Appendix F

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

This page intentionally left blank

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

This page intentionally left blank

Contents

Abbreviations iii
1.0 Introduction 1
2.0 Methods 2
2.1 Sample Preparation 2
2.2 Loss-on-Drying and Sieving 4
2.3 Preparation of Artificial Site Water 4
2.4 Batch Testing Methods 5
2.5 Column Test Methods 6
2.6 CARB Extractions 7
2.7 Analytical Methods 8
3.0 Results 9
3.1 Loss-on-Drying and Sieving 9
3.2 Batch Test Results 11
3.3 Column Test Results 15
3.3.1 Effluent Uranium Concentrations 16
3.3.2 Labile Fractions 19
4.0 References 20

Figures

Figure 1. Location Map, Riverton, Wyoming, Site 3
Figure 2. Air Drying of Samples 4
Figure 3. End-Over-End Agitation of Batch Test Samples 6
Figure 4. Column with Auto Sampler 7
Figure 5. CARB Extractions on Orbital Shaker Table 8
Figure 6. Rate of Loss-on-Drying in Percent of Sample Weight per Day (Average of 65 Samples) 10
Figure 7. Distribution of Moisture Content from NW (near the Former Mill) to the SE (near the Little Wind River). 10
Figure 8. Distribution of Grain Size (percent of sample that is <2 mm) 11
Figure 9. Effect of Agitation Time on Batch Test Results 12
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. .. 13
Figure 11. Distribution of Solid-Phase Uranium Concentrations Removed by 24-Hour Batch Tests with ASW 14
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 15
Figure 13. Uranium Concentrations in Column Effluents Arranged by Profile Type 17

Tables

Table 1. Recipe for Artificial Little Wind River Site Water (ASW) 5
Table 2. Composition of Artificial Little Wind River Water (ASW) Compared to the June 12, 2012, Analysis 5
Table 3. Loss-on-Drying (LOD) and <2 mm Fractions 9
Table 4. Column Properties 16
Table 5. Uranium Removed by ASW and by Subsequent CARB Digestion. 20

Appendixes

Appendix A Field Logs for Sample Cores Used in This Study
Appendix B Copies of Laboratory Notes

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.

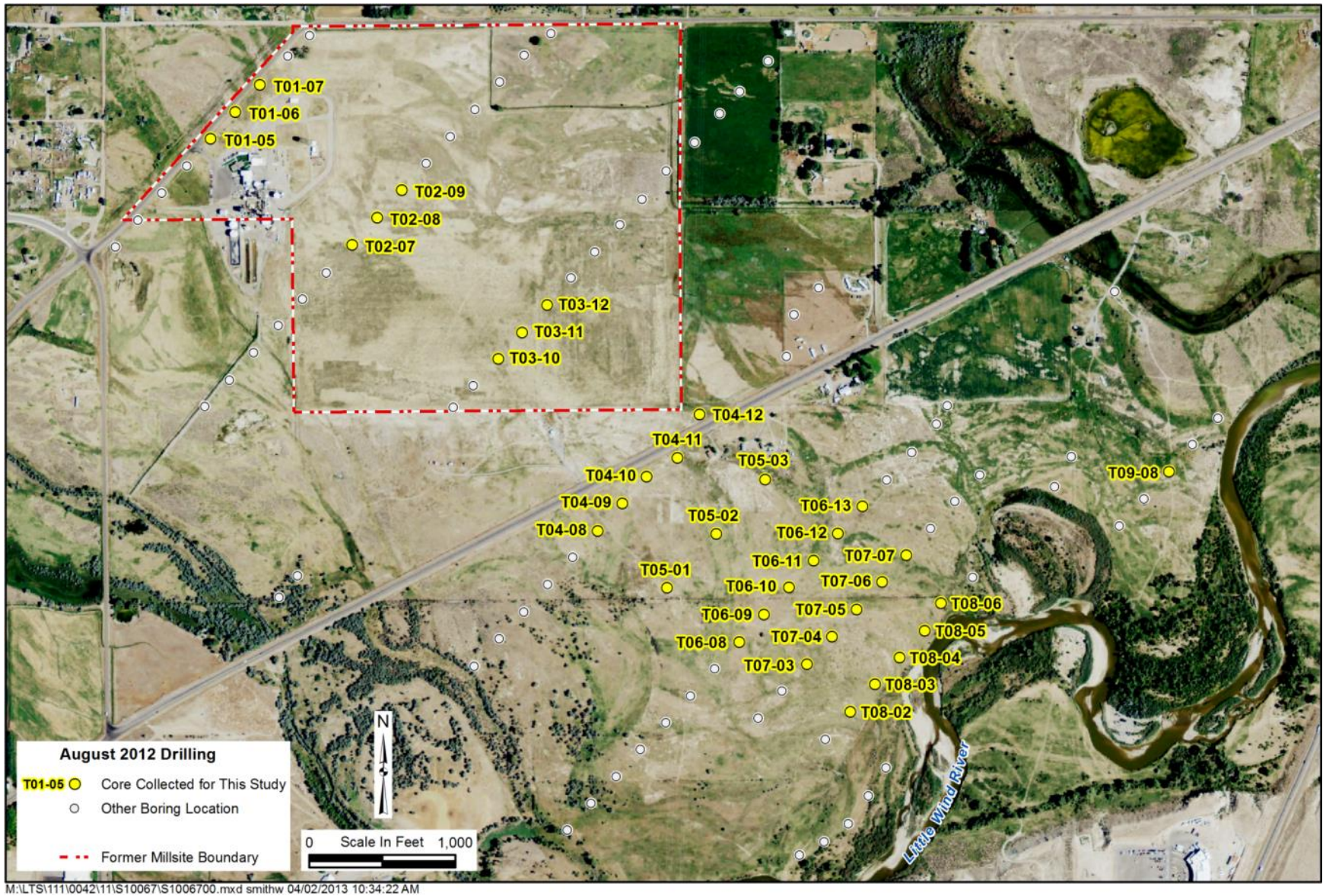


Figure 1. Location Map, Riverton, Wyoming, Site

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
$CaSO_4 \cdot 2H_2O$	1.5	140
$MgSO_4 \cdot 7H_2O$	200	0.04
$MgCl_2 \cdot 6H_2O$	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.

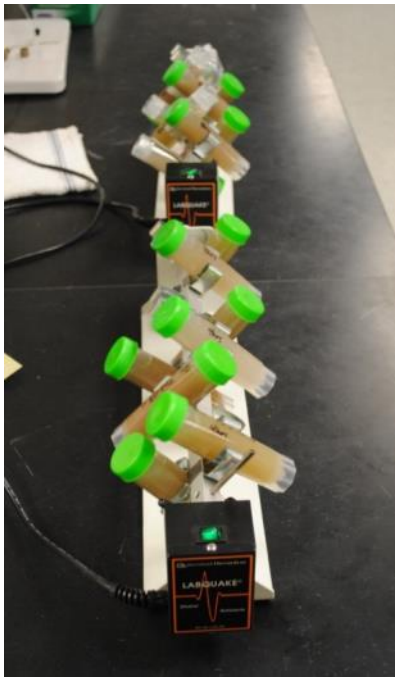


Figure 3. End-Over-End Agitation of Batch Test Samples

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

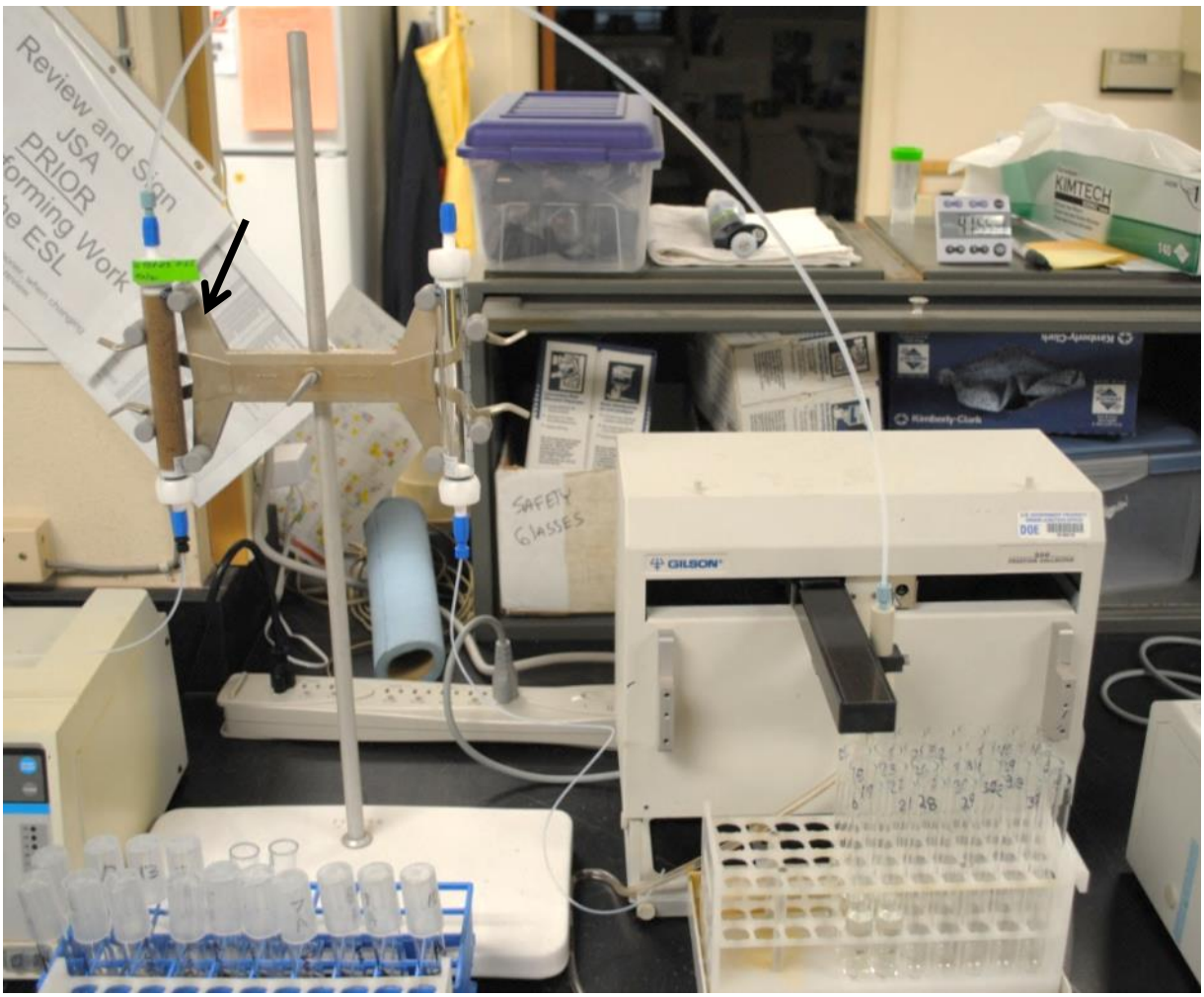


Figure 4. Column with Auto Sampler
Arrow points to sediment-filled column. In one column (sample T05-02U), flow could not be established because the sediment was too fine grained, and this sample was mixed with a 50% volume of high silica sand (Unimin Corp. #2075).

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

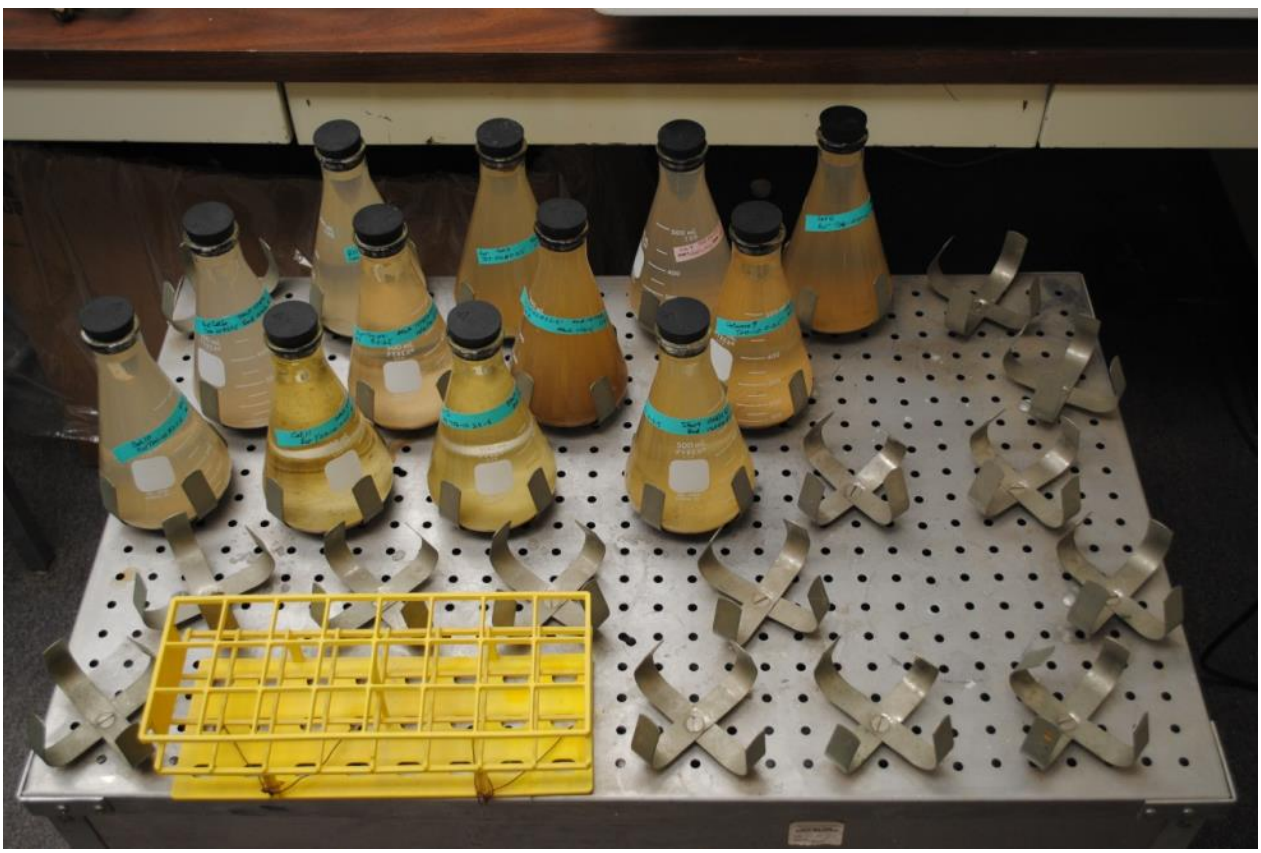


Figure 5. CARB Extractions on Orbital Shaker Table

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			

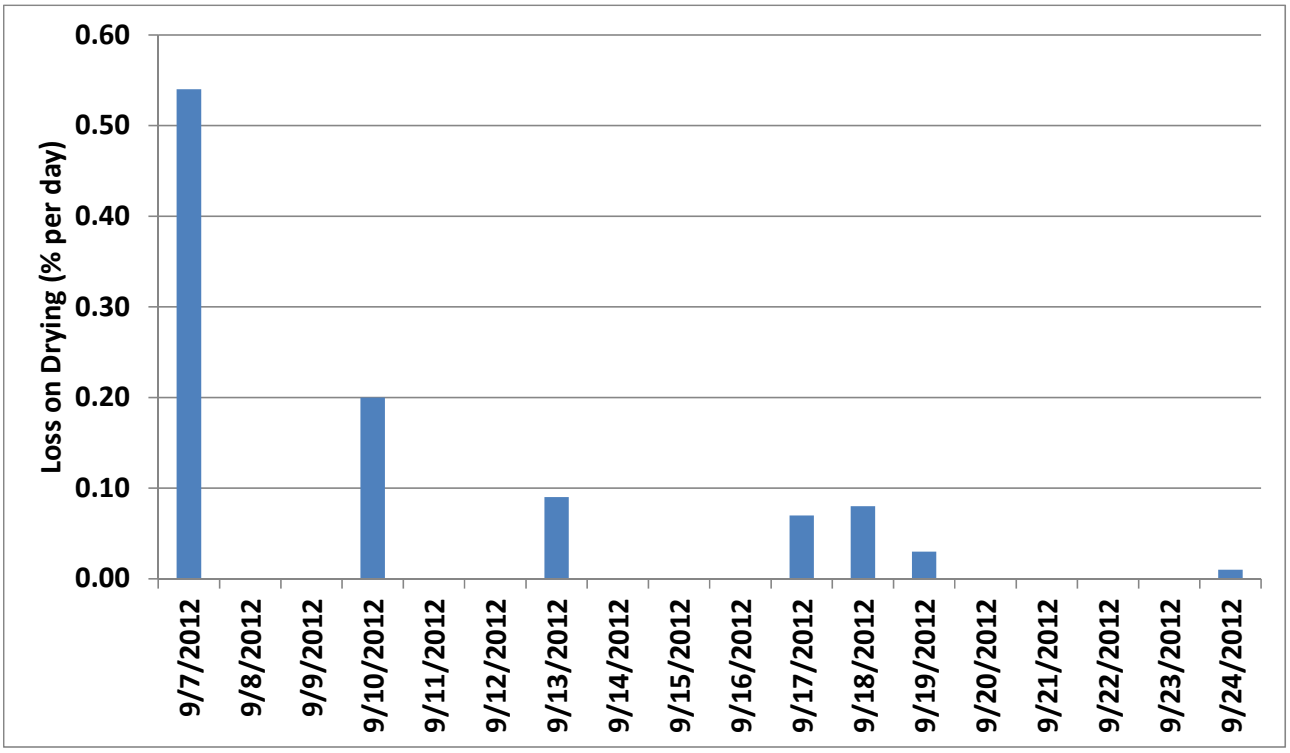


Figure 6. Rate of Loss-on-Drying in Percent of Sample Weight per Day (Average of 65 Samples)

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.

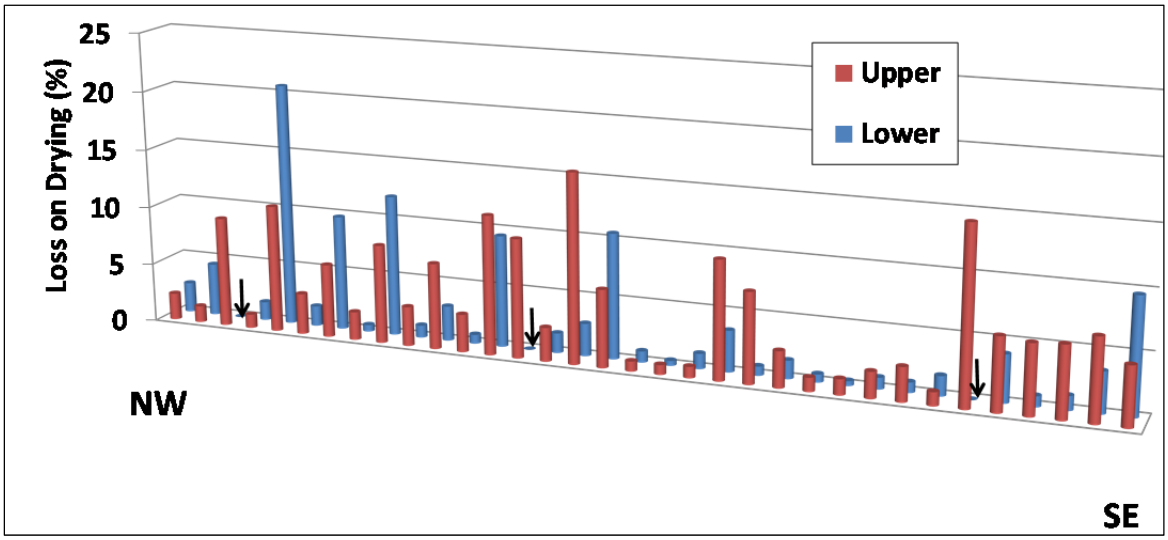


Figure 7. Distribution of Moisture Content from NW (near the Former Mill) to the SE (near the Little Wind River). Values for the upper zone samples are in red and the lower zone in blue. Arrows indicate missing samples.

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.

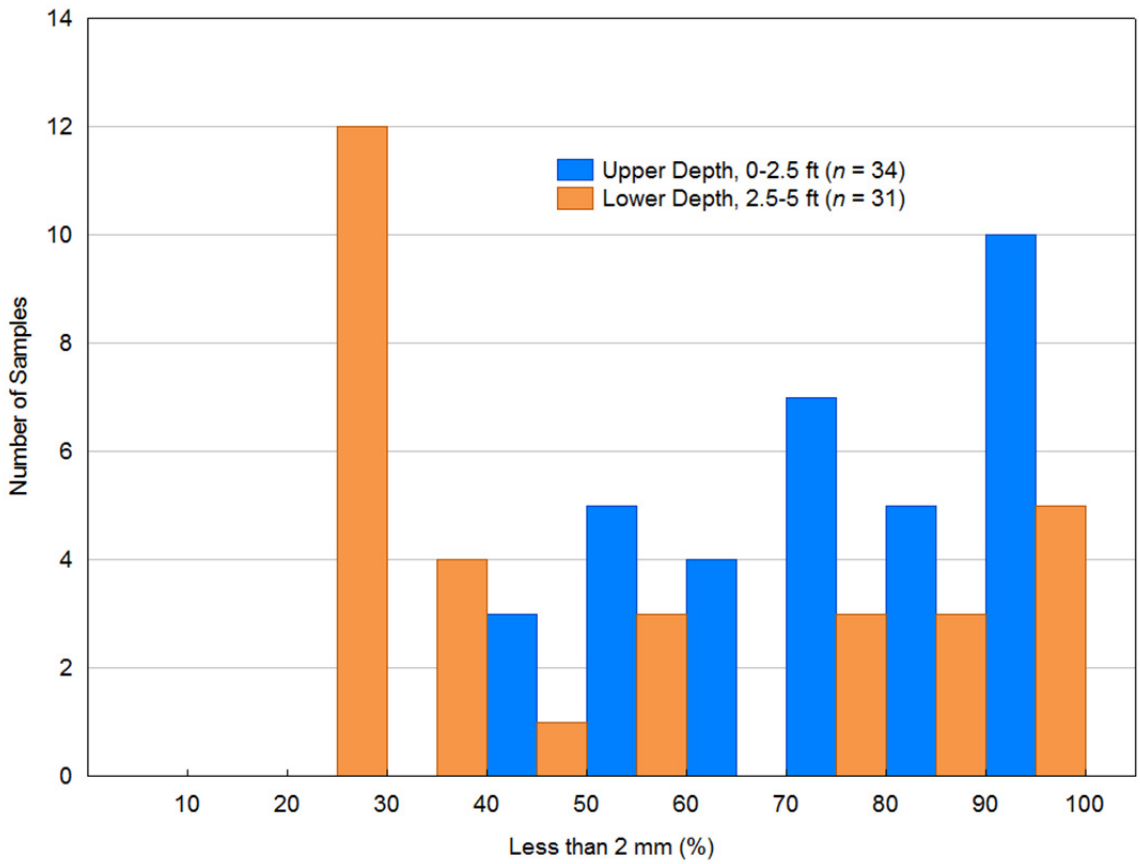


Figure 8. Distribution of Grain Size (percent of sample that is <2 mm)

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.

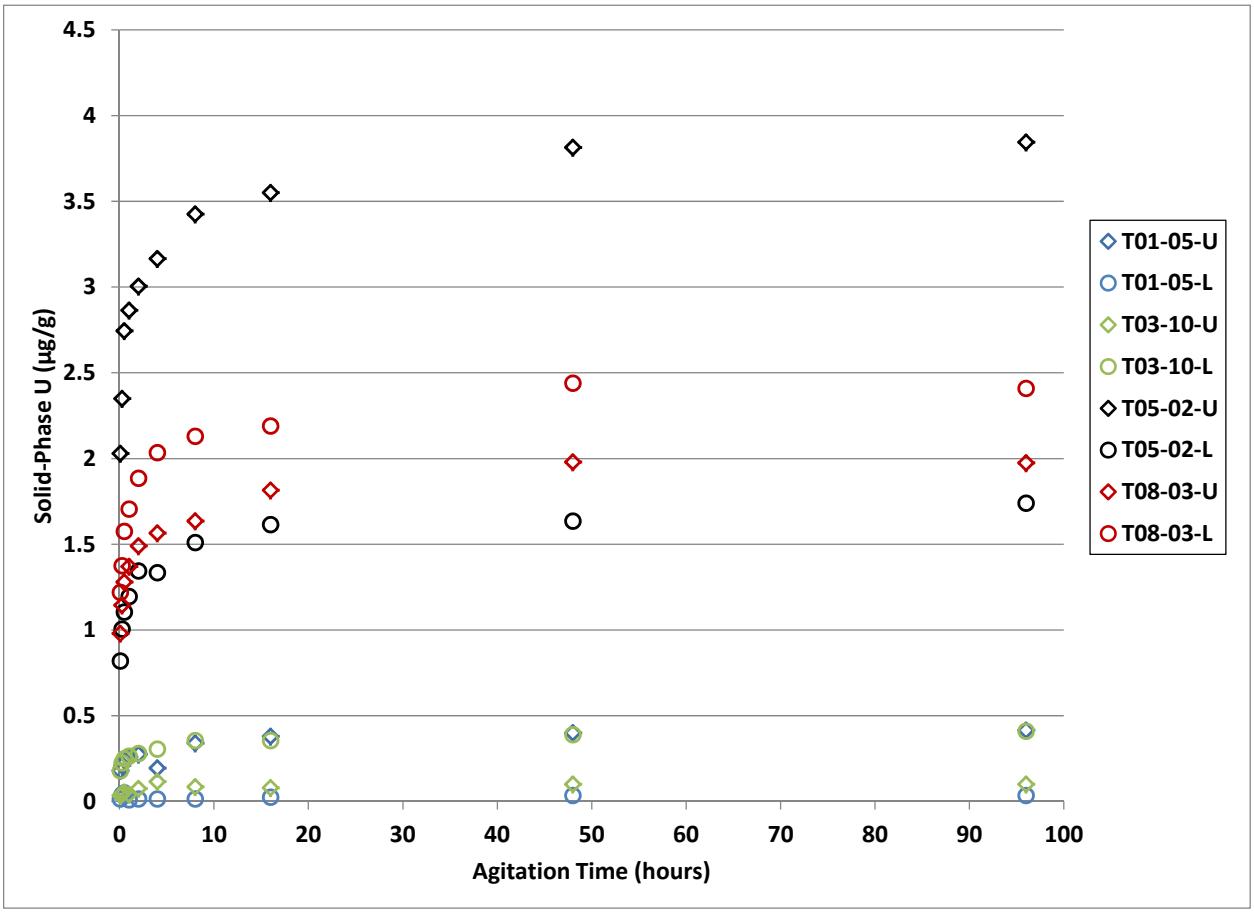


Figure 9. Effect of Agitation Time on Batch Test Results

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).

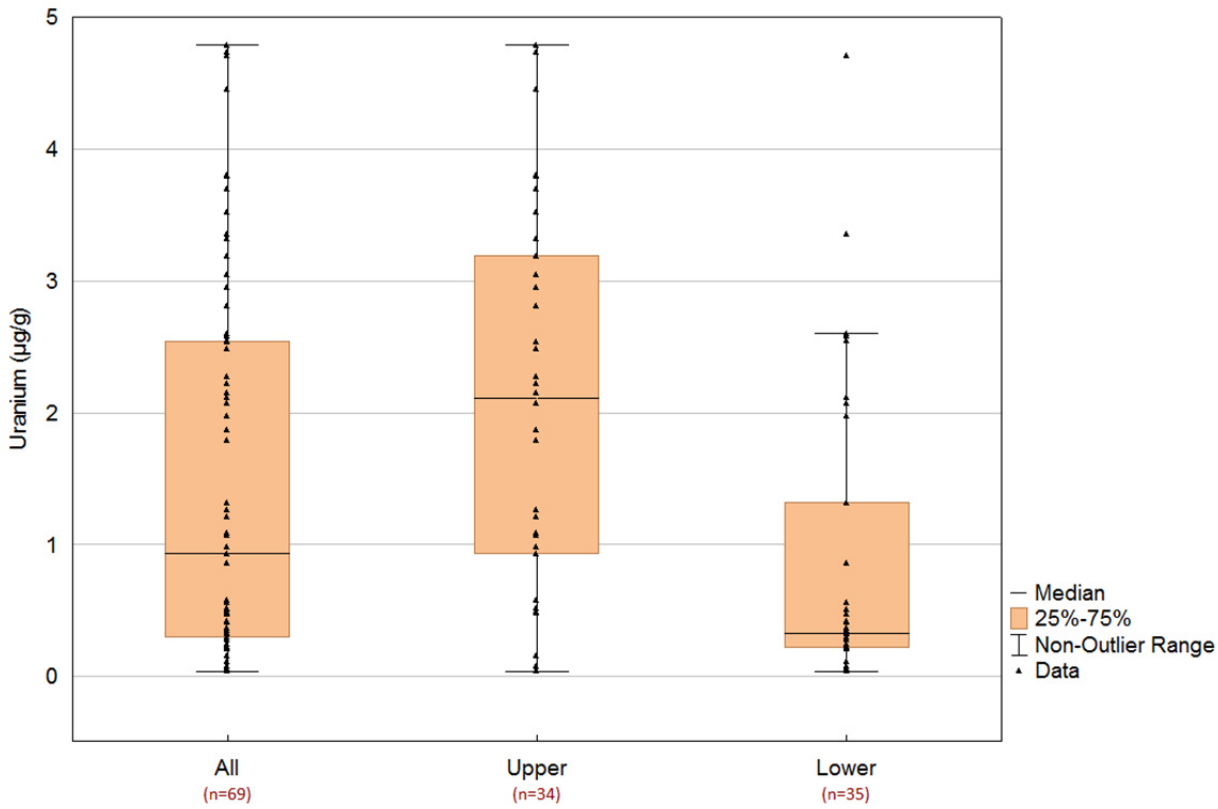


Figure 10. Distribution of Solid-Phase Uranium in Upper Zone (0 – 2.5 ft) vs. Lower Zone (2.5 – 5 ft) Samples. Batch test data using ASW and 24-hour agitation time.

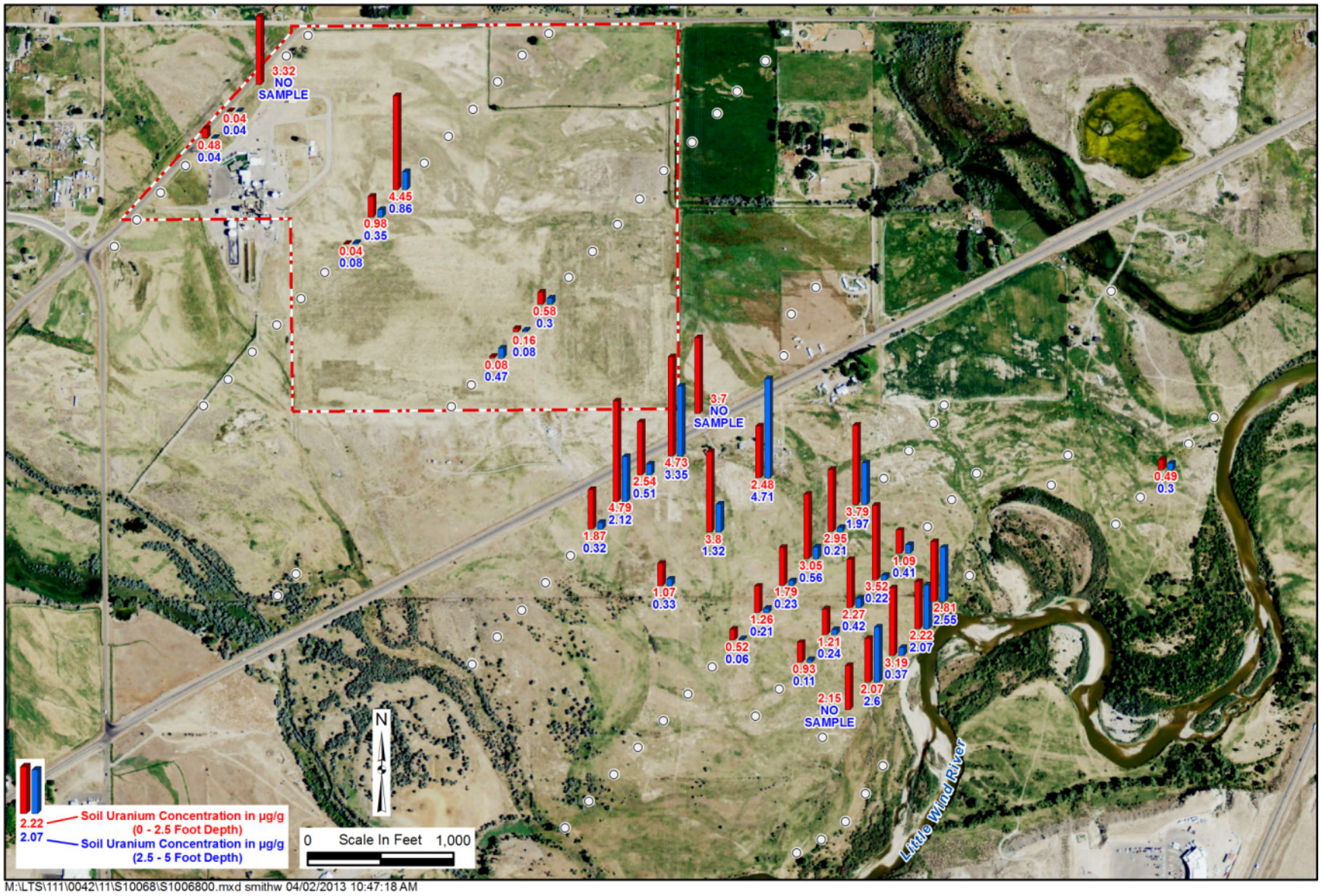


Figure 11. Distribution of Solid-Phase Uranium Concentrations Removed by 24-Hour Batch Tests with ASW

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).

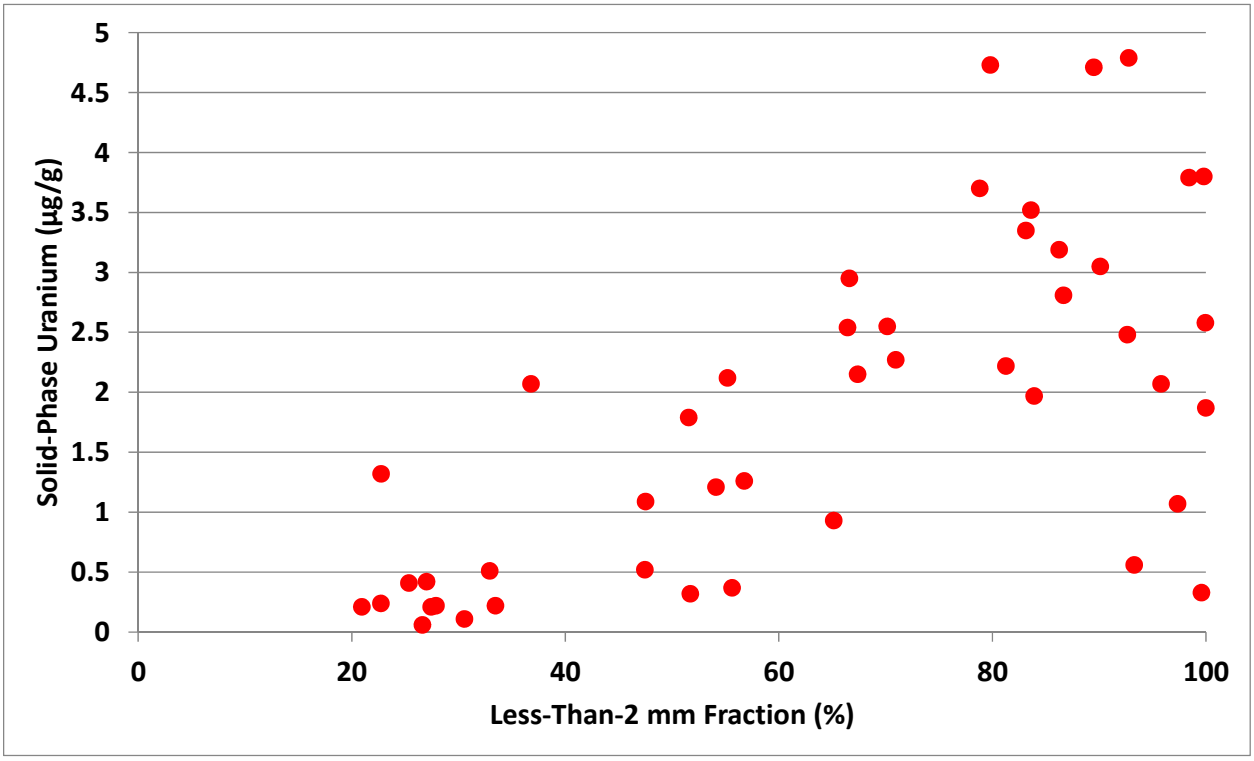


Figure 12. Relationship of Solid-Phase Uranium Removed by ASW to the Percent of <2 mm Grain Size for Offsite (Transects 04 Through 08) Samples

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.

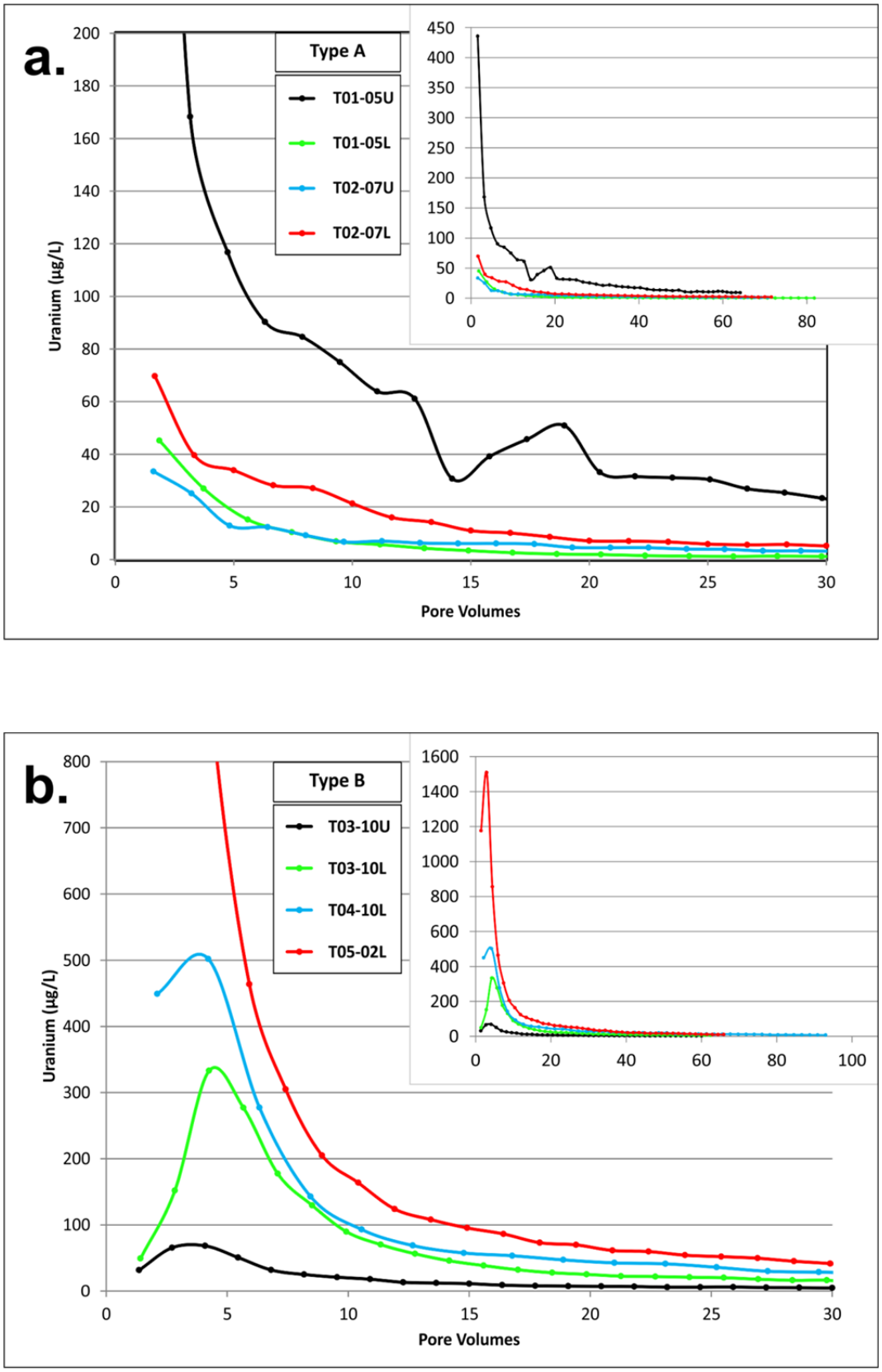
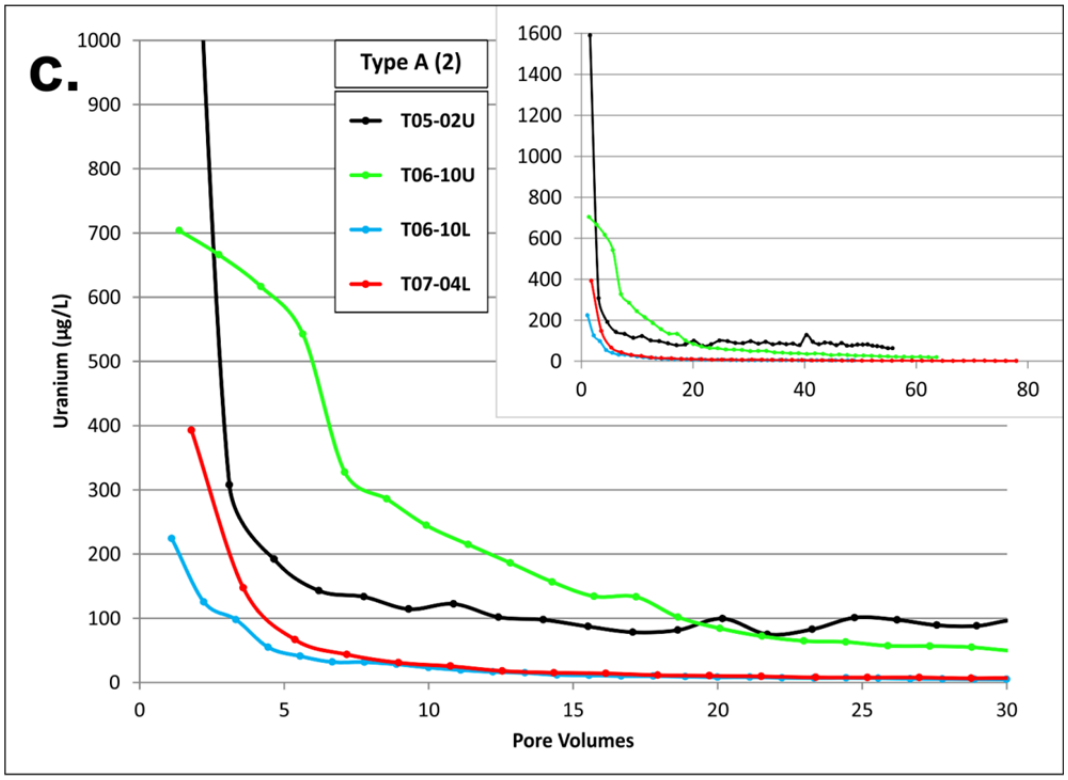


Figure 13. Uranium Concentrations in Column Effluents Arranged by Profile Type



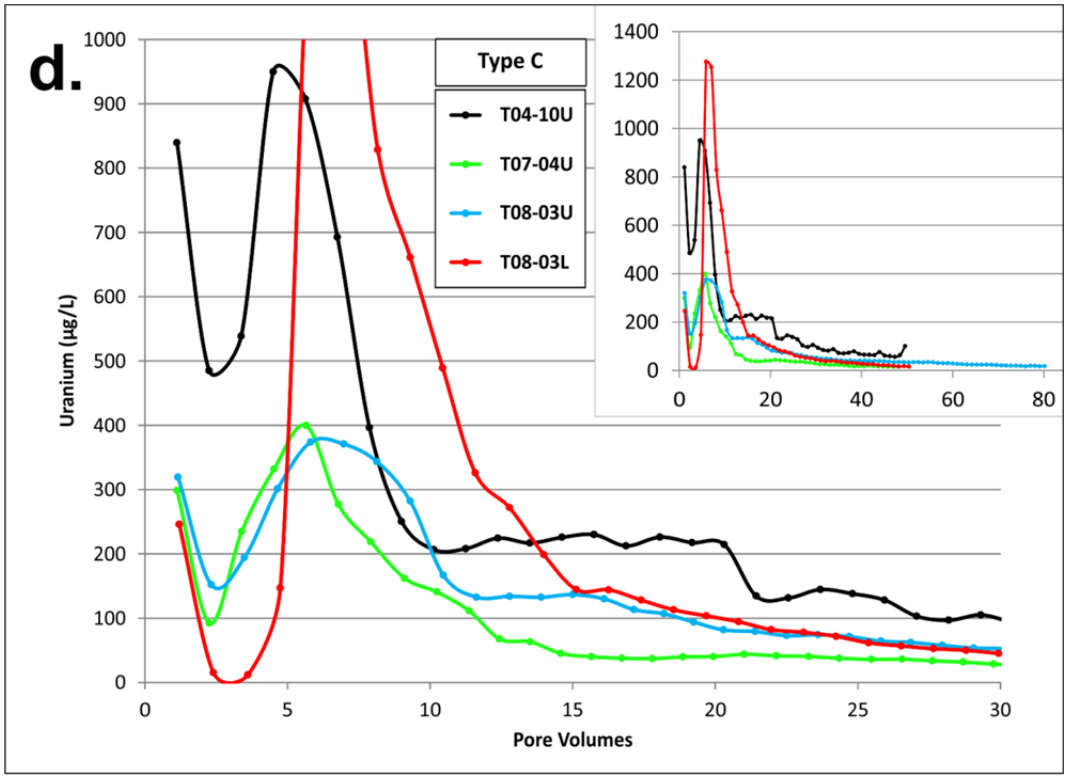


Figure 13 (continued). Uranium Concentrations in Column Effluents Arranged by Profile Type

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

This page intentionally left blank

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

This page intentionally left blank

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

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

CARB Batch #	Solutions Date made	10N NaOH (or EQ) (µL) used
1	9/5/12	140 µL

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	T08-03U	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	T08-03L	29.28	586 mL	547 mL	53.53 g/L	11/9/12 12:38	11/30/12 12:38	22.2	0.415
3	T07-04U 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	698 ~~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	643 ml	538 ml	59.74	11/16/12 15:45	12/7/12 @ 15:45	14.6 AT 45.1	0.755
9	T04-10 0-2.5	30.28	606 ~~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 @ 16:25	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	T02-07 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

34.75 ?
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	Start Date/Time	8 End Date/Time	9	10 U (ug/L)	11 U (ug/g)	12	13
	1													
	2													
	3													
14	4	T02-07255	35.14	702.8	531	66.18		11/29/12 13:20	12/30/12 08:10		3.4	0.051		
15	5	T01-05025	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	T01-05255	35.99	719.8	534	67.40		11/29/12 13:30	12/30/12 08:10		1.1	0.016	mix 280 red/320 new	
	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 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
~~200µL~~ 100µL		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 1.6 N H_2SO_4 and ~~100mL sample~~ 50mL sample. diluted to 100mL. (DF2)

Final pH = 4.49 Digits = 455 Alk = 455 x 2 x 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 x 2 x 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

p5

11/26/12	13:15 col 1	Removed sample from Colimn #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 0.45µm 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/ 200µL 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 & 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.

P

Riverton Carb Extractions

12/6/12	0810 col 7	Remove T05-02@0-2.5' from shaker table. Use above procedure to filter. Sample ~ clear very few suspended particles. Use 1 filter for 15mL. Resulting sample clear. Acidified 200ul conc. HNO_3
12/7/12	0900 col 8	Remove T05-02@2.5-5' from shaker table Use above procedure to filter Sample cloudy w/ ↑ suspended particulates. Use 6 filters for 15mL Resulting sample clear. Acidified 200 ul. conc HNO_3
12/9/12	1600 col 9	Remove T04-10@0-2.5 from shaker table Use above procedure to filter 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 col 11	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 Resulting sample clear. Acidify 200ul conc HNO_3
12/14/12	0850 col 12	Remove T03-10@2.5-5 from shaker table. Use above procedure to filter sample mostly clear 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
	Col 14	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.
	Col 15	Sample cloudy w/ moderate suspended particulates Use 2 filters for 15 ml.
		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.
	Col 16	Sample cloudy w/ moderate suspended particulates. Use 2 filters for 15 ml.
		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 Synchronization = 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~~	~~61.75~~	~~1.00~~	~~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/ Alm (see photo).

1330 Fill a column w/ soil from T08-03 0-2.5' <2mm fraction.
Column Tare 78.60 g
Full Column 106.11 g Mass of soil in column 27.51 g
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 cm^3 Dry Density = $\frac{27.51 g}{20.68 cm^3}$ = 1.33 g/cc Dry

1339 SPF is filled ~~to~~ in the supply tubing. Using a collapsible plastic 2 gal 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	1	Start by preparing ~~1gal~~ 4L of SPF3.
	2	
	3	0830 Prepared 2L of SPF3 and more 1.5g/L $CaSO_4 \cdot 2H_2O$.
	4	0835 Check pH stds. 4=4.03 7=7.01 10=9.99
	5	0837 Start measuring SPF3 pH ~8.4
	6	0840 Bubble small amt. of CO_2 into SPF3 and measure pH.
	7	0850 pH = 7.47
	8	0900 Add another 2L of SPF3.
	9	0905 pH = 7.99
	10	0910 pH = 8.00
	11	0915 alk measured on 100mL sample using 1.6 N H_2SO_4. Final pH = 4.82 Digits = 129 Alk = 129mg/L as $CaCO_3$
	12	
	13	
11/6/12	14	Preparing another 4L batch of SPF3 for Riverton columns
	15	0750 prepared 2L of SPF3
	16	0755 Check pH stds. 4=4.05 7=7.01 10=10.01
	17	0759 Start measuring pH of SPF3 pH ~8.4
	18	0801 Bubble small amt of CO_2 into SPF3 and measure pH while making a second 2L of SPF3.
	19	0810 pH = 6.67
	20	0812 Add another 2L of SPF3
	21	0815 pH = 6.91
	22	0820 pH = 6.94
	23	Let solution stir open to the atmosphere until pH is 7.90-8.10.
	24	0835 pH = 7.07
	25	0852 pH = 7.25
	26	0902 pH = 7.35 1015 measure alk on 100mL sample using 1.6 N H_2SO_4.
	27	0913 pH = 7.47 Final pH = 4.76 Digits = 131 Alk = 131mg/L as $CaCO_3$
	28	0928 pH = 7.61
	29	0939 pH = 7.70
	30	0951 pH = 7.80
	31	1005 pH = 7.90
		1010 pH = 7.93

	1	2	3	4	5	6	7	8	9	10	11	12	13
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 (DF2) w/ 1.6N H_2SO_4												
		Final pH=4.81		Digits = 67		x2 = Alk		134 mg/L as $CaCO_3$					

Riverton Column 1 T08-03 0-2.5' C012

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

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

TUBE No.	Start Fill DATE/Time	Actual Tube Vol (mL)	Cum Vol (mL)	PV (1pv=8.6mL)	Cum PV	Flow Rate mL/min	U µg/L	Collect Time (hr)	Cum collect Time (hr)	
N/A	10/31/12 13:42	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 HNO_3. 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 call ≈ 0.10 mL/min

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	5 Cum PV	Flow Rate (mL/min)	(hr) Collect Time	Cum Collect Time (hr)	9 Cl (mg/L)	10	11	12	13
23	1	9.5	11/2/12 4:17	222	1.10	25.81	0.095	1.67	38.33	64.4				
24	2	9.0	5:57	231	1.05	26.86	0.09	1.67	40.00	62.3				
25	3	9.5	7:37	240.5	1.10	27.97	0.095	1.67	41.67	57.8				
26	4	9.5	9:17	250	1.10	29.07	0.095	1.67	43.33	53.6				
27	5	9.5	10:57	259.5	1.10	30.17	0.095	1.67	45.00	52.4				
28	6	9.0	12:37	268.5	1.05	31.22	0.09	1.67	46.67	48.0				
29	7	9.0	14:17	277.5	1.05	32.27	0.09	1.67	48.33	48.7				
30	8	9.0	15:57	286.5	1.05	33.31	0.09	1.67	50.00	46.1				
31	9	9.5	17:37	296	1.10	34.42	0.095	1.67	51.67	43.3				
32	10	9.0	19:17	305	1.05	35.47	0.09	1.67	53.33	41.7				
33	11	9.0	20:57	314	1.05	36.51	0.09	1.67	55.00	40.0				
34	12	9.0	22:37	323	1.05	37.56	0.09	1.67	56.67	41.2				
35	13	9.0	11/3/12 0:17	332	1.05	38.60	0.09	1.67	58.33	38.7				
36	14	9.0	1:57	341	1.05	39.65	0.09	1.67	60.00	40.2				
37	15	9.0	3:37	350	1.05	40.70	0.09	1.67	61.67	40.6				
38	16	9.0	5:17	359	1.05	41.74	0.09		63.33	38.9				
39	17	9.5	6:57	368.5	1.10	42.85	0.095		65.00	39.5				
40	18	9.5	8:37	378	1.10	43.95	0.095		66.67	38.8				
41	19	9.0	10:17	387	1.05	45.00	0.09		68.33	37.3				
42	20	9.0	11:57	396	1.05	46.05	0.09		70.00	35.9				
43	21	9.5	13:37	405.5	1.10	47.15	0.095		71.67	34.6				
44	22	9.0	15:17	414.5	1.05	48.20	0.09		73.33	34.9				
45	23	9.5	16:57	424	1.10	49.30	0.095		75.00	34.3				
46	24	9.0	18:37	433	1.05	50.35	0.09		76.67	32.7				
47	25	9.0	20:17	442	1.05	51.40	0.09		78.33	34.0				
48	26	9.5	21:57	451.5	1.10	52.50	0.095		80.00	34.5				
49	27	9.0	23:37	460.5	1.05	53.55	0.09		81.67	32.6				
50	28	9.0	11/4/12 1:17	469.5	1.05	54.59	0.09		83.33	34.3				
51	29	9.5	2:57	479	1.10	55.70	0.095		85.00	33.4				
52	30	9.5	4:37	488.5	1.10	56.80	0.095		86.67	30.5				
53	31	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 (mL/min)	Collect Time (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~~ ~~19~~ 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 TO8-03 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) = 63.13 g
Filled Column = 92.41
Soil Weight = 29.28

Mostly silt & clay. Scattered rootlets.
Soil Column length = 11.8 cm Vol = 11.8 × 1.767 l = 20.85 mL
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 = 8.3 mL 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 = 0.10 mL/min.
1st water to soil col @ 0909
~10:27 soil col. filled (83 min)
PV = 8.3 mL
Flow 1st reached frac. col. tube @ 10:53 (26 min ~2.6 mL in outlet tube)
↑ Start Frac coll.

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

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

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

Riverton Column 2 T08-03 2.5-5'

Tube No	Fluid in Tube (mL)	Tube Start Date/Time	Cum Vol (mL)	4 pV= PV	5 Cum pV	6 Flow Rate (mL/min)	Collect Time (hr)	Cum Collect Time (hr)	9 U (µg/L)	10	11	12	13
1													
2													
3													
22 4	9.0	11/7/12 21:53	200.5	1.08	24.16	0.09	1.67	36.67	61.7				
23 5	9.0	23:33	209.5	1.08	25.24	0.09	1.67	38.33	56.9				
24 6	9.0	11/8/12 1:13	218.5	1.08	26.33	0.09	1.67	40.00	52.6				
25 7	9.0	2:53	227.5	1.08	27.41	0.09	1.67	41.67	50.0				
26 8	9.0	4:33	236.5	1.08	28.49	0.09	1.67	43.33	45.3				
27 9	9.0	6:13	245.5	1.08	29.58	0.09	1.67	45.00	41.1				
28 10	9.0	7:53	254.5	1.08	30.66	0.09	1.67	46.67	38.1				
29 11	9.0	9:33	263.5	1.08	31.75	0.09	1.67	48.33	39.7				
30 12	9.0	11:13	272.5	1.08	32.83	0.09	1.67	50.00	37.8				
31 13	9.0	12:53	281.5	1.08	33.92	0.09	1.67	51.67	34.7				
32 14	9.0	14:33	290.5	1.08	35.00	0.09	1.67	53.33	32.1				
33 15	9.0	16:13	299.5	1.08	36.08	0.09	1.67	55.00	31.5				
34 16	9.0	17:53	308.5	1.08	37.17	0.09	1.67	56.67	29.0				
35 17	9.0	19:33	317.5	1.08	38.25	0.09	1.67	58.33	27.3				
36 18	9.0	21:13	326.5	1.08	39.34	0.09	1.67	60.00	25.8				
37 19	9.0	22:53	335.5	1.08	40.42	0.09	1.67	61.67	25.5				
38 20	9.0	11/9/12 0:33	344.5	1.08	41.51	0.09	1.67	63.33	22.0				
39 21	9.0	2:13	353.5	1.08	42.59	0.09	1.67	65.00	21.1				
40 22	9.0	3:53	362.5	1.08	43.67	0.09	1.67	66.67	20.7				
41 23	9.0	5:33	371.5	1.08	44.76	0.09	1.67	68.33	19.4				
42 24	9.0	7:13	380.5	1.08	45.84	0.09	1.67	70.00	16.2				
43 25	9.0	8:53	389.5	1.08	46.93	0.09	1.67	71.67	17.7				
44 26	9.0	10:33	398.5	1.08	48.01	0.09	1.67	73.33	15.2				
27													
28													
29													
30													
31													

Riverton Column 3 T07-04 0-2.5'

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 wgt = 31.98 g

Mostly silt & clay. Scattered root lets
Soil Column length = 11.8 cm Vol = 11.8 × 1.767 l = 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 = 0.18 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)	PV = ~~8.8~~ 8.4 mL 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

CL3

TUBE No	Fluid in TUBE (mL)	TUBE START DATE/time	cum VOL (mL)	1 PV = 8.4 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	9.0	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'

	1	2	3	4	5	6	7	8	9	10	11	12	13
11/6/12 1	1400	Filling column. Same set up as Column 1.					25mL Omni glass column.			Flow bottom to top			
2		<2mm sieved fraction.											
3		Empty column = 78.01g					Mostly sand, some silt.						
4		Col + Fill = 114.36g					Soil column length = 11.8 cm			Vol = 11.8 × 1.7671 = 20.85mL			
5		Soil wgt. = 36.35g					Density (dry) = 36.35g/20.85mL = 1.74g/mL						
6													
7										Start flow 11/7/12 09:02			
8	Fluid in	Tube	Cum	1pV = 5.6 mL	Cum	Flow	Collect	Cum	U	1st water to soil @ 09:03			
9	Tube	Start	Vol.			Rate	Time	Collect		Water to top of soil @ ~~09:57~~ 09:59			
Tube No. 10	(mL)	Date/Time	(mL)	PV	PV	(mL/min)	(hr)	Time (hr)	(µg/L)	1st drip to fraction collector @ 10:21			
1 11	9.5	11/7 11/6/12 10:21	9.5	1.70	1.70	0.095	1.67	1.67	392.7	Pump rate set @ 0.12mL/min			
2 12	9.5	12:01	19	1.70	3.39	0.095	1.67	3.34	147.4				
3 13	9.5	13:41	28.5	1.70	5.09	0.095	1.67	5.01	66.6				
4 14	9.5	15:21	38	1.70	6.79	0.095	1.67	6.68	43.6				
5 15	9.5	17:01	47.5	1.70	8.48	0.095	1.67	8.35	30.8				
6 16	9.5	18:41	57	1.70	10.18	0.095	1.67	10.02	25.4				
7 17	9.5	20:21	66.5	1.70	11.88	0.095	1.67	11.69	18.0				
8 18	9.5	22:01	76	1.70	13.57	0.095	1.67	13.36	15.2				
9 19	9.5	23:41	85.5	1.70	15.27	0.095	1.67	15.03	14.1				
10 20	9.5	11/8/12 1:21	95	1.70	16.96	0.095	1.67	16.67	11.4				
11 21	9.5	3:01	104.5	1.70	18.66	0.095	1.67	18.33	10.5				
12 22	9.5	4:41	114	1.70	20.36	0.095	1.67	20.00	9.5				
13 23	10	6:21	124	1.79	22.14	0.10	1.67	21.67	7.9				
14 24	9.5	8:01	133.5	1.70	23.84	0.095	1.67	23.33	7.6				
15 25	9.5	9:41	143	1.70	25.54	0.095	1.67	25.00	7.8				
16 26	9.5	11:21	152.5	1.70	27.23	0.095	1.67	26.67	6.5				
17 27	9.5	13:01	162	1.70	28.93	0.095	1.67	28.33	7.5				
18 28	9.5	14:41	171.5	1.70	30.63	0.095	1.67	30.00	7.3				
19 29	9.5	16:21	181	1.70	32.32	0.095	1.67	31.67	6.4				
20 30	9.5	18:01	190.5	1.70	34.02	0.095	1.67	33.33	6.2				
21 31	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	* reset frac collector to position 1 @ start of tube 32			
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	11/10/12 @ 10:02												
	25													
	26													
	27													
	28													
	29													
	30													
	31													

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 #	1 Effluent Tube (mL)	2 Tube Start Date/Time	3 Cum Vol (mL)	4 1 PV = ~~7.3~~ AT =6.2 PV	5 Cum PV	6 Flow Rate mL/min	7 Collect Time (hr)	8 Cum. Collect Time (hr)	9 U (ug/L)	10	11	12	13
1	8.5 yellow	11/9 15:30	8.5	1.16	1.16	0.085	1.67	1.67	703.7	*	Start flow 13:50 11/9/12		
											1st water to soil 13:51		
											Water to top of soil @ 15:03 (73min)		
2	8.5	17:10	17	1.16	2.33	0.085	1.67	3.33	666.1	*	First drip to frac coll. @ 15:30		
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	*	pump rate 0.1mL/min PV = 7.3 mL		
5	9	22:10	44	1.23	6.03	0.09	1.67	8.33	327.5	*	tubing Vol (27 min) 2.7mL		
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	*	* Water (Effluent) has a yellow-brown color		
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	*	pump speed = 0.10 mL/min		
10	9	6:30	88.5	1.23	12.12	0.09	1.67	16.67	156.6	*	Collect Time = 100 min		
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	*	decreasing yellow intensity		
13	9	11:30	115.5	1.23	15.82	0.09	1.67	21.67	101.8	*	minutes thru 14		
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		Sample 15 is clear		
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		1/7/13 PV calculated using volume in		
18	9	19:50	160.5	1.23	21.99	0.09	1.67	30.00	57.2		AT 1st tube. 73min x 0.085mL/min		
19	9	21:30	169.5	1.23	23.22	0.09	1.67	31.67	56.7		= 6.2mL		
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				

Col 5 cont.

Col 5 cont.

Tube #	Fluid in tube (ml)	Tube Start Date/Time	Cum Vol (ml)	1 PV = ~~7.3~~ 6.2 AT PV	Cum. PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Collect Time (hr)	U (ug/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												
25													
26													
27													
28													
29													
30													
31													

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 x 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)	1PV = ~~20 mL~~ 8.1 AT 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 in tube 1

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

tube 2 → end are clear

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

Column 6 cont

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol (ml)	1 PV = 8.1 mL AT ~~9.0 mL~~ PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Collect Time (hr)	U (ug/L)
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 25 ml Omni glass column Flow bottom to top

<2mm sieved fraction

Empty column ~~61.65~~ 62.05

Col + fill ~~91.56~~ 96.80

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

see more below

Soil col. length = ~~11.8~~ 11.5 cm ~~11.8~~ *soil shift to 11.5 once filled

Density (dry) ~~29.91~~ 34.75 / ~~20.32~~ 20.32 = ~~1.43~~ 1.67 g/ml ? 1.71 g/ml

Vol 11.8 x 1.7671 = ~~20.85~~ 20.32 ml

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 subtract 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 7 50/50 mix by weight of T05-02 0-2.5 and Ulmenin plant #2075.

Start flow 11/12/12 @ 9:32

1st water 9:33

Top of col @ 10:43 (70 min)

1st drip, start frac coll 11:10

Tube # 1 9.0 11/12 11:10 9 1.29 1.41 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 1.41 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 18.28 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 Pale yellow color tube 1, some brown ppt. others are clear

→ top of soil @ 10:37 (64 min)

Rw. Col 7 cont. ~~64~~ 5.8mL AT 1PV = ~~7.0mL~~

Tube #	Fluid in tube (mL)	Tube Start Date/Time	Cum Vol (mL)	PV	Cum PV	Flowrate (mL/min)	Collect Time (hr)	Cum Collect (hr)	U (ug/L)	Cum PV	11	12	13
22 1	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 2	7.5	23:50	199.0	~~1.07~~ 1.17	28.43	0.075	1.67	38.33	82.5	31.09			
24 3	7	11/14 1:30	206	~~1~~ 1.09	29.43	0.07	1.67	40.00	88.5	32.19			
25 4	7	3:10	213	~~1~~ 1.09	30.43	0.07	1.67	41.67	83.3	33.28			
26 5	7	4:50	220	~~1~~ 1.09	31.43	0.07	1.67	43.33	86.1	34.38			
27 6	7	6:30	227	~~1~~ 1.09	32.43	0.07	1.67	45.00	78.7	35.47	* pause collection ~2min to ck pump		
28 7	7 *	8:10	234	~~1~~ 1.09	33.43	0.07	1.67	46.67	128.1	36.56	lines. No obstruction		
29 8	6.5	9:50	240.5	~~0.93~~ 1.02	34.36	0.065		48.33	94.7	37.58			
30 9	6.5	11:30	247	~~0.93~~ 1.02	35.29	0.065		50.00	83.4	38.59			
31 10	6	13:10	253	~~0.86~~ 0.94	36.14	0.06		51.67	90.7	39.53	11/7/13 PV calculated using		
32 11	6	14:50	259	~~0.86~~ 0.94	37.0	0.06		53.33	88.6	40.47	volume in 1st tube.		
33 12	6	16:30	265	~~0.86~~ 0.94	37.86	0.06		55.00	78.1	41.41	Using column started 11/12		
34 13	5.5	18:10	270.5	~~0.79~~ 0.86	38.64	0.055		56.67	88.7	42.27	64min to fill.		
35 14	5.5	19:50	276	~~0.79~~ 0.86	39.43	0.055		58.33	76.0	43.13	64min x 0.09mL/min		
36 15	5.5	21:30	281.5	~~0.79~~ 0.86	40.21	0.055		60.00	77.0	43.98	= 5.8mL		
37 16	5.5	23:10	287	~~0.79~~ 0.86	41.0	0.055		61.67	81.0	44.84			
38 17	5.5	11/15 0:50	292.5	~~0.79~~ 0.86	41.79	0.055		63.33	81.0	45.70			
39 18	5	2:30	297.5	~~0.71~~ 0.78	42.5	0.05		65.00	81.7	46.48			
40 19	5	4:10	302.5	~~0.71~~ 0.78	43.21	0.05		66.67	75.3	47.27			
41 20	5	5:50	307.5	~~0.71~~ 0.78	43.93	0.05		68.33	73.6	48.05			
42 21	5	7:30	312.5	~~0.71~~ 0.78	44.64	0.05		70.00	69.8	48.83			
43 22	6	9:10	318.5	~~0.86~~ 0.94	45.50	0.06		71.67	63.2	49.77			
44 23	5	10:50	323.5	~~0.71~~ 0.78	46.21	0.05		73.33	63.7	50.55			
24	D/C flow 11/16/12 @ 12:30												
25													
26													
27													
28													
29													
30													
31													

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 + fil 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

Tube#	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol (ml)	1 PV = ~~7.8~~ ~~7.1~~ 6.0mL AT 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

Start flow 10:05

1st water to soil 10:06

Top of column 11:24 (78 min)

Start frac coll. 11:45

* 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 6.0 mL 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 61.29g

Col. + fill 91.57g

Soil weight 30.28g

Soil Col. length 11.8 cm Vol 11.8 x 17671 = 20.85 ml

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

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol ml	1 PV = ~~9.0~~ ml ~~8.9~~ 8.0 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	2.01	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

Med.

* ~~pale~~ clear yellow tube 1

subsequent samples are clear

Top soil? or top col.

79 89

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

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

Rev Col 9 Cont T04-10 0-2.5

Tube #	Fluid in Tube (ml)	Tube Start Date Time	Cum Vol (ml)	1 PV = ~~8.9~~ 8.0 AT 4 PV	Cum 5 PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Collect (hr)	U (ug/L)
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			66.67	61.4
41	9	10:19	369.5		41.52			68.33	59.1
42	9	11:59	378.5		42.53			~~65.00~~ 70.00	56.3
43	9	13:39	387.5		43.54			~~66.67~~ 73.33	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 9mL that most of the rest of the tubes did. Tube 44 acidified w/ only 40μL HNO_3.

Riverton Col 10

T04-10 2.5-5

	1	2	3	4	5	6	7	8	9	10	11	12	13
11/13/12 1	Fill Column. Same setup as Col 1					25 mL Omnifit glass col				Flow bottom to top			
2		<2mm sieved fraction											
3		empty col 63.88 g											
4		col + fill 101.82 g				soil col. length = 11.8 cm			Vol 11.8 x 1.7671 = 20.85 mL				
5		soil weight 37.94 g				Density (dry) = 37.94/20.85 = 1.82 g/mL							
6													
7													
8	Fluid	Tube	Cum	1 PV = ~~5.5~~ ~~4.7~~	Cum	Flow	Collect	Cum	U			11/15/12	
9	in tube	Start	Vol.			Rate	Time	Collect Time	(ug/L)	Start flow @		12:34	
Tube # 10	(mL)	Date/Time	(mL)	PV 4.5	PV	(mL/min)	(hr)	(hr)	~~449~~	1st water to soil @ 12:35			
1 11	9.5	11/15 13:45	9.5	~~1.79~~ 2.02	~~1.79~~ 2.02	0.095	1.67	1.67	449.2	Water to top of soil @ 13:22		47 min	
2 12	9.5	15:25	19.0	2.02	4.04			3.33	501.8	Water to top of Col @ 13:27		53 min	
3 13	9.5	17:05	28.5		6.06			5.00	277.3	1st Drip, start frac col. @ 13:45			
4 14	9.5	18:45	38		8.09			6.67	143.0				
5 15	9.5	20:25	47.5		10.11			8.33	93.1	1st sample clear pale yellow			
6 16	9.5	22:05	57		12.13			10.00	68.9	all others clear			
7 17	9.5	23:45	66.5		14.15			11.67	57.6				
8 18	9	11/16 1:25	75.5 ~~[illegible]~~	1.91	16.06	0.09		13.33	53.5				
9 19	9.5	3:05	85.0	2.02	18.09	0.095		15.00	47.2				
10 20	9.5	4:45	94.5		20.11			16.67	42.6	PV = 4.5		47 min x 0.095 mL/min	
11 21	9.5	6:25	104		22.13			18.33	41.3			= 4.5 mL	
12 22	9.5	8:05	113.5		24.15			20.00	36.0				
13 23	9.5	9:45	123		26.17			21.67	30.0				
14 24	9.5	11:25	132.5		28.19			23.33	28.7				
15 25	9	13:05	141.5	1.91	30.11	0.09		25.00	27.4				
16 26	9.5	14:45	151.0	2.02	32.13	0.095		26.67	28.7				
17 27	9.5	16:25	160.5	2.02	34.15	0.095		28.33	24.3				
18 28	10	18:05	170.5	2.13	36.28	0.1		30.00	22.8				
19 29	10	19:45	180.5	2.13	38.40	0.1		31.67	21.3				
20 30	10	21:25	190.5	2.13	40.53	0.1		33.33	21.6				
21 31	9.5	23:05	200	2.02	42.55	0.095		35.00	20.3				

Riv Col 10 cont

T04-10 @ 2.5-5

Tube #	Fluid in Tube (ml)	Tube Stad Date/Time	Cum Vol (ml)	1 PV = ~~4.7~~ 4.5 PV	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum. Coll. Time (hr)	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		66.81			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 + soil 92.75g

soil 30.52

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

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

1 PV = ~~7.3~~ 6.6 mL

Tube #	Feed in tube (ml)	Tube Start Date/Time	Cum Vol ml	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 } 73min

water to top of soil @ 14:24

water to top of col @ 14:30

1st Drip, start free 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

Riverton Col 11 T03-10 @ 0-2.5

Cont

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol (ml)	1PV = ~~73~~ PV 6.6 AT	Cum PV	Flow Rate ml/min	Collect Time (hr)	Cum Col. Time (hr)	U ug/L
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 × 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 (µg/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	Start flow @ 15:08
										1st water to soil @ 15:10
										water to Top of soil @ 16:21
										water to Top of col @ 16:27
										1st Drip, start frac col @
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	1st Sample clear med yellow
6	9.5	11/19 1:04	57.0		~~8.03~~ 8.51			10.00	129.6	subsequent samples clear
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	PV = 71 min × 0.095 = 6.7 ml
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	

71 min
PV = ~~7.1~~ 6.7

Riverton Col 12

Cont T03-10 @ 2.5-5

Tube #	Fluid in tube (ml)	Tube Start (Date/Time)	Cum Vol (ml)	4 PV (PV=6.7)	Cum PV	Flow Rate (ml/min)	Collect Time (hr)	Cum Col. Time (hr)	U (ug/L)	10	11	12	13
22 1	9.5	11/20 03:44	209.0	1.42	31.19	0.095	1.67	36.67	13.1				
23 2	9.5	05:24	218.5		32.61			38.33	13.2				
24 3	9.5	7:04	228		34.03			40.00	12.3				
25 4	9.5	8:24	237.5		35.45			41.67	12.2				
26 5	9.5	10:24	247		36.87			43.33	11.6				
27 6	9.5	12:04	256.5		38.28			45.00	10.3				
28 7	9.5	13:44	266		39.70			46.67	10.0				
29 8	9.5	15:24	275.5		41.12			48.33	9.5				
30 9	9.5	17:04	285.0		42.54			50.00	9.5				
31 10	9.5	18:44	294.5		43.96			51.67	~~9.0~~ 8.4				
32 11	9.5	2024	304		45.37			53.33	8.6				
33 12	9.5	22:04	313.5		46.79			55.00	8.4				
34 13	9.5	23:44	323		48.21			56.67	8.1				
35 14	9.5	11/21 1:24	332.5		49.63			58.33	7.7				
36 15	9.5	3:04	342		51.04			60.00	7.6				
37 16	9.5	4:44	351.5		52.46			61.67	7.4				
38 17	9.5	6:24	361		53.88			63.33	7.2				
39 18	9.5	8:04	370.5		55.30			65.00	6.5				
40 19	9.5	9:44	380		56.72			66.67	6.6				
41 20	9.5	11:24	389.5		58.13			68.33	6.3				
42 21	9.5	13:04	399		59.55			70.00	6.2				
43 22	9.5	14:44	408.5		60.97			71.67	5.8				
44 23	9.5	16:24	418		62.39			73.33	5.3				
24	D/C flow to Column @ 18:04												
25													
26													
27													
28													
29													
30													
31													

Riverton Col 13

T02-07 0-25

11/19/12 Fill column, same setup as Col 1 25 ml 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 11.8 cm Vol = 11.8 × 1.7671 = 20.85 ml

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

Tube #T	fluid in tube (ml)	Tube Start Date/Time	Cum Vol ml	1 PV = ~~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
2	9	11:43	18		3.21			3.33	25.1
3	9	13:23	27		4.82			5.0	12.9
4	9	15:03	36		6.43			6.67	12.3
5	9	16:43	45		8.04			8.33	9.2
6	9	18:23	54		9.64			10.0	6.7
7	9	20:03	63		11.25			11.67	7.0
8	9	21:43	72		12.86			13.33	6.3
9	9	23:23	81		14.46			15	6.1
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

Start flow @ 8:35

1st water to soil @ 8:37 >62 min

water to top of soil @ 9:39

water to top of col @ 9:43

1st Drip, start frac col @ 10:03

1 st. sample very pale yellow

PV 62 × 0.09 = 5.6

Ruerton Col 13

T02-07 0-2.5 Cont.

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol (ml)	1 PV = 5.6 cum PV	PV	Flow Rate (ml/min)	Collect Time	Cum Col time	U (ug/L)
22 1	9	11/21 21:03	198	1.61	35.36	0.09	1.67	36.67	2.8
23 2	9	22:43	207		36.96			38.33	2.6
24 3	9	11/22 0:23	216		38.57			40.00	2.6
25 4	9	2:03	225		40.18			41.67	2.4
26 5	9	3:43	234		41.79			43.33	2.4
27 6	9	5:23	243		43.39			45.00	2.2
28 7	9	7:03	252		45.0			46.67	2.3
29 8	9	8:43	261		46.61			48.33	2.1
30 9	9	10:23	270		48.21			50.0	1.9
31 10	9	12:03	279		49.82			51.67	1.8
32 11	9	13:43	288		51.43			53.33	1.9
33 12	9	15:23	297		53.04			55.00	1.6
34 13	9	17:03	306		54.64			56.67	1.5
35 14	9	18:43	315		56.25			58.33	1.6
36 15	9	20:23	324		57.86			60.0	1.6
37 16	9	22:03	333		59.46			61.67	1.5
38 17	9	23:43	342		61.07			63.33	1.6
39 18	9	11/23 1:23	351		62.68			65.00	1.5
40 19	9	3:03	360		64.29			66.67	1.4
41 20	9	4:43	369		65.89			68.33	1.5
42 21	9	6:23	378		67.50			~~[illegible]~~ 70.0	1.4
43 22	9	8:03	387		69.11			~~[illegible]~~ 71.67	1.3
44 23	9	9:43	396		70.71			73.33	1.2
24	D/C flow to column @ 11:23								
25									
26									
27									
28									
29									
30									
31									

Riverton Col 14

T02-07 @ 2.5-5

11/19/12

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

<2mm sieve frac

empty col 61.49

Col + fill 96.63 Soil col length = 11.8 cm Vol 11.8 x 17.671 = 20.85 ml

fill 35.14 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 > 60 min

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 60 min = 4.5

Riverton Col 14 cont

T02-07 ~~2.2~~ 2.5-5

Tube #	Fluid in Tube (ml)	Tube Start Date/Time	Cum Vol ml	1PV=45 PV	Cum PV	Flow Rate ml/min	Collect Time (hr)	Cum Col time	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				
	DC col @ 13:03												

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

Ruerton Col 15

T01-05 0-2.5

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

<2mm sieved frac.

empty col ~~62.21~~ 63.12

Col + full ~~95.22~~ 96.74

full 33.62

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

Density (dry) 33.62/20.85 = 1.61 g/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)	
										Start flow @ 10:30
1	9	11/20 12:04	9	1.58	1.58	0.09	1.67	1.67	435.8	1st water to soil @ 10:32 > 63
2	9	13:44	18		3.16			3.33	168.3	water to top of soil @ 11:35
3	9	15:24	27		4.74			5.0	116.8	water to top of col @ 11:41
4	9	17:04	36		6.32			6.67	90.3	1st Drip, start frac col @ 12:04
5	9	18:44	45		7.89			8.33	84.6	
6	9	20:24	54		9.47			10.00	75.0	1st sample cloudy med. yellow/brown
7	9	22:04	63		11.05			11.67	63.9	~~[illegible]~~ sample had tannt. roots
8	9	23:44	72		12.63			13.33	61.1	
9	9	11/21 1:24	81		14.21			15.00	30.7	
10	9	3:04	90		15.79			16.67	39.2	PV = 0.09 × 63 = 5.7
11	9	4:44	99		17.37			18.33	45.7	
12	9	6:24	108		18.95			20.0	50.9	PPT noticed in tubes 1 →
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	↓ cloudiness thru tube 12
15	9	11:24	134	1.58	23.51	0.09		25.0	31.1	clear 13 →
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	

Riverton Col 15

T01-05 0-2.5

Tube #	Fluid in tube	Tube/start Date/time	Cum Volume	1 PV = 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		40.0	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		48.33	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 x 1.7671 = 20.85 ml

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

Tube #	Fluid in Tube (ml)	Tube Stat 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			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 frac Col @ 11:19

1st sample very pale clear yellow

Subsequent samples clear

PV = 0.095 x 54 = 5.1

Riverton Col 16

T01-05 2.5-5

Tube #	Fluid in Tube	Tube Start	Cum Vol ml	1PV=5.1 PV	Cum PV	Flow Rate	Collect Time hr	Cum Col Time	U (ug/L)	10	11	12	13
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 large
	cores for ↑ surface area exposure. Record "wet" weights. and T.D's
	listed on sample bags.

	1	2	3	4	5	6	7	8	9	10	11	12	13
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~~			Re stirring @ 1600. Cover beaker							
9/14/12	09:30	soln has been sitting				7 std = 7.01							
	overnight. Obvious white ppt					10 std = 10.01							
	(very thin cont) on bottom of beaker.							ck cal of pH meter					
	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	6	7	8	9	10	11	12	13
9/14/12	1	1315	7.94											
	2	1410	8.15		Cum 20% HNO_3									
	3	+200ul 2% HNO_3		=	600ul									
	4	1415	7.86											
	5	1455	8.12											
	6	1550	8.17											
	7	+200ul 2% HNO_3			800ul									
	8	1540	7.89											
	9	1625	8.08											
	10	1715	8.18			DC stir bar, lover, white ppt still present								
	11													
9/17	12	Ck pH Buffers		7=7.00	10=10.01									
	13	soln. has been sitting, covered, over weekend. white ppt on bottom of beaker												
	14													
0845	15	initial pH=7.69 increase to 8.04 @ 10"												
~~0940~~	16	0940	8.10											
	17	1105	8.09											
	18													

19 1300 measure alkalinity on unfiltered sample. Titrated to 60 digits using 1.6N H_2SO_4 in 100mL sample.
20 After pH rebounded added 2-3 digit increments and allowed pH to stabilize (10-15min) after each addition.
21 Final pH = 4.81 Digits = 94 15:49 Alk = 94mg/L as $CaCO_3$
22
23 1550 measure alkalinity on a filtered (0.45 μm) sample. Titrated to 45 digits using 1.6N H_2SO_4 in 100mL sample.
24 After pH rebounded added 2-3 digit increments and allowed pH to stabilize (10-15min) after each addition.
25 Final pH = 4.71 Digits = 47 Alk = 47mg/L as $CaCO_3$
26
27 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
28 S. Morrison and is called SPF-RVT01-6-2012_ver2
29
30
31

	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** 2L	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 0.6	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																					

	1	2	3	4	5	6	7	8	9	10	11	12	13
9/18/12 1	Preparation of new Synthetic Pore Fluid					SPF-RVT01-6-2012_ver2. (SPF2)				See attached recipe.			
2													
10:45	1L of SPF2 was made and transfered to a 1L beaker.						pH meter cal. checked						
4													
5	pH 7 = 7.01		pH 10 = 10.02										
6													
7	Pore fluid stirred while exposed to the atmosphere and pH readings taken.												
8	Time	pH											
9	1050	7.95											
10	1100	8.38		1105 Alk measured.		pH final = 4.81		Digits = 107		Alk = 107 mg/L as $CaCO_3$			1.6N H_2SO_4 100mL sample
11	1130	8.37											
12	~~1215~~ 1230	8.43		1415 pH 8.42 Alk. measurment			100mL sample, 1.6N H_2SO_4						
13	1300	8.43			pH final =			Digits = 103		Alk = 103 mg/L as $CaCO_3$			
14	1400	8.45											
15	1500												
16	Adding Acid (29% HNO_3) to ~300mL of SPF2												
17	Time	Acid Addition (µL)	Cum	pH									
18	14:25	0		8.37									
19	14:40	0	↓	8.45									
20	14:41	50µL	50	8.19									
21	14:46	50µL	100	7.94									
22	14:52			7.97									
23	15:48			8.30									
24	16:15			8.36									
25													
26													
27													
28													
29													
30													
31													

	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	46.00	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 drives 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 err 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 4 std = 4.00 7 std = 7.01 10 std = 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 5 min, 15 min, 30 min, 1 hr, 2 hrs
	1600	pH = 8.06
	1605	Start the 16 hr 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

		1	2	3	4	5	6	7	8	9	10	11	12	13
10/8/12	1	Check pH stds.		4=	4.04	7= 7.01		10=						
	2	0845 measure pH of SPF3:												
	3	0945 pH = 7.99												
	4	Cube sealed and an alk. measurement made.												
	5	1.6N H_2SO_4 digits for 100mL sample = 133						Final pH = 4.79	Alk = 133 mg/L @s $CaCO_3$					
	6													
	7	1130 Start 1st round of batch tests.												
	8													
10/15/12	9	Ck pH stds		4= 4.02		7=7.04	10= 10.07							
	10													
	11	0820 ck pH SPF3 = 7.96												
	12		alk = 124 mg/L as $CaCO_3$				c 1.6N H_2SO_4, 100mL sample final pH 4.51							
	13													
	14	0845 Start Round #2 of batch												
	15													
	16													
10/16/12	17	0905	check pH stds		4=4.08	7= 7.04		10= 10.02						
	18													
	19	0910	check pH SPF3 = 8.03											
	20		alk = 131 mg/L as $CaCO_3$				1.6N H_2SO_4, 100mL sample			final pH = 4.79				
	21													
	22													
10/17/12	23	0800	check pH stds		4= 4.07		7=7.02		10= 10.01					
	24													
	25	0805	check pH of SPF3 = 8.02											
	26		alk = 133 mg/L as $CaCO_3$				1.6N H_2SO_4, 100 mL sample			final pH = 4.82				
	27													
10/18	28	0830	check pH stds		4=4.06	7= 7.01		10 = 9.99						
	29													
	30	0835	Check pH of SPF3 = 8.04											
	31		alk = 131 mg/L as $CaCO_3$				1.6N H_2SO_4, 100mL sample			final pH = 4.78				

Riverton Syn Pore Fluid

	1	2	3	4	5	6	7	8	9	10	11	12	13
10/22/12	ck pH stds		4=	4.04	7=	7.06		10 = 10.09					
2													
3	pH SPF 3 = 8.05												
4	alk = 130 mg/L as CaCO3					1.6N H2SO4		100ml sample		final pH = 4.65			
5													
6													
10/23/12	ck pH stds		4=4.09		7=7.05	10=10.08							
8													
9	pH SPF 3 = 8.00												
10	alk = 127 mg/L as CaCO3					1.6N H2SO4		100ml sample		final pH = 4.60			
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

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

Sample		2	3 Tare 14.0	4	Gross Weight		7	8	9	10	11	12	13
				9/24	9/31	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

Rw5

					8/31 Grosslet	9/7	9/10	9/13	9/17	TD	9/18	9/19	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		Tare 14	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	4 Tare 14	5 9/24	6 Gross Wet 8/31	7 9/7	8 9/10	9 9/13	10 TD	11 9/17	12 9/18	13 9/19
T07-03	0-2.5				1804.0	1825.4	1812.1	1809.5	1809.3		1806.6	1805.4	1805.0
3	2.5-5				1269.4	1278.0	1270.9	1270.4	1270.4	3.6	1269.9	1269.7	1269.7
4													
T07-04	0-2.5				1787.8	1812.0	1797.0	1794.0	1793.4		1790.7	1789.4	1788.8
6	2.5-5				457.5	459.3	457.9	457.8	457.7	3.1	457.6	457.6	457.5
7													
T07-05	0-2.5				1613.1	1649.6	1624.4	1620.4	1619.7		1616.4	1615.0	1614.3
9	2.5-5				1334.9	1347.9	1336.4	1336.0	1336.0	3.6	1335.4	1335.2	1335.1
10													
T07-06	0-2.5				1645.1	1693.9	1662.7	1655.5	1653.0		1648.7	1647.0	1646.3
12	2.5-5				1506.1	1519.2	1508.4	1507.6	1507.6	4.0	1506.8	1506.5	1506.5
13													
T07-07	0-2.5				2000.0	2023.2	2007.3	2004.8	2004.2		2002.1	2001.0	2000.6
15	2.5-5				442.5	449.8	443.0	442.9	442.8	2.9	442.7	442.6	442.6
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

	1	2	3	4 9/24 Tare 14	5 9/19	6 Gross Wet	7 8/31	8 9/7	9 9/10	10 9/13 TD	11	12 9/17	13 9/18
T08-02	0-2.5			1086.9	1090.4	1273.7	1155.0	1128.0	1103.6			1094.6	1092.0
2	2.5-5					N.S.							
3													
T08-03	0-2.5			—	832.9	886.8	844.9	839.4	838.5			834.5	833.3
5	2.5-5			—	1005.5	1046.7	1013.5	1009.8	1009.6			1006.7	1005.8
6													
T08-04	0-2.5			1154.6	1156.5	1226.2	1181.1	1169.4	1165.5			1159.4	1157.3
8	2.5-5			970.1	970.3	978.8	971.5	971.0	971.0	4.0		970.6	970.3
9													
T08-05	0-2.5			1247.2	1249.3	1326.7	1271.4	1261.1	1258.0			1252.1	1250.2
11	2.5-5			1787.6	1788.0	1809.4	1793.2	1790.5	1790.4	4.3		1788.7	1788.2
12													
T08-06	0-2.5			952.5	953.3	1022.7	970.9	961.3	958.8			954.8	953.6
14	2.5-5			1308.7	1309.6	1355.1	1321.0	1314.8	1313.7	4.1		1310.8	1309.8
15													
16													
17													
18													
T09-08	0-2.5			1228.3	1229.2	1292.0	1244.5	1236.3	1234.5			1230.8	1229.6
20	2.5-5			1044.7	1045.1	1155.5	1064.9	1051.6	1049.3	4.1		1046.2	1045.3
21													
22													
23													
24													
25													
26	9/19/12	Mettler	PE16 Scale Check			Weight set 5182							
27		X12680				100g	100.0						
28						200g	200.0						
29						500g	500.0						
30						1000g	1000.0						
31						2000g	2000.0						
						5000g	5000.1						

Riverton Sieving Analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13
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 50 mL centrifuge tubes. From these tubes samples were syringe filtered through 0.45 μm nylon acrodisk filters into a third centrifuge tube. ~~Samples acidified w/ 100~~ 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

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, filtered and acidified.

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

Note: U measured on Rw. SPF3 at beginning and end of experiment (15min, 96hrs)
U ≤ 0.2 μg/L

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

	1	2	3	4	Mass of Soil (g)	7	8	9	10	11	12	13
5 min Tests		Sample		U (ug/L)		15 min Tests		Sample		Mass of soil (g) U (ug/L)		
2												
3		T01-05	0-2.5	3.6	1.00			T01-05	0-2.5	4.2	1.00	
4		T01-05	2.5-5	0.3	1.00			T01-05	2.5-5	0.8	1.00	
5												
6		T03-10	0-2.5	0.7	1.00			T03-10	0-2.5	0.9	1.00	
7		T03-10	2.5-5	3.6	1.00			T03-10	2.5-5	4.5	1.00	
8												
9		T05-02	0-2.5	40.6	1.00			T05-02	0-2.5	47.0	1.00	
10		T05-02	2.5-5	16.4	1.00			T05-02	2.5-5	20.1	1.00	
11												
12		T08-03	0-2.5	19.6	1.00			T08-03	0-2.5	22.9	1.00	
13		T08-03	2.5-5	24.4	1.00			T08-03	2.5-5	27.5	1.00	
14												
15												
16												
30 min Tests		Sample		U (ug/L)	Mass of Soil (g)	1hr Tests		Sample		Mass of Soil (g) U (ug/L)		
18												
19		T01-05	0-2.5	4.8	1.00			T01-05	0-2.5	5.2	1.00	
20		T01-05	2.5-5	1.0	1.00			T01-05	2.5-5	<0.2	1.00	
21												
22		T03-10	0-2.5	1.1	1.00			T03-10	0-2.5	0.8	1.00	
23		T03-10	2.5-5	5.0	1.00			T03-10	2.5-5	5.3	1.00	
24												
25		T05-02	0-2.5	54.9	1.00			T05-02	0-2.5	57.3	1.00	
26		T05-02	2.5-5	22.1	1.00			T05-02	2.5-5	23.9	1.00	
27												
28		T08-03	0-2.5	25.6	1.00			T08-03	0-2.5	27.4	1.00	
29		T08-03	2.5-5	31.5	1.00			T08-03	2.5-5	34.1	1.00	
30												
31												

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

~~9/19/12~~

2hr Tests	Sample		u (ug/L)	Mass of Soil (g)
	T01-05	0-2.5	5.5	1.00
	T01-05	2.5-5	0.3	1.00
	T03-10	0-2.5	1.5	1.00
	T03-10	2.5-5	5.6	1.00
	T05-02	0-2.5	60.1	1.00
	T05-02	2.5-5	26.9	1.00
	T08-03	0-2.5	29.8	1.00
	T08-03	2.5-5	37.7	1.00

4hrs Tests	Sample		u (ug/L)	Mass of Soil (g)
	T01-05	0-2.5	3.9	1.00
	T01-05	2.5-5	0.3	1.00
	T03-10	0-2.5	2.3	1.00
	T03-10	2.5-5	6.1	1.00
	T05-02	0-2.5	63.3	1.00
	T05-02	2.5-5	26.4	1.00
	T08-03	0-2.5	31.3	1.00
	T08-03	2.5-5	40.7	1.00

8hr Tests	Sample			Mass of Soil (g)
	T01-05	0-2.5	6.8	1.00
	T01-05	2.5-5	0.3	1.00
	T03-10	0-2.5	1.7	1.00
	T03-10	2.5-5	7.1	1.00
	T05-02	0-2.5	68.5	1.00
	T05-02	2.5-5	34.2	1.00
	T08-03	0-2.5	32.7	1.00
	T08-03	2.5-5	42.6	1.00

16hr Tests	Sample			Mass of Soil (g)
	T01-05	0-2.5	7.6	1.00
	T01-05	2.5-5	0.5	1.00
	T03-10	0-2.5	1.6	1.00
	T03-10	2.5-5	7.1	1.00
	T05-02	0-2.5	71.0	1.00
	T05-02	2.5-5	32.3	1.00
	T08-03	0-2.5	36.3	1.00
	T08-03	2.5-5	43.8	1.00

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

	1	2	3	4	5	6	7	8	9	10	11	12	13
48hr Tests	Sample		U (µg/L)	Mass of Soil (g)		96hr Tests		Sample		U (µg/L)	Mass of Soil (g)		
2													
3	T01-05	0-2.5	8.0	1.00				T01-05	0-2.5	8.3	1.00		
4	T01-05	2.5-5	0.7	1.00				T01-05	2.5-5	0.7	1.00		
5													
6	T03-10	0-2.5	2.0	1.00				T03-10	0-2.5	2.0	1.00		
7	T03-10	2.5-5	7.8	1.00				T03-10	2.5-5	8.2	1.00		
8													
9	T05-02	0-2.5	76.3	1.00				T05-02	0-2.5	76.9	1.00		
10	T05-02	2.5-5	32.7	1.00				T05-02	2.5-5	34.8	1.00		
11													
12	T08-03	0-2.5	39.6	1.00				T08-03	0-2.5	39.5	1.00		
13	T08-03	2.5-5	48.8	1.00				T08-03	2.5-5	48.2	1.00		
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

Riverton Sieve Analysis

	1	2	3	4	5	6	7	8	9	10	11	13
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 plant 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 ~~chunks~~ 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)	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				

Sample	1	2	3	4 Tare (g)	5	Gross (g)	7	8 Net (g)	Comments	10	11	12	13
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 broken down.				
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		~~3.075~~ 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													

TOPS FORM 3812
MADE IN U.S.A.

	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					

TOPS FORM 3932 MADE IN U.S.A.

Sample	1	2	3	4 Tare (g)	5	Gross (g)	7	8 Net (g)	Comments	10	11	12	13
1	T07-07	0-2.5							Some plant debris. Some is large and woody. Cobbles up to				
2		#10		561.9		1599.8		1037.9	1.5"				
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				
9		#10		561.9		907.7		345.8	dirt chunks that could be further broken down.				
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							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				
21		#10		561.9		790.8		228.9	chunks that could be further broken down.				
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				
27		#10		561.9		685.6		123.7	all +2mm could be further broken down.				
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					

TDPS FORM #922
SEED IN U.S.A.

	1	2	3	4 Tare (g)	5	6 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													
24	10/9/12 1130 Samples off stir bar. Placed in centrifuge @ 3000 rpm for 20 min then decanted into 200mL volumetric flask. 50mL												
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
1													
2	T04-09	0-2.5	2-1		2.00		47.9						
3	T04-09	2.5-5	2-2		2.00		21.2						
4	T04-10	0-2.5	2-3		2.00		25.4						
5	T04-10	2.5-5	2-4		2.00		5.1						
6	T04-11	0-2.5	2-5		2.00		47.3						
7	T04-11	2.5-5	2-6		2.00		33.5						
8	T04-12	0-2.5	2-7		2.00		37.0						
9	T05-01	0-2.5	2-8		2.00		10.7						
10	T05-01	2.5-5	2-9		2.00		3.3						
11	T05-02	0-2.5	2-10		2.00		38.0						
12	T05-02	2.5-5	2-11		2.00		13.2						
13	T05-03	0-2.5	2-12		2.00		24.8						
14	T05-03	2.5-5	2-13		2.00		47.1						
15	T06-08	0-2.5	2-14		2.00		5.2						
16	T06-08	2.5-5	2-15		2.00		0.6						
17	T06-09	0-2.5	2-16		2.00		12.6						
18	T06-09	2.5-5	2-17		2.00		2.1						
19	T06-10	0-2.5	2-18		2.00		17.9						
20	T06-10	2.5-5	2-19, ~~20~~		2.00/~~2.00~~		2.2						
21	T06-10	2.5-5	2-20		2.00		2.3						
22													
10/15/12 23	Start @ 0845 after pH, alk ck. w/ SPF3 Stir on End-over-End @ ~ 8 RPM												
10/16/12 24	Remove from stir bar Cent 20"x 3KRPM. Decant into 200mL Vol flask. Stopper flasks												
25	Refill cent tubes w/ SPF3. Replace on stir bar @ 8RPM												
10/17/12 26	Remove from stir bar Cent 20"x 3KRPM. Decant into above mentioned Vol flask												
27	Fill to Volume. Vac Filter thru 0.45um filter acidify pH<2 c̄ Conc HNO_3												
28	Analyze for U												
29													
30													
31													

Riverton Batch Tests

10/16/12	Sample	2	3 Tube	4	5 Mass (g)	6	U (µg/L)	8	9	10	11	12	13
1													
2	T06-11	0-2.5	3-1		2.00		30.5		10/18/12 0830 Remove from stir bar				
3	T06-11	2.5-5	3-2		2.00		5.6		Cent 20" x 3K RPM. Decant into				
4	T06-12	0-2.5	3-3		2.00		29.5		200mL vol flask. Stopper flasks.				
5	T06-12	2.5-5	3-4		2.00		2.1		Refill cent. tubes w/ 50mL SPF3				
6	T06-13	0-2.5	3-5		2.00		37.9		Replace on stir bar @ 8 RPM				
7	T06-13	2.5-5	3-6		2.00		19.7		10/19/12 Remove from stir bar,				
8	T07-03	0-2.5	3-7		2.00		9.3		Cent 20" x 3K RPM. Decant into				
9	T07-03	2.5-5	3-8		2.00		1.1		above mentioned flask.				
10	T07-04	0-2.5	3-9		2.00		12.1		Fill to volume. Vac filter through				
11	T07-04	2.5-5	3-10		2.00		2.4		0.45uM filter. Acidify pH<2 w/				
12	T07-05	0-2.5	3-11		2.00		22.7		Conc HNO_3				
13	T07-05	2.5-5	3-12		2.00		4.2						
14	T07-06	0-2.5	3-13		2.00		35.2		10/24 Analyze for U				
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 ~ 5 RPM												
23	T08-04	0-2.5	4-1		2.00		31.9		10/22 Start @ 94 after SPF pH/alk ck				
10/22/12 24	T08-04	2.5-5	4-2		2.00		37		10/23 Remove from stir bar Cent 20" x				
25	T08-05	0-2.5	4-3		2.00		22.2		3K RPM, Decant into 200mL vol flask. Stopper flasks				
26	T08-05	2.5-5	4-4		2.00		20.7		Refill cent tubes w/ 50mL SPF3. Replace on bar @ 8 RPM				
27	T08-06	0-2.5	4-5		2.00		28.1		10/24 Remove from stir bar, Cent 20" x 3K RPM				
28	T08-06	2.5-5	4-6		2.00		25.5		Decant into above mentioned flasks. Fill to				
29	T09-08	0-2.5	4-7		2.00		4.9		Volume Vac filter thru 0.45 um filter				
30	T09-08	2.5-5	4-8		2.00		3.0		Acidify pH<2 w/ Conc HNO_3				
31	T09-08	2.5-5	4-9		2.00		2.8						