07-04 0-2.5' from shaker table. Used same procedure to filter. Sample very cloudy filtering might be difficult. It required 2 filters. 8mL passed through the 1st 7 through the 2nd. Filtered sample has a very light yellow color. Acidified w/ 200 μL HNO_3
12/1/12	18:00 col 4	Removed T07-04 2.5-5' from shaker table. Using procedure above to filter. Sample relatively clear directly off shaker table. Two filters required. Sample clear. Acidified HNO_3 200ul. ↳ not muddy looking, but ↑ fine particulates suspended
12/3/12	0800 col 5	Remove T06-10 @ 0-2.5' from shaker table. Using above procedure to filter. Sample rel. clear directly off shaker table. Two filters required. Sample clear. 200ul HNO_3 (conc). ↳ not muddy looking, but ↑ fine particulates suspended
12/4/12	0930 col 6	Remove T06-10 @ 2.5-5' from shaker table. Use above procedure to filter. Sample relatively clear - not muddy looking but ↑ suspended fine particulates. Use 2 filters for 15ml. Resulting sample clear. Acidified HNO_3 200ul.

Riverton Carb Extractions

p6

12/6/12 0810 Remove T05-02@0-2.5' from shaker table. Use above procedure to filter.
col 7 Sample ~ Clear Very few suspended particles. Use 1 filter for 15ml.
Resulting sample clear. Acidified 200ul conc. HNO_3

12/7/12 0900 Remove T05-02@ 2.5-5' from shaker table Use above procedure to filter
col 8 Sample Cloudy w/ ↑ suspended particulates. Use 6 filters for 15ml
Resulting sample clear. Acidified 200 ul conc HNO_3

12/9/12 1600 Remove T04-10 @0-2.5 from shaker table Use above procedure to filter
col 9 Sample ~~mod~~ cloudy w/moderate suspended particles. Use 2 filters for 15ml
Resulting sample Clear. Acidify 200ul conc HNO_3

col 10 Remove T04-10 @2.5-10 from shaker table. Use above procedure to filter
Sample mod cloudy w/ mod. suspended particles. Use 3 filters for 15ml
Resulting sample clear. Acidify 200ul conc HNO_3

12/10/12 0815 Remove T03-10@0-2.5 from shaker table. Use above procedure to filter
sample mostly clear w/ few suspended particles. Use 1 filter for 15ml
col 11 Resulting sample clear. Acidify 200ul. conc HNO_3

12/14/12 0850 Remove T03-10@2.5-5 from shaker table. Use above procedure to filter sample mostly clear
col 12 w/ few suspended particles. Use 1 filter for 15mL. Resulting sample clear. Acidify 200μL conc HNO_3.

col 13 Remove T02-07@ 0-2.5 from shaker table. Use above procedure to filter sample mostly clear
w/ few suspended particles. Use 1 filter for 15mL. Resulting sample clear and pale yellow. Acidify
200μL conc. HNO_3

Riverton Carb Extractions

12/20/12 0800 Remove T02-07@2.5-5 from shaker table. Use above procedure to filter
Col14 sample cloudy c̄ mod. suspended particles. Use 3 filters for 15 ml.
Resulting sample clear. Acidify 200ul Conc HNO_3

Remove T01-05@0-2.5 from shaker table. Use above procedure to filter.
Col15 Sample cloudy w/ moderate suspended particulates. Use 2 filters for 15ml.
Resulting sample clear ~~pale~~ pale amber. Acidify 200ul Conc HNO_3

Remove T01-05@2.5-5 from shaker table. Use above procedure to filter.
col16 Sample cloudy w/ moderate suspended particulates. Use 2 filters for 15ml.
Resulting sample clear. Acidify 200ul Conc HNO_3

Col 1

Riverton Column Tests

10/31/2012 Fraction Collector Set up: MODE = Time, Rack Code = 22, Waste = 0.00 min, Inject = 0.01 min.
Wait = 0.00 min, No. of Collects = 44, Rinse = 0.00, Loop No. INJ = 1, Interval = NA, Cycles = 1
Collect time = 100 min, Separate Cycles = NO, Use Syncronization = NO

Using 100 min collect time. Masterflex peristaltic pump (#13 head) set at 0.10 mL/min yields Approx 10 mL samples (Approx every Pore Vol).

Using OMNI 300 psi Columns ~~1.7671 (length)~~ x BED = Vol mL = 1.7671 x Bed length (cm) (~22 mL empty)

Source Solution is RIV SPF-3. (See recipe)

	Na	K	Ca	Mg	SO4	Cl	C
~~TOTALS~~	~~51.76~~	~~1.70~~	~~26.20~~	~~16.11~~	~~121.23~~	~~3.84~~	~~28.83~~
~~Actual~~	~~24.00~~	~~1.70~~	~~48.00~~	~~16.00~~	~~120.00~~	3.80	

	Na	K	Ca	Mg	SO4	Cl	C
TOTAL	68.45	1.70	48.91	2.06	120.12	3.84	35.97
Actual	24.00	1.70	48.00	16.00	120.00	3.80	27.80

Bubbled CO_2 (very small amount) to adjust pH. High C was needed to get actual Alk value near 116 mg/L as $CaCO_3$. Couldn't get "perfect" solution so opted to get Ca and Alk correct (because of their importance in U mobilization). And get pH close (using CO_2 gas). Na and Mg are slightly off - couldn't be avoided.

Using a 1 gal plastic collapsible bag for source solution to avoid contact w/ Atm (See photo).

1330 Fill a column w/ soil from T08-03 0-2.5' <2mm fraction.
Column Tare 78.60g
Full Column 106.11g Mass of soil in column 27.51g
Splits made by taking random scoops from a tray of < 2mm soil. Probably mostly silt/clay.
Lightly tamped to fill column. Length of Dry fill = 11.7 cm (x 1.7671) = 20.68 cm³ Dry Density = $\frac{27.51g}{20.68cm^3}$ = 1.33 g/cc Dry

13:39 SPF is filled ~~to~~ in the supply tubing. Using a collapsible plastic 2gal bag for source fluid to prevent air exposure.

13:40 Start flow @ 0.10 mL/min. Flow from bottom to top.

Riverton Column Tests

10/31/12 Start by preparing ~~1 gal~~ 4L of SPF3.

0830 Prepared 2L of SPF3 and more 1.5g/L $CaSO_4 \cdot 2H_2O$.
0835 Check pH stds. 4=4.03 7=7.01 10=9.99
0837 Start measuring SPF3 pH ~8.4
0840 Bubble small amt. of CO_2 into SPF3 and measure pH.
0850 pH = 7.47
0900 Add another 2L of SPF3.
0905 pH = 7.99
0910 pH = 8.00
0915 alk measured on 100mL sample using 1.6 N H_2SO_4. Final pH = 4.82 Digits = 129 Alk = 129mg/L as $CaCO_3$

11/6/12 Preparing another 4L batch of SPF3 for Riverton columns
0750 prepared 2L of SPF3
0755 Check pH stds. 4=4.05 7= 7.01 10=10.01
0759 Start measuring pH of SPF3 pH ~8.4
0801 Bubble small amt of CO_2 into SPF3 and measure pH while making a second 2L of SPF3.
0810 pH = 6.67
0812 Add another 2L of SPF3
0815 pH = 6.91
0820 pH = 6.94
Let solution stir open to the atmosphere until pH is 7.90-8.10.
0835 pH = 7.07
0852 pH = 7.25
0902 pH = 7.35
0913 pH = 7.47
0928 pH = 7.61
0939 pH = 7.70
0951 pH = 7.80
1005 pH = 7.90
1010 pH = 7.93

1015 measure alk on 100mL sample using 1.6 N H_2SO_4.
Final pH = 4.76 Digits = 131 Alk = 131mg/L as $CaCO_3$

11/7/12 Preparing 1L of SPF3
0825 prepared 1L of SPF3
0830 check pH stds. 4=4.05 7=7.02 10= 10.00
0835 measure pH of SPF3 ~ 8.5
Bubble small amt of CO_2 into SPF3 and measure pH.
0840 pH=7.95
0845 pH=7.98
0845 measure alk on a 50mL sample diluted to 100mL (OF2) w/ 1.6N H_2SO_4
Final pH= 4.81 Digits = 67 x 2 = Alk 134 mg/L as $CaCO_3$

Riverton Column 1 T08-03 0-2.5'

C012

13:42 1st visible entry of SPF3 to bottom of column

15:08 ~~15:09?~~ ~~15:06~~ Filled soil pores (86 min)

15:11 Fluid to column exit.

15:36 Fluid at frac collector

Summary of Volumes Column 1

Inlet Tubing ≃ 0.82 mL

Inlet tubing to soil ≃ 0.20 mL

Soil Pores ≃ 8.6 mL

Outlet tubing = 2.8 mL

Dry Soil Den = 1.33 g/cc

Soil (Dry) Vol = 20.68 cc

Tube No.	Start Fill Date/Time	Actual Tube Vol (mL)	Cum Vol (mL)	PV (1pv=8.6mL)	Cum PV	Flow Rate mL/min	U ug/L	Collect Time (hr)	Cum collect Time (hr)	
N/A	10/31/12 15:42	Start Flow in Soil								
1	10/31/12 15:37	10.0	10.0	1.16	1.16	0.10	319.3	1.67	1.67	Yellow-brown color (ORG?)
2	17:17	10.0	20.0	~~2.33~~ 1.16	2.33	0.10	152.1	1.67	3.34	
3	18:57	10.0	30.0	1.16	3.49	0.10	194.3	1.67	5.01	
4	20:37	10.0	40.0	1.16	4.65	0.10	301.2	1.67	6.68	
5	22:17	10.0	50.0	1.16	5.81	0.10	374.0	1.67	8.35	
6	23:57	10.0	60.0	1.16	6.98	0.10	370.7	1.67	10.02	
7	11/1/12 1:37	10.0	70.0	1.16	8.14	0.10	343.3	1.67	11.69	
8	3:17	10.0	80.0	1.16	9.30	0.10	282.1	1.67	13.36	
9	4:57	10.0	90.0	1.16	10.46	0.10	166.7	1.67	15.03	11/1/12 0750 Removed 9 samples. Acidified with 200 uL Conc HNO3. Marked "A". All tubes had 10 mL
10	6:37	10.0	100.0	1.16	11.63	0.10	132.7	1.67	16.67	
11	8:17	10.0	110.0	1.16	12.79	0.10	134.1	1.67	18.33	
12	9:57	9.5	119.5	1.10	13.90	0.095	132.6	1.67	20.00	
13	11:37	9.5	129	1.10	15.00	0.095	136.7	1.67	21.67	
14	13:17	9.5	138.5	1.10	16.10	0.095	130.1	1.67	23.33	
15	14:57	9.0	147.5	1.05	17.15	0.09	113.3	1.67	25.00	
16	16:37	9.0	156.5	1.05	18.20	0.09	106.9	1.67	26.67	
17	18:17	9.0	165.5	1.05	19.24	0.09	94.0	1.67	28.33	
18	19:57	9.0	174.5	1.05	20.29	0.09	81.8	1.67	30.00	
19	21:37	9.5	184	1.10	21.40	0.095	79.3	1.67	31.67	
20	23:17	9.5	193.5	1.10	22.50	0.095	72.9	1.67	33.33	
21	11/2/12 0:57	9.5	203	1.10	23.60	0.095	74.4	1.67	35.00	
22	2:37	9.5	212.5	1.10	24.71	0.095	71.4	1.67	36.67	

PV calc c̄ 0.10 mL/min

Riverton Column 1 T08-03 0-2.5'

Tube No	Fluid in Tube (mL)	2 Tube Start Date/Time	3 Cum (mL) Vol.	1PV=8.6mL 4 PV	5 Cum PV	Flow Rate (mL/min)	(hr) Collect 7 Time	Cum Collect 8 Time (hr)	9 Cl (mg/L)	10	11	12	13
23	9.5	11/2/12 4:17	222	1.10	25.81	0.095	1.67	38.33	64.4				
24	9.0	5:57	231	1.05	26.86	0.09	1.67	40.00	62.3				
25	9.5	7:37	240.5	1.10	27.97	0.095	1.67	41.67	57.8				
26	9.5	9:17	250	1.10	29.07	0.095	1.67	43.33	53.6				
27	9.5	10:57	259.5	1.10	30.17	0.095	1.67	45.00	52.4				
28	9.0	12:37	268.5	1.05	31.22	0.09	1.67	46.67	48.0				
29	9.0	14:17	277.5	1.05	32.27	0.09	1.67	48.33	48.7				
30	9.0	15:57	286.5	1.05	33.31	0.09	1.67	50.00	46.1				
31	9.5	17:37	296	1.10	34.42	0.095	1.67	51.67	43.3				
32	9.0	19:17	305	1.05	35.47	0.09	1.67	53.33	41.7				
33	9.0	20:57	314	1.05	36.51	0.09	1.67	55.00	40.0				
34	9.0	22:37	323	1.05	37.56	0.09	1.67	56.67	41.2				
35	9.0	11/3/12 0:17	332	1.05	38.60	0.09	1.67	58.33	38.7				
36	9.0	1:57	341	1.05	39.65	0.09	1.67	60.00	40.2				
37	9.0	3:37	350	1.05	40.70	0.09	1.67	61.67	40.6				
38	9.0	5:17	359	1.05	41.74	0.09	↓	63.33	38.9				
39	9.5	6:57	368.5	1.10	42.85	0.095		65.00	39.5				
40	9.5	8:37	378	1.10	43.95	0.095		66.67	38.8				
41	9.0	10:17	387	1.05	45.00	0.09		68.33	37.3				
42	9.0	11:57	396	1.05	46.05	0.09		70.00	35.9				
43	9.5	13:37	405.5	1.10	47.15	0.095		71.67	34.6				
44	9.0	15:17	414.5	1.05	48.20	0.09		73.33	34.9				
45	9.5	16:57	424	1.10	49.30	0.095		75.00	34.3				
46	9.0	18:37	433	1.05	50.35	0.09		76.67	32.7				
47	9.0	20:17	442	1.05	51.40	0.09		78.33	34.0				
48	9.5	21:57	451.5	1.10	52.50	0.095		80.00	34.5				
49	9.0	23:37	460.5	1.05	53.55	0.09		81.67	32.6				
50	9.0	11/4/12 1:17	469.5	1.05	54.59	0.09		83.33	34.3				
51	9.5	2:57	479	1.10	55.70	0.095		85.00	33.4				
52	9.5	4:37	488.5	1.10	56.80	0.095		86.67	30.5				
53	9.0	6:17	497.5	1.05	57.85	0.09	↓	88.33	29.9				

Riverton Column 1 T08-03 0-2.5'

Tube No		Fluid in Tube (mL)	Tube Start Date/Time	Cum Vol (mL)	1PV=8.6mL 4 PV	Cum 5 PV	Flow Rate 6 (mL/min)	Collect Time 7 (hr)	Cum Collect Time (hr)	U (ug/L)	10	11	12	13
54	1	9.0	11/4/12 7:57	506.5	1.05	58.90	0.09	1.67	90.00	30.1				
55	2	9.5	9:37	516	1.10	60.00	0.095		91.67	28.6				
56	3	9.0	11:17	525	1.05	61.05	0.09		93.33	26.6				
57	4	9.0	12:57	534	1.05	62.09	0.09		95.00	26.1				
58	5	9.0	14:37	543	1.05	63.14	0.09		96.67	24.9				
59	6	9.0	16:17	552	1.05	64.19	0.09		98.33	24.3				
60	7	9.5	17:57	561.5	1.10	65.29	0.095		100.00	24.0				
61	8	9.5	19:37	571	1.10	66.40	0.095		101.67	23.6				
62	9	9.0	21:17	580	1.05	67.44	0.09		103.33	24.2				
63	10	9.5	22:57	589.5	1.10	68.55	0.095		105.00	23.1				
64	11	9.0	11/5/12 0:37	598.5	1.05	69.59	0.09		106.67	21.9				
65	12	9.5	2:17	608	1.10	70.70	0.095		108.33	20.9				
66	13	9.0	3:57	617	1.05	71.74	0.09		110.00	20.1				
67	14	9.0	5:37	626	1.05	72.79	0.09		111.67	19.6				
68	15	9.5	7:17	635.5	1.10	73.90	0.095		113.33	~~24.6~~ ~~18~~ 19.8				
69	16	9.0	8:57	644.5	1.05	74.94	0.09		115.00	18.8				
70	17	9.0	10:37	653.5	1.05	75.99	0.09		116.67	16.9				
71	18	9.0	12:17	662.5	1.05	77.03	0.09		118.33	19.1				
72	19	9.0	13:57	671.5	1.05	78.08	0.09		120.00	18.8				
73	20	9.0	15:37	680.5	1.05	79.13	0.09		121.67	17.2				
74 last tube	21	9.0	17:17	689.5	1.05	80.17	0.09		123.33	17.7				
	22	11/5/2012		17:58	D/C Flow to column.									
	23													
	24													
	25													
	26													
	27													
	28													
	29													
	30													
	31													

Riverton Column 2 T08-03 2.5-5'

11/6/2012 0600 Using <2mm sieved fraction to fill 25mL OMNI glass column. Set up is the same as for Riverton Column 1. Flow from bottom to top

Column Fill:
TARE (empty column) = 63.13g
Filled Column = 92.41
Soil Weight = 29.28

Mostly Silt & clay. Scattered rootlets.
Soil Column length = 11.8 cm Vol=11.8×1.7671=20.85mL
Density (DRY) = 29.28/20.85 = 1.40 g/mL

TUBE No	Fluid in Tube (mL)	TUBE Start DATE/Time	Cum VOL (mL)	1 PV=8.3mL PV	Cum PV	FLOW RATE (mL/min)	Collect TIME (hr)	Cum Collect Time (hr)	U (µg/L)
1	9.5	11/6/12 10:53	9.5	1.14	1.14	0.095	1.67	1.67	245.9
2	9.5	12:33	19	1.14	2.29	0.095	1.67	3.33	15.0
3	9.5	14:13	28.5	1.14	3.43	0.095	1.67	5.00	11.7
4	9.0	15:53	37.5	1.08	4.52	0.09	1.67	6.67	147.1
5	9.0	17:33	46.5	1.08	5.60	0.09	1.67	8.33	1275.7
6	9.0	19:13	55.5	1.08	6.69	0.09	1.67	10.00	1253.7
7	9.0	20:53	64.5	1.08	7.77	0.09	1.67	11.67	828.7
8	9.0	22:33	73.5	1.08	8.86	0.09	1.67	13.33	661.1
9	9.0	11/7/12 0:13	82.5	1.08	9.94	0.09	1.67	15.00	489.1
10	9.0	1:53	91.5	1.08	11.02	0.09	1.67	16.67	326.0
11	9.5	3:33	101	1.14	12.17	0.095	1.67	18.33	271.9
12	9.5	5:13	110.5	1.14	13.31	0.095	1.67	20.00	198.9
13	9.0	6:53	119.5	1.08	14.40	0.09	1.67	21.67	144.5
14	9.0	8:33	128.5	1.08	15.48	0.09	1.67	23.33	144.1
15	9.0	10:13	137.5	1.08	16.57	0.09	1.67	25.00	128.1
16	9.0	11:53	146.5	1.08	17.65	0.09	1.67	26.67	113.0
17	9.0	13:33	155.5	1.08	18.73	0.09	1.67	28.33	103.7
18	9.0	15:13	164.5	1.08	19.82	0.09	1.67	30.00	94.5
19	9.0	16:53	173.5	1.08	20.90	0.09	1.67	31.67	82.2
20	9.0	18:33	182.5	1.08	21.99	0.09	1.67	33.33	78.1
21	9.0	20:13	191.5	1.08	23.07	0.09	1.67	35.00	71.7

11/6/12 0903 Start Flow @0903
PUMP RATE = 0.10mL/min.
1st Water to SOIL col @ 0904
~10:27 SOIL Col. filled (83min)
PV = 8.3 mL
Flow 1st reached frac. col. tube
@ 10:53 (26 min ~2.6mL in outlet tube)
↑
Start Frac coll.

Pump rate = 0.10 mL/min
Collect Time = 100min

* yellow brown color noted in 1st sample
subsequent samples clear

11/19 change PV to account for 0.095 flow rate to 7.9ml

Riverton Column 2 T08-03 2.5-5'

Tube No	Fluid in Tube (mL)	Tube Start Date/Time	Cum Vol (mL)	1 PV= PV	Cum PV	Flow Rate (mL/min)	Collect Time (hr)	Cum Collect Time (hr)	U (ug/L)	10	11	12	13
22	9.0	11/7/12 21:53	200.5	1.08	24.16	0.09	1.67	36.67	61.7				
23	9.0	23:33	209.5	1.08	25.24	0.09	1.67	38.33	56.9				
24	9.0	11/8/12 1:13	218.5	1.08	26.33	0.09	1.67	40.00	52.6				
25	9.0	2:53	227.5	1.08	27.41	0.09	1.67	41.67	50.0				
26	9.0	4:33	236.5	1.08	28.49	0.09	1.67	43.33	45.3				
27	9.0	6:13	245.5	1.08	29.58	0.09	1.67	45.00	41.1				
28	9.0	7:53	254.5	1.08	30.66	0.09	1.67	46.67	38.1				
29	9.0	9:33	263.5	1.08	31.75	0.09	1.67	48.33	39.7				
30	9.0	11:13	272.5	1.08	32.83	0.09	1.67	50.00	37.8				
31	9.0	12:53	281.5	1.08	33.92	0.09	1.67	51.67	34.7				
32	9.0	14:33	290.5	1.08	35.00	0.09	1.67	53.33	32.1				
33	9.0	16:13	299.5	1.08	36.08	0.09	1.67	55.00	31.5				
34	9.0	17:53	308.5	1.08	37.17	0.09	1.67	56.67	29.0				
35	9.0	19:33	317.5	1.08	38.25	0.09	1.67	58.33	27.3				
36	9.0	21:13	326.5	1.08	39.34	0.09	1.67	60.00	25.8				
37	9.0	22:53	335.5	1.08	40.42	0.09	1.67	61.67	25.5				
38	9.0	11/9/12 0:33	344.5	1.08	41.51	0.09	1.67	63.33	22.0				
39	9.0	2:13	353.5	1.08	42.59	0.09	1.67	65.00	21.1				
40	9.0	3:53	362.5	1.08	43.67	0.09	1.67	66.67	20.7				
41	9.0	5:33	371.5	1.08	44.76	0.09	1.67	68.33	19.4				
42	9.0	7:13	380.5	1.08	45.84	0.09	1.67	70.00	16.2				
43	9.0	8:53	389.5	1.08	46.93	0.09	1.67	71.67	17.7				
44	9.0	10:33	398.5	1.08	48.01	0.09	1.67	73.33	15.2				

RIVERTON COLUMN 3 T07-04 0-25'

11/6/2012 0700 Filling column. SAme set up as Column 1. 25mL OMNI glass column. flow bottom to top
<2mm Sieved fraction.

Empty ColumN = 63.11 g
Col + Fill = 95.09 g
Soil LOST = 31.98 g

Mostly silt & clay. Scattered rootlets
Soil Column length = 11.8 cm Vol = 11.8 x 1.7671 = 20.85 mL
Density (DRY) = 31.98/20.85 = 1.53 g/mL

START FLOW 11/6/12 14:04
1st WAter to SoiL @ 14:05
Water to top of SoiL @ ~15:33 (88 mins)
8.8 mL
FIRST Drip to Frac Coll @ 16:04

pump speed = 0.10 ml/min
Collect Time = 100 mins

Clear yellow brown 1st sample
Subsequent samples clear

TUBE No.	Fluid in Tube (mL)	TUBE START DATE/TIME	Cum Vol (mL)	1pv = ~~8.8mL~~ 8.4 PV	Cum PV	Flow RATE (mL/min)	Collect Time (hr)	Cum Collect Time (hr)	U (µg/L)
1	9.5	11/6/12 16:04	9.5	1.08	1.08	0.095	1.67	1.67	298.4
2	9.5	17:44	19	1.08	2.16	0.095	1.67	3.33	92.3
3	9.5	19:24	28.5	1.08	3.24	0.095	1.67	5.00	234.9
4	9.5	21:04	38	1.08	4.32	0.095	1.67	6.67	331.9
5	9.5	22:44	47.5	1.08	5.40	0.095	1.67	8.33	399.6
6	9.5	11/7/12 0:24	57	1.08	6.48	0.095	1.67	10.00	276.9
7	9.5	2:04	66.5	1.08	7.56	0.095	1.67	11.67	218.9
8	10.0	3:44	76.5	1.14	8.69	0.10	1.67	13.33	162.1
9	9.5	5:24	86	1.08	9.77	0.095	1.67	15.00	140.8
10	9.5	7:04	95.5	1.08	10.85	0.095	1.67	16.67	111.5
11	9.0	8:44	104.5	1.02	11.88	0.09	1.67	18.33	67.7
12	9.0	10:24	113.5	1.02	12.90	0.09	1.67	20.00	63.3
13	9.0	12:04	122.5	1.02	13.92	0.09	1.67	21.67	45.3
14	9.0	13:44	131.5	1.02	14.94	0.09	1.67	23.33	40.1
15	9.0	15:24	140.5	1.02	15.97	0.09	1.67	25.00	37.8
16	9.0	17:04	149.5	1.02	16.99	0.09	1.67	26.67	37.1
17	9.0	18:44	158.5	1.02	18.01	0.09	1.67	28.33	39.9
18	9.0	20:24	167.5	1.02	19.03	0.09	1.67	30.00	40.3
19	9.0	22:04	176.5	1.02	20.06	0.09	1.67	31.67	43.9
20	9.5	23:44	186	1.08	21.14	0.095	1.67	33.33	41.5
21	9.5	11/8/12 1:24	195.5	1.08	22.22	0.095	1.67	35.00	40.4

* Some drips missed tubes

Ul3

TUBE No		Fluid in TUBE(mL)	TUBE START DATE/time	cum VOL(mL)	1pV= 8.4 4 PV	cum 5 PV	FLOW RATE 6(mL/min)	collect TIME 7 (hr)	cum collect 8 Time(hr)	U 9 (ug/L)	10	11	12	13
22	1	9.0	11/8/12 3:04	204.5	1.02	23.24	0.09	1.67	36.67	37.8				
23	2	9.5	4:44	214	1.08	24.32	0.095	1.67	38.33	35.9				
24	3	9.0	6:24	223	1.02	25.34	0.09	1.67	40.00	36.2				
25	4	9.0	8:04	232	1.02	26.36	0.09	1.67	41.67	33.8				
26	5	9.0	9:44	241	1.02	27.39	0.09	1.67	43.33	31.7				
27	6	9.0	11:24	250	1.02	28.41	0.09	1.67	~~50.00~~ 45.00	28.7				
28	7	9.0	13:04	259	1.02	29.43	0.09	1.67	~~51.67~~ 46.67	25.3				
29	8	9.0	14:44	268	1.02	30.45	0.09	1.67	~~53.33~~ 48.33	25.7				
30	9	* ~~8.5~~ 9	16:24	277	1.02	31.48	0.09	1.67	~~55.00~~ 50.00	22.9				
31	10	~~8.0~~ 9	18:04	286	1.02	32.50	0.09	1.67	~~56.67~~ 51.67	23.1				
32	11	~~8.0~~ 9	19:44	295	1.02	33.52	0.09	1.67	~~58.33~~ 53.33	22.7				
33	12	~~8.5~~ 9	21:24	304	1.02	34.55	0.09	1.67	~~60.00~~ 55.00	21.4				
34	13	~~8.0~~ 9	23:04	313	1.02	35.57	0.09	1.67	~~61.67~~ 56.67	18.3				
35	14	~~8.0~~ 9	11/9/12 0:44	322	1.02	36.59	0.09	1.67	~~63.33~~ 58.33	17.2				
36	15	~~8.0~~ 9	2:24	331	1.02	37.61	0.09	1.67	~~65.00~~ 60.00	17.8				
37	16	~~8.5~~ 9	4:04	340	1.02	38.64	0.09	1.67	~~66.67~~ 61.67	17.2				
38	17	9.0	5:44	349	1.02	39.66	0.09	1.67	~~68.33~~ 63.33	20.3				
39	18	9.0	7:24	358	1.02	40.68	0.09	1.67	65.00	17.6				
40	19	9.0	9:04	367	1.02	41.70	0.09	1.67	66.67	17.4				
41	20	9.0	10:44	376	1.02	42.73	0.09	1.67	68.33	16.9				
42	21	9.0	12:24	385	1.02	43.75	0.09	1.67	70.00	15.5				
43	22	9.5	14:24	394.5	1.08	44.83	0.095	1.67	71.67	14.9				
44	23	9.0	15:44	403.5	1.02	45.85	0.09	1.67	73.33	16.0				
	24	Stop flow @ 17:23												
	25													
	26													
	27													
	28													
	29													
	30													
	31													

Small Amount was lost (missed tubes)
✓Corrections were made (minimal error)
Best guess

Riverton Column 4 T07-04 2.5-5'

11/6/12 1400 Filling column. Same set up as Column 1. 25mL Omni glass column. Flow bottom to top

<2mm sieved fraction.

Empty column = 78.01g

Col + Fill = 114.36g

Soil wgt. = 36.35g

Mostly Sand, some silt.

Soil column length = 11.8 cm Vol = 11.8 × 1.7671 = 20.85mL

Density (dry) = 36.35g/20.85mL = 1.74g/mL

Start flow 11/7/12 09:02

1st water to soil @ 09:03

Water to top of soil @ ~~09:57~~ 09:59

1st drip to fraction collector @ 10:21

Pump rate set @ 0.12mL/min

Tube No.	Fluid in Tube (mL)	Tube Start Date/Time	Cum Vol. (mL)	1pV = 5.6 mL PV	Cum PV	Flow Rate (mL/min)	Collect Time (hr)	Cum Collect Time (hr)	U (µg/L)
1	9.5	11/7 ~~11/6~~/12 10:21	9.5	1.70	1.70	0.095	1.67	1.67	392.7
2	9.5	12:01	19	1.70	3.39	0.095	1.67	3.34	147.4
3	9.5	13:41	28.5	1.70	5.09	0.095	1.67	5.01	66.6
4	9.5	15:21	38	1.70	6.79	0.095	1.67	6.68	43.6
5	9.5	17:01	47.5	1.70	8.48	0.095	1.67	8.35	30.8
6	9.5	18:41	57	1.70	10.18	0.095	1.67	10.02	25.4
7	9.5	20:21	66.5	1.70	11.88	0.095	1.67	11.69	18.0
8	9.5	22:01	76	1.70	13.57	0.095	1.67	13.36	15.2
9	9.5	23:41	85.5	1.70	15.27	0.095	1.67	15.03	14.1
10	9.5	11/8/12 1:21	95	1.70	16.96	0.095	1.67	16.67	11.4
11	9.5	3:01	104.5	1.70	18.66	0.095	1.67	18.33	10.5
12	9.5	4:41	114	1.70	20.36	0.095	1.67	20.00	9.5
13	10	6:21	124	1.79	22.14	0.10	1.67	21.67	7.9
14	9.5	8:01	133.5	1.70	23.84	0.095	1.67	23.33	7.6
15	9.5	9:41	143	1.70	25.54	0.095	1.67	25.00	7.8
16	9.5	11:21	152.5	1.70	27.23	0.095	1.67	26.67	6.5
17	9.5	13:01	162	1.70	28.93	0.095	1.67	28.33	7.5
18	9.5	14:41	171.5	1.70	30.63	0.095	1.67	30.00	7.3
19	9.5	16:21	181	1.70	32.32	0.095	1.67	31.67	6.4
20	9.5	18:01	190.5	1.70	34.02	0.095	1.67	33.33	6.2
21	9.5	19:41	200	1.70	35.71	0.095	1.67	35.00	5.8

PV = 5.6mL ?

Pump speed = 0.12 mL/min
Collect Time = 100 min

No color noted in samples

PV = 5.3

Col 4

Tube No.		Fluid in Tube (mL)	Tube Start Date/Time	Cum Vol (mL)	1pV=5.6 4 PV	cum 5 PV	Flow Rate (mL/min)	Collect time 7 (hr)	Cum collect Time (hr)	U 9 (µg/L)	10	11	12	13
22	1	9.5	11/8/12 21:21	209.5	1.70	37.41	0.095	1.67	36.67	5.2				
23	2	9.5	23:01	219	1.70	39.11	0.095	1.67	38.33	4.1				
24	3	9.5	11/9 0:41	228.5	1.70	40.80	0.095	1.67	40.00	4.6				
25	4	9.5	2:21	238	1.70	42.50	0.095	1.67	41.67	4.4				
26	5	9.5	4:01	247.5	1.70	44.20	0.095	1.67	43.33	3.1				
27	6	9.5	5:41	257	1.70	45.89	0.095	1.67	45.00	3.2				
28	7	9.5	7:21	266.5	1.70	47.59	0.095	1.67	46.67	2.9				
29	8	9.5	9:01	276	1.70	49.29	0.095	1.67	48.33	3.2				
30	9	9.5	10:41	285.5	1.70	50.98	0.095	1.67	50.00	2.9				
31	10	9.5	12:21	295	1.70	52.68	0.095	1.67	51.67	2.7				
32	11	9.5	14:01	304.5	1.70	54.38	0.095	1.67	53.33	3.6				
33	12	9.5	15:41	314	1.70	56.07	0.095	1.67	55.00	3.0				
34	13	9.5	17:21	323.5	1.70	57.77	0.095	1.67	56.67	2.7				
35	14	9.5	19:01	333	1.70	59.46	0.095	1.67	58.33	2.8				
36	15	10	20:41	343	1.79	61.25	0.10	1.67	60.00	2.1				
37	16	10	22:21	353	1.79	63.04	0.10	1.67	61.67	2.0				
38	17	10	11/10 0:01	363	1.79	64.82	0.10	1.67	63.33	2.4				
39	18	10	1:41	373	1.79	66.61	0.10	1.67	65.00	2.8				
40	19	10	3:21	383	1.79	68.39	0.10	1.67	66.67	2.7				
41	20	10	5:01	393	1.79	70.18	0.10	1.67	68.33	1.9				
42	21	10	6:41	403	1.79	71.96	0.10	1.67	70.00	1.8				
43	22	10	8:21	413	1.79	73.75	0.10	1.67	71.67	1.7				
~~44~~	23	not collected												
D/C	24	11/10/12	@ 10:02											
	25													
	26													
	27													
	28													
	29													
	30													
	31													

* reset frac collector to position 1
@ start of tube 32

Riverton Column 5 T06-10 0-2.5'

11/9/12 1300 fill column. Same setup as Column 1. 25ml Omni glass column. Flow bottom to top
<2mm sieved fraction
Empty column = 63.17 g
Col + fill = 95.34 g
soil weight 32.17

soil column length = 11.8 cm Vol 11.8 x 1.7671 = 20.85 ml
Density (dry) = 32.17 / 20.85 = 1.54 g/ml

Tube #	Eluted in Tube (ml)	Tube Start Date/Time	Cum Vol (ml)	1 PV=~~23~~ AT =6.2 PV	Cum PV	Flow Rate ml/min	Collect Time (hr)	Cum. Collect Time (hr)	U (ug/L)	
1	8.5 yellow	11/9 15:30	8.5	1.16	1.16	0.085	1.67	1.67	703.7	*
2	8.5	17:10	17	1.16	2.33	0.085	1.67	3.33	666.1	*
3	9	18.50	26	1.23	3.56	0.09	1.67	5.00	616.6	*
4	9	20:30	35	1.23	4.79	0.09	1.67	6.67	542.7	*
5	9	22:10	44	1.23	6.03	0.09	1.67	8.33	327.5	*
6	9	23:50	53	1.23	7.26	0.09	1.67	10.00	285.9	*
7	8.5	11/10 1:30	61.5	1.16	8.42	0.085	1.67	11.67	244.7	*
8	9	3:10	70.5	1.23	9.66	0.09	1.67	13.33	214.9	*
9	9	4:50	79.5	1.23	10.89	0.09	1.67	15.00	186.2	*
10	9	6:30	88.5	1.23	12.12	0.09	1.67	16.67	156.6	*
11	9	8:10	97.5	1.23	13.36	0.09	1.67	18.33	134.2	*
12	9	9:50	106.5	1.23	14.59	0.09	1.67	20.0	133.3	*
13	9	11:30	115.5	1.23	15.82	0.09	1.67	21.67	101.8	*
14	9	13:10	124.5	1.23	17.05	0.09	1.67	23.33	84.3	*
15	9	14:50	133.5	1.23	18.29	0.09	1.67	25.00	72.0	
16	9	16:30	142.5	1.23	19.52	0.09	1.67	26.67	64.7	
17	9	18:10	151.5	1.23	20.75	0.09	1.67	28.33	63.1	
18	9	19:50	160.5	1.23	21.99	0.09	1.67	30.00	57.2	
19	9	21:30	169.5	1.23	23.22	0.09	1.67	31.67	56.7	
20	9	23:10	178.5	1.23	24.45	0.09	1.67	33.33	55.0	
21	9	11/11 0:50	187.5	1.23	25.68	0.09	1.67	35.00	49.4	

Start flow 13:50 11/9/12
1st water to soil 13:51
Water to top of soil @ 15:03 (73 min)

First drip to frac coll. @ 15:30

pump rate 0.1 ml/min PV = 7.3 ml
tubing Vol (27 min) 2.7 ml

* Water (Effluent) has a yellow-brown color

pump speed = 0.10 mL/min
Collect Time = 100 min

decreasing yellow intensity in tubes thru 14

Sample 15 is Clear

1/7/13 AT PV calculated using volume in 1st tube. 73 min x 0.085 mL/min = 6.2 mL

Col 5 cont.

Col 5 cont.

Tube #	Fluid in tube (mL)	Tube Start Date/Time	3 Cum Vol (mL)	4 PV (1 PV = ~~7.3~~ 6.2 AT)	5 Cum. PV	Flow Rate (mL/min)	7 Collect Time (hr)	Cum Collect Time (hr)	U (µg/L)	10	11	12	13
22	9	11/11 2:30	196.5	1.23	26.92	0.09	1.67	36.67	50.3				
23	9	4:10	205.5	1.23	28.15	0.09	1.67	38.33	50.3				
24	9	5:50	214.5	1.23	29.38	0.09	1.67	40.00	43.1				
25	9	7:30	223.5	1.23	30.62	0.09	1.67	41.67	41.4				
26	9	9:10	232.5	1.23	31.85	0.09	1.67	43.33	38.6				
27	9	10:50	241.5	1.23	33.08	0.09	1.67	45.0	38.9				
28	9	12:30	250.5	1.23	34.32	0.09	1.67	46.67	35.4				
29	9	14:10	259.5	1.23	35.55	0.09	1.67	48.33	37.5				
30	9	15:50	268.5	1.23	36.78	0.09	1.67	50.00	35.7				
31	9	17:30	277.5	1.23	38.01	0.09	1.67	51.67	29.7				
32	9	19:10	286.5	1.23	39.25	0.09	1.67	53.33	32.4				
33	9	20:50	295.5	1.23	40.48	0.09	1.67	55.00	30.2				
34	9	22:30	304.5	1.23	41.71	0.09	1.67	56.67	27.5				
35	9	11/12 0:10	313.5	1.23	42.95	0.09	1.67	58.33	27.7				
36	9	1:50	322.5	1.23	44.18	0.09	1.67	60.00	26.2				
37	9	3:30	331.5	1.23	45.41	0.09	1.67	61.67	24.3				
38	9	5:10	340.5	1.23	46.64	0.09	1.67	63.33	23.3				
39	9	6:50	349.5	1.23	47.88	0.09	1.67	65.00	21.6				
40	9	8:30	358.5	1.23	49.11	0.09	1.67	66.67	21.5				
41	9	10:10	367.5	1.23	50.34	0.09	1.67	68.33	20.5				
42	9	11:50	376.5	1.23	51.58	0.09	1.67	70.00	21.7				
43	9	13:30	385.5	1.23	52.81	0.09	1.67	71.67	19.4				
44	9	15:10	394.5	1.23	54.04	0.09	1.67	73.33	19.6				
end	11/12/12 @ 16:50												

Riverton Column 6 T06-10 @ 2.5-5'

11/9/12 1400 fill column Same setup as col 1. 25ml Omni glass column Flow bottom to top
<2mm sieved fraction
Empty column = 61.62g
Col + fill = 99.04g
soil weight = 37.42g

soil col. length = 11.8cm Vol 11.8 × 1.7671 = 20.85 mL
Density (dry) 37.42/20.85 = 1.79 g/mL

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol (mL)	1 PV = ~~20~~ ml At 8.1 PV	Cum. PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Collect Time (hr)	U (ug/L)
1	9 x	11/10/12 1443	9	1	1	0.09	1.67	1.67	* 224.3
2	9	16:23	18	1	2	↓	↓	3.33	125.5
3	9	18:03	27	1	3			5.00	97.9
4	9	19:43	36	1	4			6.67	54.9
5	9	21:23	45	1	5			8.33	41.0
6	9	23:03	54	1	6			10.00	31.9
7	9	11/11 0:43	63	1	7			11.67	31.7
8	9	2:23	72	1	8			13.33	28.3
9	9	4:03	81	1	9			15.00	23.2
10	9	5:43	90	1	10			16.67	19.4
11	9	7:23	99	1	11			18.33	16.5
12	9	9:03	108	1	12			20.0	15.0
13	9	10:43	117	1	13			21.67	11.8
14	9	12:23	126	1	14			23.33	11.2
15	9	14:03	135	1	15			25.0	10.1
16	9	15:43	144	1	16			26.67	9.9
17	9	17:23	153	1	17			28.33	9.1
18	9	19:03	162	1	18			30.0	8.3
19	9	20:43	171	1	19			31.67	8.4
20	9 ✓	22:23	180	1	20			33.33	7.3
21	9 ✓	11/12 0:03	189	1	21	↓	↓	35.0	7.0

Start flow @ 11/10/12 1242
1st Water to soil @ 1243
Water to top of soil @ 1413 (90 mins)
First drip to frac coll. @ 1443
start Frac coll ↗

pump speed = 0.10 mL/min
collect time = 100 min

* sl. yellow tinge to effluent tube 1

✓ frac collector misaligned tubes contain 8 mL, should = 9

tube 2 → end are clear

1/7/13 PV calculated using volume in 1st tube. 90 min × 0.09 mL/min = 8.1 mL

Column 6 cont

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol (ml)	1PV= 8.1mL AT ~~9.0mL~~ PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Collect Time (hr)	U (ug/L)	10	11	12	13
22	9 ✓	11/12 01:43	198	1	22	0.09	1.67	36.67	7.2				
23	9 ✓	3:23	207	1	23	↓	↓	38.33	6.7				
24	9 ✓	5:03	216	1	24			40.00	5.8				
25	9	6:43	225	1	25			41.67	5.5				
26	9	8:23	234	1	26			43.33	5.3				
27	9	10:03	243	1	27			45.00	5.0				
28	9	11:43	252	1	28			46.67	5.0				
29	9	13:23	261	1	29			48.33	5.0				
30	9	15:03	270	1	30			50.00	5.0				
31	9	16:43	279	1	31			51.67	5.3				
32	9	18:23	288	1	32			53.33	5.4				
33	9	20:03	297	1	33			55.00	5.2				
34	9	21:43	306	1	34			56.67	5.1				
35	9	23:23	315	1	35			58.33	4.7				
36	9	11/13 1:03	324	1	36			60.00	4.6				
37	9	2:43	333	1	37			61.67	4.3				
38	9	4:23	342	1	38			63.33	4.6				
39	9	6:03	351	1	39			65.00	4.4				
40	9	7:43	360	1	40			66.67	4.3				
41	9	9:23	369	1	41			68.33	4.3				
42	9	11:03	378	1	42			70.00	4.3				
43	9	12:43	387	1	43			71.67	4.3				
44	9	14:23	396	1	44			73.33	4.2				
end	11/13/12 @16:												

Riverton Col 7 T05-02 0-2.5

11/9/12 Fill column Same setup as Col 1 25ml Omniglass column Flow bottom to top

<2mm sieved fraction

~~11.5~~ ~~11.8~~ 11.5 *soil shift to 11.5 once filled

Empty column ~~61.65g~~ 62.05

Col + fill ~~91.56~~ 96.80

Soil weight ~~29.91~~ 34.75 x 0.5 = 17.37g soil

see note below

Soil col. length = ~~11.8~~cm

Vol 11.~~8~~5 x 1.7671 = ~~20.85~~ 20.32 ml

Density (dry) ~~29.91~~/20.3~~2~~ = ~~1.43~~g/ml

34.75 ? ~~1.67~~g/mL ?

1.71g/ml

Tube #	Fluid in Tube (ml)	Tube Start date/time	Cum Vol (ml)	1 PV=~~7.0~~ ~~6.4~~ 5.3 AT PV	Cum PV	Flow Rate ml/min	Collect Time (hr)	Cum Collect time (hr)	U (ug/L)
1	9.0	11/12 11:10	9	~~1.29~~ 1.4	1.29 1.41	0.09	1.67	1.67	1590.5
2	9	12:50	18	~~1.29~~ 1.41	2.57 2.81			3.33	307.8
3	9	14:30	27	~~1.29~~ 1.41	3.86 4.22			5.00	191.9
4	9	16:10	36	1.29 1.41	5.14 5.63			6.67	142.9
5	9	17:50	45	1.29 1.41	6.43 7.03			8.33	133.5
6	9	19:30	54	1.29 1.41	7.71 8.44			10.00	114.3
7	9	21:10	63	1.29 1.41	9.00 9.84			11.67	122.4
8	9	22:50	72	1.29 1.4	10.29 11.25			13.33	101.8
9	9	11/13 00:30	81	1.29 1.41	11.51 12.66			15.00	97.7
10	9	2:10	90	1.29 1.41	12.86 14.06			16.67	87.2
11	9	3:50	99	1.29 1.41	14.14 15.47			18.33	78.4
12	9	5:30	108	1.29 1.41	15.43 16.88			20.00	81.6
13	9	7:10	117	1.29 1.41	16.71 18.78			21.67	99.5
14	9	8:50	126	1.29 1.41	18.0 19.69			23.33	75.0
15	9	10:30	135	1.29 1.41	19.29 21.09			25.00	82.9
16	8.5	12:10	143.5	1.21 1.33	20.50 22.42	0.085		26.67	101.0
17	8.5	13:50	152	1.21 1.33	21.71 23.75	0.085		28.33	97.6
18	8	15:30	160	1.14 1.25	22.86 25.00	0.08		30.00	89.2
19	8	17:10	168	1.14 1.25	24.0 26.25	0.08		31.67	88.1
20	8	18:50	176	1.14 1.25	25.14 27.50	0.08		33.33	97.3
21	8	20:30	184	1.14 1.25	26.29 28.75	0.08		35.00	88.9

Start flow @ 11/10/12 12:42

1st Water to soil @ 12:43

Water to top of soil @

First drip to frac coll @

Start frac. coll

pump speed = 0.12 mL/min
Collect time = 100 min

Column "separated" at bottom (soil col moved up) 5mm. Will need to substract 1.7671 x 0.5 = 0.8836 mL from PV calc.

Flow stopped while column being filled (About ½ way full).

11/12 Repack col w/ 50/50 mix by weight of T05-02 0-2.5 and Unimin sand #2075.

start flow 11/12/12 @ 9:32

1st water 9:33

Top of col @ 10:43 (~~70min~~)

1st drip, start frac coll 11:10

Pale yellow color tube 1, some brown ppt. others are clear

top of soil @ 10:37 (64min)

RW. Col 7 cont. ~~64~~ 5.8mL AT 1PV = 70mL

Tube #	Fluid in tube (ml)	2 Tube Start (Date/Time)	3 Cum Vol (ml)	4 PV	5 Cum PV	6 Flowrate (ml/min)	7 Collect Time (hr)	8 Cum Collect (hr)	9 U (ug/L)	10 Cum PV
22	7.5	11/13 22:10	191.5	~~1.07~~ 1.17	27.36	0.075	~~3~~ 1.67	36.67	94.5	29.92
23	7.5	23:50	199.0	~~1.07~~ 1.17	28.43	0.075	1.67	38.33	82.5	31.09
24	7	11/14 1:30	206	~~1~~ 1.09	29.43	0.07	1.67	40.00	88.5	32.19
25	7	3:10	213	~~1~~ 1.09	30.43	0.07	1.67	41.67	83.3	33.28
26	7	4:50	220	~~1~~ 1.09	31.43	0.07	1.67	43.33	86.1	34.38
27	7	6:30	227	~~1~~ 1.09	32.43	0.07	1.67	45.00	78.7	35.47
28	7	* 8:10	234	~~1~~ 1.09	33.43	0.07	1.67	46.67	128.1	36.56
29	6.5	9:50	240.5	~~0.93~~ 1.02	34.36	0.065		48.33	94.7	37.58
30	6.5	11:30	247	~~0.93~~ 1.02	35.29	0.065		50.00	83.4	38.59
31	6	13:10	253	~~0.86~~ 0.94	36.14	0.06		51.67	90.7	39.53
32	6	14:50	259	~~0.86~~ 0.94	37.0	0.06		53.33	88.6	40.47
33	6	16:30	265	~~0.86~~ 0.94	37.86	0.06		55.00	78.1	41.41
34	5.5	18:10	270.5	~~0.79~~ 0.86	38.64	0.055		56.67	88.7	42.27
35	5.5	19:50	276	~~0.79~~ 0.86	39.43	0.055		58.33	76.0	43.13
36	5.5	21:30	281.5	~~0.79~~ 0.86	40.21	0.055		60.00	77.0	43.98
37	5.5	23:10	287	~~0.79~~ 0.86	41.0	0.055		61.67	81.0	44.84
38	5.5	11/15 0:50	292.5	~~0.79~~ 0.86	41.79	0.055		63.33	81.0	45.70
39	5	2:30	297.5	~~0.71~~ 0.78	42.5	0.05		65.00	81.7	46.48
40	5	4:10	302.5	~~0.71~~ 0.78	43.21	0.05		66.67	75.3	47.27
41	5	5:50	307.5	~~0.71~~ 0.78	43.93	0.05		68.33	73.6	48.05
42	5	7:30	312.5	~~0.71~~ 0.78	44.64	0.05		70.00	69.8	48.83
43	6	9:10	318.5	~~0.86~~ 0.94	45.50	0.06		71.67	63.2	49.77
44	5	10:50	323.5	~~0.71~~ 0.78	46.21	0.05		73.33	63.7	50.55

D/C flow 11/16/12 @ 12:30

* pause collection ~2min to ck pump lines. No obstruction

1/7/13 PV calculated using volume in 1st tube.
Using column started 11/12
64min to fill.
64min x 0.09mL/min
= 5.8mL

Riverton Col 8 T05-02 @ 2.5-5'

11/12/12 Fill column. Same setup as Col 1 25ml Omnifit glass column Flow bottom to top

<2MM sieved fraction

Empty col 62.54g

Col + fill 94.68g

Soil weight 32.14

Soil col length = 11.8cm Vol ~~=~~ 11.8 x 1.7671 = 20.85ml

Density (dry) 32.14 / 20.85 = 1.54g/ml

Start flow 10:05

1st water to soil 10:06

Top of column 11:24 (78min)

Start frac coll. 11:45

1 PV = ~~7.8~~ ~~7.1~~ 6.0mL AT

Tube#	Fluid in Tube (ml)	Tube Start date/Time	Cum Vol (ml)	PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Collect Time (hr)	U (ug/L)
1	8.5	11/13 11:45	8.5	~~1.09~~ 1.20	~~1.09~~ 1.20	0.085	1.67	1.67	1176.5 *
2	9	13:25	17.5	~~1.15~~ 1.27	~~2.24~~ 2.46	0.09	↓	3.33	1509.0
3	9	15:05	26.5	~~1.15~~ 1.27	~~3.40~~ 3.73	0.09		5.00	855.8
4	9	16:45	35.5	~~1.15~~ 1.27	~~4.55~~ 5.0	0.09		6.67	463.8
5	9	18:25	44.5	~~1.15~~ 1.27	~~5.71~~ 6.27	0.09		8.33	304.9
6	9	20:05	53.5	~~1.15~~ 1.27	~~6.86~~ 7.54	0.09		10.00	205.1
7	9	21:45	62.5	~~1.15~~ 1.27	~~8.01~~ 8.80	0.09		11.67	163.7
8	9	23:25	71.5	~~1.15~~ 1.27	~~9.17~~ 10.07	0.09		13.33	124.1
9	9	11/14 1:05	80.5	~~1.15~~ 1.27	~~10.32~~ 11.34	0.09		15.00	108.0
10	9	2:45	89.5	~~1.15~~ 1.27	~~11.47~~ 12.61	0.09		16.67	95.5
11	9	4:25	98.5	~~1.15~~ 1.27	~~12.63~~ 13.87	0.09		18.33	86.4
12	9	6:05	107.5	~~1.15~~ 1.27	~~13.78~~ 15.14	0.09		20.00	73.1
13	9	7:45	116.5	~~1.15~~ 1.27	~~14.94~~ 16.41	0.09		21.67	69.9
14	9	9:25	125.5	1.27 ↓	~~16.09~~ 17.68	↓		23.33	61.4
15	9	11:05	134.5		~~17.24~~ 18.94			25.00	59.8
16	9	12:45	143.5		~~18.40~~ 20.21			26.67	54.3
17	9	14:25	152.5		~~19.55~~ 21.48			28.33	52.1
18	9	16:05	161.5		~~20.71~~ 22.75			30.00	49.7
19	9	17:45	170.5		~~21.86~~ 24.01			31.67	45.1
20	9	19:25	179.5		~~23.01~~ 25.28			33.33	41.6
21	9	21:05	188.5		~~24.17~~ 26.55		↓	35.00	36.3

* sample clear yellow

Subsequent samples are clear

Top column

~~top of soil~~ @ 1117 = 71 min

1/7/13 PV calculated using volume in 1st tube.

71min x 0.085mL/min = 6.0mL

Col 8 cont

Tube #	Fluid in tube (ml)	Tube Start	Cum Vol (ml)	1 PV = ~~7.8~~ 7.1 6.0mL AT PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Collect (h)	U ug/L
22	9	11/14 22:45	197.5	~~1.15~~ 1.27	~~25.32~~ 27.80	0.09	1.67	36.67	32.3
23	9	11/15 00:25	206.5		~~26.47~~ 29.08			38.33	34.1
24	9	2:05	215.5		~~27.63~~ 30.35			40.00	28.3
25	9	3:45	224.5		~~28.78~~ 31.62			41.67	24.7
26	9	5:25	233.5		~~29.94~~ 32.89			43.33	23.8
27	9	7:05	242.5		~~31.09~~ 34.15			45.0	20.2
28	9	8:45	251.5		~~32.24~~ 35.42			46.67	20.7
29	9	10:25	260.5		~~33.40~~ 36.69			48.33	20.9
30	9	12:05	269.5		~~34.55~~ 37.96			50.00	18.7
31	9	13:45	278.5		~~35.71~~ 39.23			51.67	16.9
32	9	15:25	287.5	1.27	40.49			53.33	17.5
33	9	17:05	296.5		41.76			55.00	17.1
34	9	18:45	305.5		43.03			56.67	16.4
35	9	20:25	314.5		44.30			58.33	16.5
36	9	22:05	323.5		45.56			60.00	15.9
37	9	23:45	332.5		46.83			61.67	14.3
38	9	11/16 01:25	341.5		48.10			63.33	13.9
39	9	03:05	350.5		49.37			65.00	12.8
40	9	04:45	359.5		50.63			66.67	11.5
41	9	06:25	368.5		51.90			68.33	11.4
42	9	08:05	377.5		53.17			70.00	10.5
43	9	09:45	386.5		54.44			71.67	10.0
44	9	11:25	395.5		55.70			73.33	10.4

D/C flow 11/16/12 @

Riverton Col 9 T04-10 0-2.5

11/14/12 Fill column. Same setup as Col 1 25 ml Omnifit glass column Flow bottom to top

<2mm sieved fraction

empty col 61.29 g

Col. + fill 91.57 g

soil weight 30.28 g

Soil Col. length 11.8 cm Vol 11.8 x 1.7671 = 20.85 ml

Density (dry) 30.28/1.7671 = 1.45 g/ml

1 PV = ~~9.0~~ml ~~8.9~~ 8.0**

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol ml	PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Coll. Time (hr)	U (ug/L)
1	9	* 11/14 15:39	9	1.01	1.01	0.09	1.67	1.67	839.4
2	9	17:19	18	1.01	2.02			3.33	485.0
3	9	18:59	27	1.01	3.03			5.00	538.7
4	9	20:39	36	1.01	4.04			6.67	949.7
5	9	22:19	45	1.01	5.06			8.33	907.7
6	9	23:59	54	1.01	6.07			10.00	692.6
7	9	11/15 1:39	63	1.01	7.08			11.67	396.3
8	9	3:19	72	1.01	8.09			13.33	250.5
9	9	4:59	81	1.01	9.10			15.0	206.7
10	9	6:39	90	1.01	10.11			16.67	208.1
11	9	8:19	99	1.01	11.12			18.33	224.5
12	9	9:59	108	1.01	12.13			20.00	217.0
13	9	11:39	117	1.01	13.15			21.67	225.7
14	9	13:19	126	1.01	14.16			23.33	230.0
15	9	14:59	135	1.01	15.17			25.00	212.5
16	9.5	16:39	144.5	1.07	16.24	0.095		26.67	226.1
17	9	18:19	153.5	1.01	17.25	0.09		28.33	217.6
18	9	19:59	162.5	1.01	18.26			30.00	214.5
19	9	21:39	171.5	1.01	19.27			31.67	134.4
20	9	23:19	180.5	1.01	20.28			33.33	131.4
21	9	** 11/16 0:59	189.5	1.01	21.29			35.0	144.6

Start flow @ 13:45

1st water to col @ 13:46

water to top of soil 1505

water to top of col 15:15

1st drip, start frac coll @ 1539

TOP SOIL? or TOP COL. 79 89

Med.

* ~~pale~~ clear yellow tube 1

subsequent samples are clear

** Tubes had some decrease in volume. Fraction Collector mis-aligned and missing tubes periodically. All volumes in these tubes were between 8-8.5mL

1/7/13 PV calculated using volume in 1st tube. 89 min x 0.09 mL/min = 8.0 mL.

Rw Col 9 cont   T04-10 0-2.5

Tube #	Fluid in Tube (mL)	Tube Start Time	Cum Vol (mL)	1 PV = ~~8.9~~ 8.0 AT PV	Cum PV	Flowrate (mL/min)	Collect Time (hr)	Cum Collect (hr)	U (µg/L)	10	11	12	13
22	9 **	11/16 2:39	198.5	1.01	22.30	0.09	1.67	36.67	138.1				
23	9 **	4:19	207.5		23.31			38.33	128.1				
24	9 **	5:59	216.5		24.33			40.00	103.1				
25	9	7:39	225.5		25.34			41.67	96.9				
26	9	9:19	234.5		26.35			43.33	105.1				
27	9	10:59	243.5		27.36			45.00	93.4				
28	9	12:39	252.5	↓	28.37	↓	↓	46.67	84.4				
29	9	14:19	261.5	1.01	29.38			48.33	81.2				
30	9	15:59	270.5		30.39			50.00	87.8				
31	9	17:39	279.5		31.40			51.67	72.1				
32	9	19:19	288.5		32.42			53.33	70.4				
33	9	20:59	297.5		33.43			55.00	73.1				
34	9	22:39	306.5		34.44			56.67	78.6				
35	9	11/17 0:19	315.5		35.45			58.33	68.3				
36	9	1:59	324.5		36.46			60.00	65.0				
37	9	3:39	333.5		37.47			61.67	64.6				
38	9	5:19	342.5		38.48			63.33	63.0				
39	9	6:59	351.5		39.49			65.00	75.9				
40	8 **	8:39	360.5		40.51			6667	61.4				
41	9	10:19	369.5		41.52			68.33	59.1				
42	9	11:59	378.5		42.53			~~65.00~~ 7000	56.3				
43	9	13:39	387.5		43.54			~~66.67~~ 7333	63.0				
44	75	15:19	396.5	↓	44.55	↓	↓		100.4 ?				

D/C Flow 11/17/12 @ 1700

Note: During the run the fraction collector got off slightly and was missing tubes. After sample 28 finished fraction collector was reset and tubes were shifted putting tube 29 in position #1 and collector was restarted. While shifting the tubes the order of the tubes was messed up starting w/ tube 36. The order was noticed and corrected at the completion of the run. However because the order was wrong the final tube (#44) was in the wrong position and the fraction collector was dripping over an empty slot instead of tube 44. This was noticed and corrected but w/ only ~20 min left in the run. That is why tube 44 has very low volume. The run was still stopped at the appropriate time. We can probably assume that if tube 44 was in the right position it would have collected the 9 mL that most of the rest of the tubes did. Tube 44 acidified w/ only 40 µL HNO_3.

Riverton Col 10

T04-10 2.5-5

11/13/12 Fill Column. Same setup as Col 1 25 ml Omnifit glass Col Flow bottom to top

<2mm sieved fraction

empty col 63.88 g

col + fill 101.82g

soil weight 37.94g

soil col. length = 11.8cm Vol 11.8x 1.7671 = 20.85ml

Density (dry) = 37.94/20.85= 1.82g/mL

Tube #	Fluid in tube (ml)	Tube Start Date/Time	Cum Vol. (ml)	1 PV = ~~5.3~~ ~~4.7~~ 4.5 PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Collect Time (hr)	U (ug/L) ~~449~~
1	9.5	11/15 13:45	9.5	~~1.79~~ 2.02	~~1.79~~ 2.02	0.095	1.67	1.67	449.2
2	9.5	15:25	19.0	2.02	4.04	↓	↓	3.33	501.8
3	9.5	17:05	28.5	↓	6.06			5.00	277.3
4	9.5	18.45	38		8.09			6.67	143.0
5	9.5	20:25	47.5		10.11			8.33	93.1
6	9.5	22:05	57		12.13			10.00	68.9
7	9.5	23:45	66.5		14.15			11.67	57.6
8	9	11/16 1:25	75.5 ~~76.5~~	1.91	16.06	0.09		13.33	53.5
9	9.5	3:05	85.0	2.02	18.09	0.095		15.00	47.2
10	9.5	4:45	94.5	↓	20.11	↓		16.67	42.6
11	9.5	6:25	104		22.13			18.33	41.5
12	9.5	8:05	113.5		24.15			20.00	36.0
13	9.5	9:45	123		26.17			21.67	30.0
14	9.5	11:25	132.5		28.19			23.33	28.7
15	9	13:05	141.5	1.91	30.11	0.09		25.00	27.4
16	9.5	14:45	151.0	2.02	32.13	0.095		26.67	28.7
17	9.5	16:25	160.5	2.02	34.15	0.095		28.33	24.3
18	10	18:05	170.5	2.13	36.28	0.1		30.00	22.8
19	10	19:45	180.5	2.13	38.40	0.1		31.67	21.3
20	10	21:25	190.5	2.13	40.53	0.1		33.33	21.6
21	9.5	23:05	200	2.02	42.55	0.095		35.00	20.3

11/15/12

Start flow @ 12:34

1st water to soil @ 12:35 > ~~47~~

Water to top of soil @ 13:22 47min

Water to top of Col @ 13:27 53min

1st Drip, Start frac Col. @ 13:45

1st sample Clear pale yellow

All others clear

PV = 4.5

47min x 0.095mL/min

= 4.5mL

Riv Col10 cont

T04-10 @ 2.5-5

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum 3 Vol (ml)	1PV=~~4.7~~ 4 PV 4.5	Cum 5 PV	Flow Rate (ml/min)	Collect Time (hr)	Cum. Coll. Time (hr)	9 U (ug/L)	10	11	12	13
22	9.5	11/17 0:45	209.5	2.02	44.57	0.095	1.67	36.67	18.5				
23	9.5	2:25	219.0		46.60			38.33	20.1				
24	9.5	4:05	228.5		48.62			40.00	19.5				
25	9.5	5:45	238		50.64			41.67	14.5				
26	9.5	7:25	247.5		52.64			43.33	13.8				
27	9.5	9:05	257		54.68			45.00	13.6				
28	9.5	10:45	266.5		56.70			46.67	13.0				
29	9.5	12:25	276		58.72			48.33	12.9				
30	9.5	14:05	285.5		60.74			50.00	12.0				
31	9.5	15:45	295		62.77			51.67	12.3				
32	9.5	17:25	304.5		64.79			53.33	12.5				
33	9.5	19:05	314		66.8~~3~~1			55.00	11.9				
34	9.5	20:45	323.5		68.83			56.67	11.9				
35	9.5	22:25	333		70.85			58.33	11.5				
36	9.5	11/18 0:05	342.5		72.87			60.00	10.9				
37	9.5	1:45	352		74.89			61.67	9.0	* 11/18 @ 12:29 Source tank switched			
38	9.5	3:25	361.5		76.91			63.33	8.8				
39	9.5	5:05	371		78.94			65.00	9.2				
40	9.5	6:45	380.5		80.96			66.67	8.6				
41	9.5	8:25	390		82.98			68.33	8.5				
42	9.5	10:05	399.5		85.00			70:00	8.1				
43	9.5	11:45	409		87.02			71.67	8.0				
44	9.5	13:25	418.5		89.04			73.33	7.3				

11/18/12 Dc flow @ 15:05

Riverton Col 11

T03-10 0-2.5

11/15/12 Fill Column Same setup as Col 1 25ml omnifit glass column Flow bottom to top

<2mm sieved fraction

empty column 62.23g

Col + fill 92.75g

fill 30.52

soil Col. length = 11.8cm Vol 11.8 x 1.7671 = 20.85ml

Density (dry) = 30.52/20.85 = 1.46g/ml

Tube#	Fluid in tube (ml)	Tube Start Date/Time	Cum Vol ml	1PV = ~~7.3~~ 6.6mL PV	Cum PV	Flow Rate ml/min	Collect Time (hr)	Cum Col. Time (hr)	U (ug/L)
1	9	11/16 14:50	9	1.23	1.23	0.09	1.67	1.67	31.7
2	9	16:30	18	↓	2.47	↓	↓	3.33	65.6
3	9	18:10	27		3.70			5.0	68.4
4	9	19:50	36		4.93			6.67	50.7
5	9	21:30	45		6.16			8.33	31.9
6	9	23:10	54		7.40			10.00	25.1
7	9	11/17 0:50	63		8.63			11.67	21.0
8	9	2:30	72		9.86			13.33	18.0
9	9	4:10	81		11.10			15.0	13.3
10	9	5:50	90		12.33			16.67	12.2
11	9	7:30	99		13.56			18.33	11.2
12	9	9:10	108		14.79			20.0	9.0
13	9	10:50	117		16.03			21.67	8.0
14	9	12:30	126		17.26			23.33	7.6
15	9	14:10	135		18.49			25.0	7.2
16	9	15:50	144		19.73			26.67	6.9
17	9	17:30	153		20.96			28.33	6.0
18	9	19:10	162		22.19			30.00	6.0
19	9	20:50	171		23.42			31.67	6.2
20	9	22:30	180		24.66			33.33	5.4
21	9	11/18 0:10	189		25.89			35.0	5.2

Start flow @ 13:09

1st Water to soil @ 13:11

water to top of soil @ 14:24 } 73min

Water to Top of Col @ 14:30

1st Drip, Start frac Col @ 14:50

1st Sample Clear pale yellow

2nd Sample very pale yellow. The rest of the samples look colorless.

1/7/13 PV calculated using volume in 1st tube. 73min x 0.09mL/min = 6.6mL

TOPS FORM 3521 MADE IN U.S.A.

Riverton Col 11 T03-10 @ 0-25

Cont

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum 3 Vol (ml)	1PV = ~~73~~ PV 6.6 AT	Cum 5 PV	Flow Rate ml/min	Collect 7 Time (hr)	Cum Col. 8 Time (hr)	U 9 ug/L	10	11	12	13
22	9	11/18 1:50	198	1.23	27.12	0.09	1.67	36.67	4.7				
23	9	3:30	207		28.36	↓	↓	38.33	4.5				
24	9	5:10	216		29.59			40.00	4.4				
25	9	6:50	225		30.82			41.67	4.3				
26	9	8:30	234		32.05			43.33	4.1				
27	9	10:10	243		33.29			45.0	3.6				
28	9	11:50	252		34.52			46.67	3.8				
29	9	13:30	261		35.75			48.33	3.5				
30	9	15:10	270		36.99			50.00	3.3				
31	9	16:50	279		38.22			51.67	3.3				
32	9	18:30	288		39.45			53.88	3.3				
33	9	20:10	297		40.68			55.00	3.1				
34	9	21:50	306		41.92			56.67	2.9				
35	9	23:30	315		43.15			58.33	~~3.4~~ 3.1				
36	9	11/19 1:10	324		44.38			60.00	3.1				
37	9	2:50	333		45.62			61.67	2.8				
38	9	4:30	342		46.85			63.33	2.9				
39	9	6:10	351		48:08			65.00	2.5				
40	9	7:50	360		49.32			66.67	2.5				
41	9	9:30	369		50.55			68.33	2.7				
42	9	11:10	378		51.78			70.00	2.7				
43	9	12:50	387		53.01			71.67	2.4				
44	9	14:30	396		54.25	↓	↓	73.33	2.2				

D/c flow to column @ 16:10

Riverton Col 12

T03-10 2.5-5

11/15/12 Fill Column, Same setup as Col 1 25 ml Omnifit glass column. Flow bottom to top

<2mm sieved fraction

empty col = 61.69 g

Col + fill 91.85

fill 30.16 g

Soil Col. length = 11.8 cm Vol 11.8 x 1.7671 = 20.85 ml

Density (dry) = 30.16 / 20.85 = 1.45 g/ml

Tube #	fluid in tube (ml)	Tube Start Date/Time	Cum Vol (ml)	1PV = ~~7.1~~ 6.7 PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum. Col. Time (hr)	U (ug/L)
1	9.5	11/18 16:44	9.5	1.~~34~~42	~~1.34~~ 1.42	0.095	1.67	1.67	49.2
2	9.5	18:24	19.0	1.42	~~2.68~~ 2.84			3.33	151.8
3	9.5	20:04	28.5		~~4.01~~ 4.25			5.00	333.0
4	9.5	21:44	38		~~5.35~~ 5.67			6.67	277.0
5	9.5	23:24	47.5		~~6.69~~ 7.09			8.33	177.4
6	9.5	11/19 1:04	57.0		~~8.03~~ 8.51			10.00	129.6
7	9.5	2:44	66.5		~~9.37~~ 9.93			11.67	89.8
8	9.5	4:24	76		~~10.70~~ 11.34			13.33	70.3
9	9.5	6:04	85.5		~~12.04~~ 12.76			15.00	56.4
10	9.5	7:44	95		14.18			16.67	45.8
11	9.5	9:24	104.5		15.60			18.33	38.6
12	9.5	11:04	114.0		17.01			20.00	32.2
13	9.5	12:44	123.5		18.43			21.67	27.8
14	9.5	14:24	133		19.85			23.33	25.3
15	9.5	16:04	142.5		21.27			25.00	22.6
16	9.5	17:44	152.0		22.69			26.67	22.0
17	9.5	19:24	161.5		24.10			28.33	21.0
18	9.5	21:04	171		25.52			30.0	20.2
19	9.5	22:44	180.5		26.94			31.67	18.0
20	9.5	11/20 0:24	190.0		28.36			33.33	16.3
21	9.5	2:04	199.5		29.78			35.00	16.4

Start flow @ 15:08

1st water to soil @ 15:10 > 71 min PV = ~~7.1~~ 6.7

water to Top of soil @ 16:21

water to Top of col @ 16:27

1st Drip, start frac col @

1st Sample clear med yellow

subsequent samples clear

PV = 71 min x 0.095 = 6.7 ml

Riverton Col 12

Cont T03-10 @ 25-5

Tube #	Fluid in tube (ml)	Tube Start (Date/Time)	Cum Vol (ml)	1 PV=6.7 PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Col. Time (hr)	U (ug/L)
22	9.5	11/20 03:44	209.0	1.42	31.19	0.095	1.67	36.67	13.1
23	9.5	05:24	218.5	↓	32.61	↓	↓	38.33	13.2
24	9.5	7:04	228		34.03			40.00	12.3
25	9.5	8:24	2375		35.45			41.67	12.2
26	9.5	10:24	247		36.87			43.33	11.6
27	9.5	12:04	256.5		38.28			45.00	10.3
28	9.5	13:44	266		39.70			46.67	10.0
29	9.5	15:24	275.5		41.12			48.33	9.5
30	9.5	17:04	285.0		42.54			50.00	9.5
31	9.5	18:44	294.5		43.96			51.67	~~9.0~~ 8.4
32	9.5	2024	304		45.37			53.33	8.6
33	9.5	22:04	313.5		46.79			55.00	8.4
34	9.5	23:44	323		48.21			56.67	8.1
35	9.5	11/21 1:24	332.5		49.63			58.33	7.7
36	9.5	3:04	342		51.04			60.00	7.6
37	9.5	4:44	351.5		52.46			61.67	7.4
38	9.5	6:24	361		53.88			63.33	7.2
39	9.5	8:04	370.5		55.30			65.00	6.5
40	9.5	9:44	380		56.72			66.67	6.6
41	9.5	11:24	389.5		58.13			68.33	6.3
42	9.5	13:04	399		59.55			70.00	6.2
43	9.5	14:44	408.5		60.97			71.67	5.8
44	9.5	16:24	418	↓	62.39	↓	↓	73.33	5.3

D/C flow to Column @ 18:04

Riverton Col 13

T02-07 0-25

11/19/12 Fill column, same setup as Col 1 25ml Omnifit glass column. Flow bottom to top

<2mm sieved fraction

empty column = 63.11

col + fill 97.00

fill 33.89 g

Soil Col. length 11.8cm Vol = 11.8 × 1.7671 = 20.85 ml

Density (dry) 33.89/20.85 = 1.63 g/ml

Tube #	fluid in tube (ml)	Tube Start Date/Time	Cum Vol ml	1PV = ~~7.1~~ 5.6 PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Coll. Time (hr)	U (ug/L)	
1	9.0	11/20 10:03	9.0	1.61	1.61	0.09	1.67	1.67	33.5	Start flow @ 8:35
2	9	11:43	18	↓	3.21	↓	↓	3.33	25.1	1st water to soil @ 8:37 >62min
3	9	13:23	27		4.82			5.0	12.9	water to top of soil @ 9:39
4	9	15:03	36		6.43			6.67	12.3	water to top of col @ 9:43
5	9	16:43	45		8.04			8.33	9.2	1st Drip, start frac col @ 10:03
6	9	18:23	54		9.64			10.0	6.7	
7	9	20:03	63		11.25			11.67	7.0	1st. sample very pale yellow
8	9	21:43	72		12.86			13.33	6.3	
9	9	23:23	81		14.46			15	6.1	PV 62 X 0.09 = 5.6
10	9	11/21 1:03	90		16.07			16.67	6.1	
11	9	2:43	99		17.68			18.33	5.9	
12	9	4:23	108		19.29			20.0	4.6	
13	9	6:03	117		20.89			21.67	4.5	
14	9	7:43	126		22.5			23.33	4.5	
15	9	9:23	135		24.11			25.00	4.0	
16	9	11:03	144		25.71			26.67	3.9	
17	9	12:43	153		27.32			28.33	3.3	
18	9	14:23	162		28.93			30.00	3.3	
19	9	16:03	171		30.54			31.67	3.2	
20	9	17:43	180		32.14			33.33	3.3	
21	9	19:23	189		33.75			35.00	3.0	

Riverton Col 13

T02-07 0-2.5 Cont.

Tube #	Fluid in tube (ml)	Tube Start Date/time	Cum Vol (ml)	1PV=5.6 PV	Cum PV	Flow Rate (ml/min)	Collect Time	Cum Col time	U (ug/L)	10	11	12	13
22	9	11/21 21:03	198	1.61	35.36	0.09	1.67	36.67	2.8				
23	9	22:43	207		36.96			38.33	2.6				
24	9	11/22 0:23	216		38.57			40.00	2.6				
25	9	2:03	225		40.18			41.67	2.4				
26	9	3:43	234		41.79			43.33	2.4				
27	9	5:23	243		43.39			45.00	2.2				
28	9	7:03	252		45.0			46.67	2.3				
29	9	8:43	261		46.61			48.33	2.1				
30	9	10:23	270		48.21			50.0	1.9				
31	9	12:03	279		49.82			51.67	1.8				
32	9	13:43	288		51.43			53.33	1.9				
33	9	15:23	297		53.04			55.00	1.6				
34	9	17:03	306		54.64			56.67	1.5				
35	9	18:43	315		56.25			58.33	1.6				
36	9	20:23	324		57.86			60.0	1.6				
37	9	22:03	333		59.46			61.67	1.5				
38	9	23:43	342		61.07			63.33	1.6				
39	9	11/23 1:23	351		62.68			65.00	1.5				
40	9	3:03	360		64.29			66.67	1.4				
41	9	4:43	369		65.89			68.33	1.5				
42	9	6:23	378		67.50			~~75.00~~70.0	1.4				
43	9	8:03	387		69.11			~~66.67~~71.67	1.3				
44	9	9:43	396		70.71			73.33	1.2				

D/C flow to column @ 11:23

Riverton Col 14

T02-07 @ 2.5-5

11/19/12

Fill column, same setup as Col 1. 25ml Omnifit glass column Fill bottom to top

<2mm sieved frac

empty col 61.49

Col + fill 96.63

fill 35.14

Soil col length = 11.8 cm Vol 11.8 x 1.7671 = 20.85 ml

Density (dry) = ~~35.14~~ 35.14/20.85 = 1.69 ml/cm

Tube #	Fluid in Tube (mL)	Tube Start Date/time	Cum Vol (mL)	1 PV=4.5 PV	Cum PV	Flow Rate (mL/min)	Collect Time (hr)	Cum Col. Time	U ug/L
1	7.5	11/26 11:43	7.5	1.67	1.67	0.075	1.67	1.67	69.7
2	7.5	13:23	15		3.33			3.33	39.6
3	7.5	15:03	22.5		5.0			5.00	33.9
4	7.5	16:43	30		6.67			6.67	28.2
5	7.5	18:23	37.5		8.33			8.33	27.1
6	7.5	20:03	45		10.0			10.00	21.3
7	7.5	21:43	52.5		11.67			11.67	16.0
8	7.5	23:23	60		13.33			13.33	14.2
9	7.5	11/27 1:03	67.5		15.0			15.00	11.0
10	7.5	2:43	75		16.67			16.67	10.1
11	7.5	4:23	82.5		18.33			18.33	8.6
12	7.5	6:03	90		20.0			20.00	7.1
13	7.5	7:43	97.5		21.67			21.67	7.0
14	7.5	9:23	105		23.33			23.33	6.7
15	7.5	11:03	112.5		25.00			25.00	5.9
16	7.5	12:43	120		26.67			26.67	5.6
17	7.5	14:23	127.5		28.33			28.33	5.7
18	7.5	16:03	135		30.00			30.00	5.2
19	7.5	17:43	142.5		31.67			31.67	5.1
20	7.5	19:23	150.0		33.33			33.33	4.6
21	7.5	21:03	157.5		35.0			35.00	4.6

Start flow at @ 10:07

1st water to soil @ 10:08 > 60min

Water @ top of soil @ 11:08

Water to top of col @ 11:14

1st Drip start frac col @ 11:43

1st Sample Very pale clear yellow

Subsequent samples clear

PV = 0.075 x 60min = 4.5

Riverton Col 14 cont

TO2-07 ~~[illegible]~~ 2.5-5

Tube #	Eludin Tube (ml)	Tube Start Date/Time	3 Cum Vol ml	1PV=45 4 PV	5 Cum PV	Flow Rate ml/min	Collect Time(hr)	Cum Col time	9 U (ug/L)	10	11	12	13
22	7.5	11/27 22:43	165	1.67	36.67	0.075	1.67	36.67	4.3				
23	7.5	11/28 0:23	172.5	1.67	38.33	0.075	↓	38.33	4.0				
24	6.5	2:03	179	1.44	39.78	0.065		40.00	3.8				
25	7.5	3:43	186.5	1.67	41.44	0.075		41.67	3.7				
26	7.5	5:23	194	1.67	43.11	0.075		43.33	3.3				
27	7.5	7:03	201.5	1.67	44.78	0.075		45.0	3.2				
28	7.5	8:43	209	1.67	46.44	0.075		46.67	3.0				
29	7.5	10:23	216.5	1.67	48.11	0.075		48.33	2.9				
30	7.5	12:03	224	1.67	49.78	0.075		50.0	2.8				
31	7.0	13:43	231	1.56	51.33	0.070		51.67	2.7				
32	7.0	15:23	238	↓	52.89	0.070		53.33	2.8				
33	7.0	17:03	245		54.44	0.070		55	2.7				
34	7.0	18:43	252		56.00	0.070		56.67	2.6				
35	7.0	20:23	259		57.56	↓		58.33	2.8				
36	7.0	22:03	266		59.11			60	2.4				
37	7.0	23:43	273		60.67			61.67	2.6				
38	7.0	11/29 1:23	280		62.22			63.33	2.4				
39	7.0	3:03	287		63.78			65	2.3				
40	7.0	4:43	294		65.33			66.67	2.5				
41	7.0	6:23	301		66.89			68.33	2.1				
42	7.0	8:03	308		68.44			70	1.7				
43	7.0	9:43	315		70.00			71.67	2.1				
44	7.0	11:23	322		71.56			73.33	2.0				

D c col @ 13:03

* Tubes 36-41 are short on Vol due to frac collector mis-align

Riverton Col 15

T01-05 0-2.5

11/19/12 Fill Column, Same setup as Col 1, 25ml omnifit glass column Flow bottom to top

<2mm sieved frac.

empty col ~~62.21~~ 63.12

Col + fill ~~95.27~~ 96.74

fill 33.62

Soil col. length 11.8cm Vol 11.8 x 1.7671 = 20.85ml

Density (dry) 33.62/20.85 = 1.61g/ml

Tube #	Fluid in Tube ml	Tube Start Date/Time	Cum Vol ml	1 PV=5.7 PV	Cum PV	Flow Rate ml/min	Collect Time hr	Cum Coll. Time hr	U (ug/L)
1	9	11/26 12:04	9	1.58	1.58	0.09	1.67	1.67	435.8
2	9	13:44	18		3.16			3.33	168.3
3	9	15:24	27		4.74			5.0	116.8
4	9	17:04	36		6.32			6.67	90.3
5	9	18:44	45		7.89			8.33	84.6
6	9	20:24	54		9.47			10.00	75.0
7	9	22:04	63		11.05			11.67	63.9
8	9	23:44	72		12.63			13.33	61.1
9	9	11/27 1:24	81		14.21			15.00	30.7
10	9	3:04	90		15.79			16.67	39.2
11	9	4:44	99		17.37			18.33	45.7
12	9	6:24	108	↓	18.95	↓		20.0	50.9
13	8.5	8:04	116.5	1.49	20.44	0.085		21.67	33.2
14	8.5	9:44	125	1.49	21.93	0.085		23.33	31.6
15	9	11:24	134	1.58	23.51	0.09		25.0	31.1
16	9	13:04	143		25.09			26.67	30.4
17	9	14:44	152		26.67			28.33	26.9
18	9	16:24	161		28.25			30.00	25.4
19	9	18:04	170		29.82			31.67	23.3
20	9	19:44	179		31.40			33.33	21.2
21	9	21:24	188	↓	32.98	↓	↓	35	22.0

Start flow @ 10:30

1st water to soil @ 10:32 > 63

water to top of soil @ 11:35

water to top of col @ 11:41

1st Drip, start frac col @ 12:04

1st sample cloudy med. yellow/brown

Soilwater sample had ↑ amt. roots

PV = 0.09 x 63 = 5.7

PPT noticed in tubes 1 →

↓ cloudiness thru tube 12

Clear 13 →

Riverton Col 15

T01-05 0-2.5

Tube #	Fluid in tube	Tube/start Date/time	Cum Vol ml	1PV=5.7 PV	Cum PV	Flow Rate ml/min	Collect Time (hr)	Cum Col Time (hr)	U (ug/L)
22	9	11/27 23:04	197	1.58	34.56	0.090	1.67	36.67	20.0
23	8.5	11/28 0:44	205.5	1.49	36.05	0.085		38.33	19.1
24	8.0	2:24	213.5	1.40	37.46	0.08		400	18.4
25	8.5	4.04	222	1.49	38.95	0.085		41.67	17.4
26	8.0	5:44	230	1.40	40.35	0.08		43.33	17.4
27	9	7:24	239	1.58	41.93	0.09		45.00	15.1
28	9	9:04	248	1.58	43.51	0.09		46.67	13.8
29	8.5	10:44	256.5	1.49	45.00	0.085		48.30	13.6
30	8.5	12:24	265	1.49	46.49	0.085		50.00	13.5
31	8.5	14.04	273.5	1.49	47.98	0.085		51.67	12.5
32	8.5	15:44	282	1.49	49.47	0.085		53.33	13.3
33	8.5	17:24	290.5	1.49	50.96	0.085		55.00	10.7
34	8.5	19:04	299	1.49	52.46	0.085		56.67	10.2
35	8	20:44	307	1.49	53.86	0.080		58.33	11.2
36	8	22:24	315	1.49	55.26	0.080		60.00	10.6
37	7.5	11/29 0:04	322.5	1.32	56.58	0.075		61.67	10.5
38	6.5	1:44	329	1.14	57.72	0.065		63.33	10.5
39	6.5	3:24	335.5	1.14	58.86	0.065		65.0	11.4
40	6	5:04	341.5	1.05	59.91	0.060		66.67	11.2
41	6	6:44	347.5	1.05	60.96	0.060		68.33	10.2
42	6	8:24	353.5	1.05	62.02	0.060		70.00	9.3
43	6	10:04	359.5	1.05	63.07	0.060		71.67	9.5
44	6	11:44	365.5	1.05	64.12	0.060	↓	73.33	9.3

DC flow to column 13:24

Riverton Col 16

T01-05 2.5-5

11/20/12 Fill Column, Same setup as Col 1 25ml omnifit glass column Flow bottom to top

<2mm sieved frac

empty col 62.30 g

col + fill 98.29 g

fill 35.99 g

Soil Col length = 11.8cm Vol = 11.8 × 1.7671 = 20.85 ml

Density (dry) 35.99/20.85 = 1.73g/ml

Tube #	Fluid in Tube (ml)	Tube Start Date/time	Cum Vol (ml)	1 PV = 5.1 PV	Cum PV	Flow Rate (ml/min)	Collect Time hr	Cum. Col time hr	U (ug/L)
1	9.5	11/26 11:19	9.5	1.86	1.86	0.095	1.67	1.67	45.2
2	9.5	12:59	19.0	↓	3.73	↓	↓	3.33	27.0
3	9.5	14:39	28.5		5.59			5.00	15.2
4	9.5	16:19	38		7.45			6.67	10.4
5	9.5	17:59	47.5		9.31			8.33	6.9
6	9.5	19:39	57		11.18			10.00	5.7
7	9.5	21:19	66.6		13.04			~~9~~ 11.67	4.3
8	9.5	22:59	76		14.9			13.33	3.4
9	9.5	11/27 0:39	85.5		16.76			15.0	2.6
10	9.5	2:19	95		18.63			16.67	2.1
11	9.5	3:59	104.5		20.49			18.33	1.9
12	9.5	5:39	114		22.35			20.0	1.5
13	9.5	7:19	123.5		24.22			21.67	1.3
14	9.5	8:59	133		26.08			23.33	1.2
15	9.5	10:39	142.5		27.94			25.00	1.3
16	9.5	12:19	152.0		29.80			26.67	1.2
17	9.5	13:59	161.5		31.67			28.33	1.1
18	9.5	15:39	171.0		33.53			30.0	1.1
19	9.5	17:19	180.5		35.39			31.67	1.1
20	9.5	18:59	190		37.25			33.33	0.9
21	9.5	20:39	199.6		39.12			35.00	0.9

Start flow @ 10:00

1st water to soil @ 10:03

Water to top of soil 1057 > 54min

Water to top of col 11:01

1st Drip, start fracCol @ 11:19

1st sample very pale clear yellow

Subsequent samples clear

PV = 0.095 × 54 = 5.1

Riverton Col 16

T01-05 2.5-5

Tube #	Fluid in Tube	Tube Start	Cum Vol ml	1PV=5.1 4 PV	Cum 5 PV	Flow 6 Rate	Collect Time hr	Cum Col 8 Time	U 9 (ug/L)
22	9.5	11/27 22:19	209	1.86	40.98	0.095	1.67	36.67	0.7
23	9.5	23:59	218.5		42.84	0.095		38.33	0.6
24	9.5	11/28 1:39	228		44.71	0.095		40.00	0.6
25	9.5	3:19	237.5		46.57	0.095		41.67	0.4
26	9.5	4:59	247		48.43	0.095		43.33	0.5
27	9.5	6:39	256.5		50.29	0.095		45.00	0.5
28	9.5	8:19	266		52.16	0.095		46.67	0.5
29	9.5	9:59	275.5		54.02	0.095		48.33	0.3
30	9.5	11:39	285		55.88	0.095		50.00	0.5
31	9.5	13:19	294.5	1.86	57.75	0.095		51.67	0.4
32	9	14:59	303.5	1.76	59.51	0.090		53.33	0.5
33	9	16:39	312.5	1.76	61.27	0.090		55.00	0.5
34	9.5	18:19	322	1.86	63.14	0.095		56.67	0.6
35	9.5	19:59	331.5		65.00	0.095		58.33	0.5
36	9.5	21:39	341		66.86	0.095		60.00	0.5
37	9.5	23:19	350.5		68.73	0.095		61.67	0.7
38	9.5	11/29 0:59	360		70.59	0.095		63.33	0.4
39	9.5	2:39	369.5		72.45	0.095		65.00	0.2
40	9.5	4:19	379		74.31	0.095		66.67	0.3
41	9.5	5:59	388.5		76.18	0.095		68.33	0.2
42	9.5	7:39	398		78.04	0.095		70.00	0.4
43	9.5	9:19	407.5		79.90	0.095		71.67	0.2
44	9.5	10:59	417		81.76	0.095		73.33	<0.2
	DC flow to column			12:39					

Riverton

8/30/12 Receive 65 soil samples from vadose zone obtained during Geoprobe sampling event @ Riverton.

8/31/12 Empty sample bags into 14g soil aluminum pans. Disaggregate larger cores for ↑ surface area exposure. Record "wet" weights. and I.D's listed on sample bags.

9/13/12 Preparation of Synthetic Pore Fluid SPF-RVT01-6-2012.

Prepared new stock solutions of K_2CO_3, $NaHCO_3$, $CaSO_4 \cdot 2H_2O$, $MgSO_4 \cdot 7H_2O$, $CaCO_3$ and $MgCl_2 \cdot 6H_2O$ according to the recipe. $CaCO_3$ is a slurry.

2L of SPF were made and transfered to a 2L beaker. pH meter calibrated @ pH 7 and 10.

Time	pH			
			7std = 6.98	
14:15	7.30	without stirring	10std = 10.00	
14:20	7.87	stirring		
14:45	8.24	stirring		
15:15	8.28	stirring		
Added 100µL of 2% HNO_3				
15:20	8.08	Stirring		
15:45	8.05	Stirring		
~~14:15~~		~~Stirring~~	Dc stirring @ 1600. Cover beaker	

9/14/12 09:30 soln has been sitting overnight. Obvious white ppt (very thin coat) on bottom of beaker.

7 std = 7.01
10 std = 10.01
ck cal of pHmeter

0930	begin ~~stirring~~	
0940	8.01	
1015	8.10	
1035	100 ul 2% HNO_3.	
1039	7.96	
1107	8.06	
1230	8.10	
+ 100 ul 2% HNO_3		
1250	8.06	
1310	8.11	
+100 ul 2% HNO_3		

	Time	2 pH	3	4	5
9/14/12	1315	7.94			
	1410	8.15		Cum 2% HNO_3	
	+200ul 2% HNO_3		=	600ul	
	1415	7.86			
	1455	8.12			
	1550	8.17			
	+200ul 2% HNO_3			800ul	
	1540	7.89			
	1625	8.08			
	1715	8.18			DC stir bar, cover, white ppt still present

9/17 Ck pH Buffers 7 = 7.00 10 = 10.01

soln. has been sitting, covered, over weekend. white ppt on bottom of beaker

0845 initial pH = 7.69 increase to 8.04 $\bar{p}$ 10"

	Time	2 pH
~~0940~~	0940	8.10
	1105	8.09

1300 measure alkalinity on unfiltered sample. Titrated to 60 digits using 1.6N H_2SO_4 in 100mL sample. After pH rebounded added 2-3 digit increments and allowed pH to stabilize (10-15min) after each addition.

Final pH = 4.81 Digits = 94 15:49 Alk = 94mg/L as $CaCO_3$

1550 measure alkalinity on a filtered (0.45 µm) sample. Titrated to 45 digits using 1.6N H_2SO_4 in 100mL sample. After pH rebounded added 2-3 digit increments and allowed pH to stabilize (10-15min) after each addition.

Final pH = 4.71 Digits = 47 Alk = 47 mg/L as $CaCO_3$

This recipe will not be used because the Alk. and CO_3^{2-} concentrations will not be sufficient. A new recipe will be created by S. Morrison and is called SPF-RVT01-6-2012_ver2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	SPF-RVT01-6-2012		Solids																		
2		mL per	mg per																		
3		L of	L of	Na	K	Ca	Mg	NH4	SO4	Cl	NO3	C	As	Cd	Mo	Pb	226Ra	Se	U	V	N3
4		Soln	Soln	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L	mg/L	mg/L	mg/L
5	Liquid Components																				
6	V2O5, V=998mg/L, 2%HNO3	0.00									0.00									0.00	
7	V2O5, V=1000mg/L, 5%HNO3	0.00									0.00									0.00	
8	**V2O5, V=1000mg/L, 1.4%HNO3**	0.00									0.00									0.00	
9	V2O5, V=1000mg/L, 2%HNO3	0.00									0.00									0.00	
10	Na2MoO4.2H2O, Mo=925mg/L	0.00		0.00											0.00						
11	Na2MoO4.2H2O, Mo=1000 mg/L,	0.00		0.00											0.00						
12	**(NH4)2MoO4, 1006 mg/L Mo**	0.00						0.00							0.00						
13	**U3O8, U=10000mg/L, 3.5%HNO3**	0.00									0.00								0.00		
14	U3O8, U=10000mg/L, 5.2%HNO3	0.00									0.00								0.00		
15	U Std, U=1000mg/L, 2% HNO3	0.00									0.00								0.00		
16	Ra Std, Ra=68.7pCi/mL, 2% HNO3	0.00									0.00						0.00				
17	As Std, As=999mg/L, 5%HNO3	0.00									0.00		0.00								
18	**As Std, As=1000mg/L, 1.4%HNO3**	0.00									0.00		0.00								
19	**Se =999 mg/L 5% HNO3**	0.00									0.00							0.00			
20	**Cd Std = 1000mg/L, ~2% HNO3** 2L	0.00									0.00			0.00							
21																					
22	100g/L K2CO3	0.00	0.00		0.00							0.00									
23	10g/L K2CO3 0.6	0.30	3.00		1.70							0.26									
24	10g/L KCl	0.00	0.00		0.00					0.00											
25	50g/L NaHCO3 3.5	1.75	87.50	23.96								12.50									
26	**100g/L Na2SO4.10H2O**	0.00	0.00	0.00					0.00												
27	100g/L Na2SO4.(0.89 H2O)	0.00	0.00	0.00					0.00												
28	500g/L (NH4)2SO4	0.00	0.00					0.00	0.00												
29	**1.5g/L CaSO4.2H2O** 150	75.00	112.50			26.20			62.76												
30	1.2 g/L CaSO4	0.00	0.00			0.00			0.00												
31	200g/L MgSO4.7H2O 1.5	0.75	150.00				14.80		58.47												
32	100g/L K2SO4	0.00	0.00		0.00				0.00												
33	conc H2SO4(36N)	0.00							0.00												
34	927.2 g/L CaCl2.2H2O	0.00	0.00			0.00				0.00											
35	92.72 g/L CaCl2.2H2O	0.00	0.00			0.00				0.00											
36	10 g/L CaCO3 (slurry) 12	6.00	60.00			24.03						7.19									
37	300g/L NaCl	0.00	0.00	0.00						0.00											
38	100g/L MgCl2.6H2O 0.22	0.11	11.00				1.31			3.84											
39	100g/L NH4Cl	0.00	0.00					0.00		0.00											
40	100g/L NaNO3	0.00	0.00	0.00							0.00										
41	2% HNO3	0.00									0.00										
42	mL 1N NaOH needed to neutralize	0.00		0.00																	
43	66.67 g/L NaN3	0.00	0.00	0.00																	0
44																					
45																					
46																					
47	Totals (mg/L)	83.91		23.96	1.70	50.23	16.11	0.00	121.23	3.84	0.00	19.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	ACTUAL (mg/L)			24.00	1.70	48.00	16.00	?	120.00	3.80	?	27.80	?	?	?	?	?	?	?	?	?
49	Totals (mol/L)			1.04E-03	4.34E-05	1.25E-03	6.63E-04	0.00E+00	1.26E-03	1.08E-04	0.00E+00	1.66E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50																					
51	ACTUAL pH	7.99																			
52	Measured pH(no acid or base)	?																			
53	Measured pH (_________added)																				
54	ACTUAL Alk (mg/L CaCO3)	118.00																			
55	Measure Alk (no acid or base)	?																			
56	Measure Alk (_________added)																				
57	EQ Acid per Liter	0																			
58																					
59																					

9/18/12 Preparation of new Synthetic Pore Fluid SPF-RVT01-6-2012_verZ. (SPF2) See attached recipe.

10:45 1L of SPF2 was made and transfered to a 1L beaker. pH meter cal. checked

pH 7 = 7.01 pH 10 = 10.02

Pore fluid stirred while exposed to the atmosphere and pH readings taken.

Time	pH
1050	7.95
1100	8.38
1130	8.37
~~1215~~ 1230	8.43
1300	8.43
1400	8.45
1500	

1105 Alk measured. pH final = 4.81 Digits = 107 Alk = 107 mg/L as $CaCO_3$ 1.6N H_2SO_4 100mL sample

1415 pH 8.42 Alk measurment 100mL sample, 1.6N H_2SO_4

pH final = Digits = 103 Alk = 103 mg/L as $CaCO_3$

Adding Acid (2% HNO_3) to ~300mL of SPF2

Time	Acid Addition (µL)		pH
14:25	0	Cum	8.37
14:40	0	↓	8.45
14:41	50µL	50	8.19
14:46	50µL	100	7.94
14:52			7.97
15:48			8.30
16:15			8.36

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	SPF-RVT01-6-2012		Solids																	
2		mL per	mg per																	
3		L of	L of	Na	K	Ca	Mg	NH4	SO4	Cl	NO3	C	As	Cd	Mo	Pb	226Ra	Se	U	V	N3
4		Soln	Soln	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L	mg/L	mg/L	mg/L
5	Liquid Components																			
6	V2O5, V=998mg/L, 2%HNO3	0.00									0.00									0.00	
7	V2O5, V=1000mg/L, 5%HNO3	0.00									0.00									0.00	
8	**V2O5, V=1000mg/L, 1.4%HNO3**	0.00									0.00									0.00	
9	V2O5, V=1000mg/L, 2%HNO3	0.00									0.00									0.00	
10	Na2MoO4.2H2O, Mo=925mg/L	0.00		0.00											0.00						
11	Na2MoO4.2H2O, Mo=1000 mg/L,	0.00		0.00											0.00						
12	**(NH4)2MoO4, 1006 mg/L Mo**	0.00						0.00							0.00						
13	**U3O8, U=10000mg/L, 3.5%HNO3**	0.00									0.00								0.00		
14	U3O8, U=10000mg/L, 5.2%HNO3	0.00									0.00								0.00		
15	U Std, U=1000mg/L, 2% HNO3	0.00									0.00								0.00		
16	Ra Std, Ra=68.7pCi/mL, 2% HNO3	0.00									0.00						0.00				
17	As Std, As=999mg/L, 5%HNO3	0.00									0.00		0.00								
18	**As Std, As=1000mg/L, 1.4%HNO3**	0.00									0.00		0.00								
19	**Se =999 mg/L 5% HNO3**	0.00									0.00							0.00			
20	**Cd Std = 1000mg/L, ~2% HNO3**	0.00									0.00			0.00							
21																				
22	100g/L K2CO3	0.00	0.00		0.00							0.00									
23	10g/L K2CO3	0.30	3.00		1.70							0.26									
24	10g/L KCl	0.00	0.00		0.00					0.00											
25	50g/L NaHCO3	4.00	200.00	54.76								28.57									
26	**100g/L Na2SO4.10H2O**	0.00	0.00	0.00					0.00												
27	100g/L Na2SO4.(0.89 H2O)	0.00	0.00	0.00					0.00												
28	500g/L (NH4)2SO4	0.00	0.00					0.00	0.00												
29	**1.5g/L CaSO4.2H2O**	75.00	112.50			26.20			62.76												
30	1.2 g/L CaSO4	0.00	0.00			0.00			0.00												
31	200g/L MgSO4.7H2O	0.75	150.00				14.80		58.47												
32	100g/L K2SO4	0.00	0.00		0.00				0.00												
33	conc H2SO4(36N)	0.00							0.00												
34	927.2 g/L CaCl2.2H2O	0.00	0.00			0.00				0.00											
35	92.72 g/L CaCl2.2H2O	0.00	0.00			0.00				0.00											
36	10 g/L CaCO3 (slurry)	0.00	0.00			0.00						0.00									
37	300g/L NaCl	0.00	0.00	0.00						0.00											
38	100g/L MgCl2.6H2O	0.11	11.00				1.31			3.84											
39	100g/L NH4Cl	0.00	0.00					0.00		0.00											
40	100g/L NaNO3	0.00	0.00	0.00							0.00										
41	2% HNO3	0.00									0.00										
42	mL 1N NaOH needed to neutralize	0.00		0.00																	
43	66.67 g/L NaN3	0.00	0.00	0.00																	0
44																				
45																				
46																				
47	Totals (mg/L)	80.16		54.76	1.70	26.20	16.11	0.00	121.23	3.84	0.00	28.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	ACTUAL (mg/L)			24.00	1.70	48.00	16.00	?	120.00	3.80	?	27.80	?	?	?	?	?	?	?	?	?
49	Totals (mol/L)			2.38E-03	4.34E-05	6.54E-04	6.63E-04	0.00E+00	1.26E-03	1.08E-04	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50																				
51	ACTUAL pH	7.99																		
52	Measured pH(no acid or base)	?																		
53	Measured pH (_________added)																			
54	ACTUAL Alk (mg/L CaCO3)	116.00																		
55	Measure Alk (no acid or base)	?																		
56	Measure Alk (_________ added)																			
57	EQ Acid per Liter	0																		
58																				
59																				

Riverton Synthetic Pore Fluid

9/18/12 Preparation of new Synthetic Pore Fluid SPF-RVT01-6-2012-ver3 (SPF3). See attached recipe.

Premise: While working with SPF1 and SPF2, it appears the solution is equilibrating with the atmosphere driving pH to increase over time (to about 8.3). We could bubble CO_2 into it to bring pH down (w/o upsetting NO_3, Cl by adding acids continually) but as soon as the solution contacts the sediment, there will be equilibration with the mineral mass. Since our goal is to examine U removal, we decided to error on the high side for C, Ca, and pH, by increasing alk w/$NaHCO_3$. This causes Na to be a bit high and Mg a bit low.

1700 Prepared new Pore Fluid SPF3. See attached recipie. 1L of SPF3 was made and transfered to a 1L beaker.

Alk measured and was approx, 135 mg/L as $CaCO_3$

9/19/12 0540 pH of SPF3 Soln made yesterday @ 1700 was 7.42. Turned on stir rod.
0625 pH of SPF3 = 7.65
0630 Check pH probe calibration pH7 = 7.11 pH 10 = 10.11 pH 4 = 3.97
0635 Re-Cal pH probe @4, 7 and 10 and check stds. 4 = 3.98 7 = 6.99 10 = 9.98
0645 pH of SPF3 = 7.61
0700 measure alk on SPF3 initial pH 7.70 final pH = 4.79 Digits = 137 Alk = 137 mg/L as $CaCO_3$
0802 pH = 7.8
803 Prepared new 1L batch of SPF-1 (to see if $CaCO_3$ will dissolve w/ addition of CO_2)
804 pH = 8.41
806 pH = 8.45
807 Bubbled CO_2 for an instant
808 pH = 7.74 AlK = 52 mg/L $CaCO_3$
827 pH = 7.38
8:29 pH = 7.52
8:56 pH = 8.02

9/19/12 1125 Prepared 6L of SPF3 according to recipie. Made it in 3 2L batches and combined in a 10L LDPE cube w/ a spigot.

13:14 pH = 8.44
13:17 Bubbled very small amt of CO_2
13:19 pH = 7.79
13:22 pH = 7.71
13:32 pH = 7.53
15:07 pH = 7.75
15:20 measure alkalinity Final pH = 4.78 Digits = 136 Alk. = 136 mg/L as $CaCO_3$
16:00 pH = 7.89
- Headspace pushed out of cube and cube sealed to sit overnight.

IC run ran overnight. Sample measured for Cl^-, NO_3^-, SO_4^{2-}. Cl^- = 3.8 mg/L, NO_3^- = <0.5 mg/L, SO_4^{2-} = 122 mg/L

9/20/12 0800 pH probe checked 4std = 4.00 7std = 7.01 10std = 9.98

0805 SPF 3 uncapped and pH measured while stirring. pH = 7.86
0815 Alk measured. Final pH = 4.76 Digits = 132 Alk = 132 mg/L as $CaCO_3$
~~0830~~ pH =
0830 Begin Extractions 5min, 15min, 30min, 1hr, 2hrs
1600 pH = 8.06
1605 Start the 16hr extraction

9/21/12 Check pH probe 4 = 4.01 7 = 7.02 10 = 9.97
0815 measure pH of SPF3. pH = 8.15
0830 Begin the 4 and 8 hr extractions
0845 measure alkalinity pH final = 4.74 Digits = 133 Alkalinity = 133 mg/L as $CaCO_3$

9/27/12 Cation analysis on Acidified split of SPF3. Mg = 2.21 mg/L Ca = 49.1 mg/L Na = 69.0 mg/L K = 1.50 mg/L sPF3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	SPF-RVT01-6-2012		Solids																		
2		mL per	mg per																		
3		L of	L of	Na	K	Ca	Mg	NH4	SO4	Cl	NO3	C	As	Cd	Mo	Pb	226Ra	Se	U	V	N3
4		Soln	Soln	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L	mg/L	mg/L	mg/L
5	Liquid Components																				
6	V2O5, V=998mg/L, 2%HNO3	0.00									0.00									0.00	
7	V2O5, V=1000mg/L, 5%HNO3	0.00									0.00									0.00	
8	**V2O5, V=1000mg/L, 1.4%HNO3**	0.00									0.00									0.00	
9	V2O5, V=1000mg/L, 2%HNO3	0.00									0.00									0.00	
10	Na2MoO4.2H2O, Mo=925mg/L	0.00		0.00											0.00						
11	Na2MoO4.2H2O, Mo=1000 mg/L,	0.00		0.00											0.00						
12	**(NH4)2MoO4, 1006 mg/L Mo**	0.00						0.00							0.00						
13	**U3O8, U=10000mg/L, 3.5%HNO3**	0.00									0.00								0.00		
14	U3O8, U=10000mg/L, 5.2%HNO3	0.00									0.00								0.00		
15	U Std, U=1000mg/L, 2% HNO3	0.00									0.00								0.00		
16	Ra Std, Ra=68.7pCi/mL, 2% HNO3	0.00									0.00						0.00				
17	As Std, As=999mg/L, 5%HNO3	0.00									0.00		0.00								
18	**As Std, As=1000mg/L, 1.4%HNO3**	0.00									0.00		0.00								
19	**Se =999 mg/L 5% HNO3**	0.00									0.00							0.00			
20	**Cd Std = 1000mg/L, ~2% HNO3**	0.00									0.00			0.00							
21	2L																				
22	100g/L K2CO3	0.00	0.00		0.00							0.00									
23	10g/L K2CO3 0.6	0.30	3.00		1.70							0.26									
24	10g/L KCl	0.00	0.00		0.00					0.00											
25	50g/L NaHCO3 10	5.00	250.00	68.45								35.71									
26	**100g/L Na2SO4.10H2O**	0.00	0.00	0.00					0.00												
27	100g/L Na2SO4.(0.89 H2O)	0.00	0.00	0.00					0.00												
28	500g/L (NH4)2SO4	0.00	0.00					0.00	0.00												
29	**1.5g/L CaSO4.2H2O** 280	140.00	210.00			48.91			117.15												
30	1.2 g/L CaSO4	0.00	0.00			0.00			0.00												
31	200g/L MgSO4.7H2O 0.08	0.04	7.60				0.75		2.96												
32	100g/L K2SO4	0.00	0.00		0.00				0.00												
33	conc H2SO4(36N)	0.00							0.00												
34	927.2 g/L CaCl2.2H2O	0.00	0.00			0.00				0.00											
35	92.72 g/L CaCl2.2H2O	0.00	0.00			0.00				0.00											
36	10 g/L CaCO3 (slurry)	0.00	0.00			0.00						0.00									
37	300g/L NaCl	0.00	0.00	0.00						0.00											
38	100g/L MgCl2.6H2O 0.22	0.11	11.00				1.31			3.84											
39	100g/L NH4Cl	0.00	0.00					0.00		0.00											
40	100g/L NaNO3	0.00	0.00	0.00							0.00										
41	2% HNO3	0.00									0.00										
42	mL 1N NaOH needed to neutralize	0.00		0.00																	
43	66.67 g/L NaN3	0.00	0.00	0.00																	0
44																					
45																					
46																					
47	Totals (mg/L)	145.45		68.45	1.70	48.91	2.06	0.00	120.12	3.84	0.00	35.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	ACTUAL (mg/L)			24.00	1.70	48.00	16.00	?	120.00	3.80	?	27.80	?	?	?	?	?	?	?	?	?
49	Totals (mol/L)			2.98E-03	4.34E-05	1.22E-03	8.49E-05	0.00E+00	1.25E-03	1.08E-04	0.00E+00	3.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50																					
51	ACTUAL pH	7.99																			
52	Measured pH(no acid or base)	?																			
53	Measured pH (________added)																				
54	ACTUAL Alk (mg/L CaCO3)	116.00																			
55	Measure Alk (no acid or base)	?																			
56	Measure Alk (________added)																				
57	EQ Acid per Liter	0																			
58																					
59																					

Riverton Synthetic Pore Fluid

10/2/12 Preparation of riverton synthetic pore fluid for Batch Tests. Pore fluid is SPF3 the same as used for the kinetic tests. Prepared 16L of SPF3. Measured pH ~~and alkalinity~~ before any pH adjustments.

14:30 Check pH stds. 4 = 4.00 7 = 7.01 10 = 9.97
14:35 pH of SPF3 = 8.13
14:45 pH = 8.39
15:00 pH = 8.40
Bubble small amt of CO_2 into SPF3.
15:15 pH = 7.30
16:00 pH = 7.20
16:40 pH = 7.24
16:45 measure alkalinity. Starting pH = 7.31 final pH = 4.80 Digits = 135 using 1.6N H_2SO_4

Alkalinity = 135 mg/L as $CaCO_3$
1700 pH = 7.24
Stir Plate off.

10/3/12 0720 Stir plate on. pH = 7.41
0810 pH = 7.50
1015 pH = 7.70
1045 pH = 7.76
1135 pH = 7.84
Stopped Stir bar. Removed as much air from container as possible and sealed.
Measured SPF3 for Anions. Cl = 3.9 mg/L NO_3 = <0.5 mg/L SO_4 = 124 mg/L

10/4/12 Check pH stds. 4 = 4.03 7 = 7.02 10 = 9.98
0900 SPF3 pH = 7.83
Sealed back up. Will start batch tests on monday 10/8/12.
Took a 50mL split and acidified for Cation Analysis.

1630 Cation Analysis Mg = ~~2.3~~ 2.25 Ca = 49.7 Na = 68.9 K = 1.57

Riverton Syn. Pore Fluid

10/8/12 Check pH stds. 4 = 4.04 7 = 7.01 10 =
0845 measure pH of SPF3 =
0945 pH = 7.99
Cube sealed and an alk measurement made.
1.6N H_2SO_4 digits for 100mL sample = 133 Final pH = 4.79 Alk = 133 mg/L @s $CaCO_3$

1130 Start 1st round of batch tests.

10/15/12 Ck pH Stds 4 = 4.02 - 7 = 7.04 10 = 10.07

0820 Ck pH SPF3 = 7.96
alk = 124 mg/L as $CaCO_3$ c̄ 1.6N H_2SO_4, 100mL sample final pH 4.51

0845 Start Round #2 of batch

10/16/12 0905 check pH stds 4 = 4.08 7 = 7.04 10 = 10.02

0910 check pH SPF3 = 8.03
alk = 131 mg/L as $CaCO_3$ 1.6N H_2SO_4, 100mL sample final pH = 4.79

10/17/12 0800 Check pH Stds 4 = 4.07 7 = 7.02 10 = 10.01

0805 check pH of SPF3 = 8.02
alk = 133 mg/L as $CaCO_3$ 1.6N H_2SO_4, 100 mL sample final pH = 4.82

10/18 0830 Check pH stds 4 = 4.06 7 = 7.01 10 = 9.99

0835 Check pH of SPF3 = 8.04
alk = 131 mg/L as $CaCO_3$ 1.6N H_2SO_4, 100mL sample final pH = 4.78

Riverton Syn Pore Fluid

10/22/12 Ck pH stds 4= 4.04 7= 7.06 10= 10.09

pH SPF 3 = 8.05
alk = 130 mg/L as $CaCO_3$ 1.6N H_2SO_4 100ml sample final pH= 4.65

10/23/12 Ck pH stds 4=4.09 7=7.05 10=10.08

pH SPF 3= 8.00
alk= 127 mg/L as $CaCO_3$ 1.6N H_2SO_4 100ml sample final pH= 4.60

9/7 Humidity 57% @ 9:15am
9/10 Humidity 44% @ 7:25am
9/13 Humidity 42% @ 8:15am
9/17 Humidity 36% @ 8:30am
9/18 Humidity 34% @ 9:00am

9/19 Humidity 35%
9/24 Humidity 46%

Riverton Soils LOD

DATE TIME ?

Sample		2	3 Tare	4	Gross Wgt		7	8	9	10	11	12	13
			14.0										
				9/24	~1400 8/31	9/7	9/10	9/13	9/17	9/18			9/19
T01-05	0-2.5			—	1535.3	1505.0	1503.2	1503.2	1501.5	1500.8			1500.6
	2.5-3.5			—	931.5	909.0	908.7	908.7	908.4	908.1	TD 3.5		908.1
T01-06	0-2.5			1610.3	1632.9	1614.4	1613.2	1613.5	1611.8	1611.0	TD 3.6		1610.8
	2.5-3.6			1333.7	1395.4	1335.3	1334.8	1334.7	1334.2	1334.0			1333.9
T01-07	0-2.2			1117.3	1231.2	1145.5	1131.1	1126.4	1120.9	1119.1	TD 2.2		1118.6
NS	2.5-5				—								
T02-07	0-2.5			2132.1	2157.0	2139.5	2137.2	2136.8	2134.5	2133.3	TD 3.3		2133.0
	2.5-3.3			955.8	970.9	957.1	956.7	956.6	956.2	956.1			956.0
T02-08	0-2.5			1272.9	1426.0	1316.7	1298.1	1287.0	1278.5	1276.2			1275.1
	2.5-4.1			962.5	1209.6	1016.6	982.2	966.5	964.1	963.3	TD 4.1		963.1
T02-09	0-2.5			1365.9	1414.6	1374.7	1371.4	1371.0	1368.1	1366.9	TD 5		1366.6
	2.5-5			1317.7	1340.0	1319.8	1319.1	1319.1	1318.3	1317.9			1317.9
T03-10	0-2.5			—	1384.8	1318.5	1309.0	1306.1	1301.3	1299.8			1299.3
	2.5-5			—	879.8	811.5	800.1	799.2	796.1	795.2	TD 3.9		795.1
T03-11	0-2.5			1717.4	1759.3	1729.7	1725.5	1724.6	1721.0	1719.4			1718.9
	2.5-5			1171.2	1177.8	1172.5	1172.1	1172.0	1171.6	1171.3	TD 3.55'		1171.3
T03-12	0-2.5			1224.3	1335.3	1258.6	1242.0	1234.4	1227.9	1226.2			1225.6
	2.5-5			811.7	920.0	830.8	818.0	816.2	813.1	812.2	TD 4 inches		812.1
					17								

Rw5

Croshlet

	1	2	3	4	5 8/31	6 9/7	7 9/10	8 9/13	9 9/17	10 TD	11 9/18	12 9/19	13 9/24
T04-08	0-2.5				1000.5	971.8	970.2	970.4	968.6		967.9	967.8	967.4
	2.5-5				1667.6	1653.1	1652.3	1652.3	1651.4	4.3	1650.9	1650.8	1650.4
T04-09	0-2.5				959.5	908.4	899.2	897.3	893.0		891.7	891.3	890.5
	2.5-5				1421.9	1391.5	1386.1	1384.7	1382.1	3.8	1381.1	1380.9	1380.2
T04-10	0-2.5				1464.5	1428.8	1424.6	1424.3	1421.0		1419.8	1419.2	1417.9
	2.5-5				868.5	863.2	862.8	862.7	862.4	3.1	862.2	862.2	862.0
T04-11	0-2.5				1441.6	1344.4	1321.5	1300.9	1285.1		1280.9	1278.4	1272.8
	2.5-5				1091.6	1020.9	1005.2	998.6	993.0	3.7	991.5	990.8	989.4
T04-12	0.2.5				1621.3	1499.5	1478.4	1469.9	1463.2	2.5	1461.5	1460.6	1459.1
	2.5-5				NS								
T05-1	0-2.5				1160.3	1133.0	1131.2	1131.2	1128.8		1128.0	1127.9	1127.3
	2.5-5				847.9	836.1	835.5	835.4	834.4	3.8	834.0	834.0	833.9
T05-2	0-2.5			—	1717.9	1546.4	1507.9	1463.6	1450.6		1446.9	1444.8	—
	2.5-5			—	613.9	598.6	598.1	598.1	597.6	2.9	597.3	597.3	—
T05-3	0-2.5				1111.6	1057.7	1048.5	1046.7	1041.9		1040.6	1040.3	1039.3
	2.5-5				1379.6	1284.5	1262.9	1247.5	1240.8	4.6	1238.5	1237.4	1234.7

15

Riverton

Sample			Tare14		Gross Wet 8/31	9/7	9/10	9/13	TD	9/17	9/18	9/19	9/24
T06-08	0-2.5				1935.2	1924.5	1922.5	1922.5		1920.8	1920.0	1919.6	1918.9
	2.5-5				729.6	723.8	723.4	723.3		723.0	722.9	722.9	722.8
T06-09	0-2.5				1717.3	1708.3	1706.6	1706.7		1704.8	1704.0	1703.9	1703.2
	2.5-5				1200.6	1196.3	1196.1	1196.0	3.4	1195.9	1195.8	1195.8	1195.6
T06-10	0-2.5				1515.2	1505.5	1503.9	1504.0		1502.1	1501.4	1501.2	1500.8
	2.5-5				877.6	868.6	867.8	867.8	3.5	867.1	866.8	866.8	866.4
T06-11	0-2.5				1485.0	1377.9	1357.5	1349.4		1342.0	1340.1	1339.2	1337.3
	2.5-5				896.5	868.9	867.5	867.5	3.8	866.1	865.7	865.7	865.6
T06-12	0-2.5				1357.5	1293.2	1277.0	1266.9		1258.6	1256.6	1255.8	1254.5
	2.5-5				773.6	768.3	768.1	768.1	3.3	767.8	767.8	767.7	767.7
T06-13	0-2.5				1275.6	1244.9	1241.3	1241.2		1238.4	1237.4	1237.2	1236.7
	2.5-5				1388.8	1371.5	1370.2	1370.5	4.1	1368.7	1368.0	1367.9	1367.5

12✓

Riverton

Sample		2	3	Tare 14	9/24	Gross Wet 8/31	9/7	9/10	9/13	TD	9/17	9/18	9/19
T07-03	0-2.5				1804.0	1825.4	1812.1	1809.5	1809.3		1806.6	1805.4	1805.0
	2.5-5				1269.4	1278.0	1270.9	1270.4	1270.4	3.6	1269.9	1269.7	1269.7
T07-04	0-2.5				1787.8	1812.0	1797.0	1794.0	1793.4		1790.7	1789.4	1788.8
	2.5-5				457.5	459.3	457.9	457.8	457.7	3.1	457.6	457.6	457.5
T07-05	0-2.5				1613.1	1649.6	1624.4	1620.4	1619.7		1616.4	1615.0	1614.3
	2.5-5				1334.9	1347.9	1336.4	1336.0	1336.0	3.6	1335.4	1335.2	1335.1
T07-06	0-2.5				1645.1	1693.9	1662.7	1655.5	1653.0		1648.7	1647.0	1646.3
	2.5-5				1506.1	1519.2	1508.4	1507.6	1507.6	4.0	1506.8	1506.5	1506.5
T07-07	0-2.5				2000.0	2023.2	2007.3	2004.8	2004.2		2002.1	2001.0	2000.6
	2.5-5				442.5	449.8	443.0	442.9	442.8	2.9	442.7	442.6	442.6

9/24

	1	2	3	Tare 14	9/19	Gross Wet 8/31	9/7	9/10	9/13	TD	9/17	9/18
T08-02	0-2.5			1086.9	1090.4	1273.7	1155.0	1128.0	1103.6		1094.6	1092.0
	2.5-5					N.S.						
T08-03	0-2.5			—	832.9	886.8	844.9	839.4	838.5		834.5	833.3
	2.5-5			—	1005.5	1046.7	1013.5	1009.8	1009.6		1006.7	1005.8
T08-04	0-2.5			1154.6	1156.5	1226.2	1181.1	1169.4	1165.5		1159.4	1157.3
	2.5-5			970.1	970.3	978.8	971.5	971.0	971.0	4.0	970.6	970.3
T08-05	0-2.5			1247.2	1249.3	1326.7	1271.4	1261.1	1258.0		1252.1	1250.2
	2.5-5			1787.6	1788.0	1809.4	1793.2	1790.5	1790.4	4.3	1788.7	1788.2
T08-06	0-2.5			952.5	953.3	1022.7	970.9	961.3	958.8		954.8	953.6
	2.5-5			1308.7	1309.6	1355.1	1321.0	1314.8	1313.7	4.1	1310.8	1309.8
T09-08	0-2.5			1228.3	1229.2	1292.0	1244.5	1236.3	1234.5		1230.8	1229.6
	2.5-5			1044.7	1045.1	1155.5	1064.9	1051.6	1049.3	4.1	1046.2	1045.3

9/19/12 Mettler PE16 Scale Check
X12680

Weight set 5182

100g	100.0
200g	200.0
500g	500.0
1000g	1000.0
2000g	2000.0
5000g	5000.1

Riverton Sieving Analysis

9/19/12 Sieving the 8 soil samples that will be used for the kinetic tests. Sieving them +/- 2mm. Placing samples on shaker for 5 min. No other disaggregation methods performed, unless noted

			Tare(g)	Gross(g)	Net(g)	Comments
Sample	T01-05	0-2.5				Many roots and plant materials. Large cobbles up to 1.5"
	Sieve	#10 (2mm)	561.9	1361.9	800.0	
		Pan	358.6	1043.9	685.3	
	T01-05	2.5-5				Large cobbles up to 1.5"
		#10	561.9	1246.8	684.9	
		Pan	358.6	567.8	209.2	
	T03-10	0-2.5				Some roots and sticks
		#10	561.9	813.7	251.8	
		Pan	358.5	1391.1	1032.6	
	T03-10	2.5-5				
		#10	561.9	763.7	201.8	
		Pan	358.6	937.6	579.0	

Riverton

	1	2	3	4 Tare(g)	5	Gross(g)	7	Net(g)	Comments	10	11	12	13
9/19/12 1	T05-02	0-2.5							Many roots. Very light disaggregation w/ motar + pestil.				
2													
3	Sieve	#10		561.9		564.9		3.0					
4		Pan		358.6		1783.1		1424.5					
5													
6													
7	T05-02	2.5-5							Large cobbles up to 2"				
8													
9		#10		561.9		1012.5		450.6					
10		Pan		358.6		491.3		132.7					
11													
12													
13	T08-03	0-2.5							Many roots, a lot of plant material including the base of a grass plant. Organic soil clumps. Very light disaggregation w/ motar and pestil.				
14													
15		#10		561.9		596.1		34.2					
16		Pan		358.6		1138.4		779.8					
17													
18													
19	T08-03	2.5-5							Many small root fragments				
20													
21		#10		561.9		562.4		0.5					
22		Pan		358.6		1347.6		989.0					
23													
24													
25													
26													
27													
28													
29													
30													
31													

Riverton Kinetic Tests

9/20/12 Began series of kinetic tests. Tests involve placing 1g of soil that has been air dried and sieved <2mm into a 50 mL centrifuge tube. To this soil was added 50 mL of Synthetic Pore Fluid (SPF3). Samples placed on end-over-end shaker for prescribed amount of time. Samples then centrifuged for 10 min @ 3500 rpm and decanted into seperate 50mL centrifuge tubes. From these tubes samples were syringe filtered through 0.45 µm nylon acrodisk filters into a third centrifuge tube. ~~Samples acidified w/ 10~~ If needed samples were brought to volume (50mL) w/ SPF3. Samples then acidified w/ 100 µL conc. HNO_3 for a pH <2. Samples were

~3RPM →

T01-05 U　T03-10 U　T05-02 U　T08-03 U
T01-05 L　T03-10 L　T05-02 L　T08-03 L

The U and L designations refer to upper and lower core samples. Holes were divided into two samples 0-2.5' and 2.5-5' of a specified TD. Upper refers to the 0-2.5' sample and Lower refers to the 2.5-5 or other TD sample.

Tests run today were the 5min, 15min, 30min, 1hr, 2hr tests and the 16hr test was started to run overnight and finish tomorrow.

9/21/12 The 16 hr. test was completed. The 4 and 8 hr tests were started and completed. The 48 and 96 hr tests were placed on the end-over-end shaker.

9/23/12 The 48 hr test was removed, centrifuged, fitered and acidified.

9/25/12 The 96 hr test was removed from the stir bar, centrifuged, filtered and acidified.

Note: U measured on Riv. SPF 3 at beginning and end of experiment (15 min, 96 hrs)
U <0.2ug/L

9/19/12 Riverton Kinetic Tests <2mm fraction 1g soil in 50mL SPF3

5min Tests	Sample		U(ug/L)	Mass of Soil (g)	15min Tests	Sample		U(ug/L)	Mass of soil (g)
	T01-05	0-2.5	3.6	1.00		T01-05	0-25	4.2	1.00
	T01-05	2.5-5	0.3	1.00		T01-05	25-5	0.8	1.00
	T03-10	0-2.5	0.7	1.00		T03-10	0-2.5	0.9	1.00
	T03-10	2.5-5	3.6	1.00		T03-10	2.5-5	4.5	1.00
	T05-02	0-2.5	40.6	1.00		T05-02	0-2.5	47.0	1.00
	T05-02	2.5-5	16.4	1.00		T05-02	2.5-5	20.1	1.00
	T08-03	0-2.5	19.6	1.00		T08-03	0-2.5	22.9	1.00
	T08-03	2.5-5	24.4	1.00		T08-03	2.5-5	27.5	1.00

30 min Tests	Sample		U(ug/L)	Mass of Soil (g)	1hr Tests	Sample		U(ug/L)	Mass of Soil (g)
	T01-05	0-2.5	4.8	1.00		T01-05	0-2.5	5.2	1.00
	T01-05	2.5-5	1.0	1.00		T01-05	2.5-5	<0.2	1.00
	T03-10	0-2.5	1.1	1.00		T03-10	0-2.5	0.8	1.00
	T03-10	2.5-5	5.0	1.00		T03-10	2.5-5	5.3	1.00
	T05-02	0-2.5	54.9	1.00		T05-02	0-2.5	57.3	1.00
	T05-02	2.5-5	22.1	1.00		T05-02	2.5-5	23.9	1.00
	T08-03	0-2.5	25.6	1.00		T08-03	0-2.5	27.4	1.00
	T08-03	2.5-5	31.5	1.00		T08-03	2.5-5	34.1	1.00

9/20/12 Riverton Kinetic Tests <2mm Fraction 1g soil in 50mL SPF3

~~9/19/12~~	1	2	3	4	5	6	7	8	9	10	11	12	13
2hr Tests	Sample		U (ug/L)	Mass of Soil (g)		4hrs Tests		Sample		U (ug/L)	Mass of Soil (g)		
	T01-05	0-2.5	5.5	1.00				T01-05	0-2.5	3.9	1.00		
	T01-05	2.5-5	0.3	1.00				T01-05	2.5-5	0.3	1.00		
	T03-10	0-2.5	1.5	1.00				T03-10	0-2.5	2.3	1.00		
	T03-10	2.5-5	5.6	1.00				T03-10	2.5-5	6.1	1.00		
	T05-02	0-2.5	60.1	1.00				T05-02	0-2.5	63.3	1.00		
	T05-02	2.5-5	26.9	1.00				T05-02	2.5-5	26.4	1.00		
	T08-03	0-2.5	29.8	1.00				T08-03	0-2.5	31.3	1.00		
	T08-03	2.5-5	37.7	1.00				T08-03	2.5-5	40.7	1.00		
8hr Tests	Sample			Mass of Soil (g)		16hr Tests		Sample			Mass of Soil (g)		
	T01-05	0-2.5	6.8	1.00				T01-05	0-2.5	7.6	1.00		
	T01-05	2.5-5	0.3	1.00				T01-05	2.5-5	0.5	1.00		
	T03-10	0-2.5	1.7	1.00				T03-10	0-2.5	1.6	1.00		
	T03-10	2.5-5	7.1	1.00				T03-10	2.5-5	7.1	1.00		
	T05-02	0-2.5	68.5	1.00				T05-02	0-2.5	71.0	1.00		
	T05-02	2.5-5	34.2	1.00				T05-02	2.5-5	32.3	1.00		
	T08-03	0-2.5	32.7	1.00				T08-03	0-2.5	36.3	1.00		
	T08-03	2.5-5	42.6	1.00				T08-03	2.5-5	43.8	1.00		

9/21/12 Riverton Kinetic Tests <2mm Fraction 1g soil in 50mL SPF3

48hr Tests	Sample		U (µg/L)	Mass of Soil (g)	96hr Tests	Sample		U (µg/L)	Mass of Soil (g)
	T01-05	0-2.5	8.0	1.00		T01-05	0-2.5	8.3	1.00
	T01-05	2.5-5	0.7	1.00		T01-05	2.5-5	0.7	1.00
	T03-10	0-2.5	2.0	1.00		T03-10	0-2.5	2.0	1.00
	T03-10	2.5-5	7.8	1.00		T03-10	2.5-5	8.2	1.00
	T05-02	0-2.5	76.3	1.00		T05-02	0-2.5	76.9	1.00
	T05-02	2.5-5	32.7	1.00		T05-02	2.5-5	34.8	1.00
	T08-03	0-2.5	39.6	1.00		T08-03	0-2.5	39.5	1.00
	T08-03	2.5-5	48.8	1.00		T08-03	2.5-5	48.2	1.00

Riverton Sieve Analysis

9/24/12 Begin Sieving the remaining soil samples. Sieving them +/- 2mm. Placing samples on shaker for ~~5min~~ 5-10min. No other disaggregation methods performed, unless noted.

Sample		Tare (g)	Gross (g)	Net (g)	Comments
T01-06	0-2.5				Few roots. Cobbles up to 1"
Sieve	#10 (2mm)	561.9	1276.8	714.9	
	Pan	358.6	1239.9	881.3	
T01-06	2.5-5				Large cobbles up to 1.5"
	#10	561.9	1525.3	963.4	
	Pan	358.6	714.7	356.1	
T01-07	0-2.5				Many roots. Sample could be further manipulated to
	#10	~~358~~ 561.9	825.8	263.9	reduce +2mm fraction. Many Dirt clumps.
	Pan	358.6	1197.6	839.0	
T02-07	0-2.5				Many roots and other plat material. Cobbles up to 1.5"
	#10	561.9	1606.1	1044.2	
	Pan	358.6	1432.1	1073.5	
T02-07	2.5-~~10~~5				Large cobbles up to 1.5"
	#10	561.9	1267.1	705.2	
	Pan	358.6	595.3	236.7	
T02-08	0-2.5				A lot of roots, sticks and other plant debris. Large portion
	#10	561.9	929.8	367.9	of + 2mm is dirt ~~chunk~~ chunks. Could be further
	Pan	358.6	1250.0	891.4	disaggregated.
T02-08	2.5-5				Entire +2mm fraction looks to be dirt clumps
	#10	561.9	644.2	82.3	which could be further disaggregated. Dropped pan
	Pan	358.6	1192.2 (+~31g)	864.6	and spilled some (~31g) of soil from -2mm fraction.
T02-09	0-2.5				
	#10	561.9	566.4	4.5	Some roots and plant debris.
	Pan	358.6	1706.9	1348.3	
T02-09	2.5-5				Few roots. Cobbles up to 1.5"
	#10	561.9	1242.1	680.2	
	Pan	358.6	982.3	623.7	

Riverton Sieve Analysis

	1	2	3	4 Tare (g)	5	Gross (g)	7	8 Net (g)	9 Comments	10	11	12	13
Sample 1	T03-11	0-2.5							Many roots, sticks, plant debris. Cobbles up to 1"				
2		#10		561.9		911.9		350.0	Put on shaker another 5min to break up a few dirt clumps.				
3		Pan		358.6		1713.3		1354.7	A few dirt clump remain in +2mm. Could be broken up.				
4	T03-11	2.5-5							Cobbles up to 2"				
5		#10		561.9		1424.0		862.1					
6		Pan		358.6		653.8		295.2					
7	T03-12	0-2.5							Some roots. Some of +2mm are dirt clumps that				
8		#10		561.9		823.3		261.4	could be further broken down, Majority looks to be shaley.				
9		Pan		358.6		1309.1		950.5					
10	T03-12	2.5-5							Few roots. Some of the +2mm is dirt clumps that				
11		#10		561.9		793.2		231.3	could be further broken down, most looks shaley.				
12		Pan		358.6		926.3		567.7					
13													
14	T04-08	0-2.5							A Lot of roots, sticks and other plant material				
15		#10		561.9		562.1		0.2					
16		Pan		358.6		1307.1		948.5					
17	T04-08	2.5-5							Very few roots. Cobbles up to 1.5"				
18		#10		561.9		1352.1		790.2					
19		Pan		358.6		1204.5		845.9					
20	T04-09	0-2.5							A lot of roots. Most of +2mm is dirt chuncks that				
21		#10		561.9		625.2		63.3	could be further broken down.				
22		Pan		358.6		1170.8		812.2					
23	T04-09	2.5-5							Many roots. Cobbles up to 1"				
24		#10		561.9		1174.3		612.4					
25		Pan		358.6		1112.5		753.9					
26	T04-10	0-2.5							Some roots. Cobbles up to 1.5"				
27		#10		561.9		~~1130.8~~	1033.3	471.4					
28		Pan		358.6		~~637.7~~	1291.3	932.7					
29	T04-10	2.5-5							Cobbles up to ~~1.5"~~ 2"				
30		#10		561.9		1130.8		568.9					
31		Pan		358.6		637.7		279.1					

	1	2	3	4 Tare (g)	5	Gross (g)	7	8 Net (g)	Comments	10	11	12	13
Sample 1	T04-11	0-2.5							Many roots and other plant debris. Most of +2mm				
2		#10		561.9		815.9		254.0	(99%) is dirt chunks that could be further brokendown.				
3		Pan		358.6		1362.3		1003.7					
4	T04-11	2.5-5							Many roots. Cobbles up to 1". Some of +2mm				
5		#10		561.9		726.3		164.4	is dirt chunks that could be further broken down.				
6		Pan		358.6		1169.0		810.4					
7	T04-12	0-2.5							A lot of roots. Cobbles up to 1.5" Some of +2mm				
8		#10		561.9		867.9		306.0	is dirt chunks that could be further broken down.				
9		Pan		358.6		1496.7		1138.1					
10	~~T04-12~~	~~2.5-5~~							No Sample				
11		~~#10~~		~~561.9~~									
12		~~Pan~~		~~358.6~~									
13													
14	T05-01	0-2.5							A lot of roots and plant material. Majority of +2mm				
15		#10		561.9		591.4		29.5	is dirt chunks that could be broken down further.				
16		Pan		358.6		1441.8		1083.2					
17	T05-01	2.5-5							Few roots				
18		#10		561.9		565.4		3.5					
19		Pan		358.6		1174.8		816.2					
20	T05-03	0-2.5							Many roots and other plant materials. Most if not all				
21		#10		561.9		637.4		~~3.0~~75.5	+2mm fraction is dirt chunks that could be broken				
22		Pan		358.6		1307.5		~~1~~ 948.9	down further.				
23	T05-03	2.5-5											
24		#10		561.9		690.1		128.2	Some roots. Most of +2mm fraction is dirt chunks				
25		Pan		358.6		1451.1		1092.5	that could be further broken down.				
26													
27													
28													
29													
30													
31													

	1	2	3	Tare (g)	5	Gross (g)	7	Net (g)	Comments	10	11	12	13
Sample 1	T06-08	0-2.5							Some roots. Cobbles up to 1.5"				
2		#10		561.9		1562.9		1001.0					
3		Pan		358.6		1262.3		903.7					
4	T06-08	2.5-5							Cobbles up to 2".				
5		#10		561.9		1082.1		520.2					
6		Pan		358.6		547.3		188.7					
7	T06-09	0-2.5							Some roots and plant debris. Cobbles up to 1.5"				
8		#10		561.9		~~1495.9~~	1292.2	730.3					
9		Pan		358.6		~~606.1~~	1317.3	958.7					
10	T06-09	2.5-5							Cobbles up to 2"				
11		#10		561.9		1495.9		934.0					
12		Pan		358.6		606.1		247.5					
13	T06-10	0-2.5							Many roots and plant materials. Cobbles up to 1"				
14		#10		561.9		1281.8		719.9					
15		Pan		358.6		1124.7		766.1					
16	T06-10	2.5-5							Cobbles up to 2"				
17		#10		561.9		1176.4		614.5					
18		Pan		358.6		596.3		237.7					
19	T06-11	0-2.5							A LOT of roots. Some other plant material. Most if				
20		#10		561.9		691.8		129.9	not all of the +2mm fraction is dirt chunks that could be				
21		Pan		358.6		1540.5		1181.9	further broken down.				
22	T06-11	2.5-5							Few roots. Most of +2mm fraction is dirt chunks				
23		#10		561.9		618.8		56.9	that could be further broken down.				
24		Pan		358.6		1148.0		789.4					
25	T06-12	0-2.5							Some roots. Cobbles up to 1.5" Some of +2mm				
26		#10		561.9		973.4		411.5	is dirt chunks that could be further broken down.				
27		Pan		358.6		1179.3		820.7					
28	T06-12	2.5-5							Cobbles up to 1"				
29		#10		561.9		1108.3		546.4					
30		Pan		358.6		565.2		206.6					
31													

	1	2	3	4 Tare (g)	5	6 Gross (g)	7	8 Net (g)	9 Comments	10	11	12	13
Sample 1	T06-13	0-2.5							A LOT of roots and plant debris.				
2		#10		561.9		581.2		19.3					
3		Pan		358.6		1550.7		1192.1					
4	T06-13	2.5-5							Few roots. Cobbles up to 1.5"				
5		#10		561.9		778.8		216.9					
6		Pan		358.6		1489.2		1130.6					
7													
8	T07-03	0-2.5							Many roots and other plant debris. Cobbles up to				
9		#10		561.9		1182.8		620.9	1.5"				
10		Pan		358.6		1518.7		1160.1					
11	T07-03	2.5-5							Cobbles up to 1.5"				
12		#10		561.9		1432.2		870.3					
13		Pan		358.6		741.6		383.0					
14	T07-04	0-2.5							Some roots. Cobbles up to 2"				
15		#10		561.9		1372.1		810.2					
16		Pan		358.6		1313.9		955.3					
17	T07-04	2.5-5		~~561.9~~ ~~56~~		~~904.0~~			Cobbles up to 1.5"				
18		#10		~~358.6~~ 561.9		~~459.2~~ 904.0		342.1					
19		Pan		358.6		459.2		100.6					
20	T07-05	0-2.5							Many roots and other plant materials. Cobbles up to				
21		#10		561.9		1023.3		461.4	1.5"				
22		Pan		358.6		1485.0		1126.4					
23	T07-05	2.5-5							Cobbles up to 2"				
24		#10		561.9		1524.5		962.6					
25		Pan		358.6		714.6		356.0					
26	T07-06	0-2.5							A LOT of roots and plant debris. Cobbles up to 1"				
27		#10		561.9		827.0		265.1					
28		Pan		358.6		1711.3		1352.7					
29	T07-06	2.5-5							Cobbles up to 1.5"				
30		#10		561.9		1553.1		991.2					
31		Pan		358.6		856.8		498.2					

	1	2	3	4 Tare (g)	5	Gross (g)	7	8 Net (g)	Comments	10	11	12	13
Sample 1	T07-07	0-2.5							Some plant debris. Some is large and woody. Cobbles up to 1.5"				
2		#10		561.9		1599.8		1037.9					
3		Pan		358.6		1297.9		939.3					
4	T07-07	2.5-5							Cobbles up to 1.5"				
5		#10		561.9		881.3		319.4					
6		Pan		358.6		467.1		108.5					
7													
8	T08-02	0-2.5							Few roots. Most if not all +2mm fraction is dirt chunks that could be further broken down.				
9		#10		561.9		907.7		345.8					
10		Pan		358.6		1072.6		714.0					
11	~~T08-02~~	~~2.5-5~~							No Sample				
12		~~#10~~											
13		~~Pan~~											
14	T08-04	0-2.5		3					Some roots. Cobbles up to 1"				
15		#10		561.9		717.2		155.3					
16		Pan		358.6		1333.3		974.7					
17	T08-04	2.5-5							Few roots				
18		#10		561.9		985.5		423.6					
19		Pan		358.6		889.3		530.7					
20	T08-05	0-2.5							A lot of roots. Most if not all +2mm is dirt chunks that could be further broken down.				
21		#10		561.9		790.8		228.9					
22		Pan		358.6		1351.2		992.6					
23	T08-05	2.5-5							Some roots. Cobbles up to 1.5"				
24		#10		561.9		1680.4		1118.5					
25		Pan		358.6		1009.5		650.9					
26	T08-06	0-2.5							Many roots and other plant materials. Most if not all +2mm could be further broken down.				
27		#10		561.9		685.6		123.7					
28		Pan		358.6		1161.4		802.8					
29	T08-06	2.5-5							Some roots and sticks. Cobbles up to 2".				
30		#10		561.9		946.6		384.7					
31		Pan		358.6		1262.8		904.2					

TOPS FORM 3622
MADE IN U.S.A.

	1	2	3	4 Tare (g)	5	Gross (g)	7	8 Net (g)	9 Comments	10	11	12	13
Sample 1	T09-08	0-2.5							A lot of roots and other plant material. Most				
2		#10		561.9		589.5		27.6	if not all +2mm could be further broken down.				
3		Pan		358.6		1525.7		1167.1					
4	T09-08	2.5-5							Many roots. Most of +2mm is dirt chunks that				
5		#10		561.9		633.7		71.8	could be further broken down.				
6		Pan		358.6		1311.1		952.5					
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

Riverton Batch Tests

10/8/12		Sample	2	3 Tube	4	5 Mass (g)	6	U (µg/L)	8	9	10	11	12	13
	1													
	2	T01-05	0-2.5	1-1		2.00		4.8						
	3	T01-05	2.5-5	1-2		2.00		<0.4						
	4	T01-06	0-2.5	1-3		2.00		<0.4						
	5	T01-06	2.5-5	1-4		2.00		<0.4						
	6	T01-07	0-2.5	1-5		2.00		33.2						
	7	T02-07	0-2.5	1-6		2.00		<0.4						
	8	T02-07	2.5-5	1-7		2.00		0.8						
	9	T02-08	0-2.5	1-8		2.00		9.8						
	10	T02-08	2.5-5	1-9		2.00		3.5						
	11	T02-09	0-2.5	1-10		2.00		44.5						
	12	T02-09	2.5-5	1-11		2.00		8.6						
	13	T03-10	0-2.5	1-12		2.00		0.8						
	14	T03-10	2.5-5	1-13		2.00		4.7						
	15	T03-11	0-2.5	1-14		2.00		1.6						
	16	T03-11	2.5-5	1-15		2.00		0.8						
	17	T03-12	0-2.5	1-16		2.00		5.8						
	18	T03-12	2.5-5	1-17		2.00		3.0						
	19	T04-08	0-2.5	1-18		2.00		18.7						
	20	T04-08	2.5-5	1-19, ~~20~~		2.00/~~2.00~~		3.2						
	21	T04-08	2.5-5D	1-20D		2.00								
	22	Start	11:30	1g of each sample in each of 2 tubes. 50mL SPF3 added to each tube. Put on stir bar for 24 hrs.										
	23													
10/9/12	24	1130 Samples off stir bar. Placed in centrifuge @ 3000 rpm for 20 min then decanted into 200 mL volumetric flask. 50 mL												
	25	SPF added to each tube and placed back on stir bar for another 24 hrs.												
	26													
	27													
	28													
	29													
	30													
	31													

Riverton Batch Tests

10/10/12	Sample	2	3 Tube	4	5 Mass (g)	6	7 U (µg/L)	8	9	10	11	12	13
	T04-09	0-2.5	2-1		2.00		47.9						
	T04-09	2.5-5	2-2		2.00		21.2						
	T04-10	0-2.5	2-3		2.00		25.4						
	T04-10	2.5-5	2-4		2.00		5.1						
	T04-11	0-2.5	2-5		2.00		47.3						
	T04-11	2.5-5	2-6		2.00		33.5						
	T04-12	0-2.5	2-7		2.00		37.0						
	T05-01	0-2.5	2-8		2.00		10.7						
	T05-01	2.5-5	2-9		2.00		3.3						
	T05-02	0-2.5	2-10		2.00		38.0						
	T05-02	2.5-5	2-11		2.00		13.2						
	T05-03	0-2.5	2-12		2.00		24.8						
	T05-03	2.5-5	2-13		2.00		47.1						
	T06-08	0-2.5	2-14		2.00		5.2						
	T06-08	2.5-5	2-15		2.00		0.6						
	T06-09	0-2.5	2-16		2.00		12.6						
	T06-09	2.5-5	2-17		2.00		2.1						
	T06-10	0-2.5	2-18		2.00		17.9						
	T06-10	2.5-5	2-19, ~~20~~		2.00/~~2.00~~		2.2						
	T06-10	2.5-5	2-20		2.00		2.3						

10/15/12 Start @ 0845 after pH, alk ck. w/ SPF3 Stir on End-over-End @ ~8 RPM

10/16/12 Remove from stir bar Cent 20"x 3KRPM. Decant into 200mL Vol flask. Stopper flasks

Refill cent tubes w/ SPF3. Replace on stir bar @ 8RPM

10/17/12 Remove from stir bar Cent 20"x 3KRPM. Decant into above mentioned Vol flask

Fill to Volume. Vac Filter thru 0.45um filter Acidify pH<2 c̄ Conc. HNO_3

Analyze for U

Riverton Batch Tests

10/16/12	Sample	2	3 Tube	4	5 Mass(g)	6	U (µg/L)	8
1								
2	T06-11	0-2.5	3-1		2.00		30.5	
3	T06-11	2.5-5	3-2		2.00		5.6	
4	T06-12	0-2.5	3-3		2.00		29.5	
5	T06-12	2.5-5	3-4		2.00		2.1	
6	T06-13	0-2.5	3-5		2.00		37.9	
7	T06-13	2.5-5	3-6		2.00		19.7	
8	T07-03	0-2.5	3-7		2.00		9.3	
9	T07-03	2.5-5	3-8		2.00		1.1	
10	T07-04	0-2.5	3-9		2.00		12.1	
11	T07-04	2.5-5	3-10		2.00		2.4	
12	T07-05	0-2.5	3-11		2.00		22.7	
13	T07-05	2.5-5	3-12		2.00		4.2	
14	T07-06	0-2.5	3-13		2.00		35.2	
15	T07-06	2.5-5	3-14		2.00		2.2	
16	T07-07	0-2.5	3-15		2.00		10.9	
17	T07-07	2.5-5	3-16		2.00		4.1	
18	T08-02	0-2.5	3-17		2.00		21.5	
19	T08-03	0-2.5	3-18		2.00		20.7	
20	T08-03	2.5-5	3-19		2.00		25.8	
21	T08-03	2.5-5	3-20		2.00		26.0	
10/17/12 22	Start @ 820 after pH and alk check. End-Over-End at ~ 8 Rpm							
23	T08-04	0-2.5	4-1		2.00		31.9	
10/22/12 24	T08-04	2.5-5	4-2		2.00		37	
25	T08-05	0-2.5	4-3		2.00		22.2	
26	T08-05	2.5-5	4-4		2.00		20.7	
27	T08-06	0-2.5	4-5		2.00		28.1	
28	T08-06	2.5-5	4-6		2.00		25.5	
29	T09-08	0-2.5	4-7		2.00		4.9	
30	T09-08	2.5-5	4-8		2.00		3.0	
31	T09-08	2.5-5	4-9		2.00		2.8	

9 10 11 12 13

10/18/12 0830 Remove from stir bar Cent 20" x 3K RPM. Decant into 200mL Vol flask. Stopper flasks. Refill cent. tubes w/ 50mL SPF3 Replace on stir bar @ 8 RPM

10/19/12 Remove from stir bar, Cent 20" x 3K RPM. Decant into above mentioned flask. Fill to Volume. Vac filter through 0.45uM filter. Acidify pH<2 c̄ Conc HNO_3

10/24 Analyze for U

10/22 Start @ 9A after SPF pH/alk ck

10/23 Remove from stir bar Cent 20" x 3K RPM, Decant into 200mL Vol flask. Stopper flasks Refill cent tubes w/ 50mL SPF3. Replace on bar @ 8 RPM

10/24 Remove from stir bar, Cent 20" x 3K RPM Decant into above mentioned flasks. Fill to Volume Vac filter thru 0.45um filter Acidify pH<2 c̄ Conc HNO_3

Appendix G

Groundwater Quality Data – Enhanced Characterization

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	T01-01	BH	08/24/2012	0001			268			#	-	-
	mg/L	T01-02	BH	08/24/2012	0001			244			#	-	-
	mg/L	T01-03	BH	08/24/2012	0001			284			#	-	-
	mg/L	T01-04	BH	08/24/2012	0001			289			#	-	-
	mg/L	T01-05	BH	08/23/2012	0001			270			#	-	-
	mg/L	T01-06	BH	08/23/2012	0001			258			#	-	-
	mg/L	T01-07	BH	08/23/2012	0001			250			#	-	-
	mg/L	T01-08	BH	08/23/2012	0001			210			#	-	-
	mg/L	T01-09	BH	08/23/2012	0001			210			#	-	-
	mg/L	T02-01	BH	08/22/2012	0001			236			#	-	-
	mg/L	T02-02	BH	08/22/2012	0001			157			#	-	-
	mg/L	T02-03	BH	08/22/2012	0001			156			#	-	-
	mg/L	T02-04	BH	08/22/2012	0001			84			#	-	-
	mg/L	T02-05	BH	08/22/2012	0001			113			#	-	-
	mg/L	T02-06	BH	08/22/2012	0001			626			#	-	-
	mg/L	T02-07	BH	08/23/2012	0001			424			#	-	-
	mg/L	T02-08	BH	08/23/2012	0001			305			#	-	-
	mg/L	T02-09	BH	08/23/2012	0001			320			#	-	-
	mg/L	T02-10	BH	08/23/2012	0001			304			#	-	-
	mg/L	T02-11	BH	08/23/2012	0001			251			#	-	-
	mg/L	T02-12	BH	08/23/2012	0001			198			#	-	-
	mg/L	T02-13	BH	08/23/2012	0001			149			#	-	-
	mg/L	T02-14	BH	08/23/2012	0001			174			#	-	-
	mg/L	T02-15	BH	08/23/2012	0001			229			#	-	-
	mg/L	T03-01	BH	08/22/2012	0001			232			#	-	-
	mg/L	T03-02	BH	08/22/2012	0001			253			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE:		ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS:			DETECTION LIMIT	UN-CERTAINTY
				DATE	ID				LAB	DATA	QA		
Alkalinity, Total (As CaCO3)	mg/L	T03-08	BH	08/21/2012	0001			308			#	-	-
	mg/L	T03-09	BH	08/22/2012	0001			356			#	-	-
	mg/L	T03-10	BH	08/22/2012	0001			314			#	-	-
	mg/L	T03-11	BH	08/22/2012	0001			338			#	-	-
	mg/L	T03-12	BH	08/21/2012	0001			299			#	-	-
	mg/L	T03-13	BH	08/21/2012	0001			267			#	-	-
	mg/L	T03-14	BH	08/21/2012	0001			236			#	-	-
	mg/L	T03-15	BH	08/21/2012	0001			238			#	-	-
	mg/L	T03-16	BH	08/21/2012	N001			203			#	-	-
	mg/L	T03-17	BH	08/21/2012	0001			236			#	-	-
	mg/L	T03-18	BH	08/24/2012	0001			280			#	-	-
	mg/L	T03-19	BH	08/24/2012	0001			265			#	-	-
	mg/L	T03-20	BH	08/24/2012	0001			321			#	-	-
	mg/L	T03-21	BH	08/24/2012	0001			338			#	-	-
	mg/L	T04-03	BH	08/26/2012	0001			452			#	-	-
	mg/L	T04-04	BH	08/26/2012	0001			370			#	-	-
	mg/L	T04-05	BH	08/26/2012	0001			380			#	-	-
	mg/L	T04-06	BH	08/26/2012	0001			436			#	-	-
	mg/L	T04-07	BH	08/26/2012	0001			392			#	-	-
	mg/L	T04-08	BH	08/27/2012	0001			384			#	-	-
	mg/L	T04-09	BH	08/27/2012	0001			368			#	-	-
	mg/L	T04-10	BH	08/27/2012	0001			398			#	-	-
	mg/L	T04-11	BH	08/27/2012	0001			307			#	-	-
	mg/L	T04-12	BH	08/24/2012	0001			268			#	-	-
	mg/L	T04-15	BH	08/24/2012	0001			243			#	-	-
	mg/L	T04-16	BH	08/24/2012	0001			235			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	T04-17	BH	08/24/2012	0001			267			#	-	-
	mg/L	T05-01	BH	08/28/2012	0001			460			#	-	-
	mg/L	T05-02	BH	08/29/2012	0001			382			#	-	-
	mg/L	T05-03	BH	08/29/2012	0001			297			#	-	-
	mg/L	T06-01	BH	08/26/2012	0001			422			#	-	-
	mg/L	T06-02	BH	08/26/2012	0001			433			#	-	-
	mg/L	T06-03	BH	08/26/2012	0001			570			#	-	-
	mg/L	T06-04	BH	08/26/2012	0001			446			#	-	-
	mg/L	T06-05	BH	08/26/2012	0001			518			#	-	-
	mg/L	T06-06	BH	08/26/2012	0001			489			#	-	-
	mg/L	T06-07	BH	08/26/2012	0001			533			#	-	-
	mg/L	T06-08	BH	08/26/2012	0001			466			#	-	-
	mg/L	T06-09	BH	08/26/2012	0001			439			#	-	-
	mg/L	T06-10	BH	08/27/2012	0001			436			#	-	-
	mg/L	T06-11	BH	08/27/2012	0001			382			#	-	-
	mg/L	T06-12	BH	08/27/2012	0001			350			#	-	-
	mg/L	T06-13	BH	08/27/2012	0001			288			#	-	-
	mg/L	T06-14	BH	08/27/2012	0001			324			#	-	-
	mg/L	T06-15	BH	08/27/2012	0001			306			#	-	-
	mg/L	T06-16	BH	08/27/2012	0001			354			#	-	-
	mg/L	T06-17	BH	08/27/2012	0001			382			#	-	-
	mg/L	T06-21	BH	08/28/2012	0001			390			#	-	-
	mg/L	T07-01	BH	08/25/2012	0001			576			#	-	-
	mg/L	T07-02	BH	08/25/2012	0001			578			#	-	-
	mg/L	T07-03	BH	08/25/2012	0001			500			#	-	-
	mg/L	T07-04	BH	08/25/2012	0001			474			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	T07-05	BH	08/25/2012	0001			424			#	-	-
	mg/L	T07-06	BH	08/28/2012	0001			425			#	-	-
	mg/L	T07-07	BH	08/29/2012	0001			334			#	-	-
	mg/L	T07-08	BH	08/28/2012	0001			270			#	-	-
	mg/L	T07-09	BH	08/28/2012	0001			309			#	-	-
	mg/L	T07-10	BH	08/28/2012	0001			320			#	-	-
	mg/L	T08-01	BH	08/25/2012	0001			591			#	-	-
	mg/L	T08-02	BH	08/25/2012	0001			588			#	-	-
	mg/L	T08-03	BH	08/25/2012	0001			503			#	-	-
	mg/L	T08-04	BH	08/25/2012	0001			427			#	-	-
	mg/L	T08-05	BH	08/25/2012	0001			368			#	-	-
	mg/L	T08-06	BH	08/25/2012	0001			349			#	-	-
	mg/L	T08-07	BH	08/27/2012	0001			387			#	-	-
	mg/L	T08-08	BH	08/28/2012	0001			374			#	-	-
	mg/L	T08-09	BH	08/28/2012	0001			350			#	-	-
	mg/L	T09-01	BH	08/25/2012	0001			194			#	-	-
	mg/L	T09-02	BH	08/25/2012	0001			221			#	-	-
	mg/L	T09-03	BH	08/25/2012	0001			271			#	-	-
	mg/L	T09-04	BH	08/25/2012	0001			281			#	-	-
	mg/L	T09-05	BH	08/25/2012	0001			391			#	-	-
	mg/L	T09-06	BH	08/28/2012	0001			366			#	-	-
	mg/L	T09-07	BH	08/28/2012	0001			375			#	-	-
	mg/L	T09-08	BH	08/28/2012	0001			314			#	-	-
	mg/L	T09-09	BH	08/28/2012	0001			288			#	-	-
	mg/L	T09-10	BH	08/28/2012	0001			328			#	-	-
Calcium	mg/L	T01-01	BH	08/24/2012	0001			140.000			#	0.06	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Calcium	mg/L	T01-02	BH	08/24/2012	0001			96.000			#	0.012	-
	mg/L	T01-03	BH	08/24/2012	0001			100.000			#	0.012	-
	mg/L	T01-04	BH	08/24/2012	0001			93.000			#	0.012	-
	mg/L	T01-05	BH	08/23/2012	0001			130.000			#	0.012	-
	mg/L	T01-06	BH	08/23/2012	0001			120.000			#	0.012	-
	mg/L	T01-07	BH	08/23/2012	0001			95.000			#	0.012	-
	mg/L	T01-08	BH	08/23/2012	0001			85.000			#	0.012	-
	mg/L	T01-09	BH	08/23/2012	0001			66.000			#	0.012	-
	mg/L	T02-01	BH	08/22/2012	0001			330.000			#	0.06	-
	mg/L	T02-02	BH	08/22/2012	0001			73.000			#	0.06	-
	mg/L	T02-03	BH	08/22/2012	0001			190.000			#	0.06	-
	mg/L	T02-04	BH	08/22/2012	0001			320.000			#	0.06	-
	mg/L	T02-05	BH	08/22/2012	0001			330.000			#	0.06	-
	mg/L	T02-06	BH	08/22/2012	0001			49.000			#	0.12	-
	mg/L	T02-07	BH	08/23/2012	0001			360.000			#	0.06	-
	mg/L	T02-08	BH	08/23/2012	0001			210.000			#	0.06	-
	mg/L	T02-09	BH	08/23/2012	0001			180.000			#	0.012	-
	mg/L	T02-10	BH	08/23/2012	0001			170.000			#	0.012	-
	mg/L	T02-11	BH	08/23/2012	0001			130.000			#	0.012	-
	mg/L	T02-12	BH	08/23/2012	0001			86.000			#	0.012	-
	mg/L	T02-13	BH	08/23/2012	0001			48.000			#	0.012	-
	mg/L	T02-14	BH	08/23/2012	0001			59.000			#	0.012	-
	mg/L	T02-15	BH	08/23/2012	0001			57.000			#	0.012	-
	mg/L	T03-01	BH	08/22/2012	0001			110.000			#	0.012	-
	mg/L	T03-02	BH	08/22/2012	0001			150.000			#	0.012	-
	mg/L	T03-08	BH	08/21/2012	0001			500.000			#	0.12	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Calcium	mg/L	T03-09	BH	08/22/2012	0001			380.000			#	0.12	-
	mg/L	T03-10	BH	08/22/2012	0001			250.000			#	0.12	-
	mg/L	T03-11	BH	08/22/2012	0001			230.000			#	0.06	-
	mg/L	T03-12	BH	08/21/2012	0001			140.000			#	0.012	-
	mg/L	T03-13	BH	08/21/2012	0001			120.000			#	0.012	-
	mg/L	T03-14	BH	08/21/2012	0001			96.000			#	0.012	-
	mg/L	T03-15	BH	08/21/2012	0001			64.000			#	0.012	-
	mg/L	T03-15	BH	08/21/2012	0002			67.000			#	0.012	-
	mg/L	T03-16	BH	08/21/2012	0001			69.000			#	0.012	-
	mg/L	T03-17	BH	08/21/2012	0001			67.000			#	0.012	-
	mg/L	T03-18	BH	08/24/2012	0001			110.000			#	0.012	-
	mg/L	T03-19	BH	08/24/2012	0001			95.000			#	0.012	-
	mg/L	T03-20	BH	08/24/2012	0001			110.000			#	0.012	-
	mg/L	T03-21	BH	08/24/2012	0001			120.000			#	0.012	-
	mg/L	T04-03	BH	08/26/2012	0001			180.000			#	0.06	-
	mg/L	T04-04	BH	08/26/2012	0001			190.000			#	0.06	-
	mg/L	T04-05	BH	08/26/2012	0001			370.000			#	0.06	-
	mg/L	T04-06	BH	08/26/2012	0001			420.000			#	0.12	-
	mg/L	T04-07	BH	08/26/2012	0001			380.000			#	0.12	-
	mg/L	T04-07	BH	08/26/2012	0002			390.000			#	0.12	-
	mg/L	T04-08	BH	08/27/2012	0001			430.000			#	0.12	-
	mg/L	T04-09	BH	08/27/2012	0001			470.000			#	0.12	-
	mg/L	T04-10	BH	08/27/2012	0001			350.000			#	0.06	-
	mg/L	T04-11	BH	08/27/2012	0001			260.000			#	0.06	-
	mg/L	T04-12	BH	08/24/2012	0001			78.000			#	0.012	-
	mg/L	T04-15	BH	08/24/2012	0001			86.000			#	0.012	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Calcium	mg/L	T04-16	BH	08/24/2012	0001			94.000			#	0.012	-
	mg/L	T04-16	BH	08/24/2012	0002			93.000			#	0.012	-
	mg/L	T04-17	BH	08/24/2012	0001			95.000			#	0.012	-
	mg/L	T05-01	BH	08/28/2012	0001			550.000			#	0.12	-
	mg/L	T05-02	BH	08/29/2012	0001			320.000			#	0.06	-
	mg/L	T05-03	BH	08/29/2012	0001			280.000			#	0.06	-
	mg/L	T05-03	BH	08/29/2012	0002			280.000			#	0.06	-
	mg/L	T06-01	BH	08/26/2012	0001			270.000			#	0.06	-
	mg/L	T06-02	BH	08/26/2012	0001			340.000			#	0.06	-
	mg/L	T06-03	BH	08/26/2012	0001			280.000			#	0.06	-
	mg/L	T06-04	BH	08/26/2012	0001			230.000			#	0.06	-
	mg/L	T06-05	BH	08/26/2012	0001			320.000			#	0.12	-
	mg/L	T06-06	BH	08/26/2012	0001			410.000			#	0.12	-
	mg/L	T06-07	BH	08/26/2012	0001			450.000			#	0.12	-
	mg/L	T06-08	BH	08/26/2012	0001			530.000			#	0.12	-
	mg/L	T06-09	BH	08/26/2012	0001			480.000			#	0.12	-
	mg/L	T06-10	BH	08/27/2012	0001			440.000			#	0.12	-
	mg/L	T06-11	BH	08/27/2012	0001			490.000			#	0.12	-
	mg/L	T06-12	BH	08/27/2012	0001			310.000			#	0.06	-
	mg/L	T06-13	BH	08/27/2012	0001			360.000			#	0.06	-
	mg/L	T06-14	BH	08/27/2012	0001			240.000			#	0.012	-
	mg/L	T06-15	BH	08/27/2012	0001			160.000			#	0.012	-
	mg/L	T06-16	BH	08/27/2012	0001			98.000			#	0.012	-
	mg/L	T06-17	BH	08/27/2012	0001			180.000			#	0.06	-
	mg/L	T06-21	BH	08/28/2012	0001			140.000			#	0.012	-
	mg/L	T07-01	BH	08/25/2012	0001			490.000			#	0.24	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Calcium	mg/L	T07-02	BH	08/25/2012	0001			480.000			#	0.24	-
	mg/L	T07-03	BH	08/25/2012	0001			470.000			#	0.24	-
	mg/L	T07-04	BH	08/25/2012	0001			460.000			#	0.12	-
	mg/L	T07-05	BH	08/25/2012	0001			450.000			#	0.12	-
	mg/L	T07-06	BH	08/28/2012	0001			480.000			#	0.06	-
	mg/L	T07-06	BH	08/28/2012	0002			470.000			#	0.06	-
	mg/L	T07-07	BH	08/29/2012	0001			330.000			#	0.06	-
	mg/L	T07-08	BH	08/28/2012	0001			330.000			#	0.06	-
	mg/L	T07-09	BH	08/28/2012	0001			140.000			#	0.012	-
	mg/L	T07-10	BH	08/28/2012	0001			110.000			#	0.012	-
	mg/L	T08-01	BH	08/25/2012	0001			760.000			#	0.24	-
	mg/L	T08-02	BH	08/25/2012	0001			570.000			#	0.24	-
	mg/L	T08-02	BH	08/25/2012	0002			560.000			#	0.6	-
	mg/L	T08-03	BH	08/25/2012	0001			450.000			#	0.24	-
	mg/L	T08-04	BH	08/25/2012	0001			500.000			#	0.12	-
	mg/L	T08-05	BH	08/25/2012	0001			480.000			#	0.012	-
	mg/L	T08-06	BH	08/25/2012	0001			480.000			#	0.06	-
	mg/L	T08-07	BH	08/27/2012	0001			420.000			#	0.06	-
	mg/L	T08-08	BH	08/28/2012	0001			130.000			#	0.012	-
	mg/L	T08-09	BH	08/28/2012	0001			110.000			#	0.012	-
	mg/L	T09-01	BH	08/25/2012	0001			72.000			#	0.012	-
	mg/L	T09-02	BH	08/25/2012	0001			100.000			#	0.012	-
	mg/L	T09-03	BH	08/25/2012	0001			170.000			#	0.06	-
	mg/L	T09-04	BH	08/25/2012	0001			210.000			#	0.06	-
	mg/L	T09-05	BH	08/25/2012	0001			400.000			#	0.06	-
	mg/L	T09-06	BH	08/28/2012	0001			160.000			#	0.06	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Calcium	mg/L	T09-07	BH	08/28/2012	0001			87.000			#	0.06	-
	mg/L	T09-08	BH	08/28/2012	0001			56.000			#	0.012	-
	mg/L	T09-09	BH	08/28/2012	0001			75.000			#	0.012	-
	mg/L	T09-10	BH	08/28/2012	0001			110.000			#	0.012	-
Chloride	mg/L	T01-01	BH	08/24/2012	0001			49			#	4	-
	mg/L	T01-02	BH	08/24/2012	0001			23			#	2	-
	mg/L	T01-03	BH	08/24/2012	0001			21			#	2	-
	mg/L	T01-04	BH	08/24/2012	0001			21			#	2	-
	mg/L	T01-05	BH	08/23/2012	0001			32			#	2	-
	mg/L	T01-06	BH	08/23/2012	0001			28			#	2	-
	mg/L	T01-07	BH	08/23/2012	0001			23			#	2	-
	mg/L	T01-08	BH	08/23/2012	0001			15			#	1	-
	mg/L	T01-09	BH	08/23/2012	0001			8.1			#	1	-
	mg/L	T02-01	BH	08/22/2012	0001			77			#	10	-
	mg/L	T02-02	BH	08/22/2012	0001			26			#	4	-
	mg/L	T02-03	BH	08/22/2012	0001			30			#	4	-
	mg/L	T02-04	BH	08/22/2012	0001			30			#	1	-
	mg/L	T02-05	BH	08/22/2012	0001			23			#	1	-
	mg/L	T02-06	BH	08/22/2012	0001			28			#	1	-
	mg/L	T02-07	BH	08/23/2012	0001			60			#	10	-
	mg/L	T02-08	BH	08/23/2012	0001			40			#	4	-
	mg/L	T02-09	BH	08/23/2012	0001			46			#	4	-
	mg/L	T02-10	BH	08/23/2012	0001			50			#	2	-
	mg/L	T02-11	BH	08/23/2012	0001			30			#	2	-
	mg/L	T02-12	BH	08/23/2012	0001			11			#	1	-
	mg/L	T02-13	BH	08/23/2012	0001			3.4			#	0.4	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Chloride	mg/L	T02-14	BH	08/23/2012	0001			4.6			#	0.4	-
	mg/L	T02-15	BH	08/23/2012	0001			4.7			#	0.4	-
	mg/L	T03-01	BH	08/22/2012	0001			8.4			#	2	-
	mg/L	T03-02	BH	08/22/2012	0001			11			#	2	-
	mg/L	T03-08	BH	08/21/2012	0001			55			#	10	-
	mg/L	T03-09	BH	08/22/2012	0001			38			#	10	-
	mg/L	T03-10	BH	08/22/2012	0001			50			#	4	-
	mg/L	T03-11	BH	08/22/2012	0001			48			#	4	-
	mg/L	T03-12	BH	08/21/2012	0001			49			#	2	-
	mg/L	T03-13	BH	08/21/2012	0001			36			#	2	-
	mg/L	T03-14	BH	08/21/2012	0001			17			#	1	-
	mg/L	T03-15	BH	08/21/2012	0001			7.7			#	1	-
	mg/L	T03-15	BH	08/21/2012	0002			7.7			#	1	-
	mg/L	T03-16	BH	08/21/2012	0001			6.7			#	1	-
	mg/L	T03-17	BH	08/21/2012	0001			4.4			#	0.2	-
	mg/L	T03-18	BH	08/24/2012	0001			5.2			#	1	-
	mg/L	T03-19	BH	08/24/2012	0001			4.5			#	0.4	-
	mg/L	T03-20	BH	08/24/2012	0001			7.2			#	1	-
	mg/L	T03-21	BH	08/24/2012	0001			7.2			#	1	-
	mg/L	T04-03	BH	08/26/2012	0001			29			#	4	-
	mg/L	T04-04	BH	08/26/2012	0001			25			#	4	-
	mg/L	T04-05	BH	08/26/2012	0001			54			#	10	-
	mg/L	T04-06	BH	08/26/2012	0001			110			#	10	-
	mg/L	T04-07	BH	08/26/2012	0001			140			#	10	-
	mg/L	T04-07	BH	08/26/2012	0002			140			#	10	-
	mg/L	T04-08	BH	08/27/2012	0001			130			#	10	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Chloride	mg/L	T04-09	BH	08/27/2012	0001			77			#	10	-
	mg/L	T04-10	BH	08/27/2012	0001			44			#	10	-
	mg/L	T04-11	BH	08/27/2012	0001			54			#	10	-
	mg/L	T04-12	BH	08/24/2012	0001			6.5			#	0.4	-
	mg/L	T04-15	BH	08/24/2012	0001			5.8			#	1	-
	mg/L	T04-16	BH	08/24/2012	0001			6.3			#	1	-
	mg/L	T04-16	BH	08/24/2012	0002			6.3			#	1	-
	mg/L	T04-17	BH	08/24/2012	0001			5.8			#	1	-
	mg/L	T05-01	BH	08/28/2012	0001			250			#	10	-
	mg/L	T05-02	BH	08/29/2012	0001			59			#	10	-
	mg/L	T05-03	BH	08/29/2012	0001			43			#	4	-
	mg/L	T05-03	BH	08/29/2012	0002			43			#	4	-
	mg/L	T06-01	BH	08/26/2012	0001			78			#	4	-
	mg/L	T06-02	BH	08/26/2012	0001			57			#	10	-
	mg/L	T06-03	BH	08/26/2012	0001			56			#	10	-
	mg/L	T06-04	BH	08/26/2012	0001			42			#	10	-
	mg/L	T06-05	BH	08/26/2012	0001			110			#	10	-
	mg/L	T06-06	BH	08/26/2012	0001			140			#	10	-
	mg/L	T06-07	BH	08/26/2012	0001			220			#	20	-
	mg/L	T06-08	BH	08/26/2012	0001			240			#	10	-
	mg/L	T06-09	BH	08/26/2012	0001			200			#	10	-
	mg/L	T06-10	BH	08/27/2012	0001			130			#	10	-
	mg/L	T06-11	BH	08/27/2012	0001			66			#	10	-
	mg/L	T06-12	BH	08/27/2012	0001			55			#	4	-
	mg/L	T06-13	BH	08/27/2012	0001			49			#	4	-
	mg/L	T06-14	BH	08/27/2012	0001			26			#	4	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Chloride	mg/L	T06-15	BH	08/27/2012	0001			16			#	2	-
	mg/L	T06-16	BH	08/27/2012	0001			17			#	2	-
	mg/L	T06-17	BH	08/27/2012	0001			37			#	4	-
	mg/L	T06-21	BH	08/28/2012	0001			9.6			#	2	-
	mg/L	T07-01	BH	08/25/2012	0001			280			#	20	-
	mg/L	T07-02	BH	08/25/2012	0001			370			#	20	-
	mg/L	T07-03	BH	08/25/2012	0001			270			#	20	-
	mg/L	T07-04	BH	08/25/2012	0001			180			#	20	-
	mg/L	T07-05	BH	08/25/2012	0001			110			#	10	-
	mg/L	T07-06	BH	08/28/2012	0001			83			#	10	-
	mg/L	T07-06	BH	08/28/2012	0002			86			#	10	-
	mg/L	T07-07	BH	08/29/2012	0001			59			#	10	-
	mg/L	T07-08	BH	08/28/2012	0001			38			#	4	-
	mg/L	T07-09	BH	08/28/2012	0001			20			#	4	-
	mg/L	T07-10	BH	08/28/2012	0001			16			#	2	-
	mg/L	T08-01	BH	08/25/2012	0001			570			#	20	-
	mg/L	T08-02	BH	08/25/2012	0001			540			#	20	-
	mg/L	T08-02	BH	08/25/2012	0002			520			#	20	-
	mg/L	T08-03	BH	08/25/2012	0001			300			#	20	-
	mg/L	T08-04	BH	08/25/2012	0001			160			#	10	-
	mg/L	T08-05	BH	08/25/2012	0001			120			#	10	-
	mg/L	T08-06	BH	08/25/2012	0001			91			#	10	-
	mg/L	T08-07	BH	08/27/2012	0001			110			#	10	-
	mg/L	T08-08	BH	08/28/2012	0001			31			#	2	-
	mg/L	T08-09	BH	08/28/2012	0001			20			#	2	-
	mg/L	T09-01	BH	08/25/2012	0001			8.9			#	1	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Chloride	mg/L	T09-02	BH	08/25/2012	0001			17			#	2	-
	mg/L	T09-03	BH	08/25/2012	0001			26			#	4	-
	mg/L	T09-04	BH	08/25/2012	0001			59			#	4	-
	mg/L	T09-05	BH	08/25/2012	0001			160			#	10	-
	mg/L	T09-06	BH	08/28/2012	0001			37			#	4	-
	mg/L	T09-07	BH	08/28/2012	0001			32			#	4	-
	mg/L	T09-08	BH	08/28/2012	0001			10			#	1	-
	mg/L	T09-09	BH	08/28/2012	0001			8.9			#	1	-
	mg/L	T09-10	BH	08/28/2012	0001			12			#	1	-
Dissolved Oxygen	mg/L	T01-01	BH	08/24/2012	N001			0.70			#	-	-
	mg/L	T01-02	BH	08/24/2012	N001			0.65			#	-	-
	mg/L	T01-03	BH	08/24/2012	N001			0.68			#	-	-
	mg/L	T01-04	BH	08/24/2012	N001			0.71			#	-	-
	mg/L	T01-05	BH	08/23/2012	N001			0.73			#	-	-
	mg/L	T01-06	BH	08/23/2012	N001			0.66			#	-	-
	mg/L	T01-07	BH	08/23/2012	N001			1.31			#	-	-
	mg/L	T01-08	BH	08/23/2012	N001			1.04			#	-	-
	mg/L	T01-09	BH	08/23/2012	N001			1.96			#	-	-
	mg/L	T02-01	BH	08/22/2012	N001			1.31			#	-	-
	mg/L	T02-02	BH	08/22/2012	N001			1.63			#	-	-
	mg/L	T02-06	BH	08/22/2012	N001			0.68			#	-	-
	mg/L	T02-07	BH	08/23/2012	N001			1.39			#	-	-
	mg/L	T02-08	BH	08/23/2012	N001			1.50			#	-	-
	mg/L	T02-09	BH	08/23/2012	N001			0.68			#	-	-
	mg/L	T02-10	BH	08/23/2012	N001			1.04			#	-	-
	mg/L	T02-11	BH	08/23/2012	N001			0.74			#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Dissolved Oxygen	mg/L	T02-12	BH	08/23/2012	N001			0.93			#	-	-
	mg/L	T02-13	BH	08/23/2012	N001			0.75			#	-	-
	mg/L	T02-14	BH	08/23/2012	N001			1.35			#	-	-
	mg/L	T02-15	BH	08/23/2012	N001			0.53			#	-	-
	mg/L	T03-01	BH	08/22/2012	N001			1.56			#	-	-
	mg/L	T03-02	BH	08/22/2012	N001			0.60			#	-	-
	mg/L	T03-18	BH	08/24/2012	N001			0.97			#	-	-
	mg/L	T03-19	BH	08/24/2012	N001			1.19			#	-	-
	mg/L	T03-20	BH	08/24/2012	N001			1.74			#	-	-
	mg/L	T03-21	BH	08/24/2012	N001			1.10			#	-	-
	mg/L	T04-03	BH	08/26/2012	N001			0.72			#	-	-
	mg/L	T04-04	BH	08/26/2012	N001			0.81			#	-	-
	mg/L	T04-05	BH	08/26/2012	N001			0.68			#	-	-
	mg/L	T04-06	BH	08/26/2012	N001			0.43			#	-	-
	mg/L	T04-07	BH	08/26/2012	N001			0.5			#	-	-
	mg/L	T04-08	BH	08/27/2012	N001			0.64			#	-	-
	mg/L	T04-09	BH	08/27/2012	N001			0.48			#	-	-
	mg/L	T04-10	BH	08/27/2012	N001			0.59			#	-	-
	mg/L	T04-11	BH	08/27/2012	N001			0.54			#	-	-
	mg/L	T04-12	BH	08/24/2012	N001			1.09			#	-	-
	mg/L	T04-15	BH	08/24/2012	N001			0.57			#	-	-
	mg/L	T04-16	BH	08/24/2012	N001			0.93			#	-	-
	mg/L	T04-17	BH	08/24/2012	N001			0.76			#	-	-
	mg/L	T05-01	BH	08/28/2012	N001			0.79			#	-	-
	mg/L	T05-02	BH	08/29/2012	N001			0.60			#	-	-
	mg/L	T05-03	BH	08/29/2012	N001			0.44			#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Dissolved Oxygen	mg/L	T06-01	BH	08/26/2012	N001			0.62			#	-	-
	mg/L	T06-02	BH	08/26/2012	N001			0.47			#	-	-
	mg/L	T06-03	BH	08/26/2012	N001			0.41			#	-	-
	mg/L	T06-04	BH	08/26/2012	N001			0.56			#	-	-
	mg/L	T06-05	BH	08/26/2012	N001			1.88			#	-	-
	mg/L	T06-06	BH	08/26/2012	N001			1.34			#	-	-
	mg/L	T06-07	BH	08/26/2012	N001			0.65			#	-	-
	mg/L	T06-08	BH	08/26/2012	N001			0.62			#	-	-
	mg/L	T06-09	BH	08/26/2012	N001			0.78			#	-	-
	mg/L	T06-10	BH	08/27/2012	N001			0.4			#	-	-
	mg/L	T06-11	BH	08/27/2012	N001			0.70			#	-	-
	mg/L	T06-12	BH	08/27/2012	N001			0.78			#	-	-
	mg/L	T06-13	BH	08/27/2012	N001			0.75			#	-	-
	mg/L	T06-14	BH	08/27/2012	N001			0.50			#	-	-
	mg/L	T06-15	BH	08/27/2012	N001			0.65			#	-	-
	mg/L	T06-16	BH	08/27/2012	N001			0.92			#	-	-
	mg/L	T06-17	BH	08/27/2012	N001			0.74			#	-	-
	mg/L	T06-21	BH	08/28/2012	N001			0.63			#	-	-
	mg/L	T07-01	BH	08/25/2012	N001			0.48			#	-	-
	mg/L	T07-02	BH	08/25/2012	N001			0.65			#	-	-
	mg/L	T07-03	BH	08/25/2012	N001			0.59			#	-	-
	mg/L	T07-04	BH	08/25/2012	N001			0.79			#	-	-
	mg/L	T07-05	BH	08/25/2012	N001			0.48			#	-	-
	mg/L	T07-06	BH	08/28/2012	N001			0.65			#	-	-
	mg/L	T07-07	BH	08/29/2012	N001			0.54			#	-	-
	mg/L	T07-08	BH	08/28/2012	N001			0.62			#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Dissolved Oxygen	mg/L	T07-09	BH	08/28/2012	N001			0.73			#	-	-
	mg/L	T07-10	BH	08/28/2012	N001			0.54			#	-	-
	mg/L	T08-01	BH	08/25/2012	N001			0.67			#	-	-
	mg/L	T08-02	BH	08/25/2012	N001			0.76			#	-	-
	mg/L	T08-03	BH	08/25/2012	N001			2.09			#	-	-
	mg/L	T08-04	BH	08/25/2012	N001			0.84			#	-	-
	mg/L	T08-05	BH	08/25/2012	N001			0.62			#	-	-
	mg/L	T08-06	BH	08/25/2012	N001			0.69			#	-	-
	mg/L	T08-07	BH	08/27/2012	N001			0.54			#	-	-
	mg/L	T08-08	BH	08/28/2012	N001			0.79			#	-	-
	mg/L	T08-09	BH	08/28/2012	N001			0.46			#	-	-
	mg/L	T09-01	BH	08/25/2012	N001			0.75			#	-	-
	mg/L	T09-02	BH	08/25/2012	N001			0.62			#	-	-
	mg/L	T09-03	BH	08/25/2012	N001			2.10			#	-	-
	mg/L	T09-04	BH	08/25/2012	N001			1.39			#	-	-
	mg/L	T09-05	BH	08/25/2012	N001			0.74			#	-	-
	mg/L	T09-06	BH	08/28/2012	N001			0.58			#	-	-
	mg/L	T09-07	BH	08/28/2012	N001			0.73			#	-	-
	mg/L	T09-08	BH	08/28/2012	N001			0.88			#	-	-
	mg/L	T09-09	BH	08/28/2012	N001			0.61			#	-	-
	mg/L	T09-10	BH	08/28/2012	N001			0.48			#	-	-
Magnesium	mg/L	T01-01	BH	08/24/2012	0001			37.000			#	0.065	-
	mg/L	T01-02	BH	08/24/2012	0001			22.000			#	0.013	-
	mg/L	T01-03	BH	08/24/2012	0001			22.000			#	0.013	-
	mg/L	T01-04	BH	08/24/2012	0001			22.000			#	0.013	-
	mg/L	T01-05	BH	08/23/2012	0001			32.000			#	0.013	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Magnesium	mg/L	T01-06	BH	08/23/2012	0001			30.000			#	0.013	-
	mg/L	T01-07	BH	08/23/2012	0001			25.000			#	0.013	-
	mg/L	T01-08	BH	08/23/2012	0001			20.000			#	0.013	-
	mg/L	T01-09	BH	08/23/2012	0001			14.000			#	0.013	-
	mg/L	T02-01	BH	08/22/2012	0001			67.000			#	0.065	-
	mg/L	T02-02	BH	08/22/2012	0001			8.700			#	0.065	-
	mg/L	T02-03	BH	08/22/2012	0001			18.000			#	0.065	-
	mg/L	T02-04	BH	08/22/2012	0001			19.000			#	0.065	-
	mg/L	T02-05	BH	08/22/2012	0001			19.000			#	0.065	-
	mg/L	T02-06	BH	08/22/2012	0001			30.000			#	0.13	-
	mg/L	T02-07	BH	08/23/2012	0001			56.000			#	0.065	-
	mg/L	T02-08	BH	08/23/2012	0001			27.000			#	0.065	-
	mg/L	T02-09	BH	08/23/2012	0001			46.000			#	0.013	-
	mg/L	T02-10	BH	08/23/2012	0001			42.000			#	0.013	-
	mg/L	T02-11	BH	08/23/2012	0001			30.000			#	0.013	-
	mg/L	T02-12	BH	08/23/2012	0001			19.000			#	0.013	-
	mg/L	T02-13	BH	08/23/2012	0001			10.000			#	0.013	-
	mg/L	T02-14	BH	08/23/2012	0001			12.000			#	0.013	-
	mg/L	T02-15	BH	08/23/2012	0001			12.000			#	0.013	-
	mg/L	T03-01	BH	08/22/2012	0001			25.000			#	0.013	-
	mg/L	T03-02	BH	08/22/2012	0001			36.000			#	0.013	-
	mg/L	T03-08	BH	08/21/2012	0001			54.000			#	0.13	-
	mg/L	T03-09	BH	08/22/2012	0001			49.000			#	0.13	-
	mg/L	T03-10	BH	08/22/2012	0001			46.000			#	0.13	-
	mg/L	T03-11	BH	08/22/2012	0001			45.000			#	0.065	-
	mg/L	T03-12	BH	08/21/2012	0001			35.000			#	0.013	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Magnesium	mg/L	T03-13	BH	08/21/2012	0001			29.000			#	0.013	-
	mg/L	T03-14	BH	08/21/2012	0001			26.000			#	0.013	-
	mg/L	T03-15	BH	08/21/2012	0001			17.000			#	0.013	-
	mg/L	T03-15	BH	08/21/2012	0002			17.000			#	0.013	-
	mg/L	T03-16	BH	08/21/2012	0001			17.000			#	0.013	-
	mg/L	T03-17	BH	08/21/2012	0001			16.000			#	0.013	-
	mg/L	T03-18	BH	08/24/2012	0001			22.000			#	0.013	-
	mg/L	T03-19	BH	08/24/2012	0001			20.000			#	0.013	-
	mg/L	T03-20	BH	08/24/2012	0001			29.000			#	0.013	-
	mg/L	T03-21	BH	08/24/2012	0001			30.000			#	0.013	-
	mg/L	T04-03	BH	08/26/2012	0001			48.000			#	0.065	-
	mg/L	T04-04	BH	08/26/2012	0001			45.000			#	0.065	-
	mg/L	T04-05	BH	08/26/2012	0001			99.000			#	0.065	-
	mg/L	T04-06	BH	08/26/2012	0001			120.000			#	0.13	-
	mg/L	T04-07	BH	08/26/2012	0001			110.000			#	0.13	-
	mg/L	T04-07	BH	08/26/2012	0002			110.000			#	0.13	-
	mg/L	T04-08	BH	08/27/2012	0001			98.000			#	0.13	-
	mg/L	T04-09	BH	08/27/2012	0001			76.000			#	0.13	-
	mg/L	T04-10	BH	08/27/2012	0001			63.000			#	0.065	-
	mg/L	T04-11	BH	08/27/2012	0001			46.000			#	0.065	-
	mg/L	T04-12	BH	08/24/2012	0001			7.700			#	0.013	-
	mg/L	T04-15	BH	08/24/2012	0001			19.000			#	0.013	-
	mg/L	T04-16	BH	08/24/2012	0001			22.000			#	0.013	-
	mg/L	T04-16	BH	08/24/2012	0002			21.000			#	0.013	-
	mg/L	T04-17	BH	08/24/2012	0001			24.000			#	0.013	-
	mg/L	T05-01	BH	08/28/2012	0001			160.000			#	0.13	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Magnesium	mg/L	T05-02	BH	08/29/2012	0001			80.000			#	0.065	-
	mg/L	T05-03	BH	08/29/2012	0001			41.000			#	0.065	-
	mg/L	T05-03	BH	08/29/2012	0002			40.000			#	0.065	-
	mg/L	T06-01	BH	08/26/2012	0001			70.000			#	0.065	-
	mg/L	T06-02	BH	08/26/2012	0001			98.000			#	0.065	-
	mg/L	T06-03	BH	08/26/2012	0001			85.000			#	0.065	-
	mg/L	T06-04	BH	08/26/2012	0001			67.000			#	0.065	-
	mg/L	T06-05	BH	08/26/2012	0001			150.000			#	0.13	-
	mg/L	T06-06	BH	08/26/2012	0001			160.000			#	0.13	-
	mg/L	T06-07	BH	08/26/2012	0001			200.000			#	0.13	-
	mg/L	T06-08	BH	08/26/2012	0001			180.000			#	0.13	-
	mg/L	T06-09	BH	08/26/2012	0001			180.000			#	0.13	-
	mg/L	T06-10	BH	08/27/2012	0001			220.000			#	0.13	-
	mg/L	T06-11	BH	08/27/2012	0001			99.000			#	0.13	-
	mg/L	T06-12	BH	08/27/2012	0001			54.000			#	0.065	-
	mg/L	T06-13	BH	08/27/2012	0001			69.000			#	0.065	-
	mg/L	T06-14	BH	08/27/2012	0001			45.000			#	0.013	-
	mg/L	T06-15	BH	08/27/2012	0001			34.000			#	0.013	-
	mg/L	T06-16	BH	08/27/2012	0001			35.000			#	0.013	-
	mg/L	T06-17	BH	08/27/2012	0001			56.000			#	0.065	-
	mg/L	T06-21	BH	08/28/2012	0001			32.000			#	0.013	-
	mg/L	T07-01	BH	08/25/2012	0001			240.000			#	0.26	-
	mg/L	T07-02	BH	08/25/2012	0001			310.000			#	0.26	-
	mg/L	T07-03	BH	08/25/2012	0001			240.000			#	0.26	-
	mg/L	T07-04	BH	08/25/2012	0001			220.000			#	0.13	-
	mg/L	T07-05	BH	08/25/2012	0001			170.000			#	0.13	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Magnesium	mg/L	T07-06	BH	08/28/2012	0001			140.000			#	0.065	-
	mg/L	T07-06	BH	08/28/2012	0002			130.000			#	0.065	-
	mg/L	T07-07	BH	08/29/2012	0001			67.000			#	0.065	-
	mg/L	T07-08	BH	08/28/2012	0001			74.000			#	0.065	-
	mg/L	T07-09	BH	08/28/2012	0001			41.000			#	0.013	-
	mg/L	T07-10	BH	08/28/2012	0001			29.000			#	0.013	-
	mg/L	T08-01	BH	08/25/2012	0001			360.000			#	0.26	-
	mg/L	T08-02	BH	08/25/2012	0001			390.000			#	0.26	-
	mg/L	T08-02	BH	08/25/2012	0002			370.000			#	0.65	-
	mg/L	T08-03	BH	08/25/2012	0001			320.000			#	0.26	-
	mg/L	T08-04	BH	08/25/2012	0001			200.000			#	0.13	-
	mg/L	T08-05	BH	08/25/2012	0001			170.000			#	0.013	-
	mg/L	T08-06	BH	08/25/2012	0001			120.000			#	0.065	-
	mg/L	T08-07	BH	08/27/2012	0001			120.000			#	0.065	-
	mg/L	T08-08	BH	08/28/2012	0001			50.000			#	0.013	-
	mg/L	T08-09	BH	08/28/2012	0001			39.000			#	0.013	-
	mg/L	T09-01	BH	08/25/2012	0001			25.000			#	0.013	-
	mg/L	T09-02	BH	08/25/2012	0001			40.000			#	0.013	-
	mg/L	T09-03	BH	08/25/2012	0001			59.000			#	0.065	-
	mg/L	T09-04	BH	08/25/2012	0001			110.000			#	0.065	-
	mg/L	T09-05	BH	08/25/2012	0001			140.000			#	0.065	-
	mg/L	T09-06	BH	08/28/2012	0001			57.000			#	0.065	-
	mg/L	T09-07	BH	08/28/2012	0001			34.000			#	0.065	-
	mg/L	T09-08	BH	08/28/2012	0001			21.000			#	0.013	-
	mg/L	T09-09	BH	08/28/2012	0001			22.000			#	0.013	-
	mg/L	T09-10	BH	08/28/2012	0001			29.000			#	0.013	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	T01-01	BH	08/24/2012	0001			0.110			#	0.00057	-
	mg/L	T01-02	BH	08/24/2012	0001			0.240			#	0.00011	-
	mg/L	T01-03	BH	08/24/2012	0001			0.350			#	0.00011	-
	mg/L	T01-04	BH	08/24/2012	0001			0.400			#	0.00011	-
	mg/L	T01-05	BH	08/23/2012	0001			0.530			#	0.00011	-
	mg/L	T01-06	BH	08/23/2012	0001			0.091			#	0.00011	-
	mg/L	T01-07	BH	08/23/2012	0001			0.022			#	0.00011	-
	mg/L	T01-08	BH	08/23/2012	0001			0.012			#	0.00011	-
	mg/L	T01-09	BH	08/23/2012	0001			0.034			#	0.00011	-
	mg/L	T02-01	BH	08/22/2012	0001			1.300			#	0.00057	-
	mg/L	T02-02	BH	08/22/2012	0001			0.270			#	0.00057	-
	mg/L	T02-03	BH	08/22/2012	0001			0.570			#	0.00057	-
	mg/L	T02-04	BH	08/22/2012	0001			2.200			#	0.00057	-
	mg/L	T02-05	BH	08/22/2012	0001			1.500			#	0.00057	-
	mg/L	T02-06	BH	08/22/2012	0001			0.160			#	0.0011	-
	mg/L	T02-07	BH	08/23/2012	0001			7.200			#	0.00057	-
	mg/L	T02-08	BH	08/23/2012	0001			0.570			#	0.00057	-
	mg/L	T02-09	BH	08/23/2012	0001			0.180			#	0.00011	-
	mg/L	T02-10	BH	08/23/2012	0001			0.040			#	0.00011	-
	mg/L	T02-11	BH	08/23/2012	0001			0.048			#	0.00011	-
	mg/L	T02-12	BH	08/23/2012	0001			0.017			#	0.00011	-
	mg/L	T02-13	BH	08/23/2012	0001			0.038			#	0.00011	-
	mg/L	T02-14	BH	08/23/2012	0001			0.040			#	0.00011	-
	mg/L	T02-15	BH	08/23/2012	0001			0.067			#	0.00011	-
	mg/L	T03-01	BH	08/22/2012	0001			0.660			#	0.00011	-
	mg/L	T03-02	BH	08/22/2012	0001			0.990			#	0.00011	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	T03-08	BH	08/21/2012	0001			2.100			#	0.0011	-
	mg/L	T03-09	BH	08/22/2012	0001			0.740			#	0.0011	-
	mg/L	T03-10	BH	08/22/2012	0001			0.360			#	0.0011	-
	mg/L	T03-11	BH	08/22/2012	0001			0.061			#	0.00057	-
	mg/L	T03-12	BH	08/21/2012	0001			0.016			#	0.00011	-
	mg/L	T03-13	BH	08/21/2012	0001			0.059			#	0.00011	-
	mg/L	T03-14	BH	08/21/2012	0001			0.095			#	0.00011	-
	mg/L	T03-15	BH	08/21/2012	0001			0.290			#	0.00011	-
	mg/L	T03-15	BH	08/21/2012	0002			0.300			#	0.00011	-
	mg/L	T03-16	BH	08/21/2012	0001			0.070			#	0.00011	-
	mg/L	T03-17	BH	08/21/2012	0001			0.150			#	0.00011	-
	mg/L	T03-18	BH	08/24/2012	0001			0.170			#	0.00011	-
	mg/L	T03-19	BH	08/24/2012	0001			0.098			#	0.00011	-
	mg/L	T03-20	BH	08/24/2012	0001			0.150	E	J	#	0.00011	-
	mg/L	T03-21	BH	08/24/2012	0001			0.210			#	0.00011	-
	mg/L	T04-03	BH	08/26/2012	0001			1.700			#	0.00057	-
	mg/L	T04-04	BH	08/26/2012	0001			1.400			#	0.00057	-
	mg/L	T04-05	BH	08/26/2012	0001			3.000			#	0.00057	-
	mg/L	T04-06	BH	08/26/2012	0001			4.100			#	0.0011	-
	mg/L	T04-07	BH	08/26/2012	0001			1.800			#	0.0011	-
	mg/L	T04-07	BH	08/26/2012	0002			1.800			#	0.0011	-
	mg/L	T04-08	BH	08/27/2012	0001			2.000			#	0.0011	-
	mg/L	T04-09	BH	08/27/2012	0001			2.000			#	0.0011	-
	mg/L	T04-10	BH	08/27/2012	0001			1.500			#	0.00057	-
	mg/L	T04-11	BH	08/27/2012	0001			0.660			#	0.00057	-
	mg/L	T04-12	BH	08/24/2012	0001			0.036			#	0.00011	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	T04-15	BH	08/24/2012	0001			0.096			#	0.00011	-
	mg/L	T04-16	BH	08/24/2012	0001			0.190			#	0.00011	-
	mg/L	T04-16	BH	08/24/2012	0002			0.180			#	0.00011	-
	mg/L	T04-17	BH	08/24/2012	0001			0.075			#	0.00011	-
	mg/L	T05-01	BH	08/28/2012	0001			1.300			#	0.0011	-
	mg/L	T05-02	BH	08/29/2012	0001			1.000			#	0.00057	-
	mg/L	T05-03	BH	08/29/2012	0001			0.760			#	0.00057	-
	mg/L	T05-03	BH	08/29/2012	0002			0.760			#	0.00057	-
	mg/L	T06-01	BH	08/26/2012	0001			1.200			#	0.00057	-
	mg/L	T06-02	BH	08/26/2012	0001			1.700			#	0.00057	-
	mg/L	T06-03	BH	08/26/2012	0001			1.400			#	0.00057	-
	mg/L	T06-04	BH	08/26/2012	0001			0.670			#	0.00057	-
	mg/L	T06-05	BH	08/26/2012	0001			0.170			#	0.0011	-
	mg/L	T06-06	BH	08/26/2012	0001			2.800			#	0.0011	-
	mg/L	T06-07	BH	08/26/2012	0001			1.700			#	0.0011	-
	mg/L	T06-08	BH	08/26/2012	0001			0.850			#	0.0011	-
	mg/L	T06-09	BH	08/26/2012	0001			0.640			#	0.0011	-
	mg/L	T06-10	BH	08/27/2012	0001			2.700			#	0.0011	-
	mg/L	T06-11	BH	08/27/2012	0001			1.400			#	0.0011	-
	mg/L	T06-12	BH	08/27/2012	0001			1.100			#	0.00057	-
	mg/L	T06-13	BH	08/27/2012	0001			2.200			#	0.00057	-
	mg/L	T06-14	BH	08/27/2012	0001			0.670			#	0.00011	-
	mg/L	T06-15	BH	08/27/2012	0001			0.700			#	0.00011	-
	mg/L	T06-16	BH	08/27/2012	0001			0.060			#	0.00011	-
	mg/L	T06-17	BH	08/27/2012	0001			0.180			#	0.00057	-
	mg/L	T06-21	BH	08/28/2012	0001			0.087			#	0.00011	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Manganese	mg/L	T07-01	BH	08/25/2012	0001			0.700			#	0.0023	-
	mg/L	T07-02	BH	08/25/2012	0001			0.330			#	0.0023	-
	mg/L	T07-03	BH	08/25/2012	0001			0.190			#	0.0023	-
	mg/L	T07-04	BH	08/25/2012	0001			3.400			#	0.0011	-
	mg/L	T07-05	BH	08/25/2012	0001			2.100			#	0.0011	-
	mg/L	T07-06	BH	08/28/2012	0001			0.520			#	0.00057	-
	mg/L	T07-06	BH	08/28/2012	0002			0.520			#	0.00057	-
	mg/L	T07-07	BH	08/29/2012	0001			1.600			#	0.00057	-
	mg/L	T07-08	BH	08/28/2012	0001			1.600			#	0.00057	-
	mg/L	T07-09	BH	08/28/2012	0001			0.840			#	0.00011	-
	mg/L	T07-10	BH	08/28/2012	0001			0.800			#	0.00011	-
	mg/L	T08-01	BH	08/25/2012	0001			2.000			#	0.0023	-
	mg/L	T08-02	BH	08/25/2012	0001			1.200			#	0.0023	-
	mg/L	T08-02	BH	08/25/2012	0002			1.100			#	0.0057	-
	mg/L	T08-03	BH	08/25/2012	0001			1.100			#	0.0023	-
	mg/L	T08-04	BH	08/25/2012	0001			1.200			#	0.0011	-
	mg/L	T08-05	BH	08/25/2012	0001			1.600			#	0.00011	-
	mg/L	T08-06	BH	08/25/2012	0001			2.200			#	0.00057	-
	mg/L	T08-07	BH	08/27/2012	0001			2.900			#	0.00057	-
	mg/L	T08-08	BH	08/28/2012	0001			1.300			#	0.00011	-
	mg/L	T08-09	BH	08/28/2012	0001			0.360			#	0.00011	-
	mg/L	T09-01	BH	08/25/2012	0001			0.740			#	0.00011	-
	mg/L	T09-02	BH	08/25/2012	0001			0.930			#	0.00011	-
	mg/L	T09-03	BH	08/25/2012	0001			2.100			#	0.00057	-
	mg/L	T09-04	BH	08/25/2012	0001			2.300			#	0.00057	-
	mg/L	T09-05	BH	08/25/2012	0001			3.500			#	0.00057	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	T09-06	BH	08/28/2012	0001			2.500			#	0.00057	-
	mg/L	T09-07	BH	08/28/2012	0001			0.440			#	0.00057	-
	mg/L	T09-08	BH	08/28/2012	0001			0.028			#	0.00011	-
	mg/L	T09-09	BH	08/28/2012	0001			0.075			#	0.00011	-
	mg/L	T09-10	BH	08/28/2012	0001			0.190			#	0.00011	-
Molybdenum	mg/L	T01-01	BH	08/24/2012	0001			0.0094			#	0.00032	-
	mg/L	T01-02	BH	08/24/2012	0001			0.0099			#	0.00032	-
	mg/L	T01-03	BH	08/24/2012	0001			0.0084			#	0.00032	-
	mg/L	T01-04	BH	08/24/2012	0001			0.0082			#	0.00032	-
	mg/L	T01-05	BH	08/23/2012	0001			0.0081			#	0.00032	-
	mg/L	T01-06	BH	08/23/2012	0001			0.0078			#	0.00032	-
	mg/L	T01-07	BH	08/23/2012	0001			0.0096			#	0.00032	-
	mg/L	T01-08	BH	08/23/2012	0001			0.0059			#	0.00032	-
	mg/L	T01-09	BH	08/23/2012	0001			0.011			#	0.00032	-
	mg/L	T02-01	BH	08/22/2012	0001			0.016			#	0.00032	-
	mg/L	T02-02	BH	08/22/2012	0001			0.016			#	0.00032	-
	mg/L	T02-03	BH	08/22/2012	0001			0.018			#	0.00032	-
	mg/L	T02-04	BH	08/22/2012	0001			0.016			#	0.00032	-
	mg/L	T02-05	BH	08/22/2012	0001			0.018			#	0.00032	-
	mg/L	T02-06	BH	08/22/2012	0001			0.032			#	0.00032	-
	mg/L	T02-07	BH	08/23/2012	0001			0.043			#	0.00032	-
	mg/L	T02-08	BH	08/23/2012	0001			0.052			#	0.00032	-
	mg/L	T02-09	BH	08/23/2012	0001			0.090			#	0.00032	-
	mg/L	T02-10	BH	08/23/2012	0001			0.031			#	0.00032	-
	mg/L	T02-11	BH	08/23/2012	0001			0.0077			#	0.00032	-
	mg/L	T02-12	BH	08/23/2012	0001			0.0062			#	0.00032	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Molybdenum	mg/L	T02-13	BH	08/23/2012	0001			0.0052			#	0.00032	-
	mg/L	T02-14	BH	08/23/2012	0001			0.0051			#	0.00032	-
	mg/L	T02-15	BH	08/23/2012	0001			0.0067			#	0.00032	-
	mg/L	T03-01	BH	08/22/2012	0001			0.0058			#	0.00032	-
	mg/L	T03-02	BH	08/22/2012	0001			0.0047			#	0.00032	-
	mg/L	T03-08	BH	08/21/2012	0001			0.350			#	0.0032	-
	mg/L	T03-09	BH	08/22/2012	0001			0.940			#	0.00032	-
	mg/L	T03-10	BH	08/22/2012	0001			0.450			#	0.0016	-
	mg/L	T03-11	BH	08/22/2012	0001			0.200			#	0.00032	-
	mg/L	T03-12	BH	08/21/2012	0001			0.110			#	0.00032	-
	mg/L	T03-13	BH	08/21/2012	0001			0.067			#	0.00032	-
	mg/L	T03-14	BH	08/21/2012	0001			0.024			#	0.00032	-
	mg/L	T03-15	BH	08/21/2012	0001			0.025			#	0.00032	-
	mg/L	T03-15	BH	08/21/2012	0002			0.025			#	0.00032	-
	mg/L	T03-16	BH	08/21/2012	0001			0.016			#	0.00032	-
	mg/L	T03-17	BH	08/21/2012	0001			0.019			#	0.00032	-
	mg/L	T03-18	BH	08/24/2012	0001			0.0046			#	0.00032	-
	mg/L	T03-19	BH	08/24/2012	0001			0.004			#	0.00032	-
	mg/L	T03-20	BH	08/24/2012	0001			0.0072			#	0.00032	-
	mg/L	T03-21	BH	08/24/2012	0001			0.0062			#	0.00032	-
	mg/L	T04-03	BH	08/26/2012	0001			0.0085			#	0.00032	-
	mg/L	T04-04	BH	08/26/2012	0001			0.009			#	0.00032	-
	mg/L	T04-05	BH	08/26/2012	0001			0.027			#	0.00032	-
	mg/L	T04-06	BH	08/26/2012	0001			0.052			#	0.00032	-
	mg/L	T04-07	BH	08/26/2012	0001			0.097			#	0.00032	-
	mg/L	T04-07	BH	08/26/2012	0002			0.098			#	0.00032	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Molybdenum	mg/L	T04-08	BH	08/27/2012	0001			0.210			#	0.0016	-
	mg/L	T04-09	BH	08/27/2012	0001			0.450			#	0.0032	-
	mg/L	T04-10	BH	08/27/2012	0001			1.100			#	0.0016	-
	mg/L	T04-11	BH	08/27/2012	0001			0.670			#	0.00032	-
	mg/L	T04-12	BH	08/24/2012	0001			0.150			#	0.00032	-
	mg/L	T04-15	BH	08/24/2012	0001			0.019			#	0.00032	-
	mg/L	T04-16	BH	08/24/2012	0001			0.009			#	0.00032	-
	mg/L	T04-16	BH	08/24/2012	0002			0.0091			#	0.00032	-
	mg/L	T04-17	BH	08/24/2012	0001			0.0089			#	0.00032	-
	mg/L	T05-01	BH	08/28/2012	0001			0.220			#	0.0032	-
	mg/L	T05-02	BH	08/29/2012	0001			0.970			#	0.0032	-
	mg/L	T05-03	BH	08/29/2012	0001			0.260			#	0.0032	-
	mg/L	T05-03	BH	08/29/2012	0002			0.260			#	0.0016	-
	mg/L	T06-01	BH	08/26/2012	0001			0.013			#	0.00032	-
	mg/L	T06-02	BH	08/26/2012	0001			0.0083			#	0.00032	-
	mg/L	T06-03	BH	08/26/2012	0001			0.012			#	0.00032	-
	mg/L	T06-04	BH	08/26/2012	0001			0.020			#	0.00032	-
	mg/L	T06-05	BH	08/26/2012	0001			0.083			#	0.00032	-
	mg/L	T06-06	BH	08/26/2012	0001			0.110			#	0.00032	-
	mg/L	T06-07	BH	08/26/2012	0001			0.170			#	0.0032	-
	mg/L	T06-08	BH	08/26/2012	0001			0.250			#	0.0032	-
	mg/L	T06-09	BH	08/26/2012	0001			0.310			#	0.0032	-
	mg/L	T06-10	BH	08/27/2012	0001			0.960			#	0.0032	-
	mg/L	T06-11	BH	08/27/2012	0001			0.970			#	0.0032	-
	mg/L	T06-12	BH	08/27/2012	0001			0.340			#	0.0032	-
	mg/L	T06-13	BH	08/27/2012	0001			0.075			#	0.0032	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Molybdenum	mg/L	T06-14	BH	08/27/2012	0001			0.030			#	0.00032	-
	mg/L	T06-15	BH	08/27/2012	0001			0.014			#	0.00032	-
	mg/L	T06-16	BH	08/27/2012	0001			0.005			#	0.00032	-
	mg/L	T06-17	BH	08/27/2012	0001			0.0048			#	0.00032	-
	mg/L	T06-21	BH	08/28/2012	0001			0.0046			#	0.00032	-
	mg/L	T07-01	BH	08/25/2012	0001			0.150			#	0.0016	-
	mg/L	T07-02	BH	08/25/2012	0001			0.190			#	0.0032	-
	mg/L	T07-03	BH	08/25/2012	0001			0.400			#	0.0032	-
	mg/L	T07-04	BH	08/25/2012	0001			0.840			#	0.0032	-
	mg/L	T07-05	BH	08/25/2012	0001			0.930			#	0.0032	-
	mg/L	T07-06	BH	08/28/2012	0001			0.530			#	0.0032	-
	mg/L	T07-06	BH	08/28/2012	0002			0.530			#	0.0032	-
	mg/L	T07-07	BH	08/29/2012	0001			0.150			#	0.0032	-
	mg/L	T07-08	BH	08/28/2012	0001			0.032			#	0.0032	-
	mg/L	T07-09	BH	08/28/2012	0001			0.021			#	0.00032	-
	mg/L	T07-10	BH	08/28/2012	0001			0.0084			#	0.00032	-
	mg/L	T08-01	BH	08/25/2012	0001			0.150			#	0.0032	-
	mg/L	T08-02	BH	08/25/2012	0001			0.280			#	0.0032	-
	mg/L	T08-02	BH	08/25/2012	0002			0.300			#	0.0016	-
	mg/L	T08-03	BH	08/25/2012	0001			0.560			#	0.0064	-
	mg/L	T08-04	BH	08/25/2012	0001			0.980			#	0.0032	-
	mg/L	T08-05	BH	08/25/2012	0001			0.870			#	0.0032	-
	mg/L	T08-06	BH	08/25/2012	0001			0.360			#	0.0032	-
	mg/L	T08-07	BH	08/27/2012	0001			0.160			#	0.0032	-
	mg/L	T08-08	BH	08/28/2012	0001			0.0045			#	0.00032	-
	mg/L	T08-09	BH	08/28/2012	0001			0.0057			#	0.00032	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Molybdenum	mg/L	T09-01	BH	08/25/2012	0001			0.006			#	0.00032	-
	mg/L	T09-02	BH	08/25/2012	0001			0.0069			#	0.00032	-
	mg/L	T09-03	BH	08/25/2012	0001			0.0096			#	0.00032	-
	mg/L	T09-04	BH	08/25/2012	0001			0.0079			#	0.00032	-
	mg/L	T09-05	BH	08/25/2012	0001			0.016			#	0.00032	-
	mg/L	T09-06	BH	08/28/2012	0001			0.0071			#	0.00032	-
	mg/L	T09-07	BH	08/28/2012	0001			0.0097			#	0.00032	-
	mg/L	T09-08	BH	08/28/2012	0001			0.007			#	0.00032	-
	mg/L	T09-09	BH	08/28/2012	0001			0.0066			#	0.00032	-
	mg/L	T09-10	BH	08/28/2012	0001			0.0055			#	0.00032	-
Oxidation Reduction Potential	mV	T01-01	BH	08/24/2012	N001			-58.5			#	-	-
	mV	T01-02	BH	08/24/2012	N001			-68.1			#	-	-
	mV	T01-03	BH	08/24/2012	N001			-103.6			#	-	-
	mV	T01-04	BH	08/24/2012	N001			-80.0			#	-	-
	mV	T01-05	BH	08/23/2012	N001			-90.7			#	-	-
	mV	T01-06	BH	08/23/2012	N001			-45.9			#	-	-
	mV	T01-07	BH	08/23/2012	N001			-95.9			#	-	-
	mV	T01-08	BH	08/23/2012	N001			-69.4			#	-	-
	mV	T01-09	BH	08/23/2012	N001			-84.8			#	-	-
	mV	T02-01	BH	08/22/2012	N001			-106.8			#	-	-
	mV	T02-02	BH	08/22/2012	N001			-103.6			#	-	-
	mV	T02-03	BH	08/22/2012	N001			-135.8			#	-	-
	mV	T02-04	BH	08/22/2012	N001			-59.8			#	-	-
	mV	T02-05	BH	08/22/2012	N001			-95.7			#	-	-
	mV	T02-06	BH	08/22/2012	N001			-143.4			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Oxidation Reduction Potential	mV	T02-07	BH	08/23/2012	N001			-34.6			#	-	-
	mV	T02-08	BH	08/23/2012	N001			-57.7			#	-	-
	mV	T02-09	BH	08/23/2012	N001			-38.9			#	-	-
	mV	T02-10	BH	08/23/2012	N001			-47.0			#	-	-
	mV	T02-11	BH	08/23/2012	N001			-24.3			#	-	-
	mV	T02-12	BH	08/23/2012	N001			-61.4			#	-	-
	mV	T02-13	BH	08/23/2012	N001			-74.8			#	-	-
	mV	T02-14	BH	08/23/2012	N001			-31.5			#	-	-
	mV	T02-15	BH	08/23/2012	N001			-28.7			#	-	-
	mV	T03-01	BH	08/22/2012	N001			-95.1			#	-	-
	mV	T03-02	BH	08/22/2012	N001			-67.2			#	-	-
	mV	T03-08	BH	08/21/2012	N001			-7.2			#	-	-
	mV	T03-09	BH	08/22/2012	N001			-2.1			#	-	-
	mV	T03-10	BH	08/22/2012	N001			-27.2			#	-	-
	mV	T03-11	BH	08/22/2012	N001			-43.5			#	-	-
	mV	T03-12	BH	08/21/2012	N001			-39.6			#	-	-
	mV	T03-13	BH	08/21/2012	N001			-46.2			#	-	-
	mV	T03-14	BH	08/21/2012	N001			-26.7			#	-	-
	mV	T03-15	BH	08/21/2012	N001			-82.8			#	-	-
	mV	T03-16	BH	08/21/2012	N001			-61.0			#	-	-
	mV	T03-17	BH	08/21/2012	N001			-89.5			#	-	-
	mV	T03-18	BH	08/24/2012	N001			-109.0			#	-	-
	mV	T03-19	BH	08/24/2012	N001			-95.0			#	-	-
	mV	T03-20	BH	08/24/2012	N001			-93.8			#	-	-
	mV	T03-21	BH	08/24/2012	N001			-69.5			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Oxidation Reduction Potential	mV	T04-03	BH	08/26/2012	N001			-70.3			#	-	-
	mV	T04-04	BH	08/26/2012	N001			-55.5			#	-	-
	mV	T04-05	BH	08/26/2012	N001			-79.9			#	-	-
	mV	T04-06	BH	08/26/2012	N001			-85.7			#	-	-
	mV	T04-07	BH	08/26/2012	N001			-74.6			#	-	-
	mV	T04-08	BH	08/27/2012	N001			-23.9			#	-	-
	mV	T04-09	BH	08/27/2012	N001			-65.0			#	-	-
	mV	T04-10	BH	08/27/2012	N001			-66.4			#	-	-
	mV	T04-11	BH	08/27/2012	N001			-55.3			#	-	-
	mV	T04-12	BH	08/24/2012	N001			-61.8			#	-	-
	mV	T04-15	BH	08/24/2012	N001			-58.3			#	-	-
	mV	T04-16	BH	08/24/2012	N001			-82.9			#	-	-
	mV	T04-17	BH	08/24/2012	N001			-61.0			#	-	-
	mV	T05-01	BH	08/28/2012	N001			-91.1			#	-	-
	mV	T05-02	BH	08/29/2012	N001			-25.7			#	-	-
	mV	T05-03	BH	08/29/2012	N001			-57.5			#	-	-
	mV	T06-01	BH	08/26/2012	N001			-93.2			#	-	-
	mV	T06-02	BH	08/26/2012	N001			-72.0			#	-	-
	mV	T06-03	BH	08/26/2012	N001			-65.1			#	-	-
	mV	T06-04	BH	08/26/2012	N001			-52.7			#	-	-
	mV	T06-05	BH	08/26/2012	N001			-64.0			#	-	-
	mV	T06-06	BH	08/26/2012	N001			-69.6			#	-	-
	mV	T06-07	BH	08/26/2012	N001			-54.3			#	-	-
	mV	T06-08	BH	08/26/2012	N001			-36.2			#	-	-
	mV	T06-09	BH	08/26/2012	N001			-9.4			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Oxidation Reduction Potential	mV	T06-10	BH	08/27/2012	N001			-40.1			#	-	-
	mV	T06-11	BH	08/27/2012	N001			-54.6			#	-	-
	mV	T06-12	BH	08/27/2012	N001			-63.8			#	-	-
	mV	T06-13	BH	08/27/2012	N001			-45.5			#	-	-
	mV	T06-14	BH	08/27/2012	N001			-58.0			#	-	-
	mV	T06-15	BH	08/27/2012	N001			-54.5			#	-	-
	mV	T06-16	BH	08/27/2012	N001			-100.5			#	-	-
	mV	T06-17	BH	08/27/2012	N001			-63.2			#	-	-
	mV	T06-21	BH	08/28/2012	N001			-63.3			#	-	-
	mV	T07-01	BH	08/25/2012	N001			-67.3			#	-	-
	mV	T07-02	BH	08/25/2012	N001			-50.3			#	-	-
	mV	T07-03	BH	08/25/2012	N001			-47.9			#	-	-
	mV	T07-04	BH	08/25/2012	N001			-48.9			#	-	-
	mV	T07-05	BH	08/25/2012	N001			-40.6			#	-	-
	mV	T07-06	BH	08/28/2012	N001			-44.1			#	-	-
	mV	T07-07	BH	08/29/2012	N001			-63.4			#	-	-
	mV	T07-08	BH	08/28/2012	N001			-36.7			#	-	-
	mV	T07-09	BH	08/28/2012	N001			-67.6			#	-	-
	mV	T07-10	BH	08/28/2012	N001			-81.2			#	-	-
	mV	T08-01	BH	08/25/2012	N001			-48.1			#	-	-
	mV	T08-02	BH	08/25/2012	N001			-39.6			#	-	-
	mV	T08-03	BH	08/25/2012	N001			-59.7			#	-	-
	mV	T08-04	BH	08/25/2012	N001			-33.1			#	-	-
	mV	T08-05	BH	08/25/2012	N001			-54.3			#	-	-
	mV	T08-06	BH	08/25/2012	N001			-43.3			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Oxidation Reduction Potential	mV	T08-07	BH	08/27/2012	N001			-74.2			#	-	-
	mV	T08-08	BH	08/28/2012	N001			-56.0			#	-	-
	mV	T08-09	BH	08/28/2012	N001			-107.9			#	-	-
	mV	T09-01	BH	08/25/2012	N001			-12.4			#	-	-
	mV	T09-02	BH	08/25/2012	N001			-69.2			#	-	-
	mV	T09-03	BH	08/25/2012	N001			-70.7			#	-	-
	mV	T09-04	BH	08/25/2012	N001			-65.8			#	-	-
	mV	T09-05	BH	08/25/2012	N001			-36.8			#	-	-
	mV	T09-06	BH	08/28/2012	N001			-44.9			#	-	-
	mV	T09-07	BH	08/28/2012	N001			-16.1			#	-	-
	mV	T09-08	BH	08/28/2012	N001			-69.3			#	-	-
	mV	T09-09	BH	08/28/2012	N001			-65.1			#	-	-
	mV	T09-10	BH	08/28/2012	N001			-73.0			#	-	-
pH	s.u.	T01-01	BH	08/24/2012	N001			7.19			#	-	-
	s.u.	T01-02	BH	08/24/2012	N001			7.22			#	-	-
	s.u.	T01-03	BH	08/24/2012	N001			7.30			#	-	-
	s.u.	T01-04	BH	08/24/2012	N001			7.16			#	-	-
	s.u.	T01-05	BH	08/23/2012	N001			7.23			#	-	-
	s.u.	T01-06	BH	08/23/2012	N001			7.59			#	-	-
	s.u.	T01-07	BH	08/23/2012	N001			7.35			#	-	-
	s.u.	T01-08	BH	08/23/2012	N001			7.30			#	-	-
	s.u.	T01-09	BH	08/23/2012	N001			7.25			#	-	-
	s.u.	T02-01	BH	08/22/2012	N001			7.24			#	-	-
	s.u.	T02-02	BH	08/22/2012	N001			7.71			#	-	-
	s.u.	T02-03	BH	08/22/2012	N001			7.60			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
pH	s.u.	T02-04	BH	08/22/2012	N001			7.54			#	-	-
	s.u.	T02-05	BH	08/22/2012	N001			7.57			#	-	-
	s.u.	T02-06	BH	08/22/2012	N001			7.84			#	-	-
	s.u.	T02-07	BH	08/23/2012	N001			6.49			#	-	-
	s.u.	T02-08	BH	08/23/2012	N001			6.94			#	-	-
	s.u.	T02-09	BH	08/23/2012	N001			7.16			#	-	-
	s.u.	T02-10	BH	08/23/2012	N001			7.20			#	-	-
	s.u.	T02-11	BH	08/23/2012	N001			7.23			#	-	-
	s.u.	T02-12	BH	08/23/2012	N001			7.29			#	-	-
	s.u.	T02-13	BH	08/23/2012	N001			7.57			#	-	-
	s.u.	T02-14	BH	08/23/2012	N001			7.45			#	-	-
	s.u.	T02-15	BH	08/23/2012	N001			7.48			#	-	-
	s.u.	T03-01	BH	08/22/2012	N001			7.28			#	-	-
	s.u.	T03-02	BH	08/22/2012	N001			7.14			#	-	-
	s.u.	T03-08	BH	08/21/2012	N001			6.81			#	-	-
	s.u.	T03-09	BH	08/22/2012	N001			7.00			#	-	-
	s.u.	T03-10	BH	08/22/2012	N001			6.97			#	-	-
	s.u.	T03-11	BH	08/22/2012	N001			7.10			#	-	-
	s.u.	T03-12	BH	08/21/2012	N001			7.09			#	-	-
	s.u.	T03-13	BH	08/21/2012	N001			7.12			#	-	-
	s.u.	T03-14	BH	08/21/2012	N001			7.02			#	-	-
	s.u.	T03-15	BH	08/21/2012	N001			7.29			#	-	-
	s.u.	T03-16	BH	08/21/2012	N001			7.49			#	-	-
	s.u.	T03-17	BH	08/21/2012	N001			7.48			#	-	-
	s.u.	T03-18	BH	08/24/2012	N001			7.19			#	-	-
	s.u.	T03-19	BH	08/24/2012	N001			7.18			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
pH	s.u.	T03-20	BH	08/24/2012	N001			7.17			#	-	-
	s.u.	T03-21	BH	08/24/2012	N001			7.10			#	-	-
	s.u.	T04-03	BH	08/26/2012	N001			7.10			#	-	-
	s.u.	T04-04	BH	08/26/2012	N001			7.11			#	-	-
	s.u.	T04-05	BH	08/26/2012	N001			7.12			#	-	-
	s.u.	T04-06	BH	08/26/2012	N001			7.12			#	-	-
	s.u.	T04-07	BH	08/26/2012	N001			7.16			#	-	-
	s.u.	T04-08	BH	08/27/2012	N001			6.86			#	-	-
	s.u.	T04-09	BH	08/27/2012	N001			6.94			#	-	-
	s.u.	T04-10	BH	08/27/2012	N001			7.01			#	-	-
	s.u.	T04-11	BH	08/27/2012	N001			7.00			#	-	-
	s.u.	T04-12	BH	08/24/2012	N001			7.10			#	-	-
	s.u.	T04-15	BH	08/24/2012	N001			7.15			#	-	-
	s.u.	T04-16	BH	08/24/2012	N001			7.16			#	-	-
	s.u.	T04-17	BH	08/24/2012	N001			7.15			#	-	-
	s.u.	T05-01	BH	08/28/2012	N001			7.04			#	-	-
	s.u.	T05-02	BH	08/29/2012	N001			6.88			#	-	-
	s.u.	T05-03	BH	08/29/2012	N001			7.04			#	-	-
	s.u.	T06-01	BH	08/26/2012	N001			7.62			#	-	-
	s.u.	T06-02	BH	08/26/2012	N001			7.24			#	-	-
	s.u.	T06-03	BH	08/26/2012	N001			7.10			#	-	-
	s.u.	T06-04	BH	08/26/2012	N001			7.12			#	-	-
	s.u.	T06-05	BH	08/26/2012	N001			7.24			#	-	-
	s.u.	T06-06	BH	08/26/2012	N001			7.08			#	-	-
	s.u.	T06-07	BH	08/26/2012	N001			7.16			#	-	-
	s.u.	T06-08	BH	08/26/2012	N001			7.06			#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
pH	s.u.	T06-09	BH	08/26/2012	N001			6.89			#	-	-
	s.u.	T06-10	BH	08/27/2012	N001			6.94			#	-	-
	s.u.	T06-11	BH	08/27/2012	N001			6.96			#	-	-
	s.u.	T06-12	BH	08/27/2012	N001			7.01			#	-	-
	s.u.	T06-13	BH	08/27/2012	N001			6.96			#	-	-
	s.u.	T06-14	BH	08/27/2012	N001			7.04			#	-	-
	s.u.	T06-15	BH	08/27/2012	N001			6.99			#	-	-
	s.u.	T06-16	BH	08/27/2012	N001			7.25			#	-	-
	s.u.	T06-17	BH	08/27/2012	N001			7.02			#	-	-
	s.u.	T06-21	BH	08/28/2012	N001			6.89			#	-	-
	s.u.	T07-01	BH	08/25/2012	N001			7.21			#	-	-
	s.u.	T07-02	BH	08/25/2012	N001			7.09			#	-	-
	s.u.	T07-03	BH	08/25/2012	N001			7.11			#	-	-
	s.u.	T07-04	BH	08/25/2012	N001			7.00			#	-	-
	s.u.	T07-05	BH	08/25/2012	N001			6.96			#	-	-
	s.u.	T07-06	BH	08/28/2012	N001			6.90			#	-	-
	s.u.	T07-07	BH	08/29/2012	N001			6.99			#	-	-
	s.u.	T07-08	BH	08/28/2012	N001			7.01			#	-	-
	s.u.	T07-09	BH	08/28/2012	N001			7.13			#	-	-
	s.u.	T07-10	BH	08/28/2012	N001			7.24			#	-	-
	s.u.	T08-01	BH	08/25/2012	N001			7.08			#	-	-
	s.u.	T08-02	BH	08/25/2012	N001			7.09			#	-	-
	s.u.	T08-03	BH	08/25/2012	N001			7.15			#	-	-
	s.u.	T08-04	BH	08/25/2012	N001			7.00			#	-	-
	s.u.	T08-05	BH	08/25/2012	N001			7.03			#	-	-
	s.u.	T08-06	BH	08/25/2012	N001			6.99			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
pH	s.u.	T08-07	BH	08/27/2012	N001			6.99			#	-	-
	s.u.	T08-08	BH	08/28/2012	N001			7.21			#	-	-
	s.u.	T08-09	BH	08/28/2012	N001			7.26			#	-	-
	s.u.	T09-01	BH	08/25/2012	N001			7.29			#	-	-
	s.u.	T09-02	BH	08/25/2012	N001			7.44			#	-	-
	s.u.	T09-03	BH	08/25/2012	N001			7.30			#	-	-
	s.u.	T09-04	BH	08/25/2012	N001			7.24			#	-	-
	s.u.	T09-05	BH	08/25/2012	N001			7.18			#	-	-
	s.u.	T09-06	BH	08/28/2012	N001			7.10			#	-	-
	s.u.	T09-07	BH	08/28/2012	N001			7.31			#	-	-
	s.u.	T09-08	BH	08/28/2012	N001			7.26			#	-	-
	s.u.	T09-09	BH	08/28/2012	N001			7.21			#	-	-
	s.u.	T09-10	BH	08/28/2012	N001			7.11			#	-	-
Potassium	mg/L	T01-01	BH	08/24/2012	0001			5.100			#	0.54	-
	mg/L	T01-02	BH	08/24/2012	0001			5.300			#	0.11	-
	mg/L	T01-03	BH	08/24/2012	0001			6.600			#	0.11	-
	mg/L	T01-04	BH	08/24/2012	0001			6.800			#	0.11	-
	mg/L	T01-05	BH	08/23/2012	0001			6.800			#	0.11	-
	mg/L	T01-06	BH	08/23/2012	0001			6.300			#	0.11	-
	mg/L	T01-07	BH	08/23/2012	0001			9.400			#	0.11	-
	mg/L	T01-08	BH	08/23/2012	0001			5.200			#	0.11	-
	mg/L	T01-09	BH	08/23/2012	0001			3.300			#	0.11	-
	mg/L	T02-01	BH	08/22/2012	0001			8.100			#	0.54	-
	mg/L	T02-02	BH	08/22/2012	0001			4.900	B		#	0.54	-
	mg/L	T02-03	BH	08/22/2012	0001			7.900			#	0.54	-
	mg/L	T02-04	BH	08/22/2012	0001			9.100			#	0.54	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Potassium	mg/L	T02-05	BH	08/22/2012	0001			9.700			#	0.54	-
	mg/L	T02-06	BH	08/22/2012	0001			12.000			#	1.1	-
	mg/L	T02-07	BH	08/23/2012	0001			11.000			#	0.54	-
	mg/L	T02-08	BH	08/23/2012	0001			7.100			#	0.54	-
	mg/L	T02-09	BH	08/23/2012	0001			6.700			#	0.11	-
	mg/L	T02-10	BH	08/23/2012	0001			6.500			#	0.11	-
	mg/L	T02-11	BH	08/23/2012	0001			4.900			#	0.11	-
	mg/L	T02-12	BH	08/23/2012	0001			3.500			#	0.11	-
	mg/L	T02-13	BH	08/23/2012	0001			2.600			#	0.11	-
	mg/L	T02-14	BH	08/23/2012	0001			3.100			#	0.11	-
	mg/L	T02-15	BH	08/23/2012	0001			3.500			#	0.11	-
	mg/L	T03-01	BH	08/22/2012	0001			5.100			#	0.11	-
	mg/L	T03-02	BH	08/22/2012	0001			5.400			#	0.11	-
	mg/L	T03-08	BH	08/21/2012	0001			11.000			#	1.1	-
	mg/L	T03-09	BH	08/22/2012	0001			12.000			#	1.1	-
	mg/L	T03-10	BH	08/22/2012	0001			5.600	B		#	1.1	-
	mg/L	T03-11	BH	08/22/2012	0001			6.600			#	0.54	-
	mg/L	T03-12	BH	08/21/2012	0001			5.500			#	0.11	-
	mg/L	T03-13	BH	08/21/2012	0001			5.500			#	0.11	-
	mg/L	T03-14	BH	08/21/2012	0001			5.200			#	0.11	-
	mg/L	T03-15	BH	08/21/2012	0001			3.900			#	0.11	-
	mg/L	T03-15	BH	08/21/2012	0002			4.300			#	0.11	-
	mg/L	T03-16	BH	08/21/2012	0001			3.600			#	0.11	-
	mg/L	T03-17	BH	08/21/2012	0001			4.900			#	0.11	-
	mg/L	T03-18	BH	08/24/2012	0001			4.000			#	0.11	-
	mg/L	T03-19	BH	08/24/2012	0001			3.800			#	0.11	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Potassium	mg/L	T03-20	BH	08/24/2012	0001			4.900			#	0.11	-
	mg/L	T03-21	BH	08/24/2012	0001			5.400			#	0.11	-
	mg/L	T04-03	BH	08/26/2012	0001			4.400	B	J	#	0.54	-
	mg/L	T04-04	BH	08/26/2012	0001			4.700	B	J	#	0.54	-
	mg/L	T04-05	BH	08/26/2012	0001			10.000			#	0.54	-
	mg/L	T04-06	BH	08/26/2012	0001			11.000			#	1.1	-
	mg/L	T04-07	BH	08/26/2012	0001			12.000			#	1.1	-
	mg/L	T04-07	BH	08/26/2012	0002			14.000			#	1.1	-
	mg/L	T04-08	BH	08/27/2012	0001			14.000			#	1.1	-
	mg/L	T04-09	BH	08/27/2012	0001			14.000			#	1.1	-
	mg/L	T04-10	BH	08/27/2012	0001			14.000			#	0.54	-
	mg/L	T04-11	BH	08/27/2012	0001			9.800			#	0.54	-
	mg/L	T04-12	BH	08/24/2012	0001			5.300			#	0.11	-
	mg/L	T04-15	BH	08/24/2012	0001			5.600			#	0.11	-
	mg/L	T04-16	BH	08/24/2012	0001			6.000			#	0.11	-
	mg/L	T04-16	BH	08/24/2012	0002			6.100			#	0.11	-
	mg/L	T04-17	BH	08/24/2012	0001			4.800			#	0.11	-
	mg/L	T05-01	BH	08/28/2012	0001			17.000			#	1.1	-
	mg/L	T05-02	BH	08/29/2012	0001			15.000			#	0.54	-
	mg/L	T05-03	BH	08/29/2012	0001			9.200			#	0.54	-
	mg/L	T05-03	BH	08/29/2012	0002			10.000			#	0.54	-
	mg/L	T06-01	BH	08/26/2012	0001			5.600			#	0.54	-
	mg/L	T06-02	BH	08/26/2012	0001			7.700			#	0.54	-
	mg/L	T06-03	BH	08/26/2012	0001			7.900			#	0.54	-
	mg/L	T06-04	BH	08/26/2012	0001			5.800			#	0.54	-
	mg/L	T06-05	BH	08/26/2012	0001			11.000			#	1.1	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Potassium	mg/L	T06-06	BH	08/26/2012	0001			12.000			#	1.1	-
	mg/L	T06-07	BH	08/26/2012	0001			18.000			#	1.1	-
	mg/L	T06-08	BH	08/26/2012	0001			16.000			#	1.1	-
	mg/L	T06-09	BH	08/26/2012	0001			18.000			#	1.1	-
	mg/L	T06-10	BH	08/27/2012	0001			17.000			#	1.1	-
	mg/L	T06-11	BH	08/27/2012	0001			13.000			#	1.1	-
	mg/L	T06-12	BH	08/27/2012	0001			11.000			#	0.54	-
	mg/L	T06-13	BH	08/27/2012	0001			12.000			#	0.54	-
	mg/L	T06-14	BH	08/27/2012	0001			13.000			#	0.11	-
	mg/L	T06-15	BH	08/27/2012	0001			7.800			#	0.11	-
	mg/L	T06-16	BH	08/27/2012	0001			6.900			#	0.11	-
	mg/L	T06-17	BH	08/27/2012	0001			6.100			#	0.54	-
	mg/L	T06-21	BH	08/28/2012	0001			7.900			#	0.11	-
	mg/L	T07-01	BH	08/25/2012	0001			12.000	B		#	2.2	-
	mg/L	T07-02	BH	08/25/2012	0001			17.000	B		#	2.2	-
	mg/L	T07-03	BH	08/25/2012	0001			16.000	B		#	2.2	-
	mg/L	T07-04	BH	08/25/2012	0001			16.000			#	1.1	-
	mg/L	T07-05	BH	08/25/2012	0001			15.000			#	1.1	-
	mg/L	T07-06	BH	08/28/2012	0001			15.000			#	0.54	-
	mg/L	T07-06	BH	08/28/2012	0002			16.000			#	0.54	-
	mg/L	T07-07	BH	08/29/2012	0001			13.000			#	0.54	-
	mg/L	T07-08	BH	08/28/2012	0001			11.000			#	0.54	-
	mg/L	T07-09	BH	08/28/2012	0001			7.500			#	0.11	-
	mg/L	T07-10	BH	08/28/2012	0001			7.800			#	0.11	-
	mg/L	T08-01	BH	08/25/2012	0001			14.000	B		#	2.2	-
	mg/L	T08-02	BH	08/25/2012	0001			19.000	B		#	2.2	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Potassium	mg/L	T08-02	BH	08/25/2012	0002			19.000	B		#	5.4	-
	mg/L	T08-03	BH	08/25/2012	0001			15.000	B		#	2.2	-
	mg/L	T08-04	BH	08/25/2012	0001			12.000			#	1.1	-
	mg/L	T08-05	BH	08/25/2012	0001			28.000			#	0.11	-
	mg/L	T08-06	BH	08/25/2012	0001			15.000			#	0.54	-
	mg/L	T08-07	BH	08/27/2012	0001			15.000			#	0.54	-
	mg/L	T08-08	BH	08/28/2012	0001			4.800			#	0.11	-
	mg/L	T08-09	BH	08/28/2012	0001			4.400			#	0.11	-
	mg/L	T09-01	BH	08/25/2012	0001			3.300			#	0.11	-
	mg/L	T09-02	BH	08/25/2012	0001			4.900			#	0.11	-
	mg/L	T09-03	BH	08/25/2012	0001			3.400	B		#	0.54	-
	mg/L	T09-04	BH	08/25/2012	0001			4.700	B		#	0.54	-
	mg/L	T09-05	BH	08/25/2012	0001			8.200			#	0.54	-
	mg/L	T09-06	BH	08/28/2012	0001			4.200	B		#	0.54	-
	mg/L	T09-07	BH	08/28/2012	0001			3.400	B		#	0.54	-
	mg/L	T09-08	BH	08/28/2012	0001			3.900			#	0.11	-
	mg/L	T09-09	BH	08/28/2012	0001			4.700			#	0.11	-
	mg/L	T09-10	BH	08/28/2012	0001			4.900			#	0.11	-
Sodium	mg/L	T01-01	BH	08/24/2012	0001			170.000			#	0.033	-
	mg/L	T01-02	BH	08/24/2012	0001			110.000			#	0.0066	-
	mg/L	T01-03	BH	08/24/2012	0001			87.000			#	0.0066	-
	mg/L	T01-04	BH	08/24/2012	0001			89.000			#	0.0066	-
	mg/L	T01-05	BH	08/23/2012	0001			110.000			#	0.0066	-
	mg/L	T01-06	BH	08/23/2012	0001			99.000			#	0.0066	-
	mg/L	T01-07	BH	08/23/2012	0001			100.000			#	0.0066	-
	mg/L	T01-08	BH	08/23/2012	0001			66.000			#	0.0066	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Sodium	mg/L	T01-09	BH	08/23/2012	0001			56.000			#	0.0066	-
	mg/L	T02-01	BH	08/22/2012	0001			420.000			#	0.033	-
	mg/L	T02-02	BH	08/22/2012	0001			230.000			#	0.033	-
	mg/L	T02-03	BH	08/22/2012	0001			340.000			#	0.033	-
	mg/L	T02-04	BH	08/22/2012	0001			560.000			#	0.033	-
	mg/L	T02-05	BH	08/22/2012	0001			610.000			#	0.033	-
	mg/L	T02-06	BH	08/22/2012	0001			1500.000			#	0.066	-
	mg/L	T02-07	BH	08/23/2012	0001			570.000			#	0.033	-
	mg/L	T02-08	BH	08/23/2012	0001			140.000			#	0.033	-
	mg/L	T02-09	BH	08/23/2012	0001			140.000			#	0.0066	-
	mg/L	T02-10	BH	08/23/2012	0001			120.000			#	0.0066	-
	mg/L	T02-11	BH	08/23/2012	0001			79.000			#	0.0066	-
	mg/L	T02-12	BH	08/23/2012	0001			35.000			#	0.0066	-
	mg/L	T02-13	BH	08/23/2012	0001			16.000			#	0.0066	-
	mg/L	T02-14	BH	08/23/2012	0001			22.000			#	0.0066	-
	mg/L	T02-15	BH	08/23/2012	0001			27.000			#	0.0066	-
	mg/L	T03-01	BH	08/22/2012	0001			100.000			#	0.0066	-
	mg/L	T03-02	BH	08/22/2012	0001			95.000			#	0.0066	-
	mg/L	T03-08	BH	08/21/2012	0001			580.000			#	0.066	-
	mg/L	T03-09	BH	08/22/2012	0001			780.000			#	0.066	-
	mg/L	T03-10	BH	08/22/2012	0001			310.000			#	0.066	-
	mg/L	T03-11	BH	08/22/2012	0001			220.000			#	0.033	-
	mg/L	T03-12	BH	08/21/2012	0001			140.000			#	0.033	-
	mg/L	T03-13	BH	08/21/2012	0001			110.000			#	0.0066	-
	mg/L	T03-14	BH	08/21/2012	0001			73.000			#	0.0066	-
	mg/L	T03-15	BH	08/21/2012	0001			71.000			#	0.0066	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Sodium	mg/L	T03-15	BH	08/21/2012	0002			72.000	E	J	#	0.0066	-
	mg/L	T03-16	BH	08/21/2012	0001			48.000			#	0.0066	-
	mg/L	T03-17	BH	08/21/2012	0001			32.000	E	J	#	0.0066	-
	mg/L	T03-18	BH	08/24/2012	0001			33.000	E	J	#	0.0066	-
	mg/L	T03-19	BH	08/24/2012	0001			26.000	E	J	#	0.0066	-
	mg/L	T03-20	BH	08/24/2012	0001			44.000	E	J	#	0.0066	-
	mg/L	T03-21	BH	08/24/2012	0001			42.000			#	0.0066	-
	mg/L	T04-03	BH	08/26/2012	0001			310.000			#	0.033	-
	mg/L	T04-04	BH	08/26/2012	0001			220.000			#	0.033	-
	mg/L	T04-05	BH	08/26/2012	0001			540.000			#	0.033	-
	mg/L	T04-06	BH	08/26/2012	0001			740.000			#	0.066	-
	mg/L	T04-07	BH	08/26/2012	0001			810.000			#	0.066	-
	mg/L	T04-07	BH	08/26/2012	0002			800.000			#	0.066	-
	mg/L	T04-08	BH	08/27/2012	0001			720.000			#	0.066	-
	mg/L	T04-09	BH	08/27/2012	0001			660.000			#	0.066	-
	mg/L	T04-10	BH	08/27/2012	0001			590.000			#	0.033	-
	mg/L	T04-11	BH	08/27/2012	0001			300.000			#	0.033	-
	mg/L	T04-12	BH	08/24/2012	0001			82.000			#	0.0066	-
	mg/L	T04-15	BH	08/24/2012	0001			28.000			#	0.0066	-
	mg/L	T04-16	BH	08/24/2012	0001			40.000			#	0.0066	-
	mg/L	T04-16	BH	08/24/2012	0002			40.000			#	0.0066	-
	mg/L	T04-17	BH	08/24/2012	0001			35.000			#	0.0066	-
	mg/L	T05-01	BH	08/28/2012	0001			1100.000			#	0.066	-
	mg/L	T05-02	BH	08/29/2012	0001			630.000			#	0.033	-
	mg/L	T05-03	BH	08/29/2012	0001			230.000			#	0.033	-
	mg/L	T05-03	BH	08/29/2012	0002			230.000			#	0.033	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Sodium	mg/L	T06-01	BH	08/26/2012	0001			350.000			#	0.033	-
	mg/L	T06-02	BH	08/26/2012	0001			420.000			#	0.033	-
	mg/L	T06-03	BH	08/26/2012	0001			580.000			#	0.033	-
	mg/L	T06-04	BH	08/26/2012	0001			380.000			#	0.033	-
	mg/L	T06-05	BH	08/26/2012	0001			970.000			#	0.066	-
	mg/L	T06-06	BH	08/26/2012	0001			990.000			#	0.066	-
	mg/L	T06-07	BH	08/26/2012	0001			1400.000			#	0.066	-
	mg/L	T06-08	BH	08/26/2012	0001			1100.000			#	0.066	-
	mg/L	T06-09	BH	08/26/2012	0001			980.000			#	0.066	-
	mg/L	T06-10	BH	08/27/2012	0001			1200.000			#	0.066	-
	mg/L	T06-11	BH	08/27/2012	0001			550.000			#	0.066	-
	mg/L	T06-12	BH	08/27/2012	0001			300.000			#	0.033	-
	mg/L	T06-13	BH	08/27/2012	0001			190.000			#	0.033	-
	mg/L	T06-14	BH	08/27/2012	0001			120.000			#	0.0066	-
	mg/L	T06-15	BH	08/27/2012	0001			98.000			#	0.0066	-
	mg/L	T06-16	BH	08/27/2012	0001			150.000			#	0.0066	-
	mg/L	T06-17	BH	08/27/2012	0001			170.000			#	0.033	-
	mg/L	T06-21	BH	08/28/2012	0001			51.000			#	0.0066	-
	mg/L	T07-01	BH	08/25/2012	0001			1500.000			#	0.13	-
	mg/L	T07-02	BH	08/25/2012	0001			1700.000			#	0.13	-
	mg/L	T07-03	BH	08/25/2012	0001			1500.000			#	0.13	-
	mg/L	T07-04	BH	08/25/2012	0001			1300.000			#	0.066	-
	mg/L	T07-05	BH	08/25/2012	0001			900.000			#	0.066	-
	mg/L	T07-06	BH	08/28/2012	0001			490.000			#	0.033	-
	mg/L	T07-06	BH	08/28/2012	0002			470.000			#	0.033	-
	mg/L	T07-07	BH	08/29/2012	0001			290.000			#	0.033	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Sodium	mg/L	T07-08	BH	08/28/2012	0001			190.000			#	0.033	-
	mg/L	T07-09	BH	08/28/2012	0001			130.000			#	0.0066	-
	mg/L	T07-10	BH	08/28/2012	0001			130.000			#	0.0066	-
	mg/L	T08-01	BH	08/25/2012	0001			1700.000			#	0.13	-
	mg/L	T08-02	BH	08/25/2012	0001			2000.000			#	0.13	-
	mg/L	T08-02	BH	08/25/2012	0002			1800.000			#	0.33	-
	mg/L	T08-03	BH	08/25/2012	0001			1700.000			#	0.13	-
	mg/L	T08-04	BH	08/25/2012	0001			1000.000			#	0.066	-
	mg/L	T08-05	BH	08/25/2012	0001			780.000			#	0.066	-
	mg/L	T08-06	BH	08/25/2012	0001			520.000			#	0.033	-
	mg/L	T08-07	BH	08/27/2012	0001			590.000			#	0.033	-
	mg/L	T08-08	BH	08/28/2012	0001			140.000			#	0.13	-
	mg/L	T08-09	BH	08/28/2012	0001			120.000			#	0.0066	-
	mg/L	T09-01	BH	08/25/2012	0001			65.000			#	0.0066	-
	mg/L	T09-02	BH	08/25/2012	0001			150.000			#	0.0066	-
	mg/L	T09-03	BH	08/25/2012	0001			170.000			#	0.033	-
	mg/L	T09-04	BH	08/25/2012	0001			320.000			#	0.033	-
	mg/L	T09-05	BH	08/25/2012	0001			630.000			#	0.033	-
	mg/L	T09-06	BH	08/28/2012	0001			170.000			#	0.033	-
	mg/L	T09-07	BH	08/28/2012	0001			260.000			#	0.033	-
	mg/L	T09-08	BH	08/28/2012	0001			120.000			#	0.0066	-
	mg/L	T09-09	BH	08/28/2012	0001			80.000			#	0.0066	-
	mg/L	T09-10	BH	08/28/2012	0001			84.000			#	0.0066	-
Specific Conductance	umhos/cm	T01-01	BH	08/24/2012	N001			1452			#	-	-
	umhos/cm	T01-02	BH	08/24/2012	N001			836			#	-	-
	umhos/cm	T01-03	BH	08/24/2012	N001			884			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Specific Conductance	umhos/cm	T01-04	BH	08/24/2012	N001			870			#	-	-
	umhos/cm	T01-05	BH	08/23/2012	N001			1120			#	-	-
	umhos/cm	T01-06	BH	08/23/2012	N001			26			#	-	-
	umhos/cm	T01-07	BH	08/23/2012	N001			953			#	-	-
	umhos/cm	T01-08	BH	08/23/2012	N001			745			#	-	-
	umhos/cm	T01-09	BH	08/23/2012	N001			589			#	-	-
	umhos/cm	T02-01	BH	08/22/2012	N001			3114			#	-	-
	umhos/cm	T02-02	BH	08/22/2012	N001			1430			#	-	-
	umhos/cm	T02-03	BH	08/22/2012	N001			2279			#	-	-
	umhos/cm	T02-04	BH	08/22/2012	N001			3424			#	-	-
	umhos/cm	T02-05	BH	08/22/2012	N001			3566			#	-	-
	umhos/cm	T02-06	BH	08/22/2012	N001			6166			#	-	-
	umhos/cm	T02-07	BH	08/23/2012	N001			3611			#	-	-
	umhos/cm	T02-08	BH	08/23/2012	N001			1556			#	-	-
	umhos/cm	T02-09	BH	08/23/2012	N001			1423			#	-	-
	umhos/cm	T02-10	BH	08/23/2012	N001			1348			#	-	-
	umhos/cm	T02-11	BH	08/23/2012	N001			989			#	-	-
	umhos/cm	T02-12	BH	08/23/2012	N001			641			#	-	-
	umhos/cm	T02-13	BH	08/23/2012	N001			360			#	-	-
	umhos/cm	T02-14	BH	08/23/2012	N001			434			#	-	-
	umhos/cm	T02-15	BH	08/23/2012	N001			441			#	-	-
	umhos/cm	T03-01	BH	08/22/2012	N001			998			#	-	-
	umhos/cm	T03-02	BH	08/22/2012	N001			1036			#	-	-
	umhos/cm	T03-08	BH	08/21/2012	N001			4147			#	-	-
	umhos/cm	T03-09	BH	08/22/2012	N001			4467			#	-	-
	umhos/cm	T03-10	BH	08/22/2012	N001			2515			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Specific Conductance	umhos/cm	T03-11	BH	08/22/2012	N001			2031			#	-	-
	umhos/cm	T03-12	BH	08/21/2012	N001			1374			#	-	-
	umhos/cm	T03-13	BH	08/21/2012	N001			1111			#	-	-
	umhos/cm	T03-14	BH	08/21/2012	N001			843			#	-	-
	umhos/cm	T03-15	BH	08/21/2012	N001			669			#	-	-
	umhos/cm	T03-16	BH	08/21/2012	N001			598			#	-	-
	umhos/cm	T03-17	BH	08/21/2012	N001			516			#	-	-
	umhos/cm	T03-18	BH	08/24/2012	N001			713			#	-	-
	umhos/cm	T03-19	BH	08/24/2012	N001			627			#	-	-
	umhos/cm	T03-20	BH	08/24/2012	N001			781			#	-	-
	umhos/cm	T03-21	BH	08/24/2012	N001			822			#	-	-
	umhos/cm	T04-03	BH	08/26/2012	N001			2251			#	-	-
	umhos/cm	T04-04	BH	08/26/2012	N001			1950			#	-	-
	umhos/cm	T04-05	BH	08/26/2012	N001			3776			#	-	-
	umhos/cm	T04-06	BH	08/26/2012	N001			4874			#	-	-
	umhos/cm	T04-07	BH	08/26/2012	N001			4951			#	-	-
	umhos/cm	T04-08	BH	08/27/2012	N001			4649			#	-	-
	umhos/cm	T04-09	BH	08/27/2012	N001			4459			#	-	-
	umhos/cm	T04-10	BH	08/27/2012	N001			2377			#	-	-
	umhos/cm	T04-11	BH	08/27/2012	N001			2459			#	-	-
	umhos/cm	T04-12	BH	08/24/2012	N001			694			#	-	-
	umhos/cm	T04-15	BH	08/24/2012	N001			589			#	-	-
	umhos/cm	T04-16	BH	08/24/2012	N001			677			#	-	-
	umhos/cm	T04-17	BH	08/24/2012	N001			666			#	-	-
	umhos/cm	T05-01	BH	08/28/2012	N001			6419			#	-	-
	umhos/cm	T05-02	BH	08/29/2012	N001			3951			#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Specific Conductance	umhos/cm	T05-03	BH	08/29/2012	N001			2174			#	-	-
	umhos/cm	T06-01	BH	08/26/2012	N001			2759			#	-	-
	umhos/cm	T06-02	BH	08/26/2012	N001			3187			#	-	-
	umhos/cm	T06-03	BH	08/26/2012	N001			3672			#	-	-
	umhos/cm	T06-04	BH	08/26/2012	N001			2750			#	-	-
	umhos/cm	T06-05	BH	08/26/2012	N001			4490			#	-	-
	umhos/cm	T06-06	BH	08/26/2012	N001			5732			#	-	-
	umhos/cm	T06-07	BH	08/26/2012	N001			7295			#	-	-
	umhos/cm	T06-08	BH	08/26/2012	N001			6414			#	-	-
	umhos/cm	T06-09	BH	08/26/2012	N001			5948			#	-	-
	umhos/cm	T06-10	BH	08/27/2012	N001			6494			#	-	-
	umhos/cm	T06-11	BH	08/27/2012	N001			3726			#	-	-
	umhos/cm	T06-12	BH	08/27/2012	N001			2537			#	-	-
	umhos/cm	T06-13	BH	08/27/2012	N001			2384			#	-	-
	umhos/cm	T06-14	BH	08/27/2012	N001			1521			#	-	-
	umhos/cm	T06-15	BH	08/27/2012	N001			1143			#	-	-
	umhos/cm	T06-16	BH	08/27/2012	N001			1077			#	-	-
	umhos/cm	T06-17	BH	08/27/2012	N001			1709			#	-	-
	umhos/cm	T06-21	BH	08/28/2012	N001			901			#	-	-
	umhos/cm	T07-01	BH	08/25/2012	N001			7977			#	-	-
	umhos/cm	T07-02	BH	08/25/2012	N001			8511			#	-	-
	umhos/cm	T07-03	BH	08/25/2012	N001			7727			#	-	-
	umhos/cm	T07-04	BH	08/25/2012	N001			7064			#	-	-
	umhos/cm	T07-05	BH	08/25/2012	N001			5570			#	-	-
	umhos/cm	T07-06	BH	08/28/2012	N001			1945			#	-	-
	umhos/cm	T07-07	BH	08/29/2012	N001			2635			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Specific Conductance	umhos/cm	T07-08	BH	08/28/2012	N001			2242			#	-	-
	umhos/cm	T07-09	BH	08/28/2012	N001			1267			#	-	-
	umhos/cm	T07-10	BH	08/28/2012	N001			1104			#	-	-
	umhos/cm	T08-01	BH	08/25/2012	N001			9744			#	-	-
	umhos/cm	T08-02	BH	08/25/2012	N001			10139			#	-	-
	umhos/cm	T08-03	BH	08/25/2012	N001			8644			#	-	-
	umhos/cm	T08-04	BH	08/25/2012	N001			6458			#	-	-
	umhos/cm	T08-05	BH	08/25/2012	N001			5299			#	-	-
	umhos/cm	T08-06	BH	08/25/2012	N001			4137			#	-	-
	umhos/cm	T08-07	BH	08/27/2012	N001			4133			#	-	-
	umhos/cm	T08-08	BH	08/28/2012	N001			1478			#	-	-
	umhos/cm	T08-09	BH	08/28/2012	N001			1195			#	-	-
	umhos/cm	T09-01	BH	08/25/2012	N001			718			#	-	-
	umhos/cm	T09-02	BH	08/25/2012	N001			1227			#	-	-
	umhos/cm	T09-03	BH	08/25/2012	N001			1694			#	-	-
	umhos/cm	T09-04	BH	08/25/2012	N001			2605			#	-	-
	umhos/cm	T09-05	BH	08/25/2012	N001			4317			#	-	-
	umhos/cm	T09-06	BH	08/28/2012	N001			1669			#	-	-
	umhos/cm	T09-07	BH	08/28/2012	N001			1635			#	-	-
	umhos/cm	T09-08	BH	08/28/2012	N001			846			#	-	-
	umhos/cm	T09-09	BH	08/28/2012	N001			779			#	-	-
	umhos/cm	T09-10	BH	08/28/2012	N001			999			#	-	-
Sulfate	mg/L	T01-01	BH	08/24/2012	0001			520			#	10	-
	mg/L	T01-02	BH	08/24/2012	0001			270			#	5	-
	mg/L	T01-03	BH	08/24/2012	0001			200			#	5	-
	mg/L	T01-04	BH	08/24/2012	0001			170			#	5	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Sulfate	mg/L	T01-05	BH	08/23/2012	0001			340			#	5	-
	mg/L	T01-06	BH	08/23/2012	0001			310			#	5	-
	mg/L	T01-07	BH	08/23/2012	0001			260			#	5	-
	mg/L	T01-08	BH	08/23/2012	0001			190			#	2.5	-
	mg/L	T01-09	BH	08/23/2012	0001			110			#	2.5	-
	mg/L	T02-01	BH	08/22/2012	0001			1700			#	25	-
	mg/L	T02-02	BH	08/22/2012	0001			580			#	10	-
	mg/L	T02-03	BH	08/22/2012	0001			1200			#	10	-
	mg/L	T02-04	BH	08/22/2012	0001			2000			#	25	-
	mg/L	T02-05	BH	08/22/2012	0001			2200			#	25	-
	mg/L	T02-06	BH	08/22/2012	0001			3200			#	25	-
	mg/L	T02-07	BH	08/23/2012	0001			1900			#	25	-
	mg/L	T02-08	BH	08/23/2012	0001			590			#	10	-
	mg/L	T02-09	BH	08/23/2012	0001			500			#	10	-
	mg/L	T02-10	BH	08/23/2012	0001			460			#	5	-
	mg/L	T02-11	BH	08/23/2012	0001			280			#	5	-
	mg/L	T02-12	BH	08/23/2012	0001			140			#	2.5	-
	mg/L	T02-13	BH	08/23/2012	0001			39			#	1	-
	mg/L	T02-14	BH	08/23/2012	0001			69			#	1	-
	mg/L	T02-15	BH	08/23/2012	0001			66			#	1	-
	mg/L	T03-01	BH	08/22/2012	0001			320			#	5	-
	mg/L	T03-02	BH	08/22/2012	0001			430			#	5	-
	mg/L	T03-08	BH	08/21/2012	0001			2600			#	25	-
	mg/L	T03-09	BH	08/22/2012	0001			2600			#	25	-
	mg/L	T03-10	BH	08/22/2012	0001			1200			#	10	-
	mg/L	T03-11	BH	08/22/2012	0001			790			#	10	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Sulfate	mg/L	T03-12	BH	08/21/2012	0001			440			#	5	-
	mg/L	T03-13	BH	08/21/2012	0001			310			#	5	-
	mg/L	T03-14	BH	08/21/2012	0001			210			#	2.5	-
	mg/L	T03-15	BH	08/21/2012	0001			150			#	2.5	-
	mg/L	T03-15	BH	08/21/2012	0002			150			#	2.5	-
	mg/L	T03-16	BH	08/21/2012	0001			120			#	2.5	-
	mg/L	T03-17	BH	08/21/2012	0001			44			#	0.5	-
	mg/L	T03-18	BH	08/24/2012	0001			130			#	2.5	-
	mg/L	T03-19	BH	08/24/2012	0001			94			#	1	-
	mg/L	T03-20	BH	08/24/2012	0001			140			#	2.5	-
	mg/L	T03-21	BH	08/24/2012	0001			150			#	2.5	-
	mg/L	T04-03	BH	08/26/2012	0001			910			#	10	-
	mg/L	T04-04	BH	08/26/2012	0001			800			#	10	-
	mg/L	T04-05	BH	08/26/2012	0001			2000			#	25	-
	mg/L	T04-06	BH	08/26/2012	0001			2800			#	25	-
	mg/L	T04-07	BH	08/26/2012	0001			2700			#	25	-
	mg/L	T04-07	BH	08/26/2012	0002			2700			#	25	-
	mg/L	T04-08	BH	08/27/2012	0001			2600			#	25	-
	mg/L	T04-09	BH	08/27/2012	0001			2600			#	25	-
	mg/L	T04-10	BH	08/27/2012	0001			2000			#	25	-
	mg/L	T04-11	BH	08/27/2012	0001			1100			#	25	-
	mg/L	T04-12	BH	08/24/2012	0001			130			#	1	-
	mg/L	T04-15	BH	08/24/2012	0001			76			#	2.5	-
	mg/L	T04-16	BH	08/24/2012	0001			120			#	2.5	-
	mg/L	T04-16	BH	08/24/2012	0002			120			#	2.5	-
	mg/L	T04-17	BH	08/24/2012	0001			110			#	2.5	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Sulfate	mg/L	T05-01	BH	08/28/2012	0001			3700			#	25	-
	mg/L	T05-02	BH	08/29/2012	0001			2100			#	25	-
	mg/L	T05-03	BH	08/29/2012	0001			980			#	10	-
	mg/L	T05-03	BH	08/29/2012	0002			990			#	10	-
	mg/L	T06-01	BH	08/26/2012	0001			1200			#	10	-
	mg/L	T06-02	BH	08/26/2012	0001			1500			#	25	-
	mg/L	T06-03	BH	08/26/2012	0001			1700			#	25	-
	mg/L	T06-04	BH	08/26/2012	0001			1200			#	25	-
	mg/L	T06-05	BH	08/26/2012	0001			2900			#	25	-
	mg/L	T06-06	BH	08/26/2012	0001			3100			#	25	-
	mg/L	T06-07	BH	08/26/2012	0001			4100			#	50	-
	mg/L	T06-08	BH	08/26/2012	0001			3600			#	25	-
	mg/L	T06-09	BH	08/26/2012	0001			3400			#	25	-
	mg/L	T06-10	BH	08/27/2012	0001			3900			#	25	-
	mg/L	T06-11	BH	08/27/2012	0001			2300			#	25	-
	mg/L	T06-12	BH	08/27/2012	0001			1200			#	10	-
	mg/L	T06-13	BH	08/27/2012	0001			1200			#	10	-
	mg/L	T06-14	BH	08/27/2012	0001			600			#	10	-
	mg/L	T06-15	BH	08/27/2012	0001			350			#	5	-
	mg/L	T06-16	BH	08/27/2012	0001			310			#	5	-
	mg/L	T06-17	BH	08/27/2012	0001			580			#	10	-
	mg/L	T06-21	BH	08/28/2012	0001			120			#	5	-
	mg/L	T07-01	BH	08/25/2012	0001			4500			#	50	-
	mg/L	T07-02	BH	08/25/2012	0001			4800			#	50	-
	mg/L	T07-03	BH	08/25/2012	0001			4400			#	50	-
	mg/L	T07-04	BH	08/25/2012	0001			4000			#	50	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Sulfate	mg/L	T07-05	BH	08/25/2012	0001			3300			#	25	-
	mg/L	T07-06	BH	08/28/2012	0001			2300			#	25	-
	mg/L	T07-06	BH	08/28/2012	0002			2300			#	25	-
	mg/L	T07-07	BH	08/29/2012	0001			1200			#	25	-
	mg/L	T07-08	BH	08/28/2012	0001			1100			#	10	-
	mg/L	T07-09	BH	08/28/2012	0001			390			#	10	-
	mg/L	T07-10	BH	08/28/2012	0001			280			#	5	-
	mg/L	T08-01	BH	08/25/2012	0001			5800			#	50	-
	mg/L	T08-02	BH	08/25/2012	0001			5900			#	50	-
	mg/L	T08-02	BH	08/25/2012	0002			5800			#	50	-
	mg/L	T08-03	BH	08/25/2012	0001			5300			#	50	-
	mg/L	T08-04	BH	08/25/2012	0001			3900			#	25	-
	mg/L	T08-05	BH	08/25/2012	0001			3100			#	25	-
	mg/L	T08-06	BH	08/25/2012	0001			2400			#	25	-
	mg/L	T08-07	BH	08/27/2012	0001			2300			#	25	-
	mg/L	T08-08	BH	08/28/2012	0001			480			#	5	-
	mg/L	T08-09	BH	08/28/2012	0001			320			#	5	-
	mg/L	T09-01	BH	08/25/2012	0001			210			#	2.5	-
	mg/L	T09-02	BH	08/25/2012	0001			500			#	5	-
	mg/L	T09-03	BH	08/25/2012	0001			750			#	10	-
	mg/L	T09-04	BH	08/25/2012	0001			1300			#	10	-
	mg/L	T09-05	BH	08/25/2012	0001			2300			#	25	-
	mg/L	T09-06	BH	08/28/2012	0001			570			#	10	-
	mg/L	T09-07	BH	08/28/2012	0001			500			#	10	-
	mg/L	T09-08	BH	08/28/2012	0001			150			#	2.5	-
	mg/L	T09-09	BH	08/28/2012	0001			140			#	2.5	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Sulfate	mg/L	T09-10	BH	08/28/2012	0001			180			#	2.5	-
Temperature	C	T01-01	BH	08/24/2012	N001			14.87			#	-	-
	C	T01-02	BH	08/24/2012	N001			15.27			#	-	-
	C	T01-03	BH	08/24/2012	N001			17.66			#	-	-
	C	T01-04	BH	08/24/2012	N001			16.01			#	-	-
	C	T01-05	BH	08/23/2012	N001			18.27			#	-	-
	C	T01-06	BH	08/23/2012	N001			20.05			#	-	-
	C	T01-07	BH	08/23/2012	N001			17.63			#	-	-
	C	T01-08	BH	08/23/2012	N001			15.61			#	-	-
	C	T01-09	BH	08/23/2012	N001			18.12			#	-	-
	C	T02-01	BH	08/22/2012	N001			22.30			#	-	-
	C	T02-02	BH	08/22/2012	N001			22.34			#	-	-
	C	T02-03	BH	08/22/2012	N001			24.11			#	-	-
	C	T02-04	BH	08/22/2012	N001			18.42			#	-	-
	C	T02-05	BH	08/22/2012	N001			20.45			#	-	-
	C	T02-06	BH	08/22/2012	N001			19.90			#	-	-
	C	T02-07	BH	08/23/2012	N001			17.58			#	-	-
	C	T02-08	BH	08/23/2012	N001			17.03			#	-	-
	C	T02-09	BH	08/23/2012	N001			15.00			#	-	-
	C	T02-10	BH	08/23/2012	N001			13.34			#	-	-
	C	T02-11	BH	08/23/2012	N001			15.07			#	-	-
	C	T02-12	BH	08/23/2012	N001			15.49			#	-	-
	C	T02-13	BH	08/23/2012	N001			17.56			#	-	-
	C	T02-14	BH	08/23/2012	N001			16.76			#	-	-
	C	T02-15	BH	08/23/2012	N001			18.49			#	-	-
	C	T03-01	BH	08/22/2012	N001			16.66			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Temperature	C	T03-02	BH	08/22/2012	N001			14.90			#	-	-
	C	T03-08	BH	08/21/2012	N001			18.83			#	-	-
	C	T03-09	BH	08/22/2012	N001			16.70			#	-	-
	C	T03-10	BH	08/22/2012	N001			16.13			#	-	-
	C	T03-11	BH	08/22/2012	N001			18.72			#	-	-
	C	T03-12	BH	08/21/2012	N001			18.59			#	-	-
	C	T03-13	BH	08/21/2012	N001			18.89			#	-	-
	C	T03-14	BH	08/21/2012	N001			20.08			#	-	-
	C	T03-15	BH	08/21/2012	N001			19.26			#	-	-
	C	T03-16	BH	08/21/2012	N001			20.49			#	-	-
	C	T03-17	BH	08/21/2012	N001			19.55			#	-	-
	C	T03-18	BH	08/24/2012	N001			17.48			#	-	-
	C	T03-19	BH	08/24/2012	N001			16.43			#	-	-
	C	T03-20	BH	08/24/2012	N001			17.85			#	-	-
	C	T03-21	BH	08/24/2012	N001			13.25			#	-	-
	C	T04-03	BH	08/26/2012	N001			16.44			#	-	-
	C	T04-04	BH	08/26/2012	N001			16.80			#	-	-
	C	T04-05	BH	08/26/2012	N001			17.78			#	-	-
	C	T04-06	BH	08/26/2012	N001			18.45			#	-	-
	C	T04-07	BH	08/26/2012	N001			14.50			#	-	-
	C	T04-08	BH	08/27/2012	N001			13.44			#	-	-
	C	T04-09	BH	08/27/2012	N001			15.65			#	-	-
	C	T04-10	BH	08/27/2012	N001			17.29			#	-	-
	C	T04-11	BH	08/27/2012	N001			16.43			#	-	-
	C	T04-12	BH	08/24/2012	N001			16.92			#	-	-
	C	T04-15	BH	08/24/2012	N001			20.73			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	SAMPLE: ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	QUALIFIERS: DATA	QUALIFIERS: QA	DETECTION LIMIT	UN-CERTAINTY
Temperature	C	T04-16	BH	08/24/2012	N001			17.94			#	-	-
	C	T04-17	BH	08/24/2012	N001			15.62			#	-	-
	C	T05-01	BH	08/28/2012	N001			16.56			#	-	-
	C	T05-02	BH	08/29/2012	N001			13.59			#	-	-
	C	T05-03	BH	08/29/2012	N001			15.27			#	-	-
	C	T06-01	BH	08/26/2012	N001			12.03			#	-	-
	C	T06-02	BH	08/26/2012	N001			11.56			#	-	-
	C	T06-03	BH	08/26/2012	N001			14.90			#	-	-
	C	T06-04	BH	08/26/2012	N001			13.85			#	-	-
	C	T06-05	BH	08/26/2012	N001			14.71			#	-	-
	C	T06-06	BH	08/26/2012	N001			13.40			#	-	-
	C	T06-07	BH	08/26/2012	N001			14.01			#	-	-
	C	T06-08	BH	08/26/2012	N001			14.67			#	-	-
	C	T06-09	BH	08/26/2012	N001			14.84			#	-	-
	C	T06-10	BH	08/27/2012	N001			17.87			#	-	-
	C	T06-11	BH	08/27/2012	N001			15.23			#	-	-
	C	T06-12	BH	08/27/2012	N001			15.67			#	-	-
	C	T06-13	BH	08/27/2012	N001			14.51			#	-	-
	C	T06-14	BH	08/27/2012	N001			15.04			#	-	-
	C	T06-15	BH	08/27/2012	N001			15.00			#	-	-
	C	T06-16	BH	08/27/2012	N001			16.48			#	-	-
	C	T06-17	BH	08/27/2012	N001			15.58			#	-	-
	C	T06-21	BH	08/28/2012	N001			17.89			#	-	-
	C	T07-01	BH	08/25/2012	N001			12.60			#	-	-
	C	T07-02	BH	08/25/2012	N001			12.80			#	-	-
	C	T07-03	BH	08/25/2012	N001			15.09			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Temperature	C	T07-04	BH	08/25/2012	N001			15.41			#	-	-
	C	T07-05	BH	08/25/2012	N001			14.93			#	-	-
	C	T07-06	BH	08/28/2012	N001			20.71			#	-	-
	C	T07-07	BH	08/29/2012	N001			15.49			#	-	-
	C	T07-08	BH	08/28/2012	N001			14.58			#	-	-
	C	T07-09	BH	08/28/2012	N001			17.39			#	-	-
	C	T07-10	BH	08/28/2012	N001			15.36			#	-	-
	C	T08-01	BH	08/25/2012	N001			13.14			#	-	-
	C	T08-02	BH	08/25/2012	N001			13.90			#	-	-
	C	T08-03	BH	08/25/2012	N001			15.16			#	-	-
	C	T08-04	BH	08/25/2012	N001			14.55			#	-	-
	C	T08-05	BH	08/25/2012	N001			15.44			#	-	-
	C	T08-06	BH	08/25/2012	N001			13.87			#	-	-
	C	T08-07	BH	08/27/2012	N001			13.03			#	-	-
	C	T08-08	BH	08/28/2012	N001			13.67			#	-	-
	C	T08-09	BH	08/28/2012	N001			13.94			#	-	-
	C	T09-01	BH	08/25/2012	N001			12.52			#	-	-
	C	T09-02	BH	08/25/2012	N001			10.37			#	-	-
	C	T09-03	BH	08/25/2012	N001			12.59			#	-	-
	C	T09-04	BH	08/25/2012	N001			11.53			#	-	-
	C	T09-05	BH	08/25/2012	N001			12.18			#	-	-
	C	T09-06	BH	08/28/2012	N001			11.66			#	-	-
	C	T09-07	BH	08/28/2012	N001			12.83			#	-	-
	C	T09-08	BH	08/28/2012	N001			13.93			#	-	-
	C	T09-09	BH	08/28/2012	N001			12.82			#	-	-
	C	T09-10	BH	08/28/2012	N001			13.52			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Turbidity	NTU	T01-01	BH	08/24/2012	N001			108			#	-	-
	NTU	T01-02	BH	08/24/2012	N001			403			#	-	-
	NTU	T01-03	BH	08/24/2012	N001			178			#	-	-
	NTU	T01-04	BH	08/24/2012	N001			352			#	-	-
	NTU	T01-05	BH	08/23/2012	N001			1000	>		#	-	-
	NTU	T01-06	BH	08/23/2012	N001			103			#	-	-
	NTU	T01-07	BH	08/23/2012	N001			47.0			#	-	-
	NTU	T01-08	BH	08/23/2012	N001			75.3			#	-	-
	NTU	T01-09	BH	08/23/2012	N001			68.5			#	-	-
	NTU	T02-01	BH	08/22/2012	N001			1000	>		#	-	-
	NTU	T02-02	BH	08/22/2012	N001			474			#	-	-
	NTU	T02-03	BH	08/22/2012	N001			186			#	-	-
	NTU	T02-04	BH	08/22/2012	N001			266			#	-	-
	NTU	T02-05	BH	08/22/2012	N001			109			#	-	-
	NTU	T02-06	BH	08/22/2012	N001			141			#	-	-
	NTU	T02-07	BH	08/23/2012	N001			157			#	-	-
	NTU	T02-08	BH	08/23/2012	N001			155			#	-	-
	NTU	T02-09	BH	08/23/2012	N001			180			#	-	-
	NTU	T02-10	BH	08/23/2012	N001			357			#	-	-
	NTU	T02-11	BH	08/23/2012	N001			214			#	-	-
	NTU	T02-12	BH	08/23/2012	N001			668			#	-	-
	NTU	T02-13	BH	08/23/2012	N001			246			#	-	-
	NTU	T02-14	BH	08/23/2012	N001			346			#	-	-
	NTU	T02-15	BH	08/23/2012	N001			472			#	-	-
	NTU	T03-01	BH	08/22/2012	N001			320			#	-	-
	NTU	T03-02	BH	08/22/2012	N001			329			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Turbidity	NTU	T03-08	BH	08/21/2012	N001			188			#	-	-
	NTU	T03-09	BH	08/22/2012	N001			103			#	-	-
	NTU	T03-10	BH	08/22/2012	N001			101			#	-	-
	NTU	T03-11	BH	08/22/2012	N001			887			#	-	-
	NTU	T03-12	BH	08/21/2012	N001			101			#	-	-
	NTU	T03-13	BH	08/21/2012	N001			336			#	-	-
	NTU	T03-14	BH	08/21/2012	N001			499			#	-	-
	NTU	T03-15	BH	08/21/2012	N001			690			#	-	-
	NTU	T03-16	BH	08/21/2012	N001			716			#	-	-
	NTU	T03-17	BH	08/21/2012	N001			1000	>		#	-	-
	NTU	T03-18	BH	08/24/2012	N001			526			#	-	-
	NTU	T03-19	BH	08/24/2012	N001			463			#	-	-
	NTU	T03-20	BH	08/24/2012	N001			1000	>		#	-	-
	NTU	T03-21	BH	08/24/2012	N001			1000	>		#	-	-
	NTU	T04-03	BH	08/26/2012	N001			186			#	-	-
	NTU	T04-04	BH	08/26/2012	N001			217			#	-	-
	NTU	T04-05	BH	08/26/2012	N001			217			#	-	-
	NTU	T04-06	BH	08/26/2012	N001			1000	>		#	-	-
	NTU	T04-07	BH	08/26/2012	N001			468			#	-	-
	NTU	T04-08	BH	08/27/2012	N001			900			#	-	-
	NTU	T04-09	BH	08/27/2012	N001			457			#	-	-
	NTU	T04-10	BH	08/27/2012	N001			306			#	-	-
	NTU	T04-11	BH	08/27/2012	N001			278			#	-	-
	NTU	T04-12	BH	08/24/2012	N001			177			#	-	-
	NTU	T04-15	BH	08/24/2012	N001			262			#	-	-
	NTU	T04-16	BH	08/24/2012	N001			297			#	-	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Turbidity	NTU	T04-17	BH	08/24/2012	N001			255			#	-	-
	NTU	T05-01	BH	08/28/2012	N001			76.9			#	-	-
	NTU	T05-02	BH	08/29/2012	N001			1000	>		#	-	-
	NTU	T05-03	BH	08/29/2012	N001			680			#	-	-
	NTU	T06-01	BH	08/26/2012	N001			86.2			#	-	-
	NTU	T06-02	BH	08/26/2012	N001			343			#	-	-
	NTU	T06-03	BH	08/26/2012	N001			260			#	-	-
	NTU	T06-04	BH	08/26/2012	N001			161			#	-	-
	NTU	T06-05	BH	08/26/2012	N001			334			#	-	-
	NTU	T06-06	BH	08/26/2012	N001			192			#	-	-
	NTU	T06-07	BH	08/26/2012	N001			478			#	-	-
	NTU	T06-08	BH	08/26/2012	N001			160			#	-	-
	NTU	T06-09	BH	08/26/2012	N001			158			#	-	-
	NTU	T06-10	BH	08/27/2012	N001			679			#	-	-
	NTU	T06-11	BH	08/27/2012	N001			1000	>		#	-	-
	NTU	T06-12	BH	08/27/2012	N001			646			#	-	-
	NTU	T06-13	BH	08/27/2012	N001			1000	>		#	-	-
	NTU	T06-14	BH	08/27/2012	N001			1000	>		#	-	-
	NTU	T06-15	BH	08/27/2012	N001			260			#	-	-
	NTU	T06-16	BH	08/27/2012	N001			141			#	-	-
	NTU	T06-17	BH	08/27/2012	N001			18.5			#	-	-
	NTU	T06-21	BH	08/28/2012	N001			1000	>		#	-	-
	NTU	T07-01	BH	08/25/2012	N001			102			#	-	-
	NTU	T07-02	BH	08/25/2012	N001			138			#	-	-
	NTU	T07-03	BH	08/25/2012	N001			334			#	-	-
	NTU	T07-04	BH	08/25/2012	N001			319			#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN- CERTAINTY
Turbidity	NTU	T07-05	BH	08/25/2012	N001			917			#	-	-
	NTU	T07-06	BH	08/28/2012	N001			1000	>		#	-	-
	NTU	T07-07	BH	08/29/2012	N001			306			#	-	-
	NTU	T07-08	BH	08/28/2012	N001			573			#	-	-
	NTU	T07-09	BH	08/28/2012	N001			147			#	-	-
	NTU	T07-10	BH	08/28/2012	N001			720			#	-	-
	NTU	T08-01	BH	08/25/2012	N001			267			#	-	-
	NTU	T08-02	BH	08/25/2012	N001			236			#	-	-
	NTU	T08-03	BH	08/25/2012	N001			95.8			#	-	-
	NTU	T08-04	BH	08/25/2012	N001			220			#	-	-
	NTU	T08-05	BH	08/25/2012	N001			636			#	-	-
	NTU	T08-06	BH	08/25/2012	N001			56.8			#	-	-
	NTU	T08-07	BH	08/27/2012	N001			199			#	-	-
	NTU	T08-08	BH	08/28/2012	N001			264			#	-	-
	NTU	T08-09	BH	08/28/2012	N001			285			#	-	-
	NTU	T09-01	BH	08/25/2012	N001			435			#	-	-
	NTU	T09-02	BH	08/25/2012	N001			977			#	-	-
	NTU	T09-03	BH	08/25/2012	N001			947			#	-	-
	NTU	T09-04	BH	08/25/2012	N001			270			#	-	-
	NTU	T09-05	BH	08/25/2012	N001			790			#	-	-
	NTU	T09-06	BH	08/28/2012	N001			174			#	-	-
	NTU	T09-07	BH	08/28/2012	N001			393			#	-	-
	NTU	T09-08	BH	08/28/2012	N001			105			#	-	-
	NTU	T09-09	BH	08/28/2012	N001			316			#	-	-
	NTU	T09-10	BH	08/28/2012	N001			426			#	-	-
Uranium	mg/L	T01-01	BH	08/24/2012	0001			0.0069			#	2.9E-05	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY
Uranium	mg/L	T01-02	BH	08/24/2012	0001			0.0053			#	2.9E-05	-
	mg/L	T01-03	BH	08/24/2012	0001			0.0039			#	2.9E-05	-
	mg/L	T01-04	BH	08/24/2012	0001			0.0062			#	2.9E-05	-
	mg/L	T01-05	BH	08/23/2012	0001			0.0068			#	2.9E-05	-
	mg/L	T01-06	BH	08/23/2012	0001			0.0068			#	2.9E-05	-
	mg/L	T01-07	BH	08/23/2012	0001			0.006			#	2.9E-05	-
	mg/L	T01-08	BH	08/23/2012	0001			0.0048			#	2.9E-05	-
	mg/L	T01-09	BH	08/23/2012	0001			0.017			#	2.9E-05	-
	mg/L	T02-01	BH	08/22/2012	0001			0.0055			#	2.9E-05	-
	mg/L	T02-02	BH	08/22/2012	0001			0.0029			#	2.9E-05	-
	mg/L	T02-03	BH	08/22/2012	0001			0.0025			#	2.9E-05	-
	mg/L	T02-04	BH	08/22/2012	0001			0.00081			#	2.9E-05	-
	mg/L	T02-05	BH	08/22/2012	0001			0.0011			#	2.9E-05	-
	mg/L	T02-06	BH	08/22/2012	0001			0.0044			#	2.9E-05	-
	mg/L	T02-07	BH	08/23/2012	0001			0.020			#	2.9E-05	-
	mg/L	T02-08	BH	08/23/2012	0001			0.084			#	2.9E-05	-
	mg/L	T02-09	BH	08/23/2012	0001			0.120			#	2.9E-05	-
	mg/L	T02-10	BH	08/23/2012	0001			0.062			#	2.9E-05	-
	mg/L	T02-11	BH	08/23/2012	0001			0.061			#	2.9E-05	-
	mg/L	T02-12	BH	08/23/2012	0001			0.037			#	2.9E-05	-
	mg/L	T02-13	BH	08/23/2012	0001			0.0049			#	2.9E-05	-
	mg/L	T02-14	BH	08/23/2012	0001			0.0085			#	2.9E-05	-
	mg/L	T02-15	BH	08/23/2012	0001			0.0079			#	2.9E-05	-
	mg/L	T03-01	BH	08/22/2012	0001			0.0028			#	2.9E-05	-
	mg/L	T03-02	BH	08/22/2012	0001			0.0074			#	2.9E-05	-
	mg/L	T03-08	BH	08/21/2012	0001			1.100			#	0.00029	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	T03-09	BH	08/22/2012	0001			0.430			#	2.9E-05	-
	mg/L	T03-10	BH	08/22/2012	0001			0.170			#	0.00015	-
	mg/L	T03-11	BH	08/22/2012	0001			0.220			#	2.9E-05	-
	mg/L	T03-12	BH	08/21/2012	0001			0.130			#	2.9E-05	-
	mg/L	T03-13	BH	08/21/2012	0001			0.130			#	2.9E-05	-
	mg/L	T03-14	BH	08/21/2012	0001			0.270			#	2.9E-05	-
	mg/L	T03-15	BH	08/21/2012	0001			0.024			#	2.9E-05	-
	mg/L	T03-15	BH	08/21/2012	0002			0.025			#	2.9E-05	-
	mg/L	T03-16	BH	08/21/2012	0001			0.014			#	2.9E-05	-
	mg/L	T03-17	BH	08/21/2012	0001			0.0051			#	2.9E-05	-
	mg/L	T03-18	BH	08/24/2012	0001			0.0054			#	2.9E-05	-
	mg/L	T03-19	BH	08/24/2012	0001			0.0057			#	2.9E-05	-
	mg/L	T03-20	BH	08/24/2012	0001			0.0086			#	2.9E-05	-
	mg/L	T03-21	BH	08/24/2012	0001			0.011			#	2.9E-05	-
	mg/L	T04-03	BH	08/26/2012	0001			0.0056			#	2.9E-05	-
	mg/L	T04-04	BH	08/26/2012	0001			0.013			#	2.9E-05	-
	mg/L	T04-05	BH	08/26/2012	0001			0.036			#	2.9E-05	-
	mg/L	T04-06	BH	08/26/2012	0001			0.070			#	2.9E-05	-
	mg/L	T04-07	BH	08/26/2012	0001			0.110			#	2.9E-05	-
	mg/L	T04-07	BH	08/26/2012	0002			0.110			#	2.9E-05	-
	mg/L	T04-08	BH	08/27/2012	0001			0.420			#	0.00015	-
	mg/L	T04-09	BH	08/27/2012	0001			0.710			#	0.00029	-
	mg/L	T04-10	BH	08/27/2012	0001			0.340			#	0.00015	-
	mg/L	T04-11	BH	08/27/2012	0001			0.240			#	2.9E-05	-
	mg/L	T04-12	BH	08/24/2012	0001			0.180			#	2.9E-05	-
	mg/L	T04-15	BH	08/24/2012	0001			0.032			#	2.9E-05	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	T04-16	BH	08/24/2012	0001			0.024			#	2.9E-05	-
	mg/L	T04-16	BH	08/24/2012	0002			0.024			#	2.9E-05	-
	mg/L	T04-17	BH	08/24/2012	0001			0.012			#	2.9E-05	-
	mg/L	T05-01	BH	08/28/2012	0001			0.480			#	0.00029	-
	mg/L	T05-02	BH	08/29/2012	0001			0.550			#	0.00029	-
	mg/L	T05-03	BH	08/29/2012	0001			0.490			#	0.00029	-
	mg/L	T05-03	BH	08/29/2012	0002			0.490			#	0.00015	-
	mg/L	T06-01	BH	08/26/2012	0001			0.051			#	2.9E-05	-
	mg/L	T06-02	BH	08/26/2012	0001			0.024			#	2.9E-05	-
	mg/L	T06-03	BH	08/26/2012	0001			0.020			#	2.9E-05	-
	mg/L	T06-04	BH	08/26/2012	0001			0.029			#	2.9E-05	-
	mg/L	T06-05	BH	08/26/2012	0001			0.170			#	2.9E-05	-
	mg/L	T06-06	BH	08/26/2012	0001			0.180			#	2.9E-05	-
	mg/L	T06-07	BH	08/26/2012	0001			0.300			#	0.00029	-
	mg/L	T06-08	BH	08/26/2012	0001			0.600			#	0.00029	-
	mg/L	T06-09	BH	08/26/2012	0001			0.960			#	0.00029	-
	mg/L	T06-10	BH	08/27/2012	0001			1.400			#	0.00029	-
	mg/L	T06-11	BH	08/27/2012	0001			0.580			#	0.00029	-
	mg/L	T06-12	BH	08/27/2012	0001			0.580			#	0.00029	-
	mg/L	T06-13	BH	08/27/2012	0001			0.660			#	0.00029	-
	mg/L	T06-14	BH	08/27/2012	0001			0.160			#	2.9E-05	-
	mg/L	T06-15	BH	08/27/2012	0001			0.075			#	2.9E-05	-
	mg/L	T06-16	BH	08/27/2012	0001			0.056			#	2.9E-05	-
	mg/L	T06-17	BH	08/27/2012	0001			0.055			#	2.9E-05	-
	mg/L	T06-21	BH	08/28/2012	0001			0.0096			#	2.9E-05	-
	mg/L	T07-01	BH	08/25/2012	0001			0.310			#	0.00015	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	T07-02	BH	08/25/2012	0001			0.670			#	0.00029	-
	mg/L	T07-03	BH	08/25/2012	0001			1.400			#	0.00029	-
	mg/L	T07-04	BH	08/25/2012	0001			1.500			#	0.00029	-
	mg/L	T07-05	BH	08/25/2012	0001			1.100			#	0.00029	-
	mg/L	T07-06	BH	08/28/2012	0001			0.890			#	0.00029	-
	mg/L	T07-06	BH	08/28/2012	0002			0.890			#	0.00029	-
	mg/L	T07-07	BH	08/29/2012	0001			0.760			#	0.00029	-
	mg/L	T07-08	BH	08/28/2012	0001			0.460			#	0.00029	-
	mg/L	T07-09	BH	08/28/2012	0001			0.120			#	2.9E-05	-
	mg/L	T07-10	BH	08/28/2012	0001			0.059			#	2.9E-05	-
	mg/L	T08-01	BH	08/25/2012	0001			0.550			#	0.00029	-
	mg/L	T08-02	BH	08/25/2012	0001			1.300			#	0.00029	-
	mg/L	T08-02	BH	08/25/2012	0002			1.400			#	0.00015	-
	mg/L	T08-03	BH	08/25/2012	0001			2.100			#	0.00058	-
	mg/L	T08-04	BH	08/25/2012	0001			1.200			#	0.00029	-
	mg/L	T08-05	BH	08/25/2012	0001			1.100			#	0.00029	-
	mg/L	T08-06	BH	08/25/2012	0001			1.000			#	0.00029	-
	mg/L	T08-07	BH	08/27/2012	0001			0.950			#	0.00029	-
	mg/L	T08-08	BH	08/28/2012	0001			0.066			#	2.9E-05	-
	mg/L	T08-09	BH	08/28/2012	0001			0.027			#	2.9E-05	-
	mg/L	T09-01	BH	08/25/2012	0001			0.0057			#	2.9E-05	-
	mg/L	T09-02	BH	08/25/2012	0001			0.0084			#	2.9E-05	-
	mg/L	T09-03	BH	08/25/2012	0001			0.018			#	2.9E-05	-
	mg/L	T09-04	BH	08/25/2012	0001			0.027			#	2.9E-05	-
	mg/L	T09-05	BH	08/25/2012	0001			0.058			#	2.9E-05	-
	mg/L	T09-06	BH	08/28/2012	0001			0.085			#	2.9E-05	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE RVT01, Riverton Processing Site
REPORT DATE: 3/7/2013 2:03 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	T09-07	BH	08/28/2012	0001			0.073			#	2.9E-05	-
	mg/L	T09-08	BH	08/28/2012	0001			0.018			#	2.9E-05	-
	mg/L	T09-09	BH	08/28/2012	0001			0.011			#	2.9E-05	-
	mg/L	T09-10	BH	08/28/2012	0001			0.024			#	2.9E-05	-

		LOCATION	LOCATION	SAMPLE:		ZONE	FLOW		QUALIFIERS:			DETECTION	UN-
PARAMETER	UNITS	CODE	TYPE	DATE	ID	COMPL	REL.	RESULT	LAB	DATA	QA	LIMIT	CERTAINTY

RECORDS: SELECTED FROM USEE200 WHERE site_code='RVT01' AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #8/1/2012# and #8/30/2012#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LOCATION TYPES: BH BOREHOLE

ZONES OF COMPLETION: a zone of completion with a "-" is cross-screened and, therefore, has two zones of completion (1st zone - 2nd zone).

FLOW CODES:

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
+	Correlation coefficient for MSA < 0.995.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
M	GFAA duplicate injection precision not met.
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
S	Result determined by method of standard addition (MSA).
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	N	Presumptive evidence that analyte is present. The analyte is "tentatively identified".	Q	Qualitative result due to sampling technique
R	Unusable result.	U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

This page intentionally left blank