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Columbia River Pore Water Sampling in 100-BC Area, November 2010

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

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Executive Summary

During the Hanford Site weapons production mission (1943 to 1989), some contaminants were released to the Columbia River directly and others, including hexavalent chromium (Cr(VI)), were released to the soil at waste disposal facilities or as unplanned spills or leaks. Some contaminants migrated from the soil into the groundwater and eventually into the Columbia River. This discharge to the river takes place where groundwater seeps up into the river bottom in spaces between rocks and sediment grains. This phenomenon is known as upwelling, and the water in these sediments is termed pore water.

This report summarizes pore water sampling activities conducted during November 2010 in support of DOE/RL-2009-44.[1] It also presents an evaluation of the recent data in conjunction with previously collected pore water data.

In November 2010, workers sampled pore water at two upstream reference stations and at ten stations near 100-BC that were previously sampled. The previous work was conducted during 2009 and early 2010 as part of the work for DOE/RL-2008-11.[2] The purpose of the sampling work was to provide data to assess the Cr(VI) levels in the Columbia River's bed near the 100-BC area. Bulk samples of pore water were collected from the river bed using the Trident[3] probe and associated deployment techniques. Samples were analyzed for total chromium and Cr(VI).

The sampling techniques used were similar to those used during previous studies for the DOE/RL-2008-11 remedial investigation. Field quality control (QC) helped to minimize the variation of the water quality caused by fluctuating river levels. Samples were collected only during relatively low river stage periods, and field teams were allowed to make several attempts around the established stations to locate pore water conductivity readings that were within 10 percent of previous sampling events. The conductivity of upwelling groundwater is higher than that of river water.

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[1] DOE/RL-2009-44, 2010, *Sampling and Analysis Plan for the 100-BC-1, 100-BC-2, and 100-BC-5 Operable Units Remedial Investigation/Feasibility Study*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=1004211024.

[2] DOE/RL-2008-11, 2008, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0810240394.

[3] Coastal Monitoring Associates (San Diego, California) Trident probe has a patent pending.

Pore water samples were collected in the deep river channel area, near the 100-BC water intake structure, at several locations near the 100-BC outfall pipelines, and near a former waste site during low river periods. Daily river fluctuations were typically about 2 m (6 ft).

Overall, Cr(VI) levels were lower during the November 2010 sampling event than during the two previous sampling events. Only three of the eleven sample results from near 100-BC exceeded the Cr(VI) water quality limit (10 μg/L). The maximum Cr(VI) pore water concentration measured was 13.6 μg/L, compared with 112 and 46 μg/L maxima measured during the previous two sample events.

Some of the Cr(VI) concentrations measured in pore water in the fall of 2009 were higher than those currently measured in 100-BC groundwater. The change in pore water concentrations between the fall of 2009 and the fall of 2010 may be due to one or more of the following:

- Greater dilution with river water in later sampling events (related to river stage)
- Variations in sampling depths in the river bed
- A source of Cr(VI) contamination other than 100-BC groundwater
- Passing of a pulse of high Cr(VI) water, which could have originated from unknown groundwater contamination (i.e., from areas vertically or horizontally not characterized) or could have represented older groundwater contamination
- A data quality problem (e.g., interference of suspended particles/turbidity)

Data were evaluated to determine whether changes in conductivity accounted for the changes in Cr(VI) concentrations in pore water. Because groundwater beneath 100-BC varies significantly in Cr(VI) concentration, even when conductivity is relatively constant, there is not a definitive correlation between Cr(VI) concentration and conductivity. The relationship of Cr(VI) and conductivity at individual stations varied: some showed a positive correlation, others showed a negative correlation, and some had no correlation.

In general, conductivity of samples increased with increasing depth in the river bed. However, as previously noted, the conductivity alone could not explain the change in Cr(VI) concentrations among the three sampling events.

Statistical evaluation of data concluded that Cr(VI) and conductivity measurements were generally consistent with river dilution of groundwater migrating into the river from beneath 100-BC. The major exception was in the fall of 2009, when several pore water samples had high Cr(VI) concentrations that statistical tests classify as outliers. No upstream sources of Cr(VI) have been identified, so it is reasonable to assume that the pore water contamination originated in 100-BC groundwater.

QC data indicate that most of the data were representative. Data quality issues may have affected individual samples but not overall conclusions.

The only remaining explanation for the elevated Cr(VI) in the fall of 2009 and the subsequent drop in concentrations is the passage of an actual pulse of high Cr(VI) water through the hydrogeologic system. Ten monitoring wells were installed after the fall of 2009 to improve characterization of groundwater contamination vertically and horizontally. The Cr(VI) plume was discovered to extend farther west than previously known, but concentrations were less than 50 μg/L (lower than the fall 2009 pore water concentrations). Historically, groundwater concentrations may have been higher, as evidenced by >100 μg/L concentrations during 1998 and 1999, in what was then the only well in western 100-BC.

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Terms

bgs	below ground surface
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
MASS1	Modular Aquatic Simulation System-1D
MDL	method detection limit
NC	not calculated
NTU	Nephelometric Turbidity Units
ORP	oxidation-reduction potential
QC	quality control
RPD	relative percent difference
SAP	sampling and analysis plan

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1 Introduction

Between 1943 and 1989, during the Hanford Site weapons production mission, some contaminated materials were discharged to the Columbia River. In addition, waste disposal practices resulted in the release of contaminants to the upland soil. Some of these contaminants migrated from the soil to the groundwater and eventually into the river. This discharge to the river takes place where the groundwater percolates up through the river bottom and mixes with river water and sediment. These areas are known as upwellings, and the intersecting waters are referred to as pore water.

The 100-BC study area is located on the south bank of the Columbia River, upstream from the rest of the Hanford Site former reactor areas (Figure 1-1). Groundwater in the unconfined aquifer beneath 100-BC is contaminated with hexavalent chromium (Cr(VI)), tritium, and strontium-90 at concentrations above water quality standards (DOE/RL-2010-11, *Hanford Site Groundwater Monitoring and Performance Report for 2009*). Chromium concentrations in groundwater range from <10 to approximately 50 µg/L.

Recent pore water characterization activities, performed under the *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River* (DOE/RL-2008-11), indicated that Cr(VI) was entering the river at concentrations above the aquatic water quality standard at 100-BC (WCH-398, *Data Summary Report for the Remedial Investigation of Hanford Site Releases to the Columbia River, Hanford Site, Washington*). In those studies, pore water samples collected in both deep and shallow river beds near the 100-BC study area had up to ten times the Cr(VI) water quality limit of 10 µg/L (DOE/RL-2008-11; WCH-380, *Field Summary Report for Remedial Investigation of Hanford Site Releases to the Columbia River, Hanford Site, Washington: Collection of Surface Water, Pore Water, and Sediment Samples for Characterization of Groundwater Upwelling*; and WCH-398).

The sampling stations selected for this study corresponded with areas where Cr(VI) concentrations above aquatic cleanup levels had been detected in the earlier pore water sampling events (WCH-398). Two additional stations, BC-Near-shore 1 and BC-Near-shore 2, which had not been previously sampled for pore water and were thought to be out of the influence of 100-BC sources of Cr(VI), were sampled to serve as upriver reference stations.

This report summarizes pore water sampling activities conducted during November 2010 in support of the sampling and analysis plan (SAP), DOE/RL-2009-44, *Sampling and Analysis Plan for the 100-BC-1, 100-BC-2, and 100-BC-5 Operable Units Remedial Investigation/Feasibility Study*. The results of these sampling activities are evaluated in conjunction with previous results.

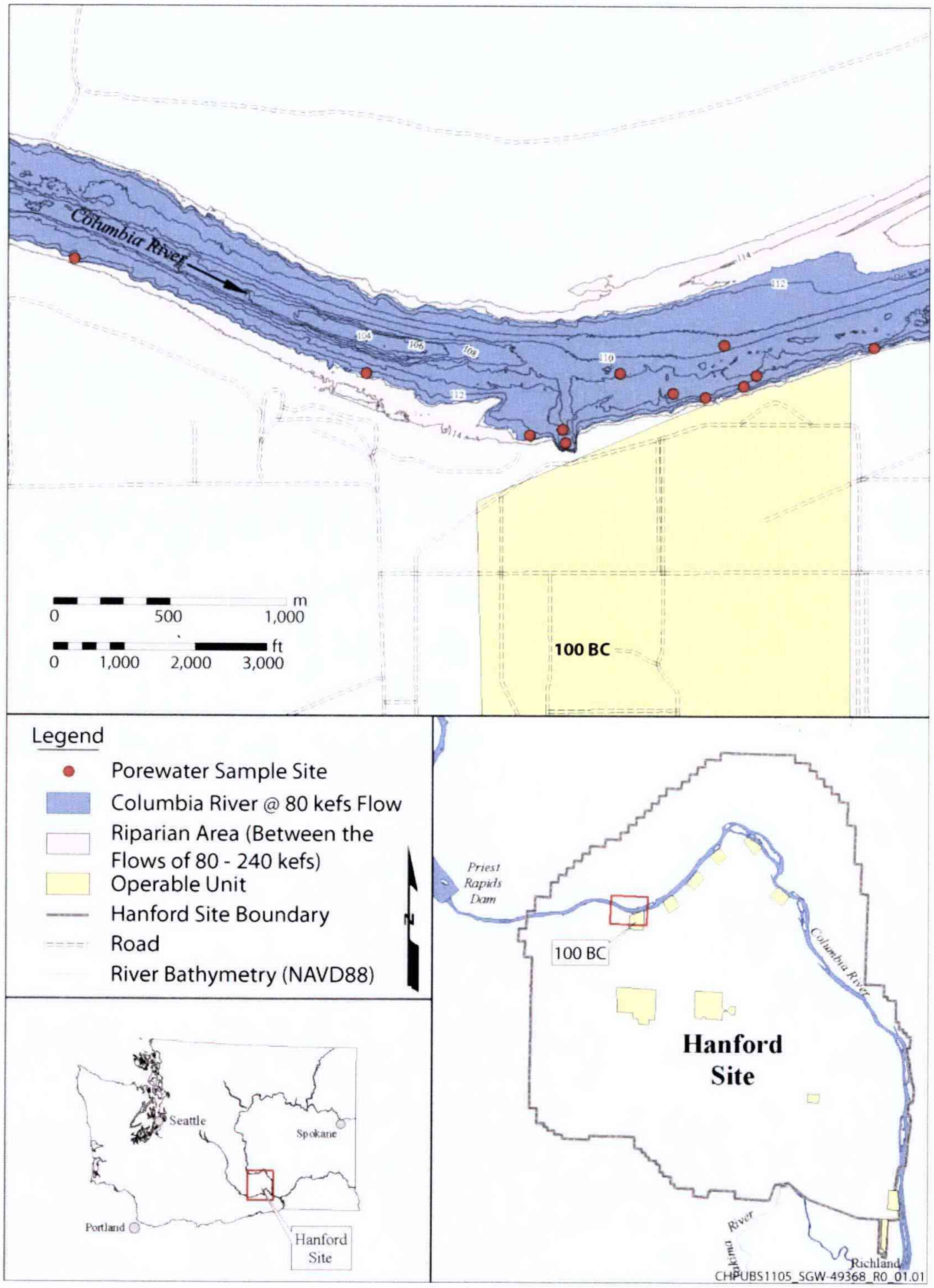

Figure 1-1. 100-BC Area, Hanford Site, Washington

2 Methods

Bulk samples of pore water were collected using the Trident probe[4] and associated deployment techniques, shown in Figure 2-1. Trident is a liquid phase groundwater mapping and sampling tool, designed for sustained use in complex offshore riverine environments. The probe is mounted on a driving frame that allows samples to be collected in turbulent waters and rocky river beds while keeping the probe stable.

In general, the field sampling techniques and data collected during this sampling effort are similar to the efforts described in WCH-380. The approach was used to detect groundwater upwellings and allowed field teams to collect pore water samples to be analyzed for the presence of specific groundwater contaminants, such as Cr(VI).

Once the offshore deployment vessel was located over a desired station, the driving frame and Trident probe were deployed to the river bed, and the probe was driven 20 to 30 cm (8 to 12 in.) below ground surface (bgs) of the river bed. The sampling tube was then purged using a peristaltic pump on board the vessel. Pore water samples were then drawn to a precleaned bulk sample container when in-situ conductivity readings of the pore water showed the presence of groundwater (greater than ~170 µS/cm) or when the pore water conductivity was similar (generally within 10 percent) to the measurements previously taken during DOE/RL-2008-11 sampling efforts.

2.1 Pore Water Sample Collection Guidelines

A great deal of research on the Hanford Site has shown the important role that the Columbia River stage (river level) has on groundwater discharge patterns and contaminant concentrations. Field sampling guidelines developed during the DOE/RL-2008-11 remedial investigation/feasibility study were used for this investigation to help minimize variation of the results associated with river stage fluctuations (WCH-380). The field sampling guidelines were used to help field teams avoid sampling during non-ideal conditions or to qualify the sample results that were collected. Implementation of these guidelines was important for obtaining results that were relatively comparable across space and over time. The following field sampling guidelines were used during this event:

- Collect samples when the river levels have been ≤0.8 m (2.6 ft) above the low water mark for at least one to two hours prior to sampling.
- Intermittently perform pore water conductivity checks at selected sample locations near the work site to check for signs of significant dilution from bank recharge and/or surface water pressure.
- Collect samples when a pore water conductivity reading is at least 90 percent of the conductivity measurements previously reported at the location during prior contaminant sampling events.
- Monitor river levels before and after each sampling event.

[4] Coastal Monitoring Associates (San Diego, California) Trident probe has a patent pending.

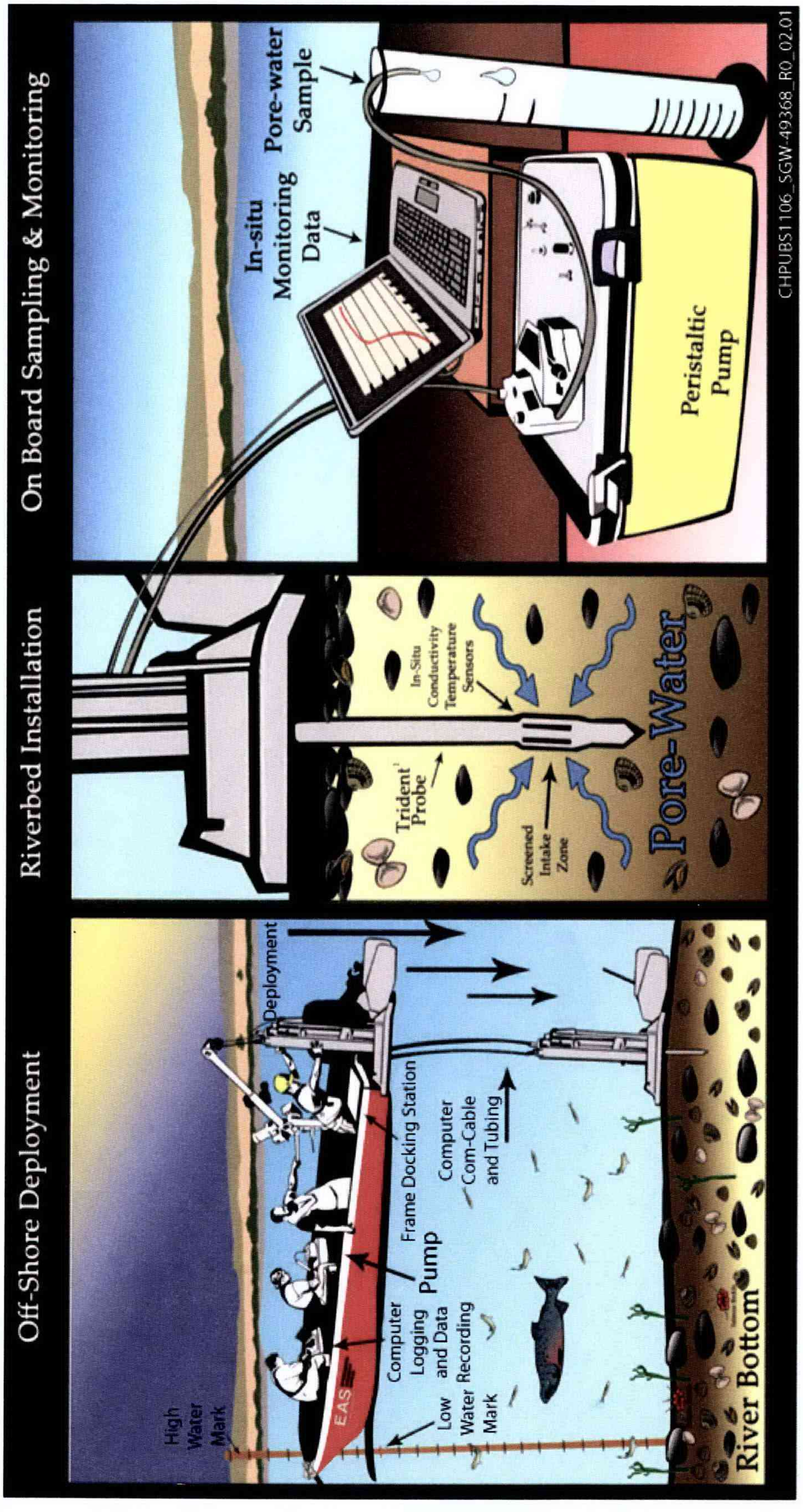

Figure 2-1. Pore Water Sampling Using the Trident Probe and Associated Deployment Techniques

A river level gauge established near 100-BC during the previous pore water sampling work (WCH-380) was measured regularly during the November 2010 sampling event to help evaluate the river level before, during, and after sampling. Staff also used the Modular Aquatic Simulation System-1D (MASS1), a one-dimensional unsteady river flow model, developed to characterize river stages and discharges encountered during each sampling event (PNNL-15226, *Hydrodynamic Simulation of the Columbia River, Hanford Reach, 1940-2004*). MASS1 simulates unsteady discharge and water surface elevations at each site by solving the one-dimensional equations of mass and momentum conservation (also known as the St. Venant equations). MASS1 was run with real discharge and forebay data when pore water conductivity readings were taken, and was used to calculate half-hour river discharge and water surface elevations for transects nearest to the groundwater upwelling sample locations. The river stage conditions encountered during the sampling events were summarized. Sampling guidelines called for flagging results with a project-unique qualifier if the river level was >0.8 m (2.6 ft) above the low water mark during the sampling event, or if the sample was collected when pore water conductivity was <90 percent of previous contaminant sampling events (WCH-380 and WCH-398).

2.2 Pore Water Sample Collection and Handling

Pore water samples were collected from 20 to 30 cm (8 to 12 in.) bgs at each sample station. Before each sample was collected, ~100 to 150 mL of water was purged and discarded. Once relatively stable, high, in situ pore water conductivity readings were measured, ~500 mL of pore water was collected from each station and placed into tamper-proof, glass, amber, precleaned containers.

Pore water conductivity was monitored in situ during each sample collection event to help verify that the samples were not artificially diluted or short circuited with surface water as a result of over pumping from a shallow point in the river bed. Staff also measured and recorded temperature, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity. Pore water samples were immediately placed into a cooler containing ice until they could be transferred to sampling support staff.

The pore water sampling methods used are provided in Appendix A. Sample results were flagged with project-unique qualifiers if the pore water conductivity changed by >10 percent during any given sample event. Surface water quality data were also obtained at each sample site. The surface water reference probes and opening of the surface water sampling tube were 30 cm (12 in.) above the river bed at all stations.

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3 Results

During this sampling event, 13 pore water samples were collected: 11 samples, including one duplicate sample, were collected from 10 previously established stations; and 2 samples were collected upstream of 100-BC and near the southern shoreline to serve as upstream reference pore water sample results (Figure 3-1). Upstream reference samples were collocated with three clusters of aquifer sampling tubes.

Pore water sampling near 100-BC began on November 4, 2010, and was completed on November 16, 2010 (Table 3-1). Quality control (QC) samples consisted of one equipment blank (collected November 4, 2010), one split, and one duplicate sample (Table 3-1). Water depths at the sampling stations ranged from 0.5 to 5.8 m (1.6 to 19 ft). The probe penetration depth ranged from 20 to 31 cm (7.9 to 12.2 in.). The stations farthest offshore had consistently less penetration than the near-shore stations.

Figure 3-2 generally illustrates the river stage fluctuations that occurred during the November 2010 pore water sampling event near 100-BC. River levels typically fluctuated about 2 m (6 ft) daily. The highest river stages shown in Figure 3-2 correspond to river discharges of ~4.5 million L/sec (160,000 ft^3/sec), and the lowest river stages correspond to river discharges of ~1.1 million L/sec (40,000 ft^3/sec). All samples were collected when the river stage was <0.8 m (2.6 ft) above the low water mark (i.e., the green line) and when river discharges ranged between ~1.08 and 1.7 million L/sec (38,000 and ~60,000 ft^3/sec) (see Table 3-1 and Figure 3-2).

3.1 Water Quality Results

The water quality field parameter measurements are related to the following variables: groundwater gradients, river bottom elevation horizons, depth of penetration, river stage, and duration of high flows conditions. These conditions all influence hydraulic heads, gradients and, ultimately, the magnitude and extent of groundwater discharge into the river. To compare the river field parameters with pore water parameters, the variable conditions need to be considered.

Table 3-2 includes conductivity measurements from the recent sampling, and Table 3-3 compares minimum and maximum field measurements of pore water and surface water. Appendix B includes pore water and surface water field measurements for each station. Conductivity of pore water ranged from 159 to 355 µS/cm, while surface water ranged from 138 to 152 µS/cm. In general, the greatest difference between conductivity of pore water and surface water was observed in the near-shore stations. Stations farther offshore had smaller, but measureable, conductivity differentials.

In November 2010, the temperature and pH of the pore water were similar to the surface water (Table 3-3). The ORP of a few pore water samples was lower than surface water but on average was not much different from surface water. Station T100BC1J1, located near the intake structure in a sand-silt dominated substrate, was the only station exhibiting a low DO and a negative ORP (indicating an oxygen-depleted environment). Turbidity of the surface water was consistently low (range 1 to 3 Nephelometric Turbidity Units [NTUs]). Turbidity of most pore water samples ranged between 5 and 60 NTU, but the three pore water samples collected from the two deep channel stations had turbidity measurements between 380 and 650 NTU (Appendix B).

Figure 3-3 illustrates the pore water composite sample conductivity measurements. Conductivity measured in the pore water samples confirmed the presence of groundwater upwelling at all stations sampled. The lowest pore water conductivity measured was 159 µS/cm at station T100BC5C, near the deep channel (thalweg) of the river. The highest pore water conductivity obtained was 355 µS/cm at the station farthest downstream (J100BC47). Figure 3-3 also identifies 4 of the 10 (40 percent) established pore water stations that exhibited substantially lower conductivity compared with previous sampling events at those locations (<90 percent; Figure 3-2 and Table 3-2).

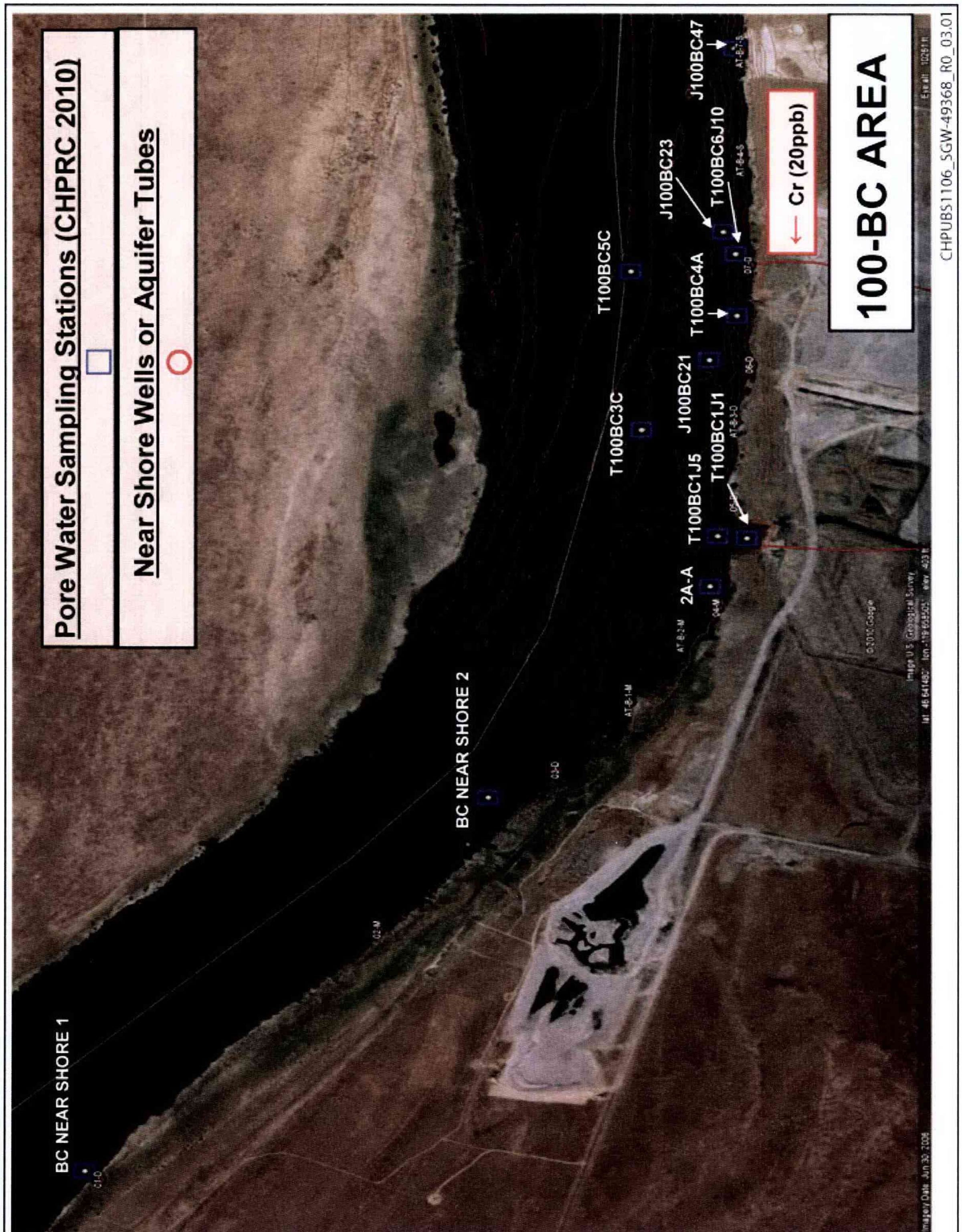

Figure 3-1. Pore Water Sampling Locations near 100-BC during November 2010

Table 3-1. Summary of Pore Water Samples Collected at 100-BC during November 2010

Station Identification	General Location	Sample Date	General Substrate Conditions	Sample Volume (mL)	QC Sample Type	River Flow at Time of Sampling (million L/sec)	River Flow at Time of Sampling (Kcfs)	River Stage Height above Low Water (m)	Field QC Qualifier	Sample Number	River Bed Elevation per NAVD88[a] (m)	Water Depth at Station at Time of Sampling (m)	Pore Water Sensor Depth (cm bgs)
2A-A	Upstream of Intake Structure	11/5/2010	silt/sand	600	-	1.60	58	0.6	-	B296J1	118.8	0.6	31
J100BC21	Moderate Depth	11/9/2010	lg/med cobble	560	-	1.63	57	0.6	b,c	B296J6	115.2	3.5	20
J100BC47	Near Shore (128-B-3)	11/10/2010	sand	800	SPLIT	1.64	40	0.5	-	B296K2	118.6	0.9	31
J100BC23	Near Shore	11/14/2010	medium cobble	600	-	1.08	38	-0.1	-	B296K1	115.6	2.5	25
T100BC1J1	Intake Structure	11/8/2010	silt/sand	575	-	1.19	45	0.1	c	B296J2	114.5	4.1	31
T100BC1J5	Intake Structure	11/9/2010	silt	600	-	1.65	42	0.7	-	B296J3	113.8	5.0	31
T100BC3C	Deep Channel	11/16/2010	lg/med boulders	550	-	1.69	58	0.7	c	B296J4	113.6	5.8	20
T100BC3C	Deep Channel	11/16/2010	lg/med boulders	550	DUPLICATE	1.66	58	0.7	c	B29B84	113.6	5.8	20
T100BC4A	Near Shore	11/7/2010	med/sm cobble	600	-	1.09	58	-0.1	-	B296J7	117.5	0.6	31
T100BC5C	Deep Channel	11/14/2010	med/sm cobble	550	-	1.07	38	-0.1	c	B296J9	115.6	3.1	23
T100BC6J10	Near Shore	11/8/2010	med/sm cobble	600	-	1.28	38	0.3	-	B296K0	117.7	0.6	28
Nearshore 1	Upstream Reference	11/4/2010	med/lg cobble	700	-	1.63	60	0.7	-	B296K3	119.4	1.3	25
Nearshore 2	Upstream Reference	11/7/2010	medium cobble	600	-	1.14	59	0.0	-	B296K4	118.8	0.5	23

a. NAVD88, 1988, *North American Vertical Datum of 1988*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland.

b. Sample conductivity is <90% of WCH-380, *Field Summary Report for Remedial Investigation of Hanford Site Releases to the Columbia River, Hanford Site, Washington: Collection of Surface Water, Pore Water, and Sediment Samples for Characterization of Groundwater Upwelling*, conductivities.

c. In situ readings increased >10% during sample collection event.

Kfcs = thousands of cubic feet per second

lg = large

med = medium

Table 3-2. Comparison of Cr(VI) Concentrations and Conductivity Measured in Pore Water Samples (2009 through 2010)

Station Identification	General Location	August/September 2009		January/February 2010			November 2010			Percent Change September 2009 to November 2010		Percent Change February 2010 to November 2010	
		Cond. (µS/cm)	Cr(VI) (µg/L)	Cond. (µS/cm)	Cr(VI) (µg/L)	Cr (Total) (µg/L)	Cond. (µS/cm)	Cr(VI) (µg/L)	Cr (Total) (µg/L)	Cond.	Cr(VI)	Cond.	Cr(VI)
2A-A	Upstream of Intake Structure	305[a]	24[a]	329[a]	10[a]	6.7[a]	305	4.4	11.4[b]	0	-82	-7	-56
J100BC21	Moderate Depth	332	73	--	--	--	244	<2	4.92[c]	-27	-97	--	--
J100BC23	Near Shore	160	91	230	<3.7	3.17	207	<2	5.2	29	-98	-10	NC
J100BC47	Near Shore (128-B-3)	370	28	344	13	8.8	355	13.6	14.5	-4	-51	3	5
T100BC1J1	Intake Structure	360	18	322[a,c]	5[a,c]	<2[a,c]	295	<2	<1[c]	-18	-89	-8	NC
T100BC1J5	Intake Structure	334	23	309	<3.7	1.29	304	<2	2.21	-9	-91	-2	NC
T100BC3C	Deep Channel	240	112	278	22	23.6	174	2.3	8.99	-28	-98	-37	-90
T100BC3C DUP	Deep Channel	--	--	--	--	--	232	6.9	15.8[c]	-3	-94	-17	-69
T100BC4A	Near Shore	350[a]	80[a]	344	46	20	341	12.6	13.7[d]	-3	-84	-1	-73
T100BC5C	Deep Channel	279	57	163	<3.7	11.1[b]	159	<2	5.01	-43	-96	-2	NC
T100BC6J10	Near Shore	299	26	302[a]	10[a]	10.2[a]	330	12.6	14.3	10	-52	9	26
BC Nearshore 1	Upstream Reference	--	--	--	--	--	204	<2	--	--	--	--	--
BC Nearshore 2	Upstream Reference	--	--	--	--	--	281	<2	--	--	--	--	--

Note: NC values near or below detection limit skew percentage.

a. Possible dilution of pore water sample is due to exceedance of river stage guidelines during sampling event.

b. Sample was not filtered.

c. Sample conductivity is <90% of prior pore water sample conductivity.

d. Unknown if sample was filtered.

Table 3-3. Comparison of Selected Water Quality Measurements between Pore Water and Surface Water Samples

Parameter	Minimum		Mean		Maximum	
	Pore Water	Surface Water	Pore Water	Surface Water	Pore Water	Surface Water
Conductivity (µS/cm)	159	138	264	143	355	152
Temperature (C°)	12.4	12.3	13.5	13.5	15.6	14.7
pH	7.07	7.32	7.48	7.67	7.82	8.02
ORP (mV)	-25	160	258	267	323	312
DO (mg/L)	7.55	8.72	8.72	9.86	10.69	10.42
Turbidity (NTU)	5	1	136	1	650	3

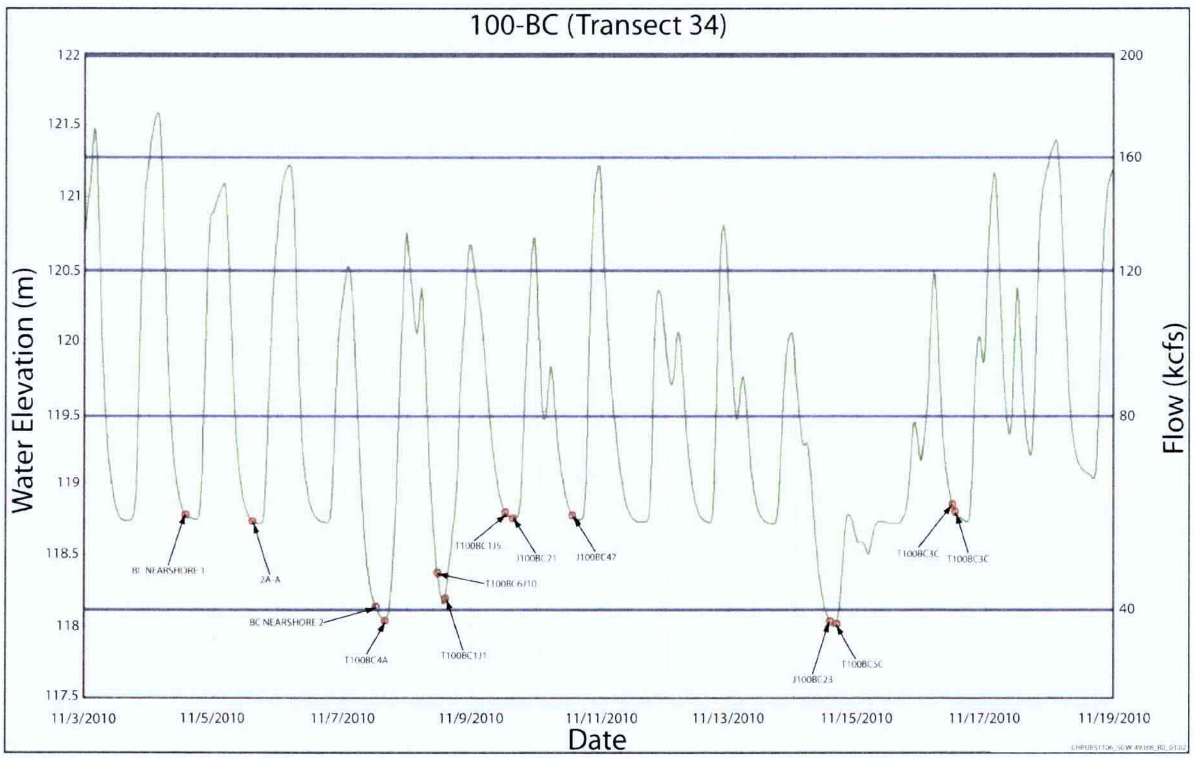

Figure 3-2. River Level Fluctuations during the November 2010 100-BC Pore Water Sampling Event

During collection of the duplicate sample from station T100BC3C, conductivity increased from 174 to 232 µS/cm (Figure 3-3). The duplicate sample was collected immediately after the parent sample, so the total volume at this site was two times the volume of all other sites, except the site where the split sample was taken (J100BC47). This is noteworthy because some sites have illustrated increases in the conductivity as the sample volume increased, whereas most had relatively stable conductivity during the sample collection event. Staff attempted to collect a third sample to serve as a more representative (high conductivity) duplicate to the second sample, but the site did not yield enough water.

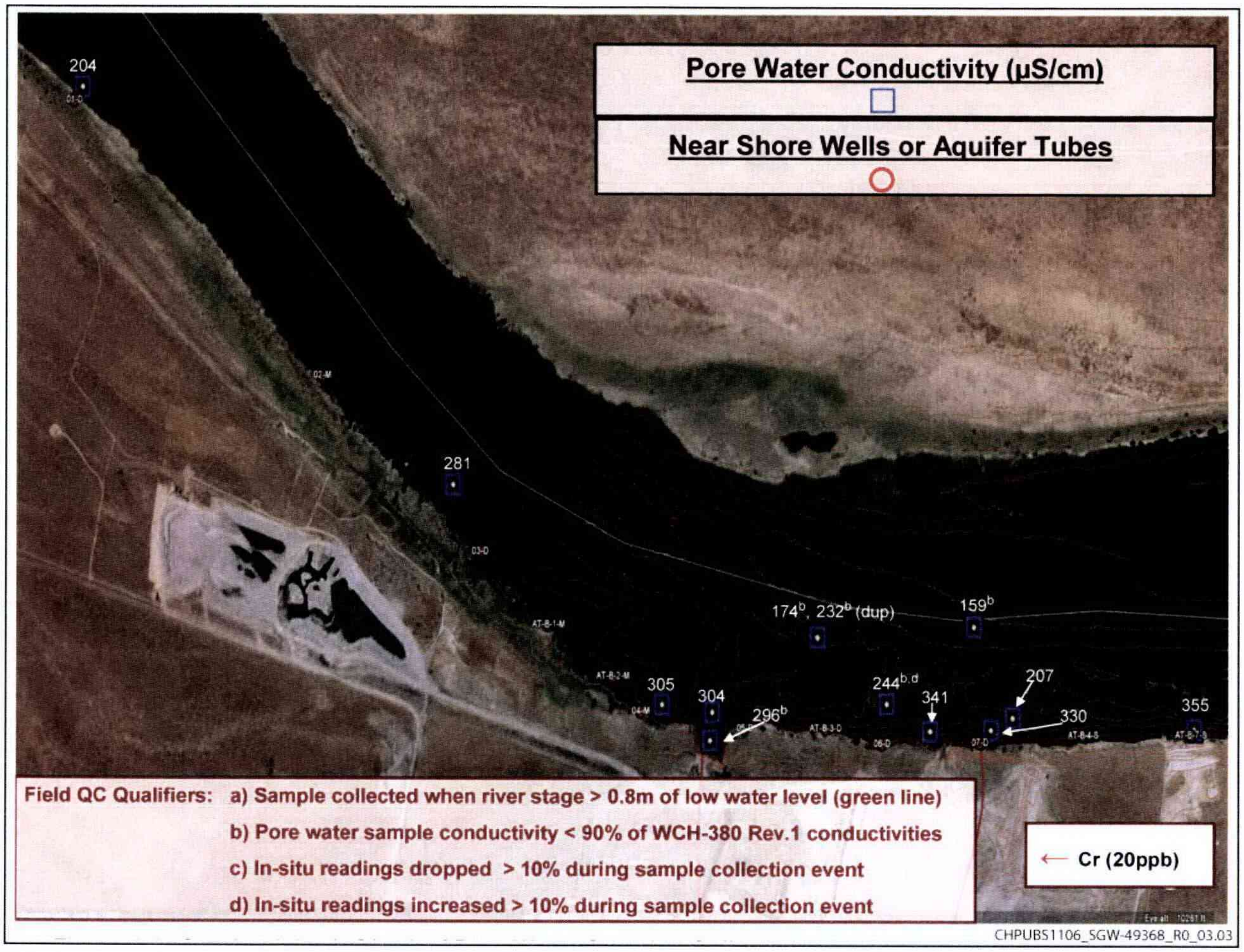

Figure 3-3. Conductivity (µS/cm) of Pore Water Samples Collected near 100-BC during November 2010

During the sample collection event, three of the twelve stations exhibited >1 percent increase in conductivity (Table 3-4). Excluding the duplicate station (J100BC47), only one station (J100BC21) showed a conductivity increase of more than 10 percent during sampling. Possibly, the large volume of water sampled before it finally stabilized at these four sites may have resulted from the lag time from recent high (nearly 2 m [6 ft]) river stage cycles that were occurring each day during the current sampling event. The decision to collect pore water samples at four of the ten stations where pore water conductivity was <90 percent of the prior sampling events (T100BC1J1, J100BC21, T100BC5C, and T100BC3C) was made after field crews made several attempts and were unable to locate higher conductivity readings in the immediate vicinity (within ~15 m [50 ft] radius) of the established station.

Table 3-4. Sample Volumes and Change in Conductivity during Sample Collection

Station Identification	Volume (mL)	November 2010 Change in Conductivity during Sample Collection (Percent)
2A-A	600	0.0
J100BC21	560	12.1
J100BC23	600	0.0
J100BC47	800	0.8
T100BC1J1	575	0.3
T100BC1J5	600	-0.3
T100BC3C	550	3.9
T100BC3C DUP*	550	4.8
T100BC4A	600	0.3
T100BC5C	550	-6.6
T100BC6J10	600	0.6
NEARSHORE 1	700	5.3
NEARSHORE 2	600	-0.4

* Conductivity increased 33 percent between parent sample and duplicate.

3.2 Hexavalent Chromium Concentrations

Hexavalent chromium was not detected in the upstream reference pore water samples but was detected at five of the ten established stations sampled near 100-BC during November 2010 (Figure 3-4; Table 3-2). The highest Cr(VI) concentration (13.6 μg/L) was measured in a pore water sample collected at station J100BC47, which is directly offshore from waste site 128-B-3. This waste site was not fully remediated because part of it is beyond the water line. The other two Cr(VI) concentrations above 10 μg/L (both 12.6 μg/L) were generally proximal to the 100-BC outfall structure (Figure 3-4) remediation sites. Hexavalent chromium concentrations were measured above the analytical detection limit in the parent and duplicate sample collected at station T100BC3C at 2.3 and 6.9 μg/L, respectively. The ~5 μg/L increase in Cr(VI) concentration measured in the duplicate sample collected at station T100BC3C corresponded to a ~60 μS/cm increase in conductivity change at that location (Figure 3-3). Station 2A-A was the only other station where Cr(VI) (4.4 μg/L) was measured above the 2.0 μg/L detection limit (Figure 3-4) during November 2010.

3.3 Quality Control

This section summarizes results of QC sampling in November 2010.

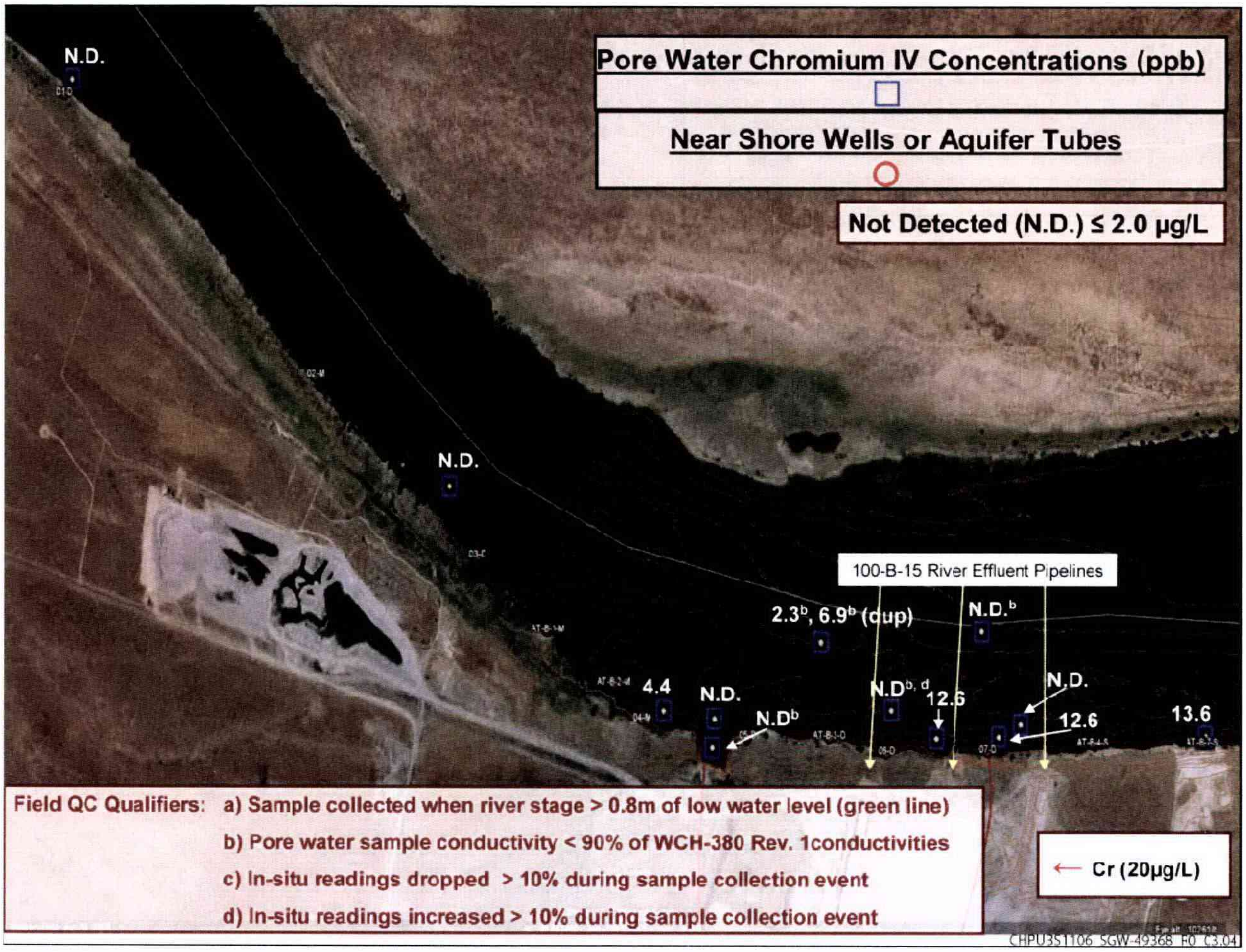

Figure 3-4. Hexavalent Chromium Concentrations in Pore Water Samples Collected near 100-BC during November 2010

3.3.1 Field Duplicates

In duplicate samples from station T100BC3C, Cr(VI) concentrations were reported at 2.3 and 6.9 µg/L. For routine Hanford Site groundwater monitoring, the accepted QC protocol is to evaluate duplicate results only when at least one of the sample results is greater than five times the method detection limit (MDL), because analytical methods are less precise at the low end of their detection range. Both of the results for the duplicate pair from station T100BC3C were less than five times the MDL (2 µg/L).

Total chromium was reported at 15.8 and 8.99 µg/L in duplicate samples from station T100BC3C in November 2010. The MDL was 1 µg/L, so both results were greater than 5 times the MDL. The relative percent difference (RPD) is 55 percent, which is greater than the 20 percent precision generally acceptable.

The difference in chromium concentrations may relate to the fact that when the duplicate was collected, the conductivity had increased significantly. Thus, the samples were not true duplicates.

3.3.2 Split Sample

Two laboratories analyzed samples from station J100BC47 for total chromium and Cr(VI). The Cr(VI) concentrations were reported at 10 and 13.6 µg/L, yielding an RPD of 30.5 percent, which is greater than the 20 percent precision generally acceptable to the project. Total chromium was reported at 14.5 and 15.1 μg/L, with an RPD of 4 percent, which is within acceptance criteria.

3.3.3 Comparison of Total and Hexavalent Chromium

Although not intended as QC samples, comparison of total chromium and Cr(VI) results provides an extra check on data. Dissolved chromium in Hanford Site groundwater is virtually all hexavalent (WHC-SD-EN-TI-302, *Speciation and Transport Characteristics of Chromium in the 100-D/H Areas of the Hanford Site*). Results of filtered total chromium analyses are analogous to Cr(VI) (Appendix C of DOE/RL-2008-01). Total chromium in unfiltered samples might be higher than Cr(VI) results because of possible inclusion of particulate chromium. Total chromium results from November 2010 generally confirmed the Cr(VI) results (Table 3-2).

3.3.4 Equipment Blank

Equipment blank results were below detection limits for total chromium and Cr(VI).

3.4 Deviations from the Sampling and Analysis Plan

No deviations from the SAP (DOE/RL-2009-44) occurred during this sampling event. All pore water samples were collected when river levels were ≤0.8 m (2.6 ft) above the low water mark (i.e., the green line) as prescribed in DOE/RL-2009-44.

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4 Discussion

This chapter provides interpretation of the 100-BC pore water sampling results. It compares the November 2010 sampling results to previous results and considers alternative explanations for changes in Cr(VI) concentrations. Statistical comparisons of pore water and groundwater are consistent with Cr(VI) in 100-BC pore water originating from 100-BC groundwater. The most likely explanation for observed decreases in pore water Cr(VI) concentrations is passage of a Cr(VI) pulse. Alternative explanations for the apparent decrease include changes in river stage, changes in sampling penetration, differences in sample volume, or QC problems. However, none of these explanations is supported by the data, as described in this chapter.

4.1 Comparisons to Previous Pore Water Sampling Events near 100-BC

The Cr(VI) concentrations in November 2010 were lower than concentrations measured during previous sampling events (Table 3-2; Figures 4-1 and 4-2). During November 2010, five of the ten established pore water stations had detectable chromium levels, compared with ten of ten[5] in the fall of 2009 and six of ten in January/February 2010. The three highest Cr(VI) concentrations measured during November 2010 were between 12.6 and 13.6 µg/L, whereas the highest Cr(VI) concentrations measured during 2009 were between 80 and 112 µg/L.

Pore water Cr(VI) concentrations decreased at all ten established stations between the fall of 2009 and January/February 2010. Of the nine stations sampled in both January/February 2010 and November 2010, Cr(VI) concentrations decreased at four stations, remained virtually unchanged in four stations, and increased in one station.

In areas of groundwater upwelling, pore water samples represent a mix of groundwater and river water. Lower Cr(VI) concentrations would be expected if sample conductivity was low (i.e., if the sample contained more river water than groundwater). Table 3-2 shows the conductivity values measured in the pore water samples, and footnotes indicate which samples were collected when significantly lower conductivity was measured compared with prior pore water sampling events. Section 4.3 discusses whether sample dilution (as reflected by conductivity) explains the apparent decrease in Cr(VI) concentrations among the three sampling events.

Figure 4-3 illustrates river stage during the three sample events. Average river stage was highest (119.6 m [392.4 ft]) during the middle sampling event (January/February 2010). Average river stage was lowest during fall 2009 (119.2 m [391.1 ft]), and was higher in November 2010 (119.5 m [392.1 ft]). Daily fluctuations also were greater in November 2010 (approximately 2 m [6.5 ft]), compared to 1 m (3.3 ft) in fall 2009.

4.2 Comparison of Chromium in Pore Water to Groundwater

One possible explanation for the anomalously high Cr(VI) concentrations in 100-BC pore water in fall 2009 is that it derived from a source other than 100-BC groundwater. No upstream pore water samples were collected in fall 2009, but there are no known sources of Cr(VI) contamination upstream of or across the river from 100-BC. An in-situ source of Cr(VI) (e.g., from sediment) is another potential, but unlikely, source since Cr(VI) is highly soluble.

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[5] Not all of the data from the fall 2009 or February 2010 sampling events are evaluated here. Only data from stations that were sampled again in November 2009 are considered.

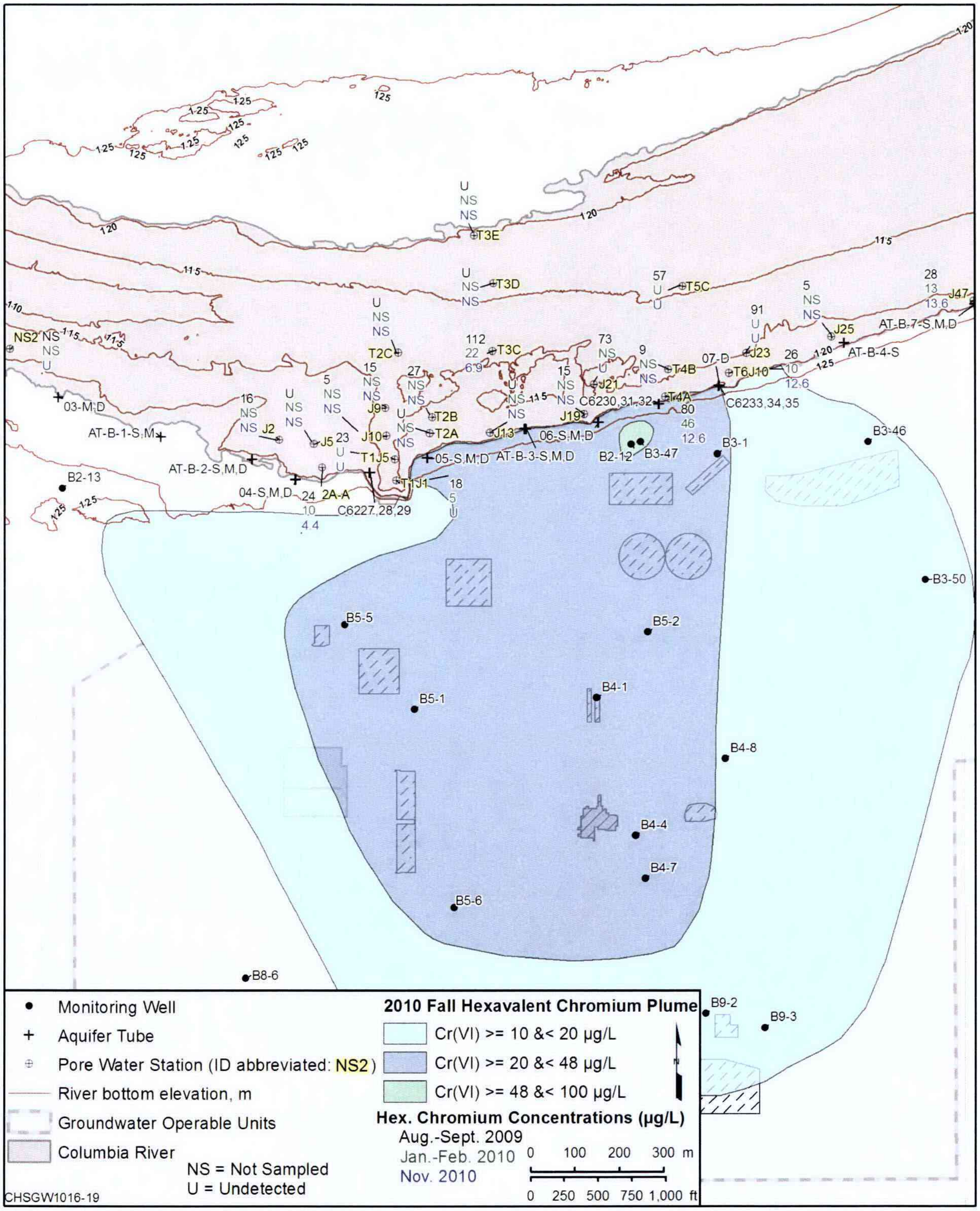


Figure 4-1. Hexavalent Chromium Concentrations from Three Pore Water Sampling Campaigns at 100-BC, with 2010 Groundwater Contaminant Plume Map

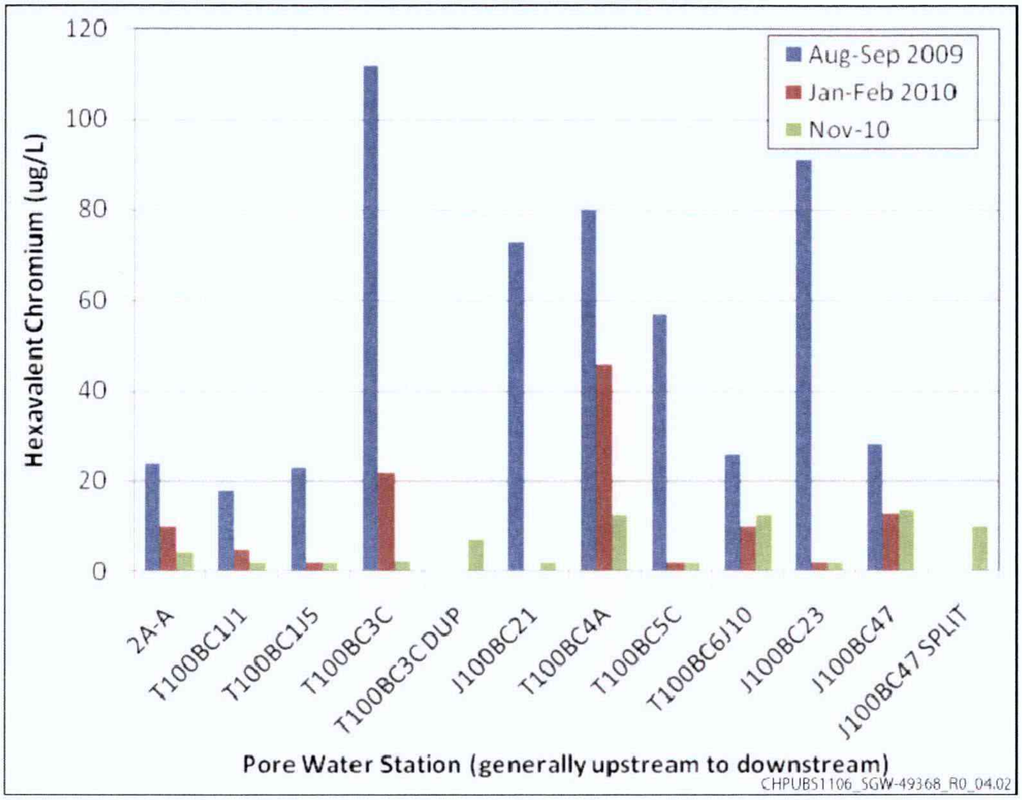


Figure 4-2. Hexavalent Chromium Concentrations in 100-BC Pore Water, August/September 2009, January/February 2010, and November 2010

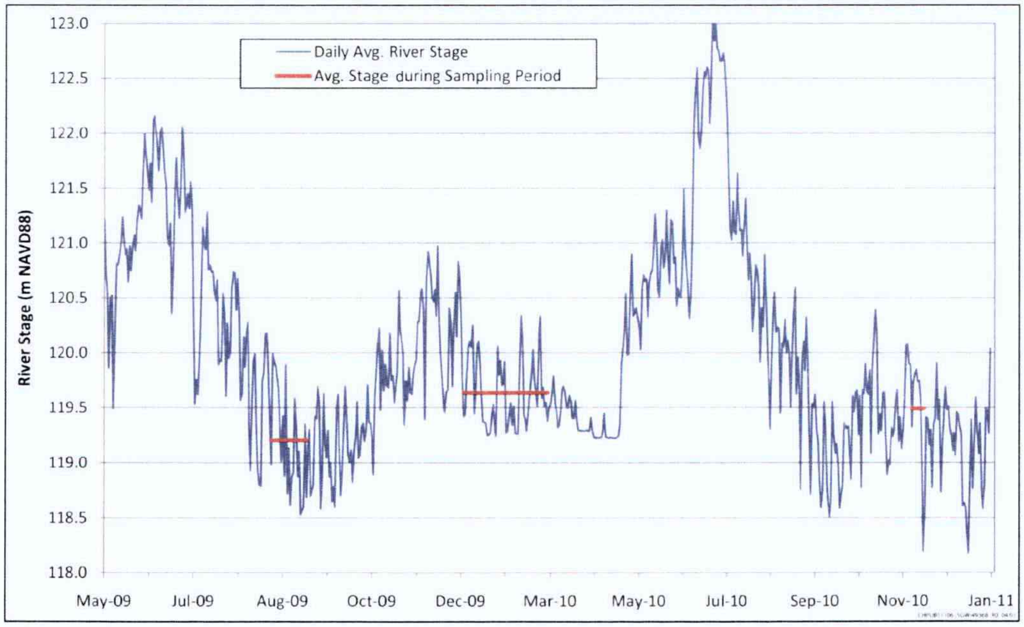


Figure 4-3. River Stage at 100-BC during Three Pore Water Sampling Events

Statistical analyses compared Cr(VI) in each of the three pore water sampling events to that in 100-BC groundwater. Because migration rates for groundwater to pore water are unknown, comparing pore water samples to groundwater samples at any specific time may be unrealistic. Therefore, average Cr(VI) concentrations over the previous five years (2006 through 2010) were used for the groundwater comparisons. For most wells, Cr(VI) concentrations were relatively stable over that time period, so the five-year averages are representative. Table 4-1 lists the results of the statistical comparisons.

Table 4-1. Statistical Comparisons of Groundwater and Pore Water

Parameter Date	T-Test	Mann-Whitney W Test
Chromium Aug/Sep 2009	0.00076544	0.00955187
Conductivity Aug/Sep 2009	0.0643894	0.143186
Chromium Jan/Feb 2010	0.284813	0.102211
Conductivity Jan/Feb 2010	0.0238003	0.0444625
Chromium Nov 2010	0.00289479	0.000485605
Conductivity Nov 2010	0.00120575	0.00329009

In order to determine whether Cr(VI) concentrations and conductivity of groundwater and pore water were drawn from the same population, the t-test and Mann-Whitney W test were applied. The t-test assumes normality of the data and equality of variances, but the Mann-Whitney W test does not. Both tests gave consistent results. Values in the table are the probabilities that pore water and groundwater would be more different than observed if they were drawn from the same population. A value less than 0.05 indicates a significant difference in the data sets at the 5 percent level. Hexavalent chromium in January/February 2010 and conductivity in August/September 2009 were not statistically different in pore water and groundwater. The other sample sets were statistically different.

Statistical differences between pore water and groundwater were greatest in August/September 2009, when Cr(VI) concentrations were significantly elevated in pore water relative to groundwater. A statistical difference was also observed in November 2010, when both Cr(VI) and conductivity were lower in pore water than in groundwater. Statistical differences were weaker or insignificant for the other monitoring event, consistent with variable groundwater dilution.

The spatial distributions of pore water and groundwater are easily seen in Figures 4-4 through 4-9. The spatial distribution is consistent with pore water being river diluted groundwater. Hexavalent chromium concentrations and conductivity decrease with increasing distance from shore. The major exception is the August/September 2009 Cr(VI), which was significantly elevated in pore water relative to groundwater at some locations.

Except for Cr(VI) in August/September 2009, Cr(VI) and conductivity values in pore water are always lower than in groundwater. This is evidenced in the distributions of data in the box-and-whiskers plots shown in Figures 4-10 through 4-12.

The box-and-whiskers plots indicate the distribution of results for the sampling events. Each box represents the 50 percent range of a given data set. The vertical line in each box represents the median for that data set. The red cross in the box represents the mean of the data set (on the right border of the box for Cr(VI) in January/February 2010). The "whiskers" represent the minimum and maximum values without considering outliers. Outliers within 1.5 box widths of the mean are represented by small squares beyond the extent of the whiskers. Outliers farther than 1.5 box widths from the mean are represented by red crosses within the distant small squares. The boxes labeled "CondAve" and "CrAve" represent groundwater results.

The box-and-whiskers plots clearly indicate that, except for August/September 2009, pore water is consistently lower in Cr(VI) and conductivity than 100-BC groundwater. This supports the view that the pore water samples represent river-diluted 100-BC groundwater.

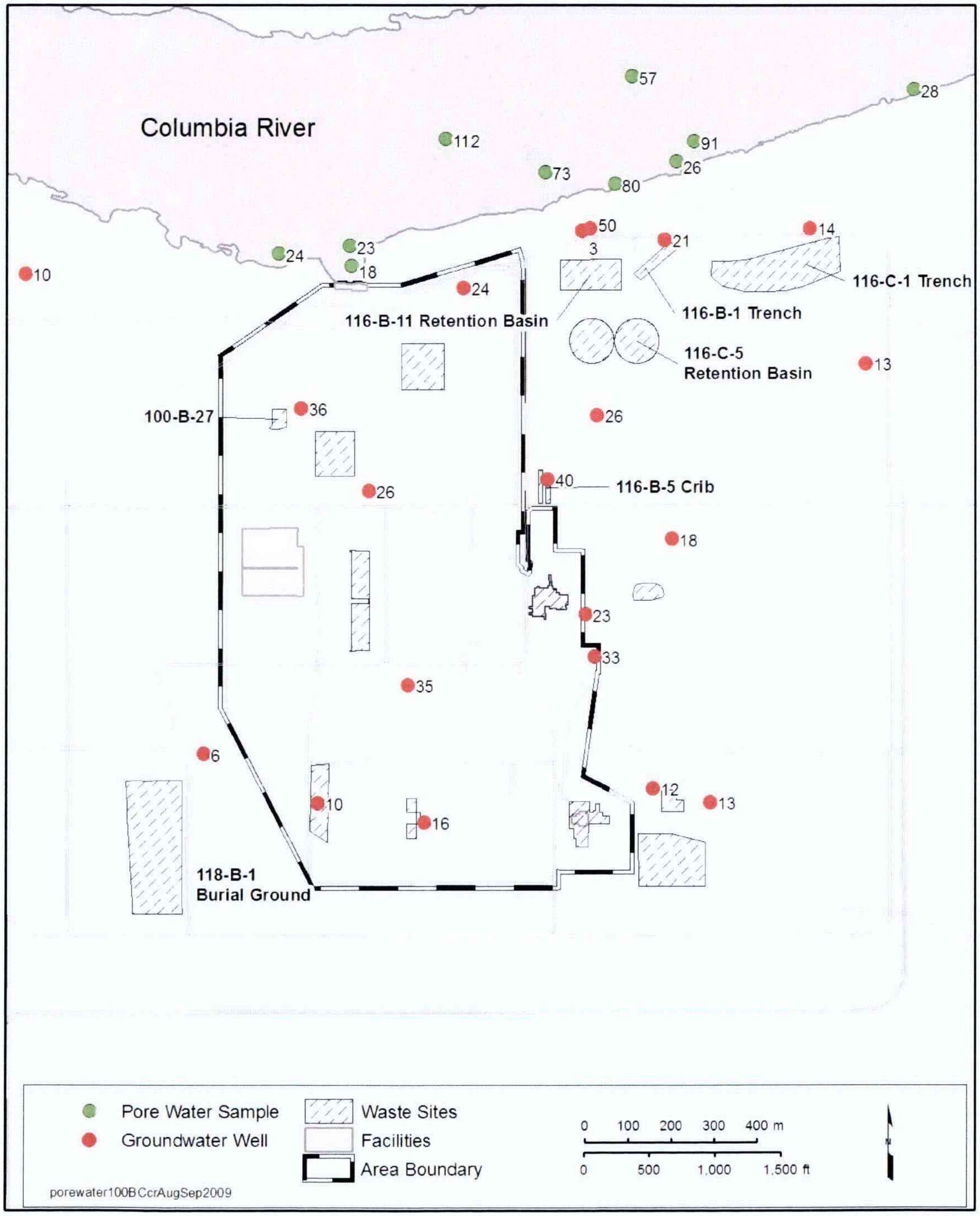


Figure 4-4. Hexavalent Chromium (μg/L) in 100-BC Pore Water (August/September 2009) and Groundwater (2006–2010 Average) Showing Elevated Cr(VI) Concentration in Pore Water

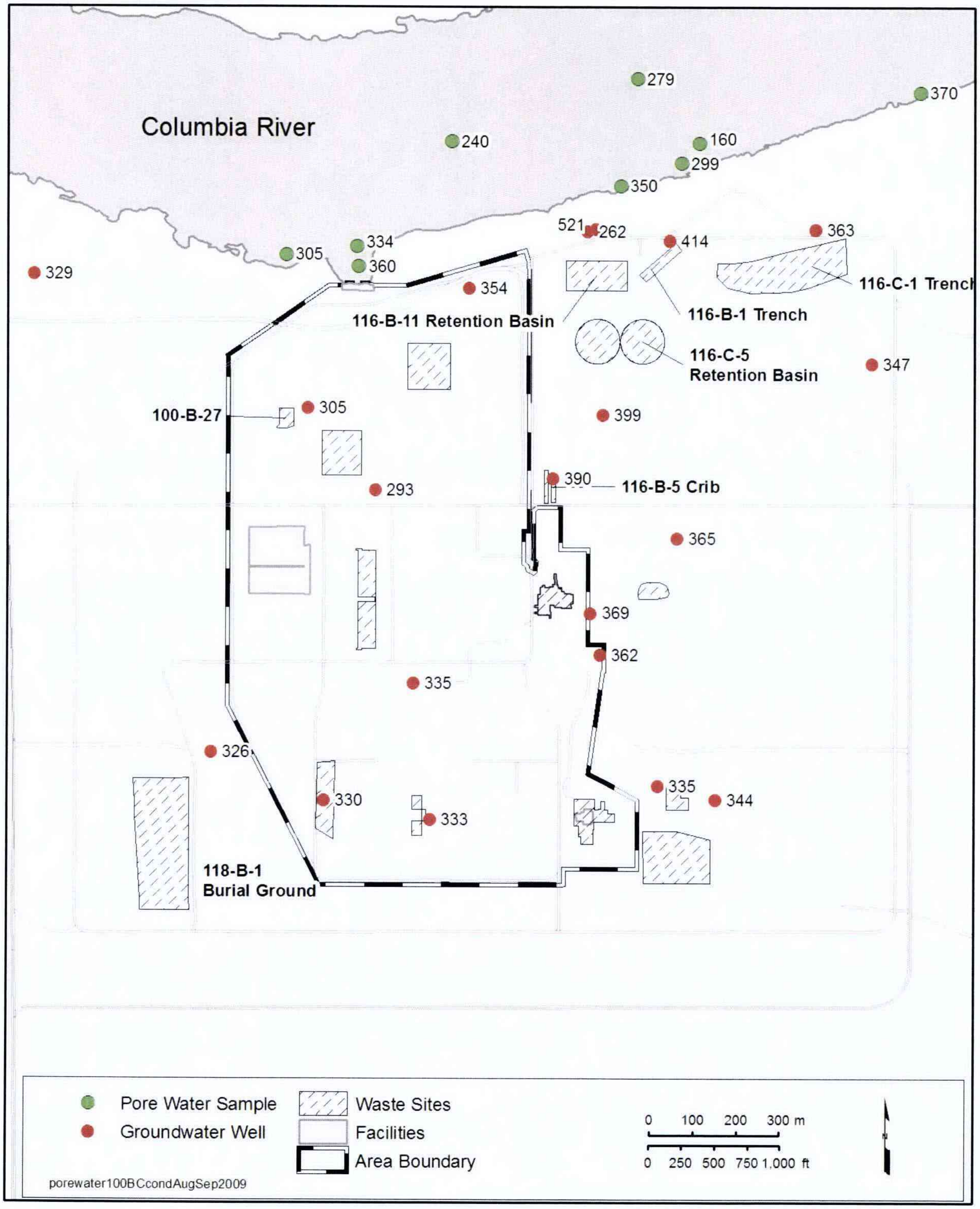


Figure 4-5. Conductivity (µS/cm) in 100-BC Pore Water (August/September 2009) and Groundwater (2006–2010 Average)

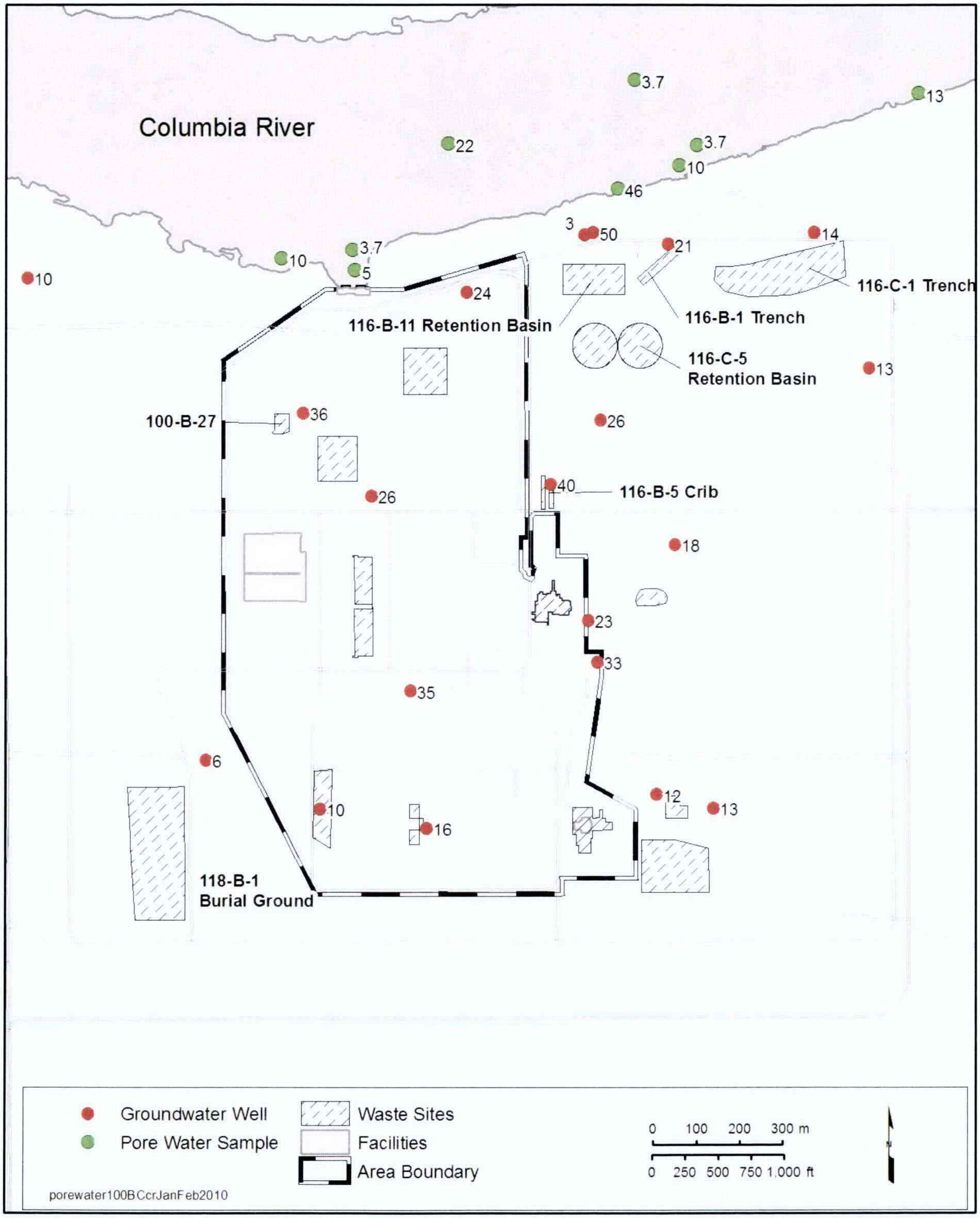


Figure 4-6. Hexavalent Chromium (μg/L) in 100-BC Pore Water (January/February 2010) and Groundwater (2006–2010 Average) Showing Pore Water Consistent with Diluted Groundwater

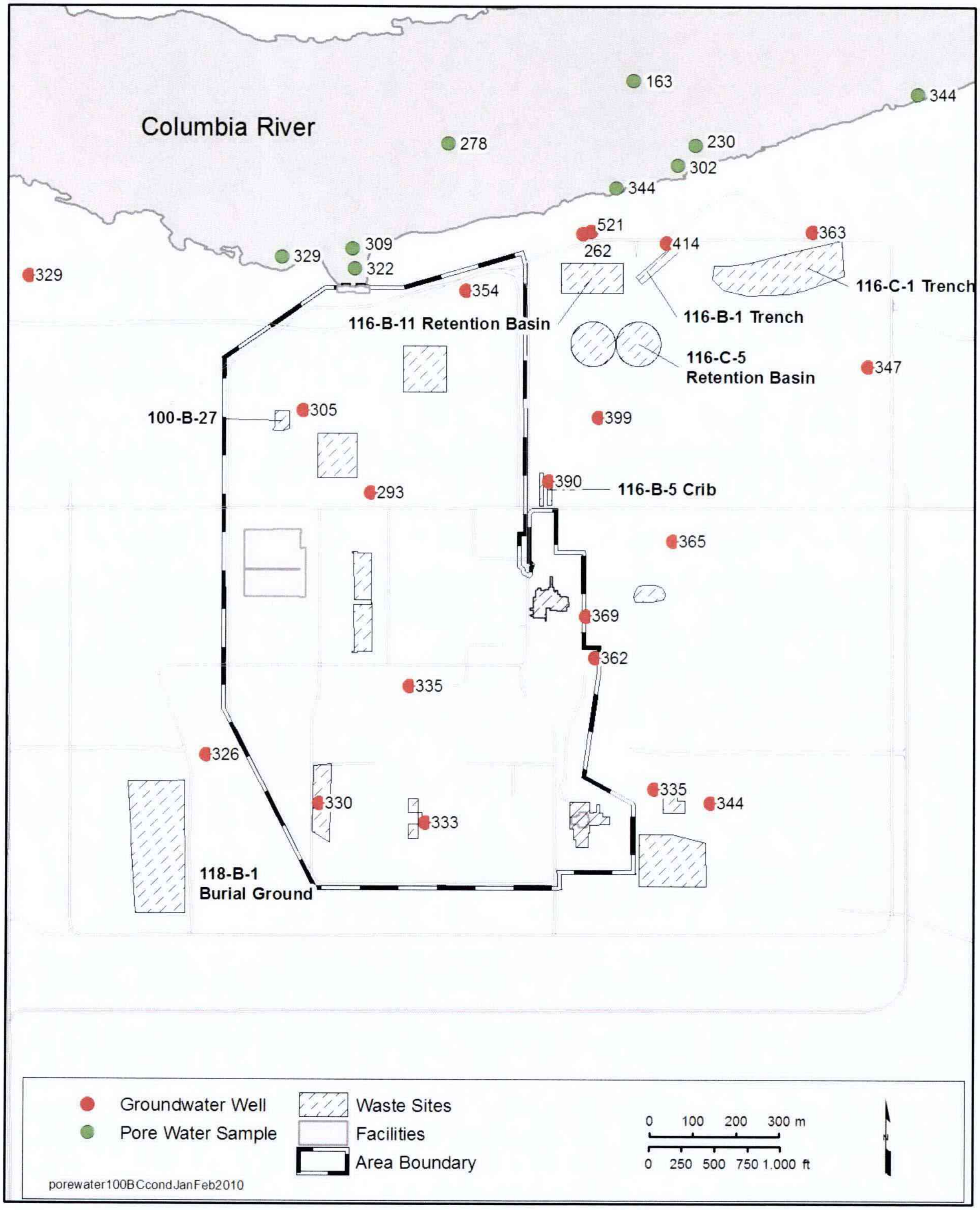


Figure 4-7. Conductivity (µS/cm) in 100-BC Pore Water (January/February 2010) and Groundwater (2006–2010 Average)

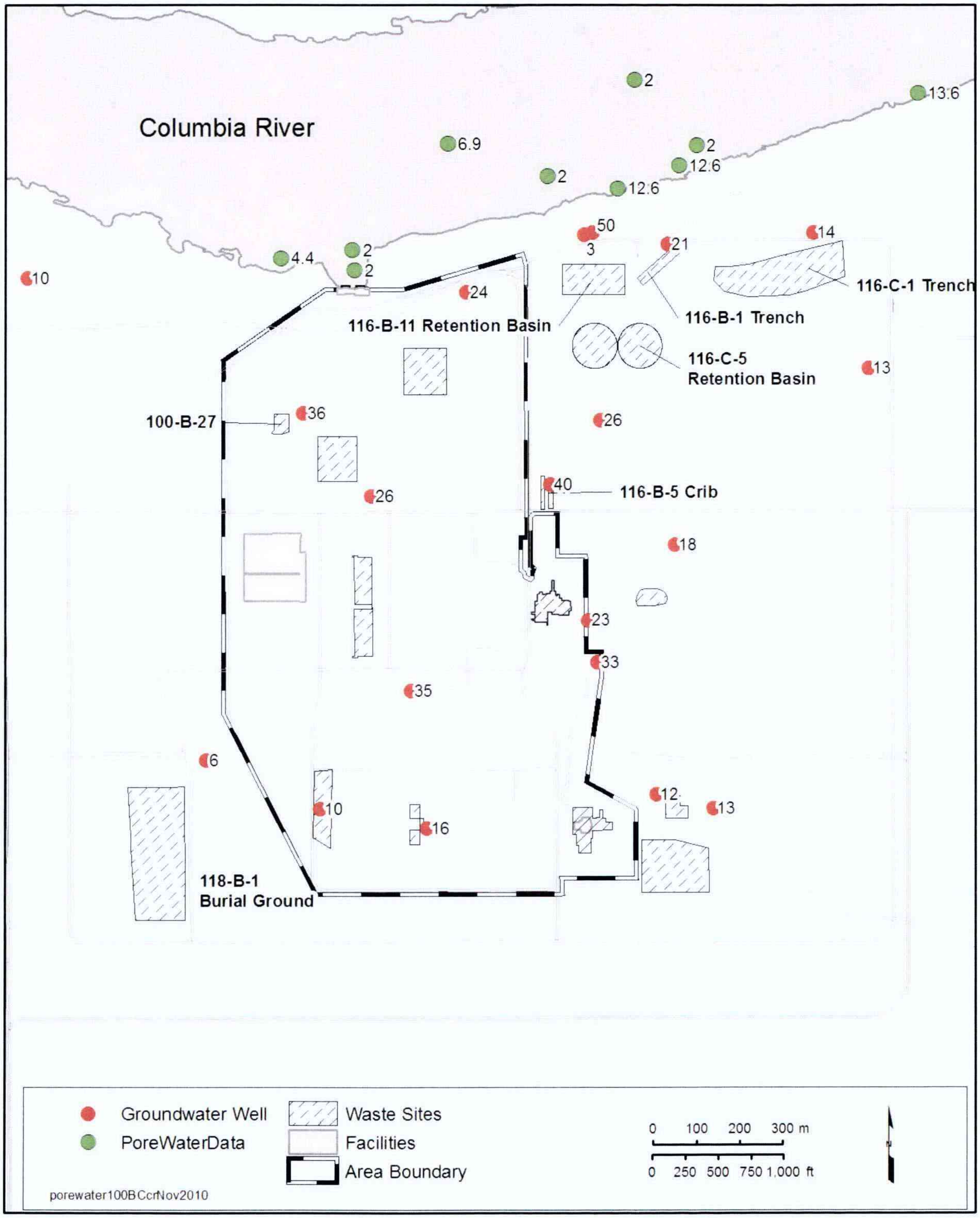


Figure 4-8. Hexavalent Chromium (µg/L) in 100-BC Pore Water (November 2010) and Groundwater (2006–2010 Average) Showing Decreasing Pore Water Cr(VI)

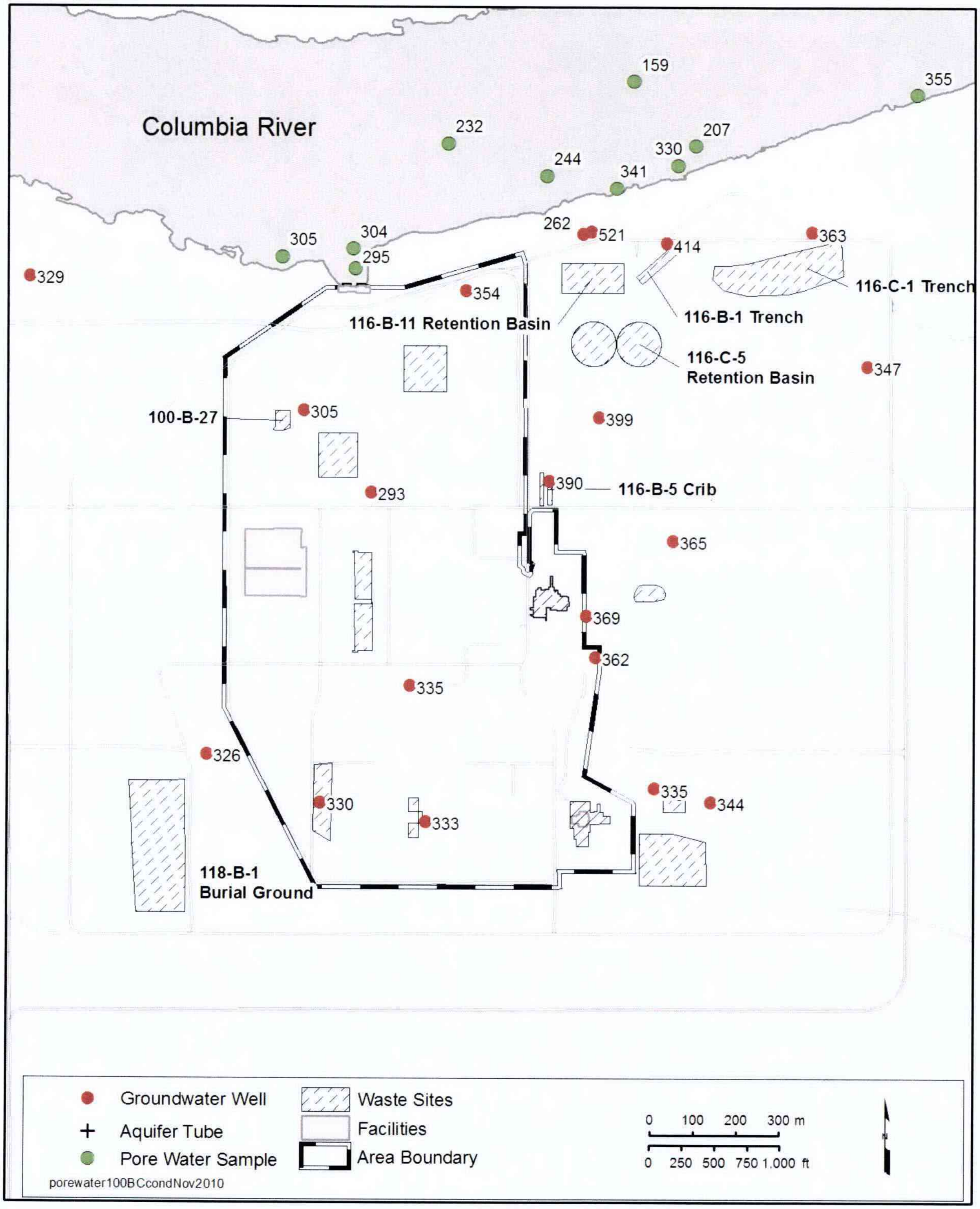


Figure 4-9. Conductivity (µS/cm) in 100-BC Pore Water (November 2010) and Groundwater (2006–2010 Average)

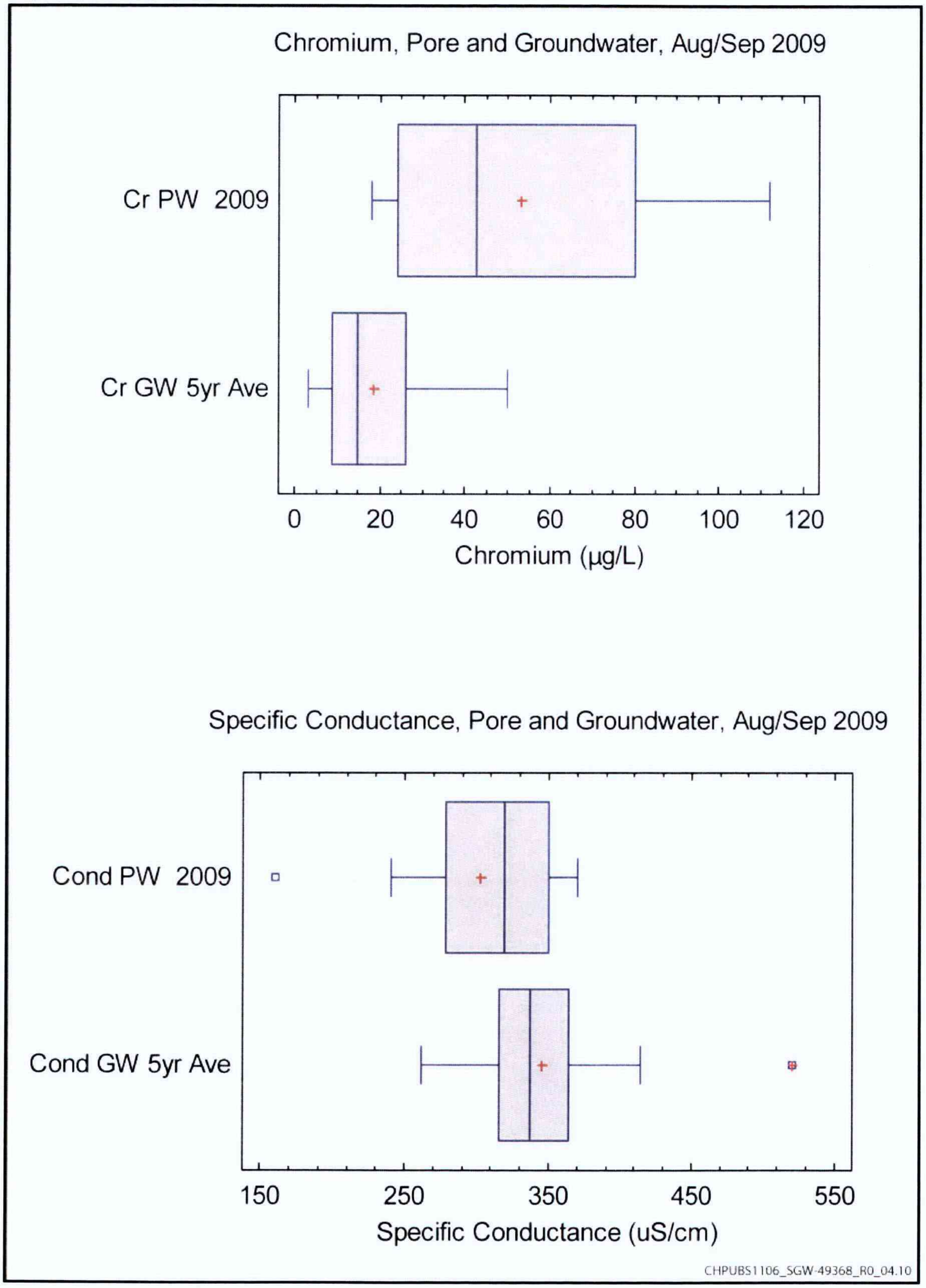


Figure 4-10. Hexavalent Chromium and Conductivity Box-and-Whiskers Plots (August/September 2009)

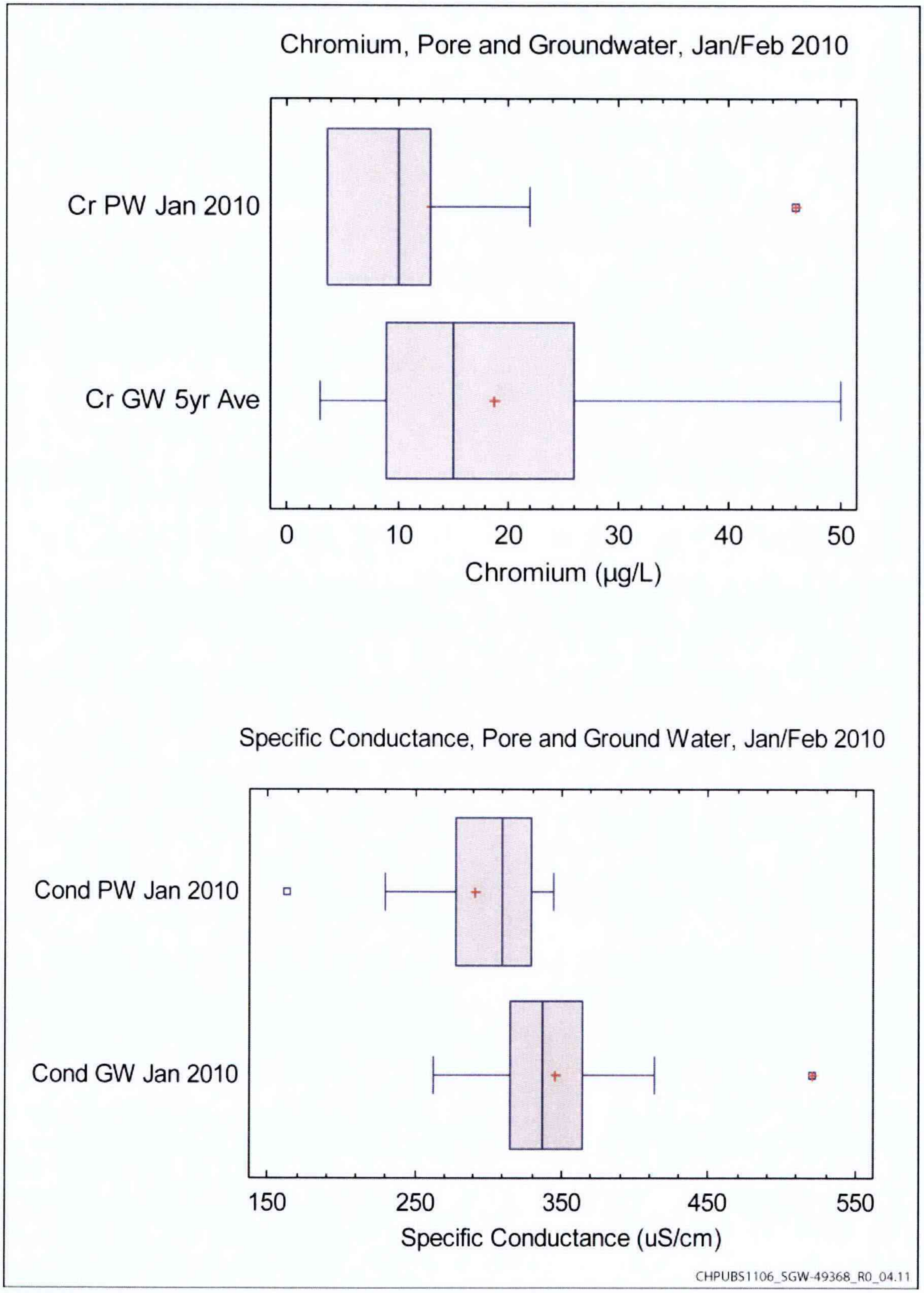


Figure 4-11. Hexavalent Chromium and Conductivity Box-and-Whiskers Plots (January/February 2010)

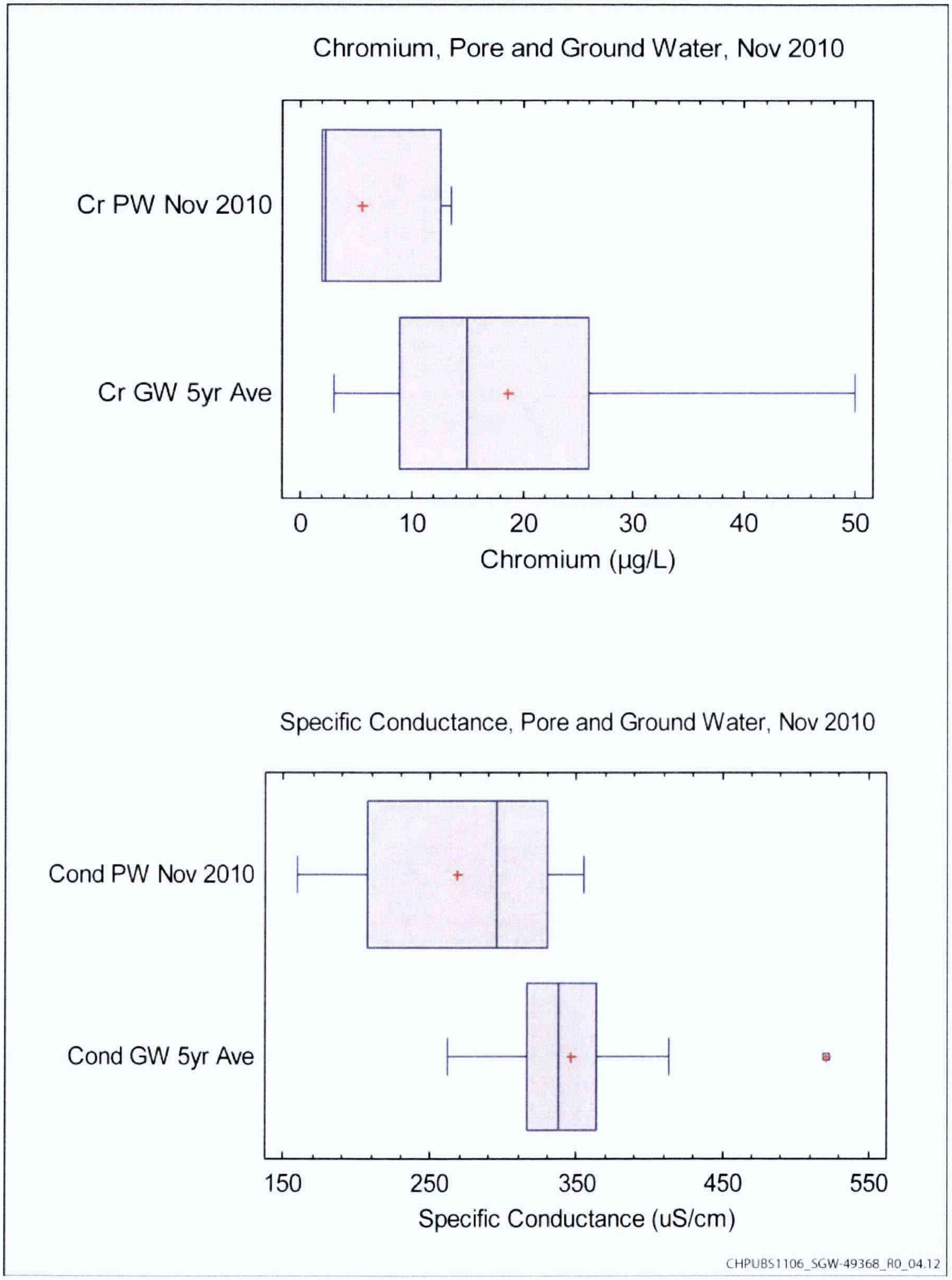


Figure 4-12. Hexavalent Chromium and Conductivity Box-and-Whiskers Plots (November 2010)

4.3 Relationship between Chromium and Conductivity

In concentrations typically seen in 100-BC groundwater or pore water, dissolved chromium has little effect on conductivity. For example, an increase of 100 μg/L of chromium would only change the pore water conductivity by ~2 μS/cm. Other dissolved ions (e.g., sodium, calcium, and bicarbonate) are present in higher concentrations and have more effect on conductivity. Therefore, conductivity is not a good indicator of chromium concentration in groundwater.

The conductivity of pore water is a good indication of the relative amount of groundwater present in pore water. Groundwater in 100-BC has a conductivity ranging from 300 to 400 μS/cm, while river water typically is 150 μS/cm. Thus, greater mixing with river water decreases both conductivity and Cr(VI) concentrations in pore water. This section investigates whether mixing (dilution) can explain the change in Cr(VI) in 100-BC pore water from August/September 2009 to November 2010.

Table 3-2 compares conductivity and Cr(VI) from the three pore water sampling events. The greatest decreases in Cr(VI) concentrations between 2009 and November 2010 occurred at sampling stations T100BC3C, J100BC23, T100BC21, T100BC4A, and T100BC5C. Conductivity did not correspondingly decrease from highs to lows at some of these stations but did at others (Figures 4-13 through 4-16).

The top panel of Figure 4-15 shows an apparently strong correlation between Cr(VI) and conductivity, with an r^2 value of 0.966. The center panel, showing Cr(VI) and conductivity trends, appears to corroborate this interpretation. However, when the conductivity is plotted on a scale more representative of many of the pore water measurements (bottom panel), the correlation is not as apparent. The change in conductivity was only 9 μS/cm (decrease of 2.5 percent) between fall 2009 and November 2010. The change in Cr(VI) concentrations was much greater (decrease of 67 μg/L or 84 percent). Statistical correlation based on just three data points may not represent practical correlation.

If we assume a conductivity change of <10 percent between sampling events can be considered stable, then six of the ten stations repeatedly sampled had conductivities that were stable or increased between fall 2009 and November 2010. Despite the conductivity stability, Cr(VI) concentrations decreased significantly at all ten stations. While some stations exhibited similar Cr(VI) and conductivity relationships, others did not; therefore, a definitive relationship between Cr(VI) and conductivity is not apparent across all sites sampled.

The first plot in Figure 4-17 shows Cr(VI) plotted against conductivity for all pore water samples. There is no correlation between Cr(VI) and conductivity when all the data are considered. Application of the Maximum Normed Residual test determined that the six largest Cr(VI) values (>28 μg/L) were outliers at <2 percent. Removing those values resulted in the weak correlation of higher Cr(VI) with higher conductivity shown in the second plot in that figure.

Plotting the relationship of Cr(VI) and conductivity at each sampling event shows negative correlation in 2009, but weak positive correlations in both 2010 sampling events (Figure 4-18). This lack of a correlation may indicate nonhomogeneous distribution of pore water conductivity. Such nonhomogeneity would be expected, given the nonhomogeneous distribution of Cr(VI) in groundwater. Other variables, such as type of river substrate, may also play a role.

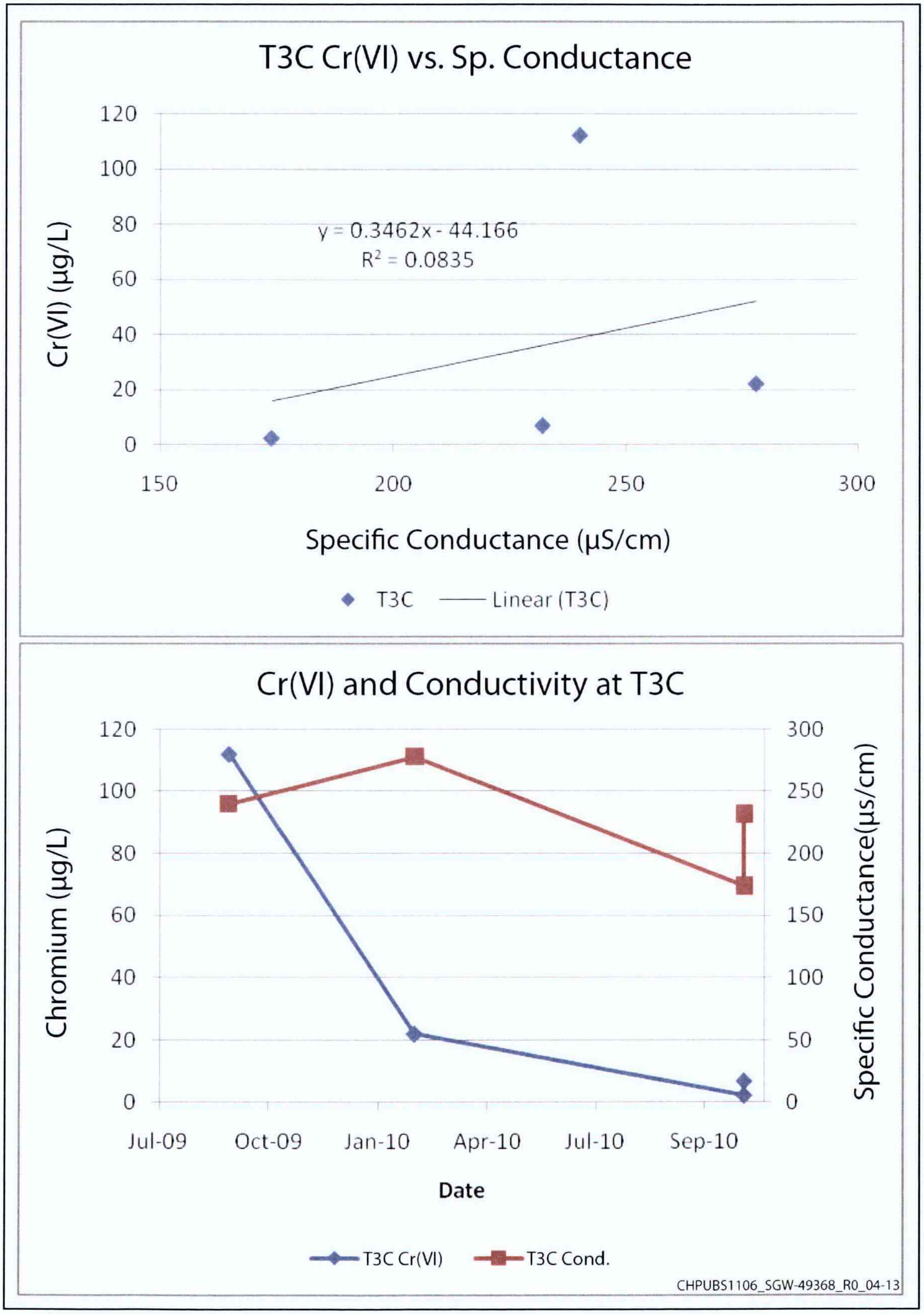


Figure 4-13. Hexavalent Chromium Relative to Conductivity, Station T100BC3C

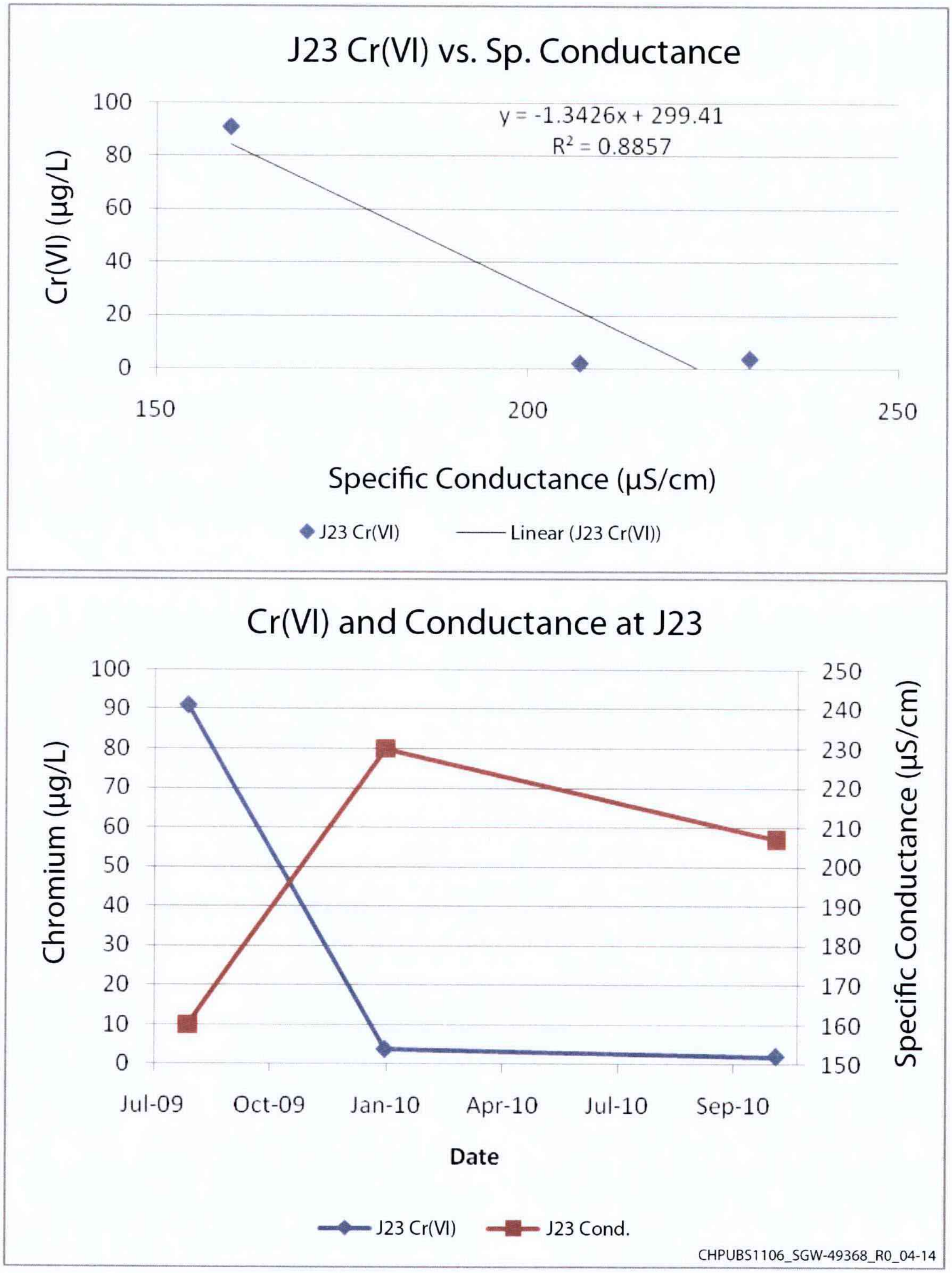


Figure 4-14. Hexavalent Chromium Relative to Conductivity, Station J100BC23

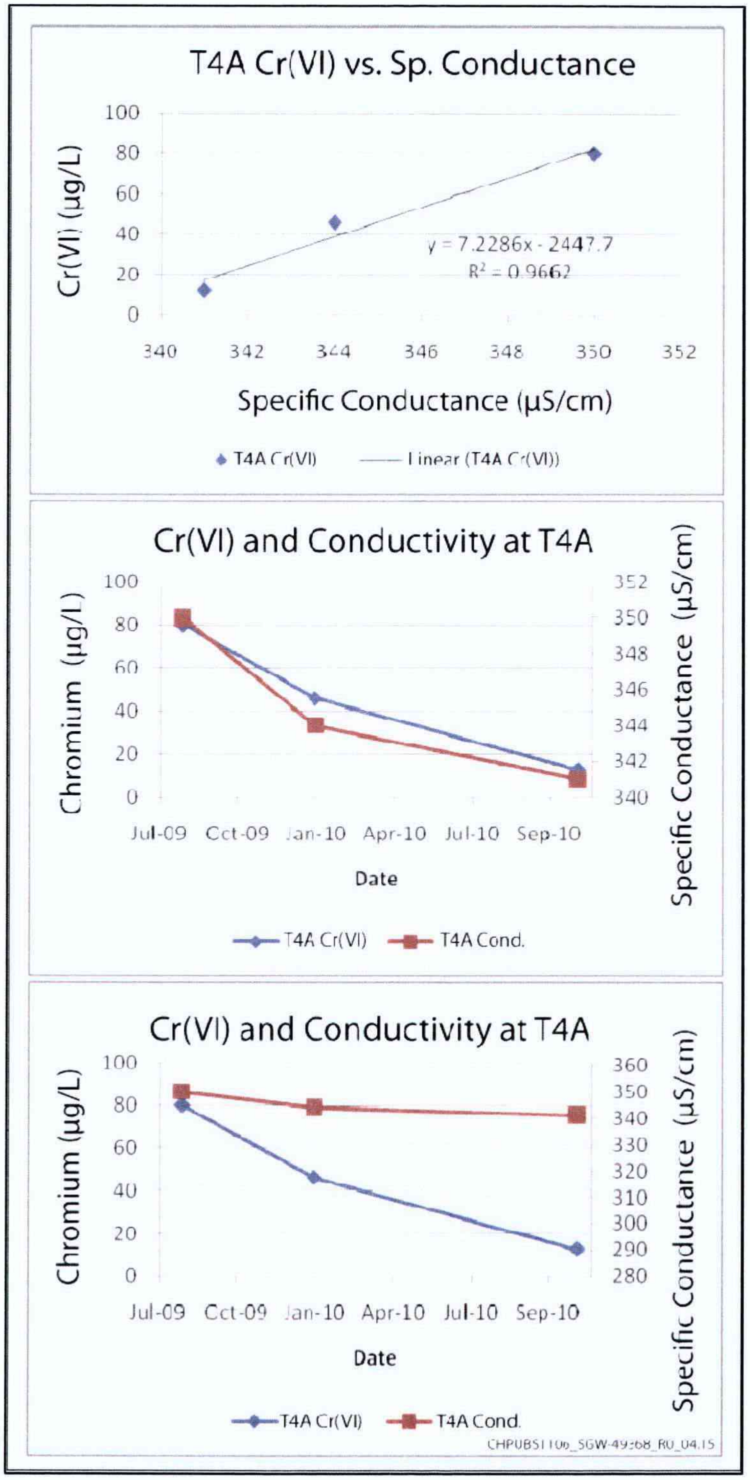


Figure 4-15. Hexavalent Chromium Relative to Conductivity, Station T100BC4A

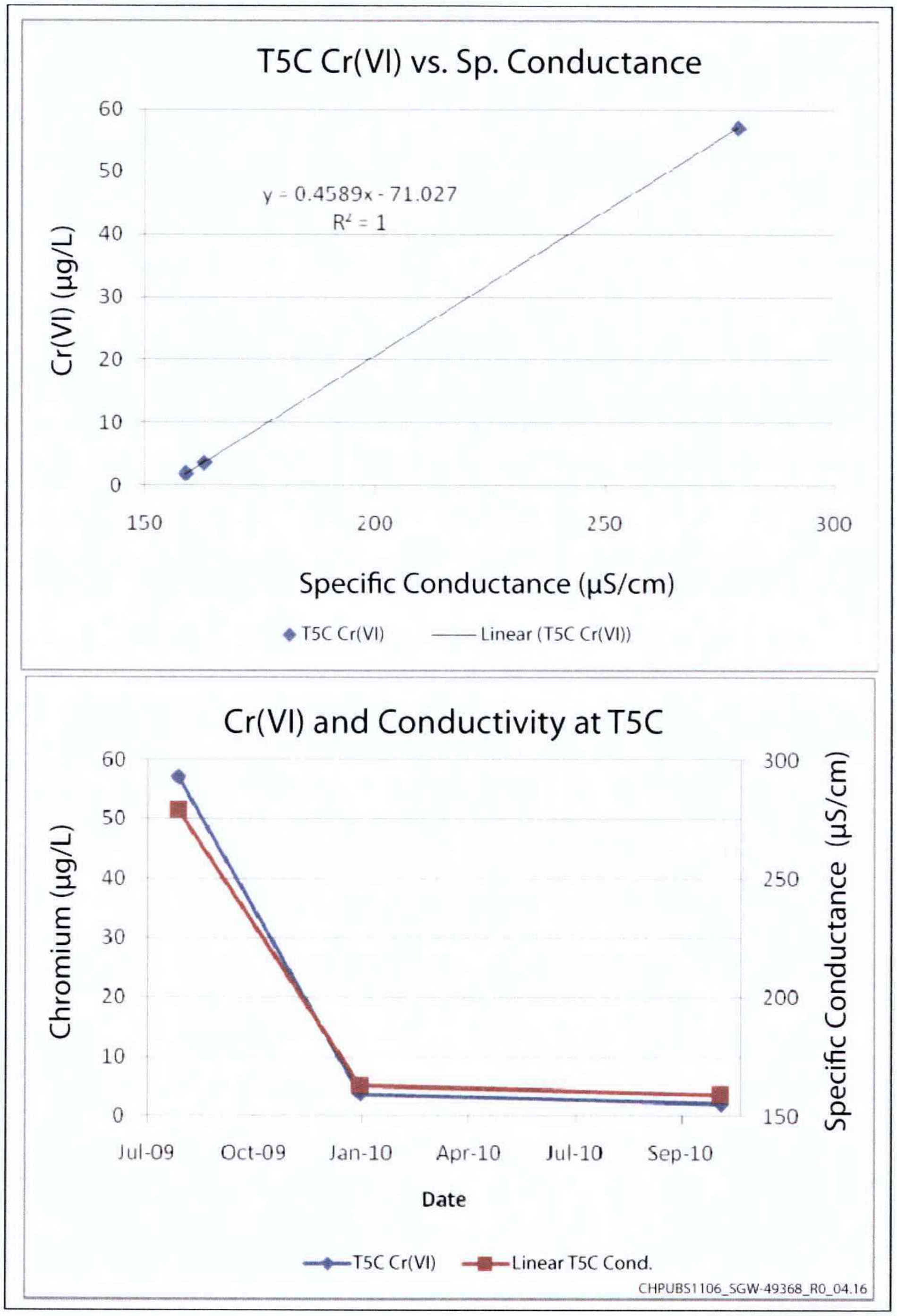
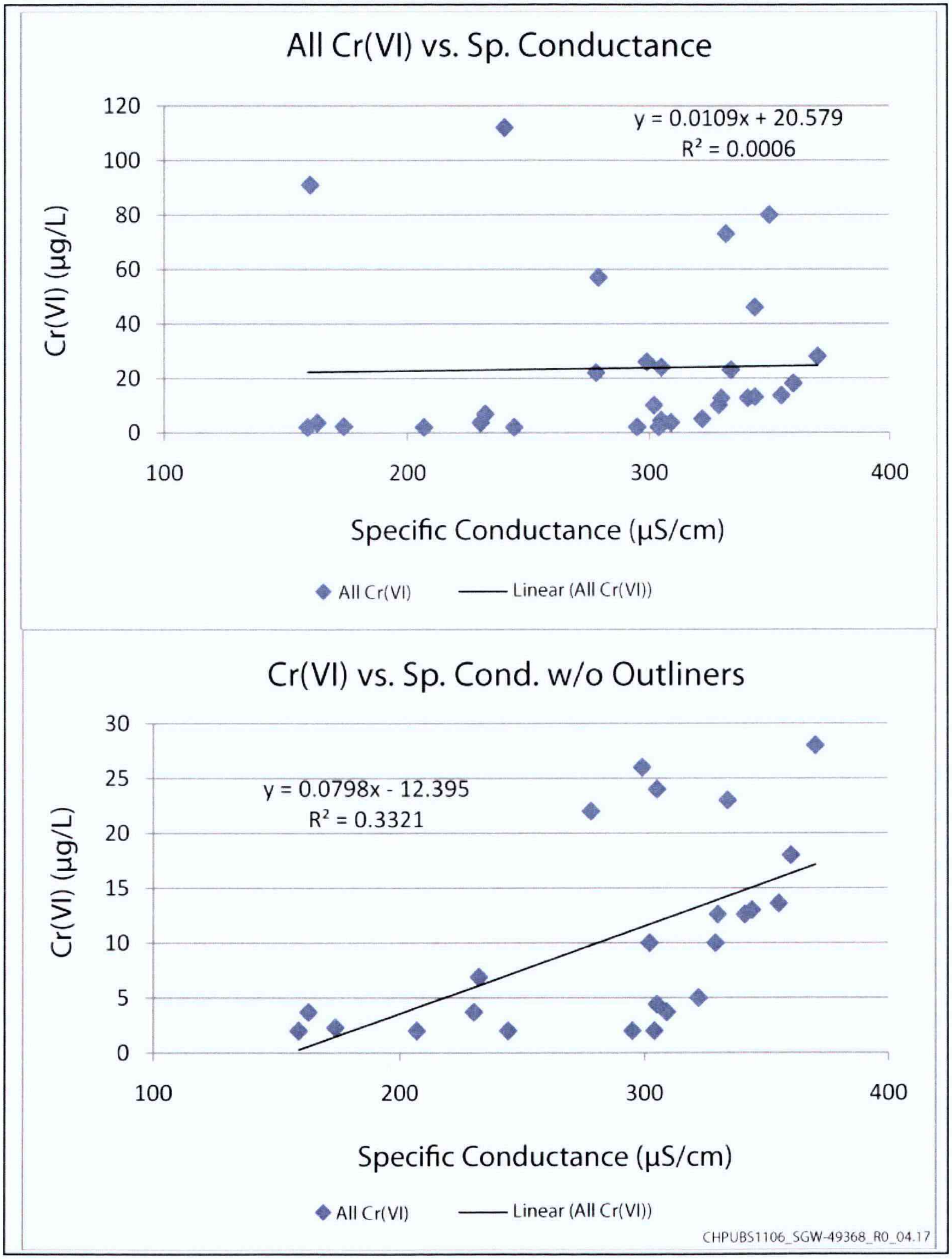


Figure 4-16. Hexavalent Chromium Relative to Conductivity, Station T100BC5C



Note: Top of figure includes all data; bottom of figure excludes outliers (chromium >28 µg/L).

Figure 4-17. Hexavalent Chromium as a Function of Conductivity

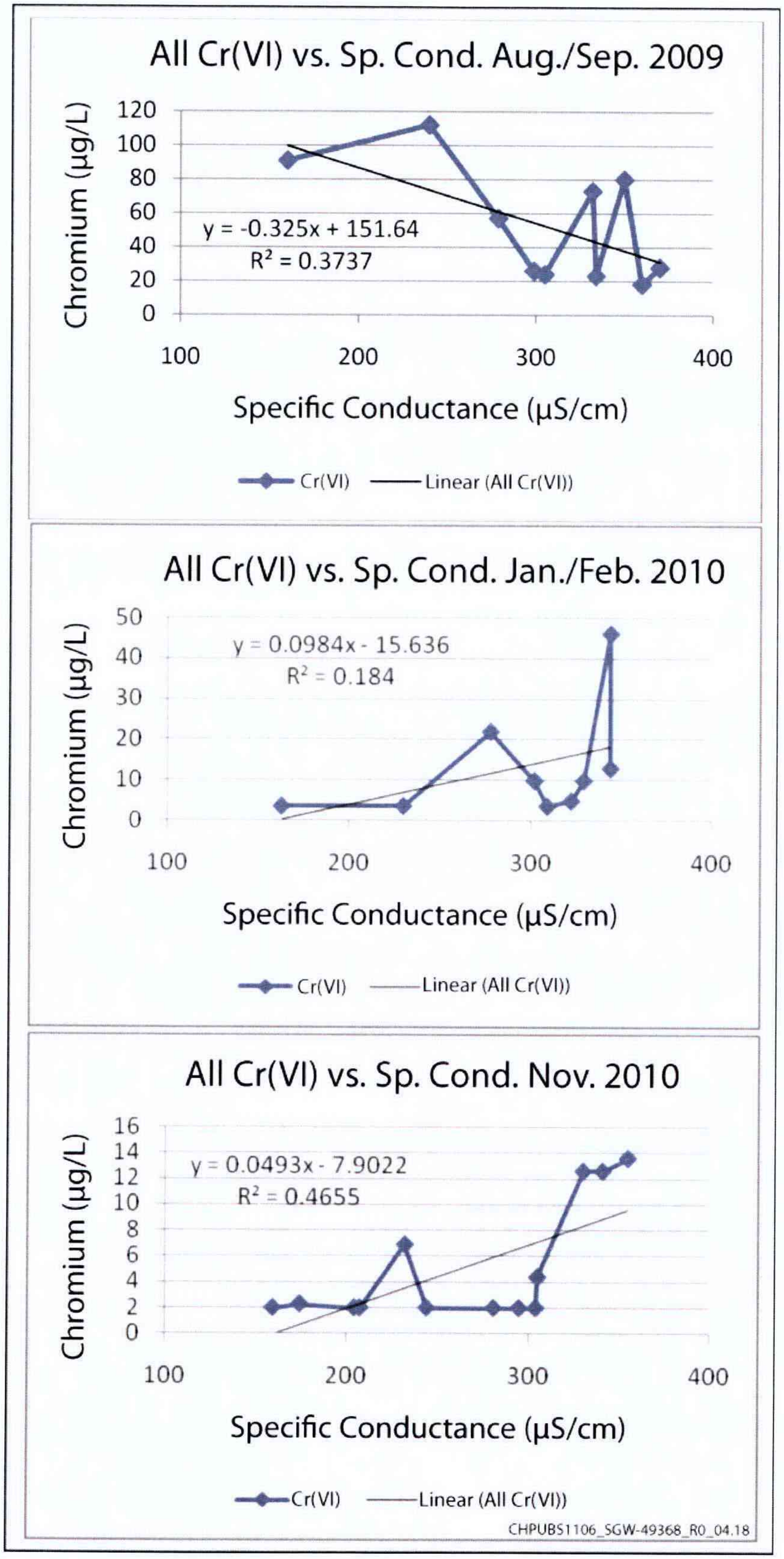


Figure 4-18. Hexavalent Chromium versus Conductivity, Sampling Events

Although some sampling stations showed Cr(VI)/conductivity correlation (Figure 4-16), others did not (Figure 4-19). The change in Cr(VI) concentration at stations T100BC6J10 and 2A-A (Figure 4-19) could not be explained by decreasing conductivity. At both of these stations, Cr(VI) concentrations decreased from ~25 to ~10 µg/L or less between fall 2009 and November 2010. Similar trends were observed at many of the stations. The consistency in the patterns of decrease in Cr(VI), and the common occurrence of elevated Cr(VI) concentrations in fall 2009, suggest that an actual change occurred.

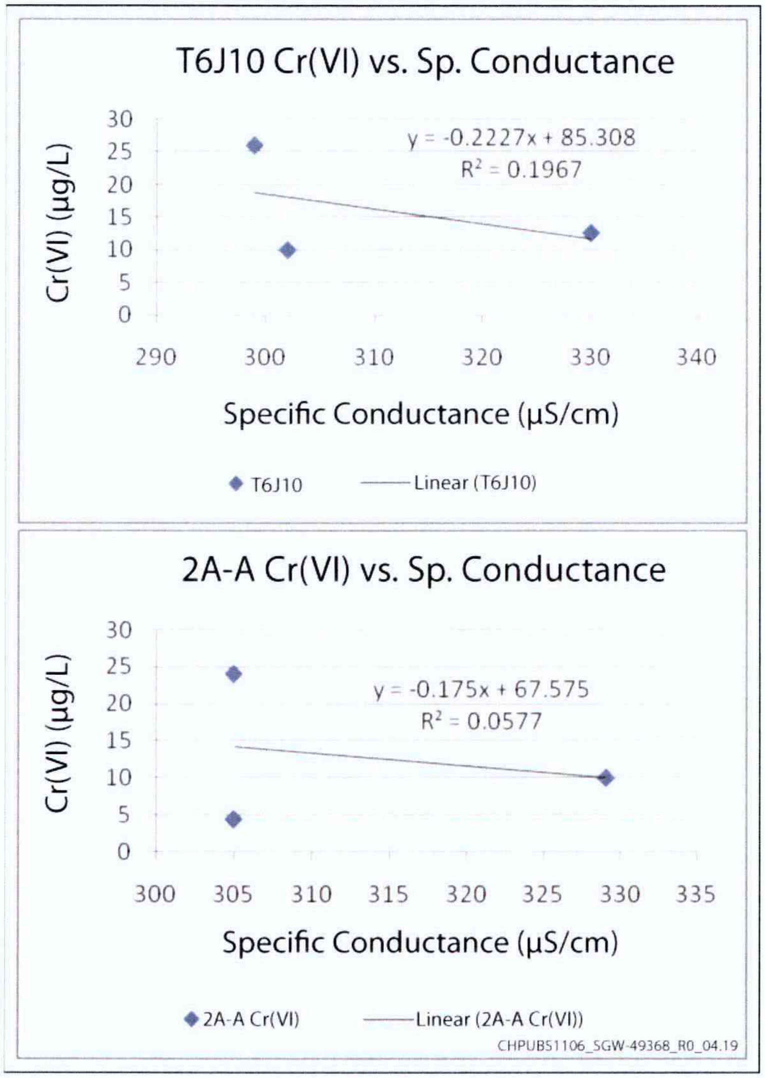


Figure 4-19. Chromium and Conductivity at Stations T100BC6J10 and 2A-A

4.4 Effects of River Stage

All pore water samples collected during this sampling event (November 2010) were taken when river discharges were minimal (<1.7 million L/sec [60,000 ft^3/sec], see Figure 3-2) and when the river stage was less than 0.8 m (2.6 ft) above the low water mark, as prescribed in the SAP (DOE/RL-2009-44). Despite these efforts and some additional time spent repositioning the probe in the general vicinity of the station, lower pore water conductivity measurements were found at seven of the ten established stations during this sampling event. At three of these stations, conductivity was more than 10 percent lower than previously measured at those locations (Table 3-2).

One plausible cause may have been the higher daily river fluctuations that occurred during the November 2010 event compared with the fall 2009 sampling event, when the daily river level fluctuations were typically <1 m (3 ft) and consistently higher concentrations of Cr(VI) were measured (Appendix G of WCH-380). Long-term suppression of relatively high pore water conductivity was also observed in some deep channel regions of the Columbia River during the previous remedial investigation sampling effort (DOE/RL-2008-11). The long-term suppression ceased after more than 48 hours of stable flows during upwelling mapping studies conducted in August 2008 (WCH-380).

4.5 Effects of Sampling Depth (Penetration)

Sample depth may affect Cr(VI) and conductivity by altering dilution effects. As the probe penetrates more deeply and the intake is farther away from the river water, less river water is present to dilute the groundwater, and conductivity would be higher. If the groundwater contains Cr(VI), then Cr(VI) concentrations in the deeper pore water would be higher.

Sample depths varied between 20 and 31 cm (8 to 12 in.). Conductivity tended to be a little higher with sample depth, but the effect was weak (Figures 4-20 through 4-22). In November 2010, Cr(VI) concentrations showed a slight increase with sample depth, but there was little change in Cr(VI) with sample depth during the previous sampling events. Chromium concentrations may not increase with sample depth because not all locations in the river bed lie in the path of Cr(VI) contaminated groundwater. The difference in sample depths (11 cm [4 in.]) may have been insufficient to have a significant impact on Cr(VI) and conductivity levels in the pore samples.

4.6 Effects of Sample Volume

Conductivity increased >1 percent during the November 2010 sampling event for three of the twelve stations (Table 3-4). Prolonged pumping to collect relatively large sample volumes may have affected the overall conductivity. However, the greatest increase in conductivity (12.1 percent) was at site J100BC21, with one of the lower sample volumes (560 mL). The split sample site (J100BC47), with a higher volume of 800 mL, had <1 percent change in conductivity. Conductivity increased modestly during collection of the parent sample at site T100BC3C, and also during collection of the duplicate. However, it increased sharply (33 percent) *between* the parent and duplicate; as previously stated, Cr(VI) did not increase significantly between the parent and the duplicate.

4.7 Micro-Site Differences between Sampling Events

Samplers attempted to place the Trident probe in the same locations during each sampling event. However, measurement error and field conditions may not allow for exactly the same locations. In addition, locations of upwellings likely are not completely constant. The samplers attempted to locate the upwelling by its conductivity signal in a general region to account for this.

4.8 Data Quality

The possibility that data from one or more of the sampling events are grossly unrepresentative is unlikely. QC sampling (e.g., duplicates and blanks) did not indicate systemic problems with data. The fact that elevated Cr(VI) was observed in multiple samples in the fall of 2009 seems to rule out an isolated sampling or laboratory error. Subsequent sampling events had Cr(VI) results generally confirmed by total chromium. The possibility of a sample mixup is remote, since only 100-BC stations were being sampled at the time.

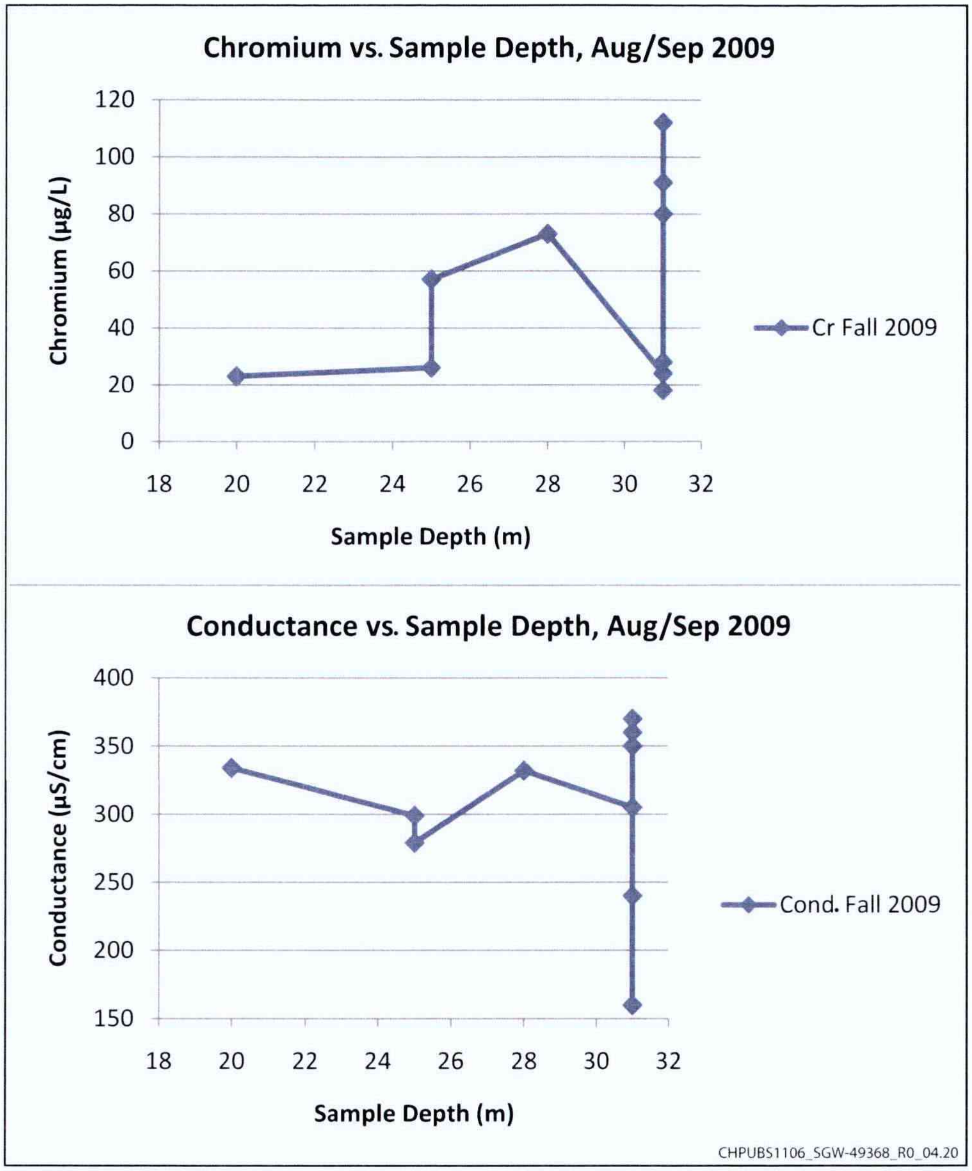


Figure 4-20. Hexavalent Chromium and Conductivity as a Function of Sample Depth (Penetration), Fall 2009

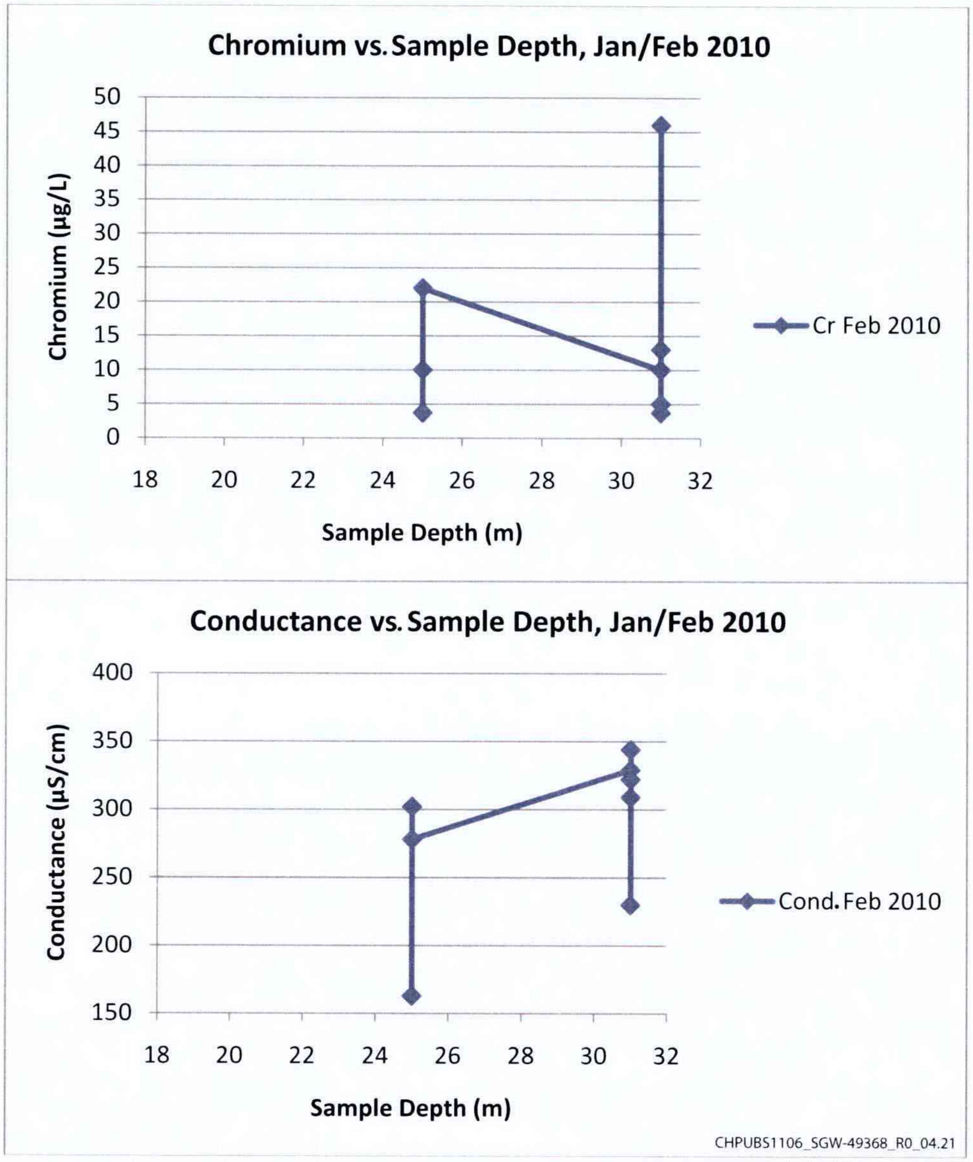


Figure 4-21. Hexavalent Chromium and Conductivity as a Function of Sample Depth (Penetration), January/February 2010

Samples from all three sampling events were analyzed for Cr(VI) using a colorimetric method, U.S. Environmental Protection Agency (EPA) Method 7196A (SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*). Turbidity in the samples can interfere with the analysis, resulting in a high bias. The laboratory corrects for this effect by subtracting the absorbance of a blank carried through the method. However, turbidity effects may still be evident. Turbidity measurements are not available from the WCH-380 sampling events (fall 2009 and January/February 2010). Samples collected for Cr(VI) analyses in November 2010 were filtered in the field; therefore, turbidity is not an issue.

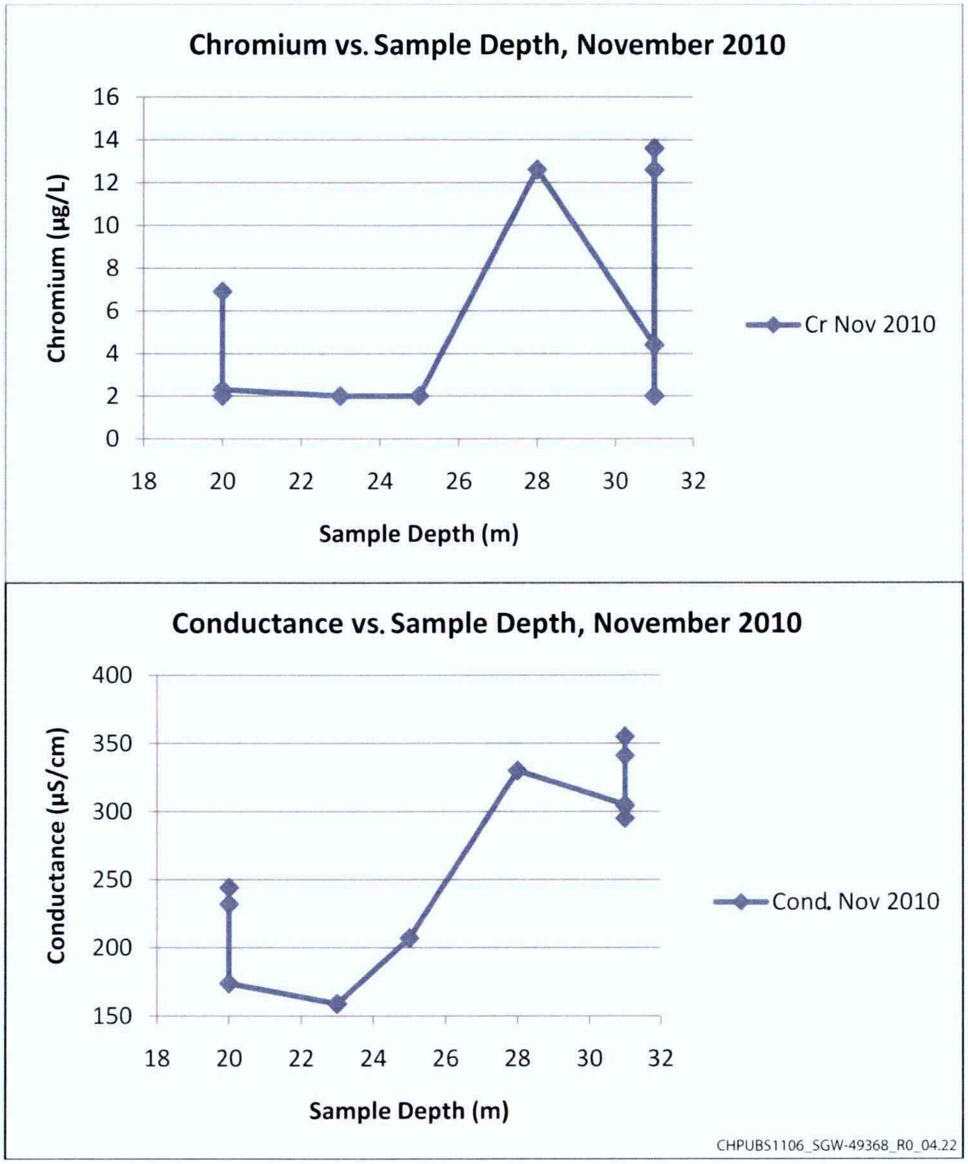


Figure 4-22. Hexavalent Chromium and Conductivity as a Function of Sampling Depth (Penetration), November 2010

During the January/February 2010 and November 2010 sampling events, the samples were analyzed for total chromium by EPA Method 200.8 (SW-846). As discussed in Section 3.3, total chromium in filtered samples should equate to Cr(VI). In the November 2010 event, total chromium and Cr(VI) were in agreement; some total chromium results in unfiltered samples were slightly higher than Cr(VI) results, which can be explained by the presence of trivalent chromium. During January/February 2010, total chromium and Cr(VI) results were in agreement with one exception: T100BC4A had significantly higher Cr(VI) than total chromium (46 µg/L compared to 20 µg/L). This suggests a potential high bias in the Cr(VI) results, since the analytical method for Cr(VI) is less accurate than EPA Method 200.8 (SW-846). Total chromium results are not available for the fall 2009 sampling event.

In conclusion, with few exceptions, data quality appears to be acceptable. Data quality problems cannot explain Cr(VI) changes in 100-BC pore water.

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5 Conclusions

Analysis of data from three rounds of Columbia River pore water sampling at 100-BC supports the following conclusions:

1. Groundwater flows from the aquifer into the Columbia River. Contaminants such as Cr(VI) present in the pore water were likely derived from 100-BC groundwater. Spatial and statistical evaluation of data concluded that Cr(VI) and conductivity measurements were generally consistent with river dilution of groundwater migrating into the river from beneath 100-BC. The major exception was in fall 2009, when five pore water samples had anomalously high concentrations of Cr(VI). No upstream sources of Cr(VI) have been identified, so it is reasonable to assume that pore water contamination originated in 100-BC groundwater.

2. Pore water Cr(VI) concentrations decreased at all ten stations sampled in both the fall of 2009 and the fall of 2010. Declines ranged from 51 to 98 percent. The maximum concentration in the fall of 2009 was 112 μg/L; in the fall of 2010, it was 13.6 μg/L. The most likely explanation for the decline in pore water Cr(VI) is the passing of a "pulse" of high Cr(VI) water. This water could have originated from unknown groundwater contamination (i.e., from areas vertically or horizontally not characterized), or could have represented older groundwater contamination.

3. Data were evaluated to determine whether changes in conductivity accounted for the changes in Cr(VI) concentrations in pore water. In concentrations typically seen in 100-BC groundwater or pore water, dissolved chromium has little effect on conductivity. Because groundwater beneath 100-BC varies significantly in Cr(VI) concentration even when conductivity is relatively constant, there is no definitive correlation between Cr(VI) concentration and conductivity. The relationship of Cr(VI) and conductivity at individual stations varied: some showed a positive correlation, others a negative correlation, and some no correlation.

4. In general, conductivity of samples increased with increasing depth in the river bed. However, as noted above, the conductivity alone could not explain the change in Cr(VI) concentrations among the three sampling events. Sample volume and differences in microenvironment also did not provide explanation for the changes in Cr(VI) concentration.

5. No systematic problems with data quality were found that would explain apparent changes in Cr(VI) concentrations with time.

Five Cr(VI) outliers in fall 2009 could not be repeated in two subsequent sampling campaigns, despite efforts to duplicate sampling conditions and rule out other effects. The only known, remaining explanation is that a pulse of Cr(VI) contamination passed through the pore water at 100-BC between the fall of 2009 and the fall of 2010.

Concentrations in 100-BC groundwater currently are less than approximately 60 μg/L. However, there is evidence of higher concentrations in the past (e.g., Well 199-B5-1 had concentrations above 100 μg/L in the late 1990s). Until 2010, only Well 199-B5-1 monitored northwestern 100-BC, and no wells monitored at depth in the unconfined aquifer. Thus, the presence of higher concentration plumes in certain areas or depths could have gone undetected. Installation of wells in 2009 and 2010, including characterization sampling of the entire aquifer thickness, confirmed that Cr(VI) concentrations in groundwater currently are less than about 60 μg/L.

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6 References

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Distribution

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Appendix A

Pore Water Sampling Methods

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Contents

Terms

DI	deionized
DO	dissolved oxygen
ORP	oxidation reduction potential
QC	quality control
SAP	sampling and analysis plan

A1 Introduction

This appendix describes the methods used for pore water sample collection. These activities were performed near or in Hanford contaminated groundwater discharge areas within the Columbia River.

Pore water sampling activities were required to evaluate contaminated groundwater discharge zones within the Columbia River adjacent to the 100-BC, 100-F, and 100-N areas of the Hanford Site. A portable conductivity and temperature probe (Trident[1] probe) was inserted into the Columbia River bed to measure the pore water parameters in situ. The probe also had the capability to collect pore water samples, which were analyzed for specific groundwater contaminants. Pore water sampling was performed to support the following sampling and analysis plans (SAPs):

- *Sampling and Analysis Plan for the 100-BC-1, 100-BC-2, and 100-BC-5 Operable Units Remedial Investigation/Feasibility Study*, DOE/RL-2009-44
- *Sampling and Analysis Plan for the 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units Remedial Investigation/Feasibility Study*, DOE/RL-2009-43
- *Sampling and Analysis Plan for the 100-NR-2 Operable Unit River Pore Water Investigation*, DOE/RL-2010-69

Sampling activities included collection of pore water using the Trident probe or Trident probe/frame. These activities were conducted using a boat as an operation platform. Sampling methods were analogous to those described in DOE/RL-2008-11, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River.*

Through previous pore water sampling work, field sampling guidelines were developed to guide decisions on sampling. The guidelines represent the best conditions for sampling. Pore water sample collection should take place when there are minimal signs of dilution from bank recharge from surface water and/or when river levels are <0.8 m (<2.6 ft) above low water level, and the river flow has been relatively stable for more than 1 hour prior to sampling.

A2 Equipment and Materials

The following equipment and materials were used during sample collection:

- Communication devices (e.g., cell phones, two-way radio, and very high frequency)
- Tape measure/river staff gauge
- Davit/Capstan system (mounted on vessel)
- Trident docking station (cradle on vessel)
- Specialized anchoring equipment (as necessary)
- Trident probe deck unit (with push pole assembly, as necessary)
- Trident driving frame
- Trident probe communication cables

[1] Coastal Monitoring Associates (San Diego, California) Trident probe has a patent pending.

- Trident and secondary field global positioning system units
- Trident probe armored tips (with backups, as necessary)
- Field computer (with software installed and operational)
- Peristaltic pump and Masterflex® tubing
- A 12 volt deep cycle battery with 750 watt power inverter
- Water quality measuring equipment capable of measuring the following parameters: pH, temperature, conductivity, dissolved oxygen (DO), and oxidation reduction potential (ORP)
- Polyethylene tubing (18+ m [60+ ft])
- Trident tool box and associated spare parts
- Underwater Aqua-Vu camera (one mounted to the frame and 1 for recon surveys)
- Digital camera
- A 500 L+ (132+ gal) graduated cylinder
- Field logbook and associated field record forms
- Sample bottle sets and associated sampling forms (including all necessary sample bottles, sample labels, sampling data sheets, and sample chain of custody forms)
- Nitrile gloves
- Deionized (DI) water (typically, 4 to 8 L [1 to 2 gal] is sufficient for one field day)
- One percent Liqui-nox® solution (typically, 1 L [0.25 gal] is sufficient for one field day)
- Decontamination tools (e.g., brushes and towels)
- A 19 L (5 gal) bucket (for capturing decontamination rinsate fluids)
- Precleaned 9.5 L (2.5 gal) cubitainers (one per station)

A3 Methods

The following methods were used for sample collection:

- Sampling activities included boating to location, collecting pore water using the Trident probe or Trident probe/frame, and collecting surface water using a peristaltic pump and tubing.
- Measurements of pore water and surface water were made concurrently at each sample location.
- Chain of custody documentation was maintained for all samples.
- Field decontamination was performed on sampling equipment as needed.

® Masterflex is a registered trademark of Cole-Parmer, Vernon Hills, Illinois.

® Liqui-nox™ is a registered trademark of Alconox, Inc., White Plains, New York.

- Water quality parameter measurements (i.e., pH, temperature, conductivity, DO, and ORP) were recorded on field paperwork.
- Activities associated with this fieldwork were documented in controlled field logbooks.

A3.1 Pore Water Sampling

Staff performed the following tasks during pore water sampling:

- At the laboratory, all field instruments were calibrated and results were recorded in the field logbook. Trident probe temperature calibration checks were performed monthly. Certificates of analyses and record calibration solution lot numbers and expiration dates were retained in the field logbook.
- At the selected sampling site, decontamination of field sampling equipment was performed by pumping three tube volumes with Liqui-nox solution followed by six volumes of DI water. Decontamination rinsate was discarded in accordance with the applicable operable unit's waste control plan.
- River level, time, and river staff station identification were measured and recorded at the beginning and end of each sampling event. (Note: if river stages were near 0.8 m above the green line or flows were unstable, pore water conductivity was checked and recorded at a nearby pore water baseline sampling station.)
- The Trident pole assembly was pushed or the Trident driving frame was deployed, approximately 6 to 12 in. below the river bed or until it resisted further insertion. The depth of the unit into the sediment was measured and recorded.
- After the peristaltic pump was turned on according to manufacturer's instructions, the system was slowly purged (6 to10 mL/min) until stable readings were achieved. Typically, approximately 100 mL of fluid purging was needed to remove nonrepresentative water from the tubing. Purge water was discarded in accordance with the applicable waste control plan prior to leaving the sampling location or after that area's sampling event was completed.
- Conductivity readings were recorded intermittently while drawing the sample and sampling was stopped or slowed temporarily if the conductivity dropped substantially from the initial reading to allow the conductivity to restore to near the starting value. Because of the variability of each location, the time varied from site to site and with river level. A number of observations such as the probe's position/depth, pump rate, river flow cycles, substrate types, and water depth were made to ensure a consistent measurement of the pore water.
- Once stable readings were attained, the pore water and surface water conductivity and temperature were logged using the Trident computer logging feature.
- Volatile organic analyte samples were collected first (where required by the applicable SAP).
- The desired volume of pore water was collected in precleaned containers, and enough water was collected so that minimum sample volumes were attained and final composite sample water quality readings (conductivity, DO, ORP, and pH) could be obtained.
- Sample labels and custody seals were attached, and samples were immediately placed into a chilled cooler. Remaining composite pore water was emptied into a clean, wide-mouth container to allow for measurement of the selected water quality measurements (pH, conductivity, DO, and ORP). (Note:

the composite sample temperature was ***not*** recorded because this was not representative of the sample temperature. The temperature logged on the Trident unit was used to represent the sample temperature. These parameters were recorded on field paperwork.)

- Time and river level were recorded at the end of sampling, using the nearby river staff gauge, denoting the river staff identification.
- River bed conditions were documented with a digital photograph, using an underwater camera or video recorder.
- A full set of quality control (QC) samples of pore water were collected and one duplicate for every 20 samples was collected, or at least one QC set and one duplicate were collected for fewer than 20 samples.
- The sample tubing was decontaminated by pumping three tubing volumes of Liqui-nox solution, followed by six volumes of DI water, through the sample tubing.
- All decontamination fluids were collected and disposed in accordance with the applicable waste control plan.

A3.2 Waste Disposal

Staff disposed of all waste in accordance with DOE/RL-2004-30, *Waste Control Plan for the 100-BC-5 Operable Unit*; DOE/RL-200-31, *Waste Control Plan for the 100-FR-3 Operable Unit*; or DOE/RL-2000-41, *Interim Action Waste Management Plan for the 100-NR-2 Operable Unit*.

A4 References

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Appendix B

Data File for November 2010 Pore Water Sampling

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Terms

ags	above ground surface
bgs	below ground surface
DO	dissolved oxygen
NA	not available
NTU	Nephelometric Turbidity Units
ORP	oxidation reduction potential
PRC	Plateau Remediation Company
QC	quality control
USCOE	U.S. Army Corps of Engineers

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Table B-1A. Site Coordinates, Sample Metadata, and Water Quality Data for 100-BC Pore Water Sampling, November 2010

Station Identification	General Region	Date	Time (Start)	Time (End)	Latitude[b] (Degrees)	Longitude[b] (Degrees)	Easting[f] (m)	Northing[f] (m)	General Substrate	Bulk Sample Number	Volume (mL)	QC	QC Tied to	QC Volume (mL)	Number of Bottles
2A-A	Upstream of Intake Structure	11/5/2010	14:32	15:47	46.63757	-119.65535	564667.44	145312.33	silt/sand	B29883	600	-	-	-	1
J100BC21	Moderate Depth	11/9/2010	15:00	17:55	46.63913	-119.64728	565283.02	145492.13	lg/med cobble	B29888	560	-	-	-	1
J100BC23	Near Shore	11/14/2010	13:17	14:37	46.63980	-119.64260	565640.49	145570.48	medium cobble	B29893	600	-	-	-	1
J100BC47	Near Shore (128-B-3)	11/10/2010	13:02	16:13	46.64084	-119.63597	566146.43	145691.29	sand	B29894	800	SPLIT	B29895	1000	2
T100BC1J1	Intake Structure	11/8/2010	13:55	15:13	46.63728	-119.65335	564820.54	145281.50	silt/sand	B29884	575	-	-	-	1
T100BC1J5	Intake Structure	11/9/2010	12:00	13:20	46.63778	-119.65350	564808.63	145336.95	silt	B29885	600	-	-	-	1
T100BC3C	Deep Channel	11/16/2010	11:21	12:18	46.63993	-119.65025	565054.69	145578.59	lg/med boulders	B29886	550	-	-	-	1
T100BC3C	Deep Channel	11/16/2010	12:21	13:51	46.63993	-119.65025	565054.69	145578.59	lg/med boulders	B29B83	550	DUP	B29886	550	1
T100BC4A	Near Shore	11/7/2010	15:40	16:54	46.63897	-119.64545	565423.31	145475.86	med/sm cobble	B29889	600	-	-	-	1
T100BC5C	Deep Channel	11/14/2010	15:45	16:40	46.64098	-119.64438	565502.80	145700.15	med/sm cobble	B29891	550	-	-	-	1
T100BC6J10	Near Shore	11/8/2010	11:08	12:24	46.63938	-119.64330	565587.06	145523.21	med/sm cobble	B29892	600	-	-	-	1
NEARSHORE 1	Upstream Reference	11/4/2010	13:20	14:53	46.64453	-119.68078	562712.17	146065.15	med/lg cobble	B29896	700	-	-	-	1
NEARSHORE 2	Upstream Reference	11/7/2010	11:56	13:23	46.64003	-119.66445	563967.50	145578.00	medium cobble	B29897	600	-	-	-	1

Table B-1B. Site Coordinates, Sample Metadata, and Water Quality Data for 100-BC Pore Water Sampling, November 2010

Station Identification	River bed Elevation[a] per NAVD88 (m)	River Discharge[l] (Kcfs)	River Level[a,l] (m)	Nearest USCOE Bathymetry Transect	40 Kcfs Steady State[l] River Elevation[a] at Nearest Transect	Height[l] (m) above Low Water	Staff Gage Reading Before (m)	Staff Gage Reading After (m)	River Depth at Station (ft)	Pore Water Sensor Depth (in. bgs)	Surface Water Sensor Height (in. ags)	Field QC Qualifier
2A-A	118.8	56.7	118.74	34	118.12	0.6	0.7	N/A[d]	1.9	12	12	
J100BC21	115.2	57.6	118.61	35	117.98	0.6	0.8	N/A[d]	11.4	8	12	h,k
J100BC23	115.6	38.2	117.73	36	117.80	-0.1	0.2	0.2	8.2	10	12	
J100BC47	118.6	58.0	118.03	37	117.49	0.5	0.8	0.8	2.9	12	12	
T100BC1J1	114.5	42.2	118.20	34	118.12	0.1	0.3	0.5	13.3	12	12	h
T100BC1J5	113.8	58.4	118.80	34	118.12	0.7	0.8	0.8	16.5	12	12	
T100BC3C	113.1	59.6	118.71	35	117.98	0.7	0.7	0.7	19.0	8	12	h, j
T100BC3C	113.1	58.5	118.66	35	117.98	0.7	0.7	0.7	19.0	8	12	j
T100BC4A	117.6	38.4	117.90	35	117.98	-0.1	0.2	0.2	1.9	12	12	
T100BC5C	114.9	37.9	117.88	35	117.98	-0.1	0.2	N/A[d]	10.2	9	12	h
T100BC6J10	117.9	45.3	118.25	35	117.98	0.3	0.3	0.3	2.1	11	12	

Table B-1B. Site Coordinates, Sample Metadata, and Water Quality Data for 100-BC Pore Water Sampling, November 2010

Station Identification	River bed Elevation[a] per NAVD88 (m)	River Discharge[l] (Kcfs)	River Level[a,j] (m)	Nearest USCOE Bathymetry Transect	40 Kcfs Steady State[l] River Elevation[a] at Nearest Transect	Height[l] (m) above Low Water	Staff Gage Reading Before (m)	Staff Gage Reading After (m)	River Depth at Station (ft)	Pore Water Sensor Depth (in. bgs)	Surface Water Sensor Height (in. ags)	Field QC Qualifier
NEARSHORE 1	119.4	57.5	118.98	31	118.28	0.7	0.7	0.7	4.1	10	12	
NEARSHORE 2	118.7	40.1	118.22	33	118.19	0.0	0.2	0.2	1.6	9	12	

Table B-1C. Site Coordinates, Sample Metadata, and Water Quality Data for 100-BC Pore Water Sampling, November 2010

Station Identification	Bottom Photo Filename	Logbook Page Number	Composite Pore Water Conductivity (µS/cm)	Trident Sensor Pore Water Temp. (C°)	Composite Pore Water pH	Composite Pore Water ORP (mV)	Composite Pore Water DO (mg/L)	Composite Pore Water Turbidity (NTU)	Surface Water Conductivity (µS/cm)	Trident Sensor Surface Water Temp. (C°)	Surface Water pH	Surface Water ORP (mV)	Surface Water DO (mg/L)	Surface Water Turbidity (NTU)	Diff. in Pore Water and Surface Water Cond. (µS/cm)	Change in Conductivity Reading During Sample Collection (Percent)	Pore Water PRC Sample No.	Cr(VI) (µg/L)
2A-A	100BC2A-A_11052010.JPG	15	305	14.3	7.15	313	8.38	5	146	13.7	7.48	291	10.27	3	159	0.0	B296J1	4.4
J100BC21	J100BC21_11092010.JPG	25	244	13.0	7.38	283	10.69	75	142	13.2	7.43	284	10.17	2	102	12.1	B296J6	<2.0
J100BC23	J100BC23_11142010.JPG	32	207	12.9	7.64	261	9.68	45	142	13.0	7.32	284	9.98	1	65	0.0	B296K1	<2.0
J100BC47	J100BC47_11102010.JPG	28	355	14.2	7.72	232	10.20	6	140	14.7	7.82	259	10.42	2	215	0.8	B296K2	13.6
T100BC1J1	T100BC1J1_11082010.JPG	21	295	13.6	7.07	-25	6.34	60	151	14.6	7.47	160	9.81	1	145	0.3	B296J2	<2.0
T100BC1J5	T100BC1J5_11092010.JPG	24	304	14.2	7.23	289	8.62	19	138	12.7	7.77	281	10.21	1	165	-0.3	B296J3	<2.0
T100BC3C	T100BC3C_11162010.JPG	40	174	12.4	7.78	232	8.79	650	139	13.1	7.80	223	8.72	3	35	3.9	B296J4	2.3
T100BC3C		41	232	12.4	7.82	231	7.55	450	139	12.3	7.50	246	9.21	3	93	4.8	B29B84	6.9
T100BC4A	T100BC4A_11072010.JPG	18	341	12.7	7.65	323	9.03	11	144	14.4	8.02	284	10.05	2	197	0.3	B296J7	12.6
T100BC5C	T100BC5C_11142010.JPG	34	159	12.7	7.43	311	9.52	380	143	12.7	7.66	282	9.74	2	16	-6.6	B296J9	<2.0
T100BC6J10	NA[d]	20	330	13.8	7.78	306	8.42	23	141	12.6	7.90	312	9.82	1	189	0.6	B296K0	12.6
NEARSHORE 1	100BCNS1_11042010.JPG	12	204	14.2	7.34	281	7.89	38	146	14.2	7.98	277	10.01	1	59	5.3	B296K3	<2.0
NEARSHORE 2	100BCNS2_11072010.JPG	17	281	15.6	7.22	313	8.22	9	152	14.5	7.56	283	9.76	1	129	-0.4	B296K4	<2.0

a. Elevations are in NAVD88, 1988, *North American Vertical Datum of 1988*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland.

b. Latitude and longitude are in NAD83, 1991, *North American Datum of 1983*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland, as revised.

c. Probe malfunctioned; no reading was recorded.

d. Data are not recorded.

e. Recorded with probe held at surface.

f. NAD83 State Plane Washington South FIPS 4602 Meters.

g. Possible dilution of pore water sample is due to exceedance of river stage guidelines during sampling event.

h. Sample conductivity is <90% of Phase IIb conductivity.

i. In situ readings dropped >10% during sample collection event.

j. Sample conductivity is <90% of Phase III conductivity.

k. In-situ readings increased >10% during sample collection event.

l. Height was calculated with Modular Aquatic Simulation System-1D (PNNL-15226, 2005, *Hydrodynamic Simulation of the Columbia River, Hanford Reach, 1940-2004*, Pacific Northwest National Laboratory, Richland, Washington).

B1 References

NAD83, 1991, *North American Datum of 1983*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland, as revised.

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PNNL-15226, 2005, *Hydrodynamic Simulation of the Columbia River, Hanford Reach, 1940-2004*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-15226.pdf.

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Appendix C

Photographs of River Bed at Pore Water Stations

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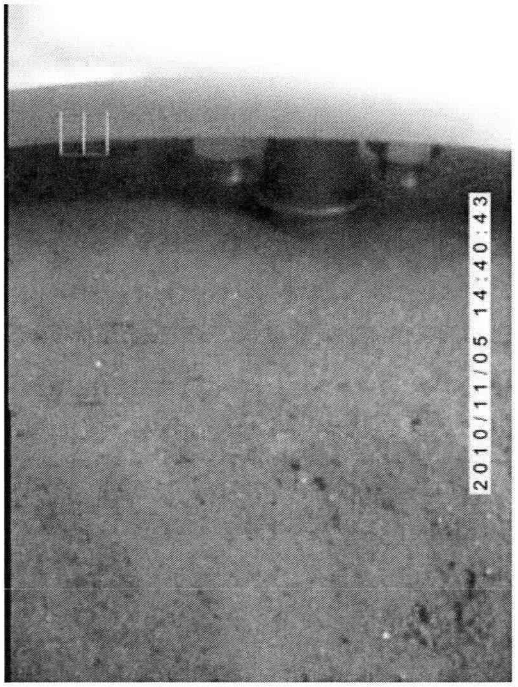

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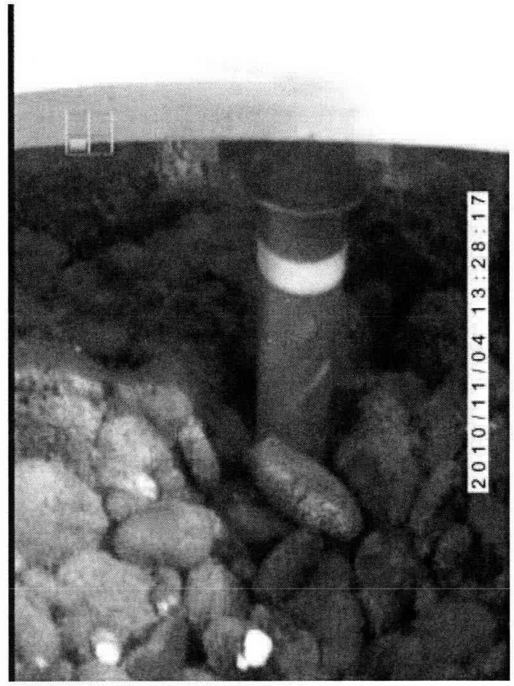

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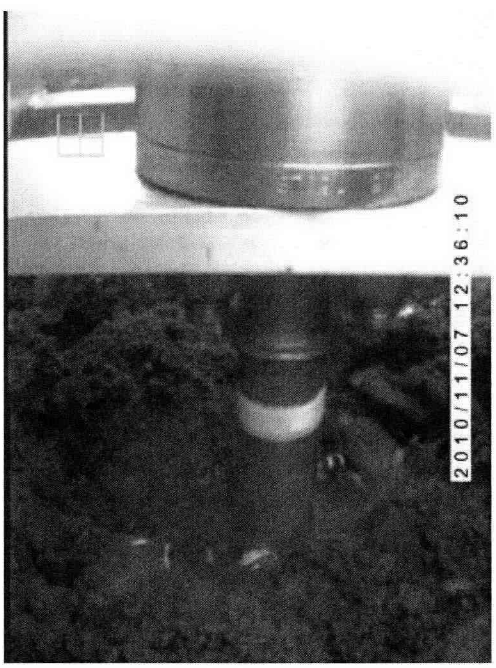

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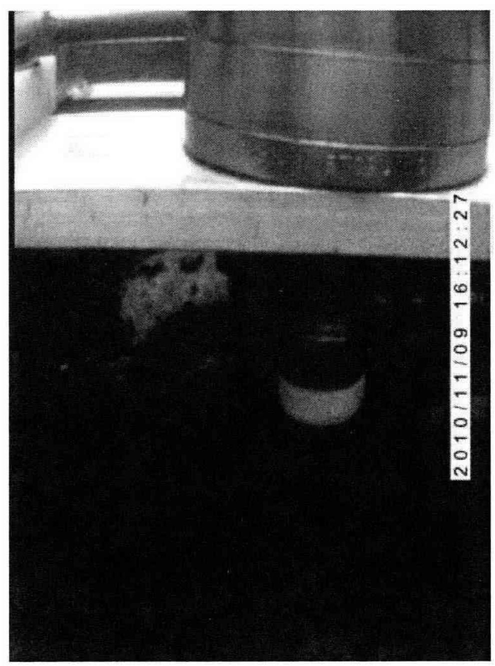

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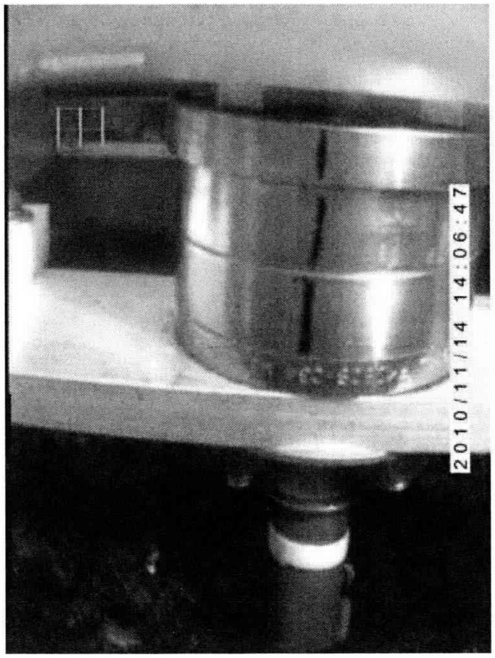

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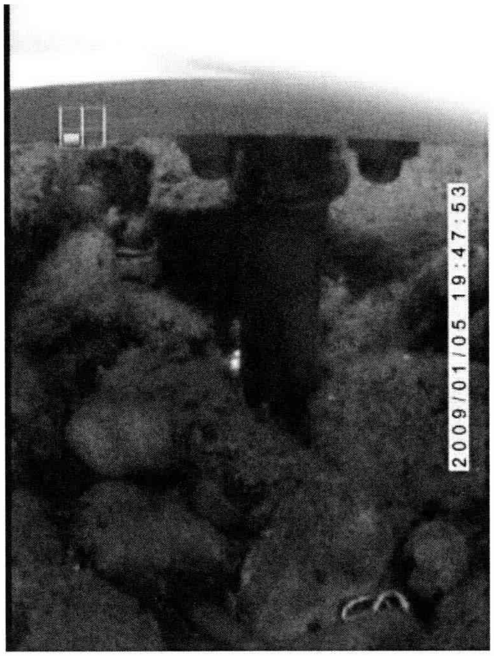

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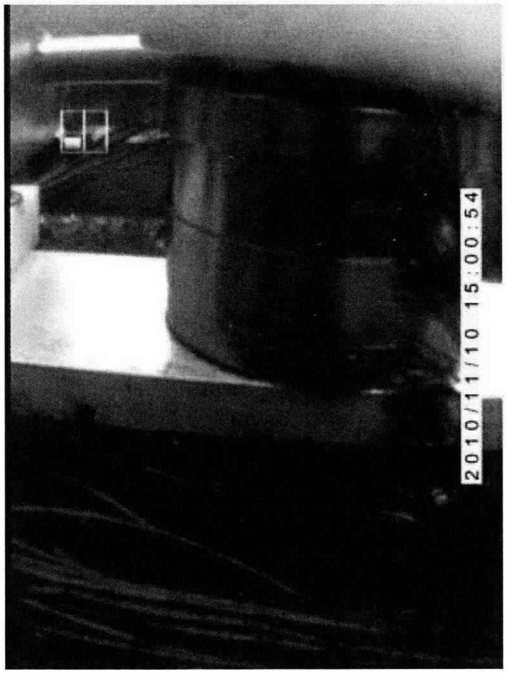

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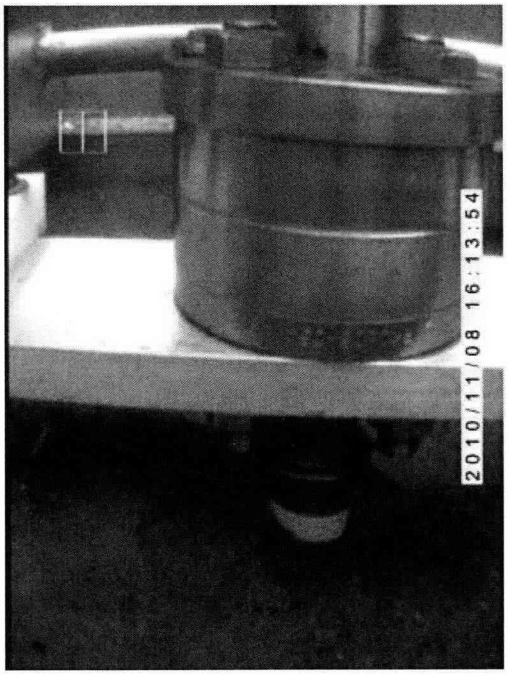

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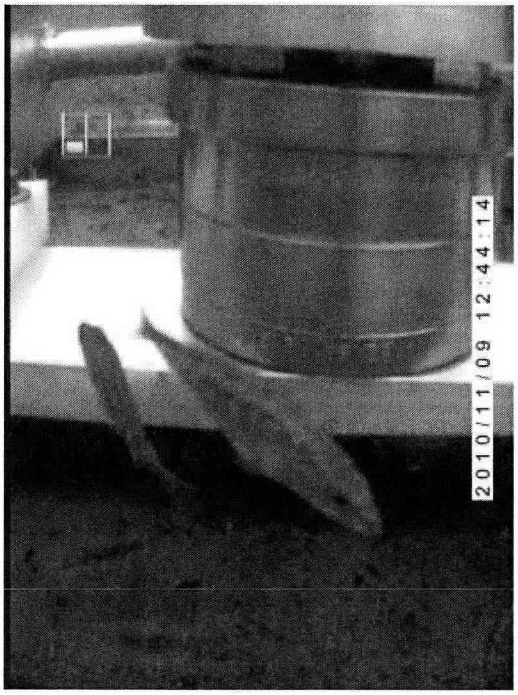

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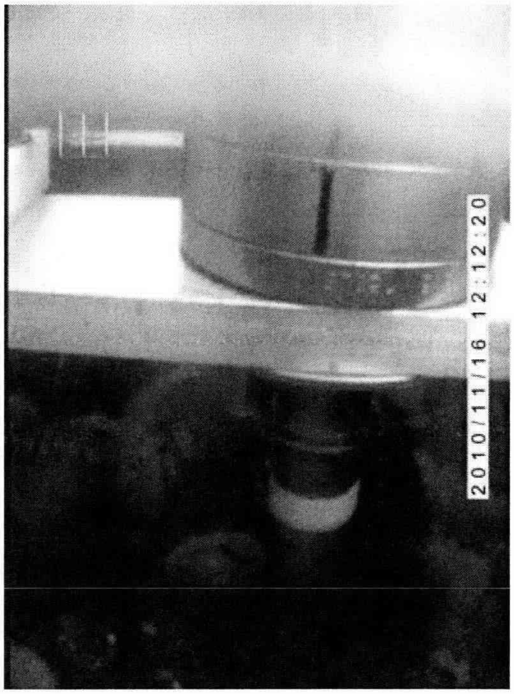

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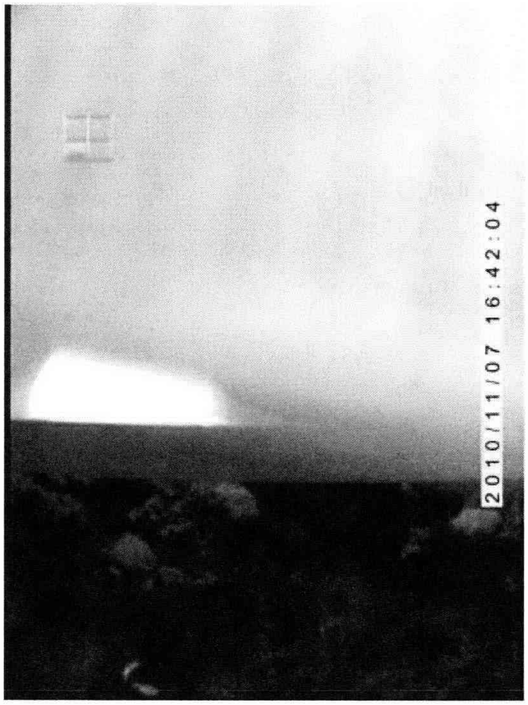
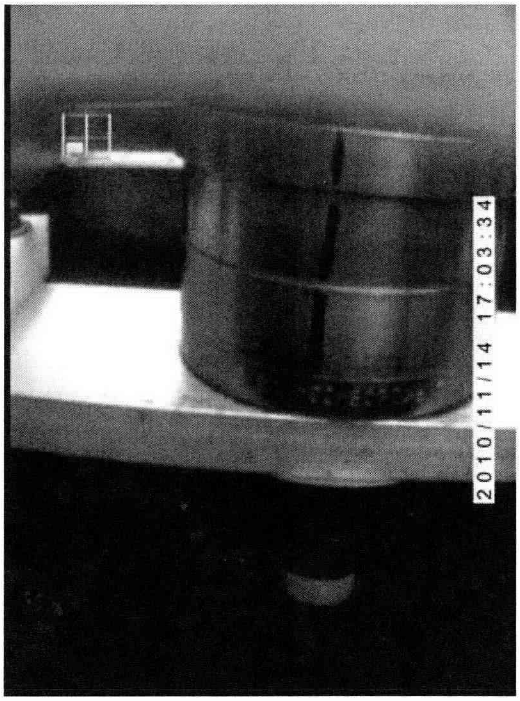


T100BC4A_11072010.JPG



T100BC5C_11142010.JPG

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Appendix D

Field Logbook HNF-N-701

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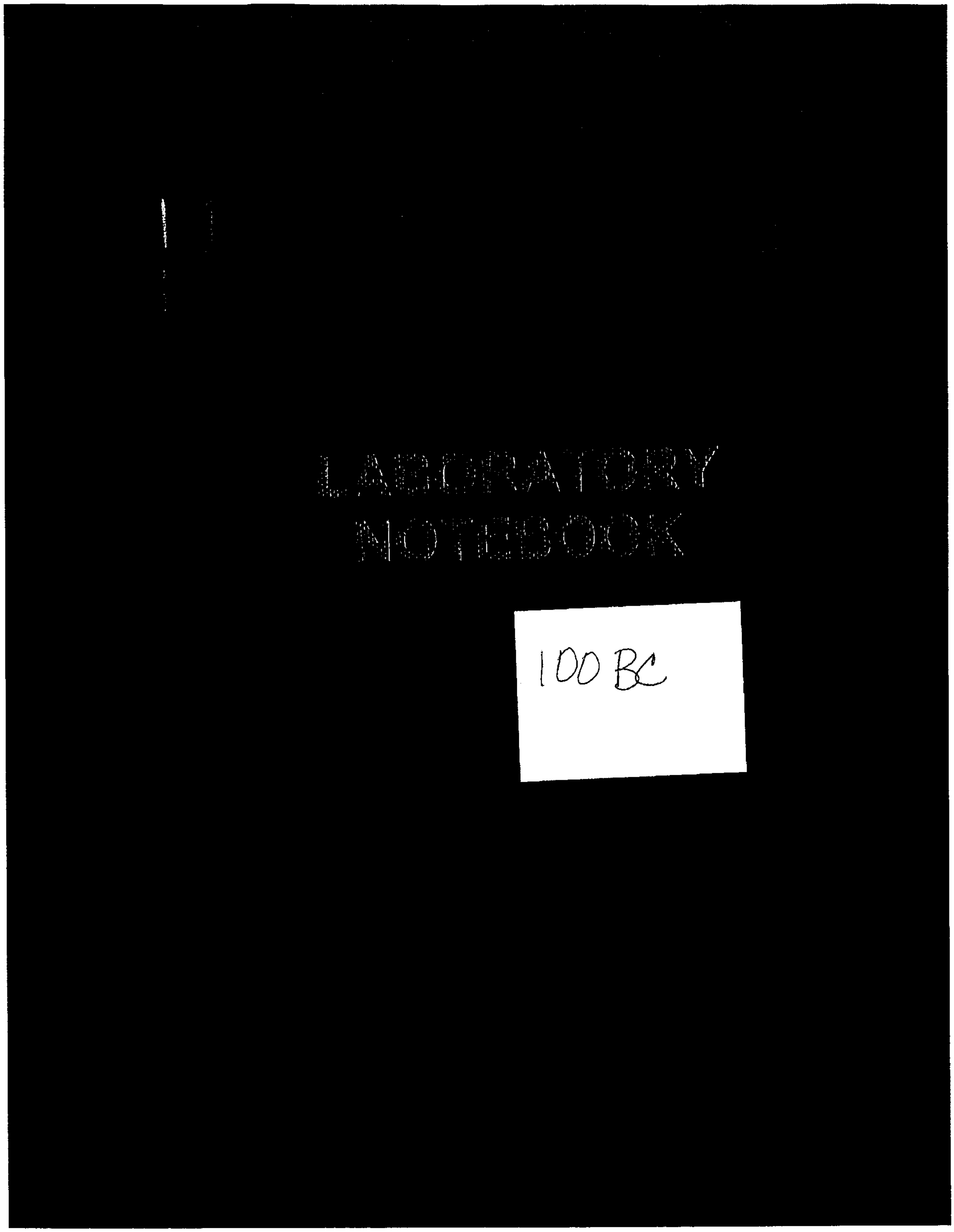
LABORATORY
NOTEBOOK
100 BC

NOTEBOOK/LOGBOOK COVERSHEET

SECTION I	Notebook/Logbook No. HNF-N-701 1	
RECORD COPY **Not for Circulation**	Date of Issue 11/02/2010	Copy 1
	Title PORE WATER SAMPLING	
Author ANNA RADLOFF	If continued from another notebook/ logbook, give the book number	

This is a controlled notebook/logbook. The assigned custodian is responsible for this book. See MSC-PRO-10863, *Notebooks and Logbooks*, for instructions about controlling, placing input, preserving, and retiring the notebook/ logbook. When the book is completed or no longer needed, contact your Records Management Specialist for a Retention Schedule. Complete Section II of this form and return the notebook/logbook to Controlled Document Management, A3-95. **DO NOT DESTROY.**

Responsible Custodian	Hanford ID No.	MSIN	Date Assigned
ANNA RADLOFF	5143821	R3-50	11/02/2010

SECTION II Complete this section before returning notebook/logbook to Controlled Document Management, A3-95

Abstract: (Give brief description of contents)

Period Covered: (Inclusive dates - Month/Day/Year) ____________

Custodian's Name | Custodian's Signature and Date

Custodian's Manager's Name | Custodian's Manager Signature and Date

Retention Schedule:	Specialist Concurrence Name

BD-6001-256 (REV 1)

Book No. HNF-N-7011 1

Title CHPRC Porewater Sampling 2010 Project No. 41274/216515

From Page No. NA

B. Tiller (EAS) [signature] initiates Field logbook planned to document all Field records pertinent to the following SAPs, in support of Measuring and collecting samples of pore water.

- DOE/RL-2009-44 Rev0: SAP For the 100-BC-1, 100-BC-2, and 100-BC-5 O.U.s RIFS.
- DOE/RL-2010-69 DRAFT A: SAP for the 100-NR-2 O.U. RIB PORE WATER INVESTIGATION
- OTHER RELEVANT CHPRC FIELD SAMPLING INSTRUCTIONS. "Pore Water Sampling" XXXXX Rev 2.

BT 10-23-10 — This Book is Assigned to B. Tiller. DAY TO DAY logbook custodian will be Zeke Simmons (EAS) [signature]

BT 10-23-10

NA

Signature [signature] Date 10-23-10 Concurred/Checked by [signature] Date 12/28/2010

2

BOOK NO.

TITLE PORE WATER SAMPLING — Project No. 41274/216575

From Page No. NA

10/23/2010 Zeke Simmons (EAS) (logbook scribe), Zeke Simmons Rob Curet (EAS), Ron Paulsen (CMA), George Paulsen (CMA)
Tailgate meeting (POD) @ 10:00 at Apel. B. Tiller attended
Weather: Overcaste w/ Showers; River Flow Steady ~55 Kcfs

Trident Probe Conductivity Calibration Check

Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
				104	104
m.S.uS	CP	CC8596	4/30/2011	454	451
447	Oakton	205259	May/2011		

Myron L Ultrameter Calibration Check: SN

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L	1001397 EB	9/9/2011	7.04
	4	Myron L	2003077 JM	8/3/2011	4.07
Cond.	100.5	CP	CC8596	4/30/2011	94.89
	447	Oakton	205259	5/2011	440.9

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O. NA	NA	NA	NA	NA	NA

Zeke Simmons

Zeke Simmons

Field measurements prescribed in these SAP's will be recorded in this logbook.
Metadata of Trident System will be recorded on CMA field record forms.
Substrate: Silt/Sand
2A-A (Station) Weather: Gradually improved to clear skies/sunshine.

ZS 10/23/2010

CHPRC 2010 — Date: 10/23/2010

Porewater ~~Sample~~ Readings

Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg) NAD83	
2A-A	N/A	before: 0.6 after: 0.6	Start: 14:20 End: 14:40	E -119.65532	N 46.63755

Water quality results from sample composite — *See CMA Insitu Record

Probe Tip Depth (Inches) (6"-12")	Conductivity (µS/cm)	Temp (C°)	ORP	pH	D.O.
12"	299.4	16.31	308	6.90	N/A

HEIS Sample No.(s)	Volume (mL)	Duplicate? Tied To:	# Bottles/Notes:
N/A	N/A	N/A	N/A

Zeke Simmons

To Page No. 03

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	10/23/2010	[signature]	12/26/2010

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Book No. HNF-N-701 / 3

TITLE PORE WATER SAMPLING Project No. 41274/216515

From Page No. 02 10/23/2010 cont'd Station ID: 2A-A

Time: 14:50 Installed Semi-permanent Trident hardened pore water Sampler probe (QA/QC point for station 2A-A). Substrate: Silt/Sand

Initiated a porewater reading using the above mentioned probe at 14:55. Lost signal at 15:09 rendering incomplete readings. Re-Started at 15:12 yielding results listed in data sheet below.

CHPRC 2010		ZS 10/23/2010			Date: 10/23/2010
		Porewater ~~Sample~~ Readings			
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg) NAD83	
2A-A	N/A	before: 0.6 after: 0.6	Start: 15:12 End: 15:20	E -119.65525	N 46.63755
Probe Tip Depth (Inches) (6"-12")		Water quality results from sample composite			
	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.
12"	296.8	16.3	285	6.41	N/A
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
N/A		N/A		N/A	N/A

Zeke Simmons

Decon in field at 15:23 per SAI (See page 1)

- purge Teflon tubing 03 times with 1% liquinox solution
- purge teflon tubing 06 times with DI Water
  - 01 purge = 180ml ~ Volume of Teflon tubing (V) x 3

Actual Volume of Teflon tubing to be determined using Volume of a cylinder formula. 25ft Teflon tube = 762cm

$V = \pi r^2 h$

$V = \pi (0.15875)^2 (762 cm)$ $3V = 180.989 \sim 180ml$

$V = \pi (0.025201563)(762)$

$V = 60.33ml$

50ft Teflon tube = 1524 cm

$V = \pi (0.15875)^2 (1524 cm)$ $3V = 361.979 \sim 360ml$

$V = \pi (0.025201563)(1524)$

$V = 120.66 ml$

ZS 10/23/2010

To Page No. NA

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	10/23/2010	[signature]	12/28/2010

CONTINUED FILE

4 Book No. HNF-N-701 1

Title PORE WATER SAMPLING Project No. 41274/216575

From Page No. NA

10/27/2010 Zeke Simmons (EAS: logbook scribe) Zeke Simmons,
Neil Sullivan (EAS), Ron Paulsen (CMA), George Paulsen (CMA)
Tailgate meeting (POD) at 09:00 held at Apel.
Weather: Sunshine with few clouds & light winds
River Flow: 56 KCFS at 10:00 hrs.

CHPRC 2010 Date: 10 27 2010

Trident Probe Conductivity Calibration Check

Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	98	103
447	Oakton	205259	05/31/11	447	459

Myron L Ultrameter Calibration Check: SN

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	7.02
	4	Myron L Company	2003077 JM	08/03/11	3.98
Cond.	100.5	Control Co.	CC8596	04/30/11	97.8
	447	Oakton	205259	05/31/11	441.8

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	~~0.18~~ 0.17

ZS 10/27/2010

Zeke Simmons

100 N Outfall Substrate: Cobble
Water depth at Station: 4.7 ft
12:19 purged 30 ft Teflon tubing with 200ml surface river water
Cleaned/rinsed Myron unit holding cell 3 x's with surface river water

ZS 10/27/2010

To Page No. 05

Signature: Zeke Simmons Date: 10/27/2010 Witnessed/Reviewed by: [signature] Date: 12/28/2010

Book No. HNF-N-7011 5

Title PORE WATER SAMPLING Project No. 41274/216515

From Page No 04

CHPRC 2010		ZS 10/27/2010		Date: 10/27/10	
Porewater ~~Sample~~ Readings					
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg) NAD83	
100N Outfall	NA	before: 0.6 after: 0.6	Start: 12:51 End: ~13:10	E -119.57160	N 46.67528
Probe Tip Depth (Inches) (6"-12")	Water quality results ~~from sample composite~~ ZS 10/27/2010				
	Conductivity (µS/cm)	Temp (C°)* Probe	ORP	pH	D.O.
12"	287	14.654	NA	NA	NA
	Turbidity NA			TDS 136.3	
HEIS Sample No.(s)	Volume (mL)			Duplicate? Tied To:	# Bottles/Notes:
NA	NA			NA	NA
Surfacewater Readings River Myron					
	TDS 65.77	Water quality results (after 3x purge water)			
	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.
	134.9	14.640	239	7.98	9.40
*see CMA Insitu Record (from Trident at beginning of sample)					

ZS

Pore Water (PW) Myron:

Cond	277.7
Temp	NA
ORP	251
pH	7.41
DO	7.08
TDS	136.3 ppm

LATE ENTRY: ZS 11/03/2010 The station described below is Station ID T100N1A

T100N1A1 arrived at station at 15:50 Substrate: Cobble

15:55-16:00 pumped/purged Teflon tubing with 90ml surface river water.

This Station is referred to as T100N1A in CMA records for 10/27/2010.

River Water depth at station: 3.1 ft

ZS 10/27/2010

To Page No 06

Signature	Date	Witnessed & Understood by Me	Date
Zre S[signature]	10/27/2010	[signature]	12/28/2010

CONFIDENTIAL

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Title: PORE WATER SAMPLING — Book No. HNF-N-701 1 — Project No. 41274/216575

From Page No. 05

ZS 10/27/2010

CHPRC 2010		Porewater Sample Readings Trident			Date: 10/27/2010
Station ID: T100NIA ZS 10/27/2010 SAP#		Staff Guage (m.m)	Sample Time	Coordinates (deg.deg) NAD83	
T100NIAT	NA	before: 0.6 after: 0.6	Start: 16:05 End: 16:25	E -119.56905	N 46.67788
Probe Tip Depth (Inches) (6"-12")	Water quality results from sample composite				
	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.
11"	543	14.986	NA	NA	NA
	Turbidity NA			TDS	
HEIS Sample No.(s)	Volume (mL)			Duplicate? Tied To:	# Bottles/Notes:
NA	NA			NA	NA

Surfacewater Readings River Myron				
TDS 66.46	Water quality results (after 3x purge water)			See CMA Records
Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.
136.2	NA	216	8.09	

*see CMA Insitu Record (from Trident at beginning of sample)

Zeke Simmons

PW Myron:
Cond. 548.5
Temp. NA
ORP 218
pH 7.43
DO 3.80
TDS 254.3

Reference Probe:
Temp 14.865
Cond 150

Decon in field at 16:45 per SAI.

ZS 10/27/2010

To Page No. NA

Signature	Date	Witnessed & Understood by	Date
Zeke Simmons	10/27/2010	[signature]	12/28/2010

Book No. HNF-N-701 1 7

Title PORE WATER SAMPLING Project No. 41274/216575

From Page No. NA

10/28/2010 Zeke Simmons (EAS) Zeke Simmons, Neil Sullivan (EAS)
Ron Paulsen (CMA), George Paulsen (CMA)
08:00 Tailgate meeting (POD) held at Apel.
Weather: Overcast with showers
River Flow: 56 KCFS at 08:00

CHPRC 2010				Date: 10/28/2010	
Trident Probe Conductivity Calibration Check					
Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	99	102
447	Oakton	205259	05/31/11	449	474

Myron L Ultrameter Calibration Check: SN					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	7.02
	4	Myron L Company	2003077 JM	08/03/11	3.99
Cond.	100.5	Control Co.	CC8596	04/30/11	93.7
	447	Oakton	205259	05/31/11	NA

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	~~0.18~~ 0.12

ZS 10/28/2010

Turbidity NA				

Zeke Simmons

ZS 10/28/2010

To Page No. 08

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	10/28/2010	[signature]	12/28/2010

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Title: PORE WATER SAMPLING

Book No. HNF-N-701 1

Project No. 41274/216575

From Page No. 07

CHPRC 2010			ES 10/28/2010		Date: 10/28/2010	
Porewater ~~Sample~~ Readings Trident						
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg) NAD83		
2A-A	NA	before: 0.1 after: 0.1	Start: 11:40 End: 12:05	E -119.65532	N 46.63755	
Probe Tip Depth (Inches) (6"-12")	Water quality results from sample composite					
	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.	
12"	306.8	NA	NA	NA	NA	
	Turbidity NA			TDS NA		
HEIS Sample No.(s)	Volume (mL)			Duplicate? Tied To:	# Bottles/Notes:	
NA	NA			NA	NA	
Surfacewater Readings NONE TAKEN						
Substrate: Silt/Sand	Water quality results (after 3x purge water)					
	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.	
	NA	NA	NA	NA	NA	
*see CMA Insitu Record (from Trident at beginning of sample)						

ZS
ZWS

J100BC47 Substrate: Cobble
Water depth at Station: 3.2 ft

CHPRC 2010			ES 10/28/2010		Date: 10/28/2010	
Porewater Readings						
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg) NAD83		
J100BC47	NA	before: 0.1 after: 0.1	Start: 13:00 End: 13:20	E -119.63627	N 46.64078	
Probe Tip Depth (Inches) (6"-12")	Water quality results from sample composite					
	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.	
9"	219	14.820	NA	NA	NA	
	Turbidity NA			TDS NA		
HEIS Sample No.(s)	Volume (mL)			Duplicate? Tied To:	# Bottles/Notes:	
NA	NA			NA	NA	
River Surfacewater Readings Myron						
	TDS 66.97 Water quality results (after 3x purge water)					
	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.	
	139.4	NA	286	7.88	9.30	
*see CMA Insitu Record (from Trident at beginning of sample)						

ZWS

To Page No. 09

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	10/28/2010	[signature]	12/28/2010

Book No. HNF-N-701 1 9

Title PORE WATER SAMPLING Project No. 41274/216575

From Page No. 08

J1008C47 continued

PW Myron:

Cond 288.4
Temp NA
ORP 278
pH 7.61
DO 6.60
TDS 139.80

Reference Probe:

Cond 150
Temp 14.373

100 N Outfall Substrate: Cobble

CHPRC 2010	ZS 10/28/2010			Date: 10/28/2010	
			Porewater ~~Sample Trident~~ Readings Myron		
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg) NAD83	
100N Outfall	NA	before: 0.6 after: 0.6	Start: 13:50 End: ~14:10	E -119.57160	N 46.67528
			Water quality results from sample composite		
Probe Tip Depth (inches) (6"-12")	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.
12"	350.4	NA	334	7.60	5.68
	Turbidity NA			TDS 170.3	
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
NA		NA		NA	NA
		Surfacewater Readings			
		Water quality results (after 3x purge water)			
	Conductivity (µS/cm)	Temp (C°)*	ORP	pH	D.O.
	NA	NA	NA	NA	9.25

*see CMA Insitu Record (from Trident at beginning of sample)

T100N1A
~~T100N1A1~~ ZS 10/28/2010 Substrate: Cobble
Water depth at Station 3.5 ft

ZS 10/28/2010

To Page No. 10

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
[signature]	10/28/2010	[signature]	12/28/2010

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Book No. HNF-N-701 1

TITLE PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 09

CHPRC 2010		ZS 10/28/2010		Date: 10/28/2010	
T100N1A 10/28/2010		Porewater Sample Trident Readings			
Station ID: T100N1A	SAF# NA	Staff Guage (m.m) before: 0.6 after: 0.6	Sample Time Start: 14:31 End: 14:45	Coordinates (deg.deg) NAD83 E -119.56900	N 46.67787
		Water quality results from sample composite			
Probe Tip Depth (inches) (6"-12") 11"	Conductivity (µS/cm) 648	Temp (C°)* 14.824	ORP NA	pH NA	D.O. NA
	Turbidity NA			TDS 66.86	
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
NA		NA		NA	NA
		Surfacewater Readings Myron			
	TDS 66.86	Water quality results (after 3x purge water)			
	Conductivity (µS/cm) 139.3	Temp (C°)* NA	ORP 204	pH 7.92	D.O. 9.27

*see CMA Insitu Record (from Trident at beginning of sample)

PW Myron:
Cond 649.5
Temp NA
ORP 144
pH 7.33
DO 3.79
TDS 311.8

Reference Probe:
Cond 150
Temp 14.510

Decon in field at 15:00 per SAI.

Mixed Liquinox solution: At 17:30 hrs. Mixed in Lab 151 (Apel)
-22.0 L 1% Liquinox
- Using DI water from Apel Lab 151/153
- DI water at 17.6 megohm-cm

For CMA de-con use
DI water provided/supplied from Apel Lab 153
Manufacturer: Barnstead
Model: E-pure
property of Applied Process Engineering Laboratory

To Page No. NA

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	10/28/2010	[signature]	12/28/2010

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Book No. HNF-N-701 1 | 11

Project No. 41274/216575

Title PORE WATER SAMPLING

From Page No NA

11/04/2010 Zeke Simmons (EAS) Zeke Simmons, Rob Curet (EAS), Chris Smith (CMA), Mark Biser (CMA)
09:00 Tailgate meeting (POD) held at Apel
Weather: Sunshine, slight breeze
River Flow: 56 KCFS at 08:00

CHPRC 2010 — Date: 11-4-10

Trident Probe Conductivity Calibration Check					
Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	104	103
447	Oakton	205259	05/31/11	454	449

Myron L Ultrameter II Calibration Check: SN 6227090					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	7
	4	Myron L Company	2003077 JM	08/03/11	3.88
Cond.	100.5	Control Co.	CC8596	04/30/11	98.6
	447	Oakton	205259	05/31/11	447.1

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.3

4 point Cal. preceeding HANNA Turbidimeter Calibration Check: SN 08292360					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
Turbidity	100	Hanna	0277	09/30/2012	100

2A-A QC Station Start Time 12:02 conductivity 310
Staff Guage: before 0.7 after 0.7 End Time 12:15
EB1 12:10 - 12:35 Sample No. B29887 / LAG
Equipment Blank Lot No. 043612
Sample Volume 1L

ZS 11/04/2010

To Page No. 12

Signature	Date	Witnessed & Understood by	Date
Zeke Simmons	11/04/2010	[signature]	12/28/2010

Confidential

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Book No. HNF-N-7011

Title: PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 11

BC Nearshore 1 Substrate: Medium & large cobble
Water depth at station: 4.1 ft
Telephone Call to Brett Tiller (EAS) regarding sample volume at 12:52 hrs
Returned telephone call from Brett Tiller (EAS) at 13:35 hrs:
- Conversation: Brett relayed from Anna Radloff (CHPRC) that we are to collect 550ml - 600ml at a minumum.

Initial Porewater Readings 11/04/2010

Water quality results (after purge water)

Conductivity (μS/cm)[a]	Temp (C°)[b]	ORP[b]	pH[b]	D.O.[c]
210	14.208	281	NA	NA
Turbidity[d] NA				

SurfacewaterReadings

Water quality results (after purge water)

Conductivity (μS/cm)[a]	Temp (C°)[b]	ORP[b]	pH[b]	D.O.[c]
145.5	14.174	277	7.98	10.01
Turbidity[d] 0.10 NTU				

LATE ENTRY 11/04/10 Coordinates - Trimble. Trimble SN 4636497348

COMPOSITE Porewater Sample

Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83 Trident	
BCNS1	F11-016	before: 0.7 after: 0.65	Start: 13:20 End: 14:53	E -119.68078	N 46.64453
Probe Tip Depth (Inches) (6"-12")	→ Trimble Coordinates N 46.6445 8011 Accuracy 1.95 ft E -119.68078078				
10"	Water quality results (Composite)				
	Conductivity (μS/cm)[a]	Temp (C°)[b]	ORP[b]	pH[b]	D.O.[c]
	204.3	~~NA~~ 14.200	281	7.34	7.89
	Turbidity[d] 38.0 NTU				
HEIS Sample No.(s)	Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:	
B29896	~ 700 ml		NA	01 1LAG	

FINAL Porewater Readings

Water quality results (after 3x purge water)

Conductivity (μS/cm)[a]	Temp (C°)[b]	ORP[b]	pH[b]	D.O.[c]
NA	NA	NA	NA	NA

a) Myron
b) Trident
c) YSI
d) Hanna Meter

[signature]

Sample Volume: ~700ml Bottle Size: 1 LAG
Decon in field at 15:00 per SAI.

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SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
[signature]	11/04/2010	[signature]	12/28/2010

Book No. HNF-N-701 / 13

TITLE PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 12

2A-A QC Station Start time 15:45 Conductivity 308

Staff Guage: before 0.65 after 0.65 End Time 15:48 Decon at 16:00 (SAI)

~16:28 I asked Roy Plunkett (CHPRC) for Custody Seals

16:30 - 16:33 Relinquised Sample & Equipment blank

Sample No. B29896 (BC Nearshore 1)

EB1 Sample No. B29887

~16:36 Asked Roy Plunkett for custody seals again (for the 2nd time)

Response: We will put them on the bottles... it shouldn't be an issue... we will be opening the bottles this evening anyways. We will get you some custody seals and play by the rules from now on.

Per Roy Plunkett, custody seals were placed on bottles immediately following sample handoff.

Roy Plunkett provided custody seals to EAS at ~17:00.

ES 11/04/2010

To Page No. NA

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zelle Summers	11/04/2010	[signature]	12/28/2010

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Book No. HNF-N-701

TITLE PORE WATER SAMPLING

Project No. 41274/216575

From Page No. NA

11/05/2010 Zeke Simmons (EAS) Zeke Simmons, Rob Curet (EAS), Chris Smith (CMA), Mark Biser (CMA)

10:00 Tailgate meeting (POD) held at Apel

Weather: Slight overcast / Cloudy

River Flow: 56 KCFS at 08:00 hrs

0100	152 KCFS
0200	151 KCFS
03 00	161 KCFS
04:00	83 KCFS
05:00	42 KCFS
06:00	55 KCFS
07:00	56 KCFS

CHPRC 2010 — Date: 11/05/2010

Trident Probe Conductivity Calibration Check

Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	109	95
447	Oakton	205259	05/31/11	457	451

Myron L Ultrameter II Calibration Check: SN 6227090

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	6.94
	4	Myron L Company	2003077 JM	08/03/11	3.78
Cond.	100.5	Control Co.	CC8596	04/30/11	97.27
	447	Oakton	205259	05/31/11	448.7

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.14

HANNA Turbidimeter Calibration Check: SN 08292360

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
	< 0.10	HANNA	0279	09/2012	0.05
Turbidity	100	Hanna — Did 4 point calibration	0277	9/30 12	100

13:00 Decon per SAI

2A-A QC Station Start time: 13:35 End time: 13:40

Staff guage before: 0.67 staff guage after: 0.67

Conductivity: 306.9

ZS 11/05/2010

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SIGNATURE: Zeke Simmons — DATE: 11/05/2010 ZS 11/05/2010 — WITNESSED & UNDERSTOOD BY: [signature] — DATE: 12/28/2010

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Book No. HNF-N-701 / 15

TITLE PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 14

~~BC Nearshore~~ ZS 11/05/2010 2A-A Substrate : Silt/Sand
Water depth at Station : 1.9 ft
Steve Lowe (CHPRC) present on shore at Station 2A-A. 13:40 hrs
Steve Lowe took photos of the operation from shore

INITIAL Porewater Readings					11/05/2010
	Water quality results (after purge water)				
	Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	308	~~14.34~~ 14.27 ZS 11/05/10	301	7.50	8.31
	Turbidity[d] 25.0 NTU				

SurfacewaterReadings					
	Water quality results (after purge water)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[b] a ZS 11/05/2010	pH[b] a ZS 11/05/2010	D.O.[c]
	145.9	13.7	291	7.48	10.27
	Turbidity[d] 2.5 NTU				

River depth at Station 1.9 ft		COMPOSITE Porewater Sample			
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83 Accuracy 1.69 feet	
2A-A	F11-016	before: 0.67 after:	Start: 14:32 End: 15:47	E -119.65534518	N 46.63757212
Probe Tip Depth (inches) (6"-12")					
12" BSG	Water quality results (Composite)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[b] a ZS 11/05/2010	pH[b] a ZS 11/05/2010	D.O.[c]
	304.7	14.3	313	7.15	8.38
	Turbidity[d] 5.0				
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
B29883		~600 mL		NA	01 / 1LAG

FINAL Porewater Readings					
	Water quality results ~~(after 3x purge water)~~ ZS 11/05/2010				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[b] a ZS 11/05/2010	pH[b] a ZS 11/05/2010	D.O.[c]
	303.9	14.86	313	7.54	8.21

Turbidity 0.85 NTU

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Zeke Simmons

Sample Volume : ~600 ml
Bottle Size : 1L Amber Glass (AG)
Decon in field per SAI 16:05 hrs

To Page No. NA

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	11/05/2010	[signature]	12/20/2010

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Title PORE WATER SAMPLING Project No. 41274/216575

From Page No. NA

11/07/2010 Zeke Simmons (EAS) Zeke Simmons, Neil Sullivan (EAS), Chris Smith (CMA), Mark Biser (CMA)
08:30 Tailgate meeting (POD) held at Apel
Weather: Mostly Cloudy with Showers in A.M. / Mostly sunny with slight breeze P.M.
River Flow: 38 KCFS at 07:00 hrs

Time	KCFS
0100	130
0200	92
0300	71
0400	39
0500	38
0600	38
0700	38

CHPRC 2010 Date: 11/07/2010

Trident Probe Conductivity Calibration Check

Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	106	100
447	Oakton	205259	05/31/11	450	450

Myron L Ultrameter II Calibration Check: SN 6227090

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	6.98
	4	Myron L Company	2003077 JM	08/03/11	3.82
Cond.	100.5	Control Co.	CC8596	04/30/11	97.76
	447	Oakton	205259	05/31/11	446.8

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.14

HANNA Turbidimeter Calibration Check: SN 08292360

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
Turbidity(NTU)	< 0.10	Hanna	0279	09/30/12	0.5
Turbidity(NTU)	15	Hanna	0286	10/31/12	15.0
Turbidity(NTU)	100	Hanna	0277	09/30/12	100.0
Turbidity(NTU)	750	Hanna	0285	10/31/12	750.0

10:30 Decon por SAI
2A-A QC Station Start time: 11:00 End time: 11:07
Staff guage: before 0.20 after 0.20 VERY LOW WATER
Conductivity: 306

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Signature	Date	Witnessed & Understood by	Date
Zeke Simmons	11/07/2010	[signature]	11/28/2010

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Title PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 16

BC Nearshore 2 (BCNS2) Substrate: Medium Cobble
Water depth at Station: 1.6 ft

INITIAL Porewater Readings Date: 11/07/2010

Water quality results (after purge water)

Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
283	13.895	220	6.99	8.10
Turbidity[d] 80.0 NTU				

SurfacewaterReadings

Water quality results (after purge water)

Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
152	14.5	283	7.56	9.76
Turbidity[d] 1.20 NTU				

COMPOSITE Porewater Sample

Station ID:	SAF#	Staff Guage (m.m) VERY LOW	Sample Time	Coordinates (deg.deg)NAD83 Accuracy 1.9 ft	
BCNS2	F11-016	before 0.20 after: 0.20	Start: 11:56 End: 13:23	E-119.66450409	N46.64002920

Probe Tip Depth (Inches) (6"-12"): 9 inches BSG

Water quality results (Composite)

Conductivity (µS/cm)[a]	Temp (C°)[a] (ZS 11/07/10)	ORP[a]	pH[a]	D.O.[c]
281	15.6	313	7.22	8.22
Turbidity[d] 8.60 NTU				

HEIS Sample No.(s)	Volume (mL)	Duplicate? Tied To:	# Bottles/Notes:
B29897	~600 mL	NA	01 / 1 LAG

FINAL Porewater Readings

Water quality results

Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
278	14.025	295	6.87	7.51
Turbidity[d] 7.80				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

13:30 Decon per SAI
Sample Volume: ~600 ml
Bottle: 1 LAG
15:38 Cell phone call with Roy Plunkett: Status Update

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Signature	Date	Witnessed & Understood by	Date
Zeke Simmons	11/07/2010	[signature]	12/28/2010

Book No. HNF-N-701 1

TITLE PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 17

T100BC4A Substrate: Medium/Small cobble

Water depth at station: 1.9 ft

INITIAL Porewater Readings					Date: 11/07/2010
	Water quality results (after purge water)				
	Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	332	15.126	256	7.56	7.81
	Turbidity[d] 90.0 NTU				

SurfacewaterReadings					
	Water quality results (after purge water)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	144	14.4	284	8.02	10.05
	Turbidity[d] 2.00 NTU				

COMPOSITE Porewater Sample					
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83 Accuracy 1.4 ft	
T100BC4A	F11-016	before: 0.20 after: 0.20	Start: 15:40 End: 16:54	E-119.64548718	N46.63896000
Probe Tip Depth (Inches) (6"-12")	Water quality results (Composite)				
12 inches BSG	Conductivity (µS/cm)[a]	Temp (C°)[a] (ZS 11/07/10)	ORP[a]	pH[a]	D.O.[c]
	340.5	12.7	323	7.65	9.03
	Turbidity[d] 11.0 NTU				
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
B29889		~600 mL		NA	01 / 1 LAG

FINAL Porewater Readings					
	Water quality results				
	Conductivity (µS/cm)[a]	Temp (C°)[a] (ZS 11/07/10)	ORP[a]	pH[a]	D.O.[c]
	310.4	12.7	325	7.64	8.47
	Turbidity[d] 11.0 NTU				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Zele Simmons

17:00 Decon per SAI
Sample Volume: ~600 ml
Bottle: 1 LAG
17:03 Cell phone call with Roy Plunkett notifying ETA for Sample/COC relinquishment.

To Page No. NA

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zele Simmons	11/07/2010	[signature]	11/29/2010

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Book No. HNF-N-7011 19

Title PORE WATER SAMPLING Project No. 41274/216575

From Page No. NA

11/08/2010 Zeke Simmons (EAS) Zeke Simmons, Neil Sullivan (EAS), Chris Smith (CMA), Mark Biser (CMA)
07:30 Tailgate meeting (POD) held at Apel.
Weather: Sunshine with slight breeze ZS 11/08/2010
River Flow: 38 KCFS at ~~0??~~ 07:00.

Time	KCFS
0100	94
0200	79
0300	133
0400	149
0500	40
0600	38
0700	38

07:40 Mixed Liquinox solution as described on Page No. 10 of this logbook (HNF-N-7011). For CMA de-con use. DI water at 17.6 megohm-cm.

CHPRC 2010				Date: 11/08/2010	
Trident Probe Conductivity Calibration Check					
Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	99	94
447	Oakton	205259	05/31/11	454	454

Myron L Ultrameter II Calibration Check: SN 6227090					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	6.93
	4	Myron L Company	2003077 JM	08/03/11	3.83
Cond.	100.5	Control Co.	CC8596	04/30/11	93.7
	447	Oakton	205259	05/31/11	446.3

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.19
HANNA Turbidimeter Calibration Check: SN 08292360					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
Turbidity(NTU)	< 0.10	Hanna	0279	09/30/12	.05
Turbidity(NTU)	15	Hanna	0286	10/31/12	15
Turbidity(NTU)	100	Hanna	0277	09/30/12	100
Turbidity(NTU)	750	Hanna	0285	10/31/12	750

ZS 11/08/2010

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SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	11/08/2010	Anna WM Radloff	12/28/2010

20 Book No HNF-N-701 1

Title PORE WATER SAMPLING Project No 41274/216575

From Page No. 19

10:00 Decon per SAI.
2A-A QC Station Start time ~10:20 end time ~10:25
Staff guage before 0.3 after 0.3
Conductivity: 305

T100BC6J10 Substrate: Med/small Cobble
Water depth at Station: 2.1 ft.

INITIAL Porewater Readings				Date: 11/08/2010
Water quality results (after purge water)				
Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
311.5	13.423	340	7.27	8.35
Turbidity[d] 270				

SurfacewaterReadings				
Water quality results (after purge water)				
Conductivity (µS/cm)[a]	Temp (C°)[b] a 2S 11/08/10	ORP[a]	pH[a]	D.O.[c]
141.4	12.6	312	7.90	9.82
Turbidity[d] 0.80 NTU				

COMPOSITE Porewater Sample				CMA Trimble	
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83	2.04 ft accuracy
T100BC6J10	F11-016	before: 0.3 after: 0.3	Start: 11:08 End: 12:24	E-119.64330461	N46.63940585
Probe Tip Depth (Inches) (6"-12") 11" BSG	Water quality results (Composite) ~600 mL				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	329.9	13.931	306	7.18	8.42
	Turbidity[d] 23.0				
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
B29892		~600 mL		NA	01 / 1LAG

FINAL Porewater Readings				
Water quality results				
Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
331.4	13.627	301	7.12	7.56
Turbidity[d] 3.10				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

LKE Simmons

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SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Lke Simmons	11/08/2010	[signature]	12/28/2010

Book No HNF-N-701 / 21

Title PORE WATER SAMPLING Project No 41274/216575

From Page No. 20

12:40 Decon in field per SAI

T100BC1J1 Substrate: Silt/Sand

Water depth at station: 13.3 ft.

INITIAL Porewater Readings				Date: 11/08/2010
Water quality results (after purge water)				
Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
296.2	13.601	-41 (Negative)	6.99	5.29
Turbidity[d] 40.0				

SurfacewaterReadings				
Water quality results (after purge water)				
Conductivity (µS/cm)[a]	Trident temp 13.845 ZS 11/08/10 Temp (C°)[b] a	ORP[a]	pH[a]	D.O.[c]
150.8	14.6	160	7.47	9.81
Turbidity[d] 0.60				

COMPOSITE Porewater Sample					
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83	1.76 ft accuracy
T100BC1J1	F11-016	before: 0.3 after: 0.5	Start: 13:55 End: 15:13	E-119.65336601	N46.63725932
Probe Tip Depth (Inches) (6"-12") 12 inches BSG	Water quality results (Composite)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	295.3	13.588	-25 (Negative)	7.07	6.34
	Turbidity[d] 60.0 NTU				
HEIS Sample No.(s)	Volume (mL)			Duplicate? Tied To:	# Bottles/Notes:
B29884	~575 mL			NA	01/1LAG

FINAL Porewater Readings				
Water quality results				
Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
307.7	13.686	-63 (Negative)	6.92	6.47
Turbidity[d] 3.30 NTU				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Zeke Simmons

15:30 Decon per SAI

ZS 11/08/2010

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SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	11/08/2010	[signature]	12/26/2010

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Book No. HNF-N-7011

Title: PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 21

2A-A QC Station Start Time: ~15:40 End Time: ~15:45

Staff guage: before: 0.5 after: 0.5

Conductivity: 305

16:30 Cell phone call to Anna Radloff: Verifying/confirming Sample delivery

ZS 11/08/2010

NA

Signature: [signature] Date: 11/08/2010

Witnessed & Understood by: [signature] Date: 12/29/2010

Book No. HNF-N-7011 23

TITLE PORE WATER SAMPLING Project No. 41274/216575

From Page No. NA 11/09/2010

Zeke Simmons (EAS) Zeke Simmons, Neil Sullivan (EAS), Chris Smith (CMA), Mark Biser (CMA). 11/09/2010

08:00 Tailgate meeting (POD) held at Apel.

Weather: Mostly Sunny / Partial-few clouds in the A.M. hrs

River Flow: 57 KCFS at 07:00 hrs.

Time	KCFS
0100	104
0200	95
0300	82
0400	69
0500	65
0600	59
0700	57

Weather: P.M. hrs - Overcast, breezy → decreasing temperature & rain.

Zeke Simmons

CHPRC 2010				Date: 11/09/2010	
Trident Probe Conductivity Calibration Check					
Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	95	96
447	Oakton	205259	05/31/11	446	458

Myron L Ultrameter II Calibration Check: SN 6227090					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	6.97
	4	Myron L Company	2003077 JM	08/03/11	3.78
Cond.	100.5	Control Co.	CC8596	04/30/11	93.03
	447	Oakton	205259	05/31/11	443.5

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.17
HANNA Turbidimeter Calibration Check: SN 08292360					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
Turbidity(NTU)	< 0.10	Hanna	0279	09/30/12	0.05
Turbidity(NTU)	15	Hanna	0286	10/31/12	15
Turbidity(NTU)	100	Hanna	0277	09/30/12	100
Turbidity(NTU)	750	Hanna	0285	10/31/12	750

DI Water from Apel Lab 151/153			
Property of	Mfr.	Model	megohm-cm
Applied Process Engineering Laboratory	Barnstead	E-pure	17.5

Decon in field per SAI at 10:00 hrs

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SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	11/09/2010	[signature]	12/20/2010

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Title: PORE WATER SAMPLING

Book No. HNF-N-7011

Project No. 41274/216575

From Page No. 23

ZS 11/09/2010 ZS 11/09/2010

2A-A QC Station Start time: ~~12:55~~ 10:55 End time: ~~13:00~~ 11:00

Staff guage: 0.75 before: 0.75 after: 0.75

Conductivity: 329.8 ~330

T100BC1J5 Substrate: Silt

Water depth at Station: 16.5 ft

	INITIAL Porewater Readings		Date: 11/09/2010		
Myron Cond. 295.1	Water quality results (after purge water)				
	Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	309	14.122	284	7.20	7.18
	Turbidity[d] 50.0 NTU				

	SurfacewaterReadings				
	Water quality results (after purge water)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	130.4	12.721	281	7.77	10.21
	Turbidity[d] 0.50 NTU				

COMPOSITE Porewater Sample				CMA Trimble Coordinates (deg.deg)NAD83 Accuracy 2.08 ft	
Station ID:	SAF#	Staff Guage (m.m)	Sample Time		
T100BC1J5	F11-016	before 0.75 after 0.75	Start: 12:00 End: 13:20	E-119.65349785	N46.6377800
Probe Tip Depth (Inches) (6"-12")	TDS 147.4				
12 inches BSG	Water quality results (Composite)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	303.7	14.221	289	7.23	8.62
	Turbidity[d] 19.0 NTU				
HEIS Sample No.(s)	Volume (mL)			Duplicate? Tied To:	# Bottles/Notes:
B29885	~600 mL			NA	01 / 1LAG

	FINAL Porewater Readings				
	Water quality results				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	305.5	13.426	292	7.32	7.29
	Turbidity[d] 65.0 NTU				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Zike Simmons

To Page No. 25

Signature: Zike Simmons Date: 11/09/2010 Witnessed & Understood by: [signature] Date: 11/22/2010

Book No. HNF-N-701 I　　25

Title POREWATER SAMPLING　　Project No. 41274/216575

From Page No. 24

13:30 Decon in field per SAI.

21:02 Cell phone call with Roy Plunkett (CHPRC) reguarding sample/traveler relinquishment time.

J100BC21　　Substrate: Med/Large cobble

Water depth at Station: 11.4 ft

Myron Cond. 216.3	INITIAL Porewater Readings		Date: 11/09/2010		
	Water quality results (after purge water)				
	Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	229	13.230	285	7.23	9.40
	Turbidity[d] 950.0 NTU				

	SurfacewaterReadings				
	Water quality results (after purge water)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	142.1	13.180	284	7.43	10.17
	Turbidity[d] 1.80 NTU				

COMPOSITE Porewater Sample				CMA Trimble Coordinates (deg.deg)NAD83 Accuracy 1.5ft	
Station ID:	SAF#	Staff Guage (m.m)	Sample Time		
J100BC21	F11-016	before: 0.75 after: NA	Start: 15:00 End: 17:55	E-119.64727433	N46.63914266
Probe Tip Depth (Inches) (6"-12") 8" BSG	Water quality results (Composite)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	243.6	12.971	283	7.38	10.69
	Turbidity[d] 75.0 NTU				
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
B29888		~560 mL		NA	01/1LAG

	FINAL Porewater Readings				
	Water quality results				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	255.2		298	7.28	10.33
	Turbidity[d] 13.0 NTU				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Pete Simmons

18:10 Decon per SAI.
15:41 Cell phone call with Jim Hogan (CHPRC): Status update
19:50 Cell phone call with Jim Hogan reguarding sample relinquishment

To Page No. NA

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Pete Simmons	11/09/2010	[signature]	11/28/2010

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TITLE PORE WATER SAMPLING

Book No. HNF-N-701 1

Project No. 41274/216575

From Page No. NA

11/10/2010 Zeke Simmons (EAS) Zeke Simmons, Neil Sullivan (EAS),
Chris Smith (CMA), Mark Biser (CMA)
08:00 Tailgate meeting (POD) held at Apel.
Weather: Sunshine / partial clouds with slight breeze
River Flow:

Time	KCFS
0100	51
0200	NA
0300	111
0400	108
0500	51
0600	58
0700	58

Zeke Simmons

CHPRC 2010				Date: 11/10/2010	
Trident Probe Conductivity Calibration Check					
Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	95	94
447	Oakton	205259	05/31/11	451	450

Myron L Ultrameter II Calibration Check: SN 6227090					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	7.05
	4	Myron L Company	2003077 JM	08/03/11	4.01
Cond.	100.5	Control Co.	CC8596	04/30/11	92.87
	447	Oakton	205259	05/31/11	444.2

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.17
HANNA Turbidimeter Calibration Check: SN 08292360					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
Turbidity(NTU)	< 0.10	Hanna	0279	09/30/12	0.05
Turbidity(NTU)	15	Hanna	0286	10/31/12	15
Turbidity(NTU)	100	Hanna	0277	09/30/12	100
Turbidity(NTU)	750	Hanna	0285	10/31/12	750

DI Water from Apel Lab 151/153			
Property of	Mfr.	Model	megohm-cm
Applied Process Engineering Laboratory	Barnstead	E-pure	17.6

ZS ~~10/11/2010~~ 11/10/2010

To Page No. 27

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	11/10/2010	[signature]	02/03/2011

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Title: PORE WATER SAMPLING

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Project No. 41274/216575

From Page No. 26

Telephone Call to Anna Radloff (CHPRC) at 0729. Conversation regarding Site ID No./LOCATION of J100BC47.

ZS ~~10/11/2010~~ 11/10/2010

QC Station
2A-A Start time: 10:25 End time: 10:30
Staff guage: before 0.80 after 0.80
Conductivity: 304.4

J100BC47 Substrate: Sand
Water depth at Station: 2.9 ft

12:20 Roy Plunkett (CHPRC) called to inform us that he does have personell (NCO'S/Sample intake) available until ~ 8:30 PM/20:30.

ZS ~~10/11/2010~~ 11/10/2010

Primary Sample collection vessel for SPLIT Sample taken/collected at J100BC47: 160-2.5; 2.5 Gallon LDPE Cubitainer
BOTTLE TYPE: Plastic
QA LEVEL: 01
LOT NO: 038556
MANUFACTURER: EP Scientific Products LLC
200 B.J. Tunnell Blvd.
Miami, OK 74354
Sample collected in cubitainer described above to be SPLIT into 02 1 L Amber Glass bottles (1LAG). 1 LAG described below.
112-01A: 1 Liter Amber Narrow Mouth Boston Round
BOTTLE TYPE: Glass
QA LEVEL: 01
LOT NO: 043612
MANUFACTURER: Same as above (EP Scientific Products LLC)

ZS ~~10/11/2010~~ 11/10/2010

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Zeke Summers ~~10/11/2010~~ ZS 11/10/2010 [signature] 02/03/2011

TITLE PORE WATER SAMPLING

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Project No. 41274/216575

From Page No. 27

INITIAL Porewater Readings					Date: 11/10/2010
	Water quality results (after purge water)				
	Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	160	13.176	269	7.67	9.54
	Turbidity[d] 130.0 NTU				

Trident Cond. Reference Probe, 142	SurfacewaterReadings				
Myron Temp. 12.6°C	Water quality results (after purge water)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	139.8	14.689	259	7.82	10.42
	Turbidity[d] 1.50 NTU				

COMPOSITE Porewater Sample					
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83 accuracy 2.26 ft	
J100BC47	F11-016	before 0.80 after: 0.80	Start: 13:02 End: 16:13	E-119.63597471	N46.64083715
Probe Tip Depth (Inches) (6"-12") 12 inches BSG	Water quality results (Composite)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	354.7	14.174	232	7.72	10.20
	Turbidity[d] 5.60 NTU				
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
B29894		~ 800 mL		SPLIT	01/1LAG
B29895		1000 mL / 1 L		SPLIT	01/1LAG

FINAL Porewater Readings					
	Water quality results				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	355.7	13.404	257	7.73	9.36
	Turbidity[d] 1.30 NTU				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Zeke Simmons

PURGE
INITIAL PW Readings

At station J100BC47.

mL	Cond. (µS/cm)	Temp.
0	148	12.840
30	160	13.176
60	306	13.718
90	322	14.213
120	335	14.379
150	345	14.566

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SIGNATURE Zeke Simmons DATE 11/10/2010 WITNESSED & UNDERSTOOD BY [signature] DATE 11/16/2010

Book No. HNF-N-701 1 29

TITLE PORE WATER SAMPLING Project No. 41274/216575

From Page No. 28

14:27 Cell phone call with (from) Awna Radloff (CHPRC): Informed Awna that the sample collection start time at Station ID J100BC47 (Sample No's B29894 & B29895) was 13:02. Collection start time into Cubitainer for Split Sample. = 13:02.

Decon per SAI at 16:30

2A-A QC Station Start time 16:45 End time 16:50
Conductivity: 305

16:44 Cell phone call to Roy Plunkett (CHPRC) regarding sample relingishment.

17:09 Cell phone call with Awna Radloff: Informed Awna that sampling at J100BC47 is complete.

17:40 Relinquished samples & COC's/Travelers to NCO's/Sample intake personell accompanied by Roy Plunkett.

ZS 11/10/2010

To Page No. NA

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	11/10/2010	Awna ... Radloff	12/28/2010

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Book No. HNF-N-701 1

TITLE PORE WATER SAMPLING

Project No. 41274/216575

From Page No. NA

11/12/2010 Zeke Simmons (EAS) Zeke Simmons

16:00 Cell phone call/"Tailgate Meeting" (POD) with Brett Tiller (EAS).

Discussed hourly safety check in with Brett via cell phone.

Weather: Sunshine

River Flow:

Time	KCFS

Myron L Ultrameter II Calibration Check: SN 6227090 11/12/2010					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	7.02
	4	Myron L Company	2003077 JM	08/03/11	3.98
Cond.	100.5	Control Co.	CC8596	04/30/11	97.41
	447	Oakton	205259	05/31/11	445.0

*ORP is calibrated using results of pH cal. Check

Zeke Simmons

2A-A (QC Station)

Conductivity	Time
303	18:15
307	19:15
305	20:15
306	21:15
306	22:15
306	23:15

Could not read staff guage with Mag Light (flashlight).

Purged >500 mL between each conductivity reading

Cell phone hourly safety check in with Brett Tiller (✓ INTICATES COMPLETE)

✓ 17:30
✓ 18:30
✓ 19:30
✓ 20:30
✓ 21:30
✓ 22:30
✓ 23:30

Decon in field per SAI at 23:20 hrs.

ZS 11/12/2010

To Page No. NA

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	11/12/2010	[signature]	02/03/2011

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Title PORE WATER SAMPLING Project No. 41274/216575

From Page No. NA

11/14/2010 Zeke Simmons (EAS) Zeke Simmons, Rob Coret (EAS), Chris Smith (CMA), Mark Biser (CMA)
Personell mentioned above to be on EAS vessel 2
Neil Sullivan (EAS), Adam Predmore (EAS) to be on EAS vessel 1 (pilot Boat)

08:30 Tailgate meeting (POD) held at Apel: Discussion of hand held radio communication between EAS vessel 1 & EAS vessel 2
Weather: Sunshine
River Flow:

Time	KCFS
0100	66
0200	59
0300	81
0400	79
0500	38
0600	38
0700	38

Zeke Simmons

CHPRC 2010 — Date: 11-14-10

Trident Probe Conductivity Calibration Check

Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	106	101
447	Oakton	205259	05/31/11	452	452

Myron L Ultrameter II Calibration Check: SN 6227090

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	6.96
	4	Myron L Company	2003077 JM	08/03/11	3.76
Cond.	100.5	Control Co.	CC8596	04/30/11	97.97
	447	Oakton	205259	05/31/11	448.6

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.08

HANNA Turbidimeter Calibration Check: SN 08292360

	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
Turbidity(NTU)	< 0.10	Hanna	0279	09/30/12	0.05
Turbidity(NTU)	15	Hanna	0286	10/31/12	15.0
Turbidity(NTU)	100	Hanna	0277	09/30/12	100.0
Turbidity(NTU)	750	Hanna	0285	10/31/12	750.0

DI Water from Apel Lab 151/153

Property of	Mfr.	Model	megohm-cm
Applied Process Engineering Laboratory	Barnstead	E-pure	17.5

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SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
Zeke Simmons	11/14/2010	[signature]	02/03/2011

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Book No. HNF-N-701 I

Title: PORE WATER SAMPLING

Project No. 41274/216575

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10:30 Decon per SAI in field

2A-A QC Station Start time: 10:30 End time. 10:35
Staff guage: 0.15m before 0.15m after
Conductivity: 308

J100BC23 Substrate: Medium cobble water depth at station 8.2 ft

INITIAL Porewater Readings					Date: 11/14/2010
	Water quality results (after purge water)				
	Conductivity (µS/cm)[b]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	225	12.994	289	7.69	9.26
	Turbidity[d] 220 NTU				

SurfacewaterReadings					
	Water quality results (after purge water)				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	142	13.041	284	7.32	9.98
	Turbidity[d] 0.95 NTU				

COMPOSITE Porewater Sample					
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83	1.62 ft accuracy
J100BC23	F11-016	before: 0.15 after: 0.15	Start: 13:17 End: 14:37	E-119.6425896	N46.6398027
Probe Tip Depth (Inches) (6"-12")					
	Water quality results (Composite)				
10 inches BSG	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	207	12.931	261	7.64	9.68
	Turbidity[d] 45.0 NTU				
HEIS Sample No.(s)		Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:
B29893		~600 mL		NA	01/1LAG

FINAL Porewater Readings					
	Water quality results				
	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	200.8	12.931	286	7.77	9.63
	Turbidity[d] 11.0 NTU				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Luke Simmons

To Page No. 33

Signature	Date	Witnessed & Understood by	Date
Luke Simmons	11/14/2010	[signature]	12/28/2010

Title PORE WATER SAMPLING

From Page No. 32

J100BC23 Continued
PURGE/Initial PW Readings

mL	Cond (uS/cm)	Temp.
0	144	12.746
30	183	12.810
60	234	12.991
90	228	13.005
120	222	13.016
150	NA	NA

Decon per SAI at 14:45 hrs

13:33 Cell phone call from Jim Hogan (CHPRC) Concerning sample relinquishment
13:50 Cell phone call from Brett Tiller (EAS): Status update
15:05 Cell phone call to Jim Hogan concerning sample/traveler/coc relinquishment place and time
15:08 Cell phone call with Anna Radloff (CHPRC) concerning the Station ID No for Station J100BC23/Sample No. B29893 Granted permission to Strike the LOCATION No. to correct it.
(EX. ~~T100BC23~~ ZS 11/14/2010 J100BC23)

T100BC5C Substrate: Medium cobble/Small cobble
Water depth at Station: 10.2 ft
PURGE/Initial PW Readings

mL	Cond (uS/cm)	Temp.
0	142	12.878
30	151	12.794
60	166	12.829
90	166	12.827
120	169	12.914

ZS 11/14/2010
ZS 11/14/2010
ZS 11/14/2010

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Signature: Zeke Simmons Date: 11/14/2010
Read & Understood by: Anna WM Radloff Date: 12/28/2010

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Book No. HNF-N-7011

Title: PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 33

INITIAL Porewater Readings — Date: 11/14/2010

Myron Conductivity 159

Water quality results (after purge water)				
Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
170	12.829	279	7.32	9.53
Turbidity[d] 340 NTU				

SurfacewaterReadings

1421.6 ~

Water quality results (after purge water)				
Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
143	12.6888	282	7.66	9.74
Turbidity[d] 1.60 NTU				

COMPOSITE Porewater Sample

Station ID: T100BC5C	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83 Accuracy 1.74 ft	
T100BC5C	F11-016	before: 0.15 after: NA	Start: 15:45 End: 16:40	E-119.64436901	N46.64101069

Probe Tip Depth (Inches) (6"-12")	Water quality results (Composite)				
9 inches BSG	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	158.7	12.740	311	7.43	9.52
	Turbidity[d] 3000 NTU				

HEIS Sample No.(s)	Volume (mL)	Duplicate? Tied To:	# Bottles/Notes:
B29891	~550 mL	NA	01/1LAG

FINAL Porewater Readings

Water quality results				
Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
146.8	12.740	307	7.74	9.58
Turbidity[d] 4000 NTU				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Zeke Simmons

16:50 Decon in field per SAI.

18:00 Samples relinquished to CHPRC Rep(s)/NCO's/Sample intake personell accompanied by Jim Hogan.
COC's/Traveler relinquished/Signed at 18:00.
~~ZS 11/14/2010~~

To Page No. NA

Signature	Date	Witnessed & Understood by	Date
Zeke Simmons	11/14/2010	[signature]	12/29/2010

Book No. HNF-N-701 I 35

Title PORE WATER SAMPLING

Project No. 41214/216575

From Page No. NA

11/15/10 Shannan Johnson (EAS) [signature], Rob Curet (EAS) Chris Smith (CMA), Mark Biser (CMA) on EAS Vessel #2.

Neil Sullivan (EAS) and Adam Predmore (EAS) on EAS Vessel #1 (Pilot Boat).

0800 Tailgate meeting (POD) held at Apel: Discussion of high wind potential and importance of wearing hard hats.

Weather: Mostly Cloudy

[signature]

CHPRC 2010					Date: 11-15-10
Trident Probe Conductivity Calibration Check					
Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	103	98
447	Oakton	205259	05/31/11	448	447

Myron L Ultrameter II Calibration Check: SN 6227090					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	7.00
	4	Myron L Company	2003077 JM	08/03/11	3.90
Cond.	100.5	Control Co.	CC8596	04/30/11	98.43
	447	Oakton	205259	05/31/11	444.3

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.09
HANNA Turbidimeter Calibration Check: SN 08292360					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
Turbidity(NTU)	< 0.10	Hanna	0279	09/30/12	0.05
Turbidity(NTU)	15	Hanna	0286	10/31/12	15
Turbidity(NTU)	100	Hanna	0277	09/30/12	100
Turbidity(NTU)	750	Hanna	0285	10/31/12	750

DI Water from Apel Lab 151/153			
Property of	Mfr.	Model	megohm-cm
Applied Process Engineering Laboratory	Barnstead	E-pure	17.5

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SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
[signature]	11/15/20	[signature]	12/28/2010

Book No. HNF-N-7011

Title: PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 35

Telephone call to Awna Radloff (CHPRC) regarding additional T100BC3C COC. Instructed to place note indicating "to be destroyed" and turn in with other Chain of Custodies (COC). ~0745

1030 Received call from Roy Plunkett (CHPRC) concerning sample relinquishment time and place.

~~11:30~~ 09:30 (initialed 11/15/10) Decon per SAI in field.

2A-A QC Station Start Time: 11.35 End Time: 11:40 (11:59)
Staff guage: 0.60
Conductivity: 304

1325 Telephone call to B. Tiller to relay that 11 attempts have been made ~~to acq~~ (initialed 11/15/10) without success to acquire target conductivity. Plan is to verify that there are no leaks and continue attempts.

Column 1 - mL / Column 2 - Conductivity

Attempt #1 (80ft SW of site)

0	141
30	147
60	143

Attempt #2 (40ft SW of site)

0	142
30	145
60	145

Attempt #3 (Dead On)

0	145
30	149
60	149

Attempt #4 (10ft N)

0	145
30	148
60	152

Attempt #5 (10ft S)

0	147
30	150
60	148

Attempt #6 (5ft further N)

0	145
30	145
60	145

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Signature: [signature] Date: 11/15/10 Witnessed & Understood by: [signature] Date: 12/20/2010

CONFIDENTIAL

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TITLE PORE WATER SAMPLING Project No. 41214/216575
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Attempt #7 (20 ft further E)
0 145
30 162
60 172

Attempt #8 (20 ft further E)
0 145
30 145
60 145

Attempt #9 (10 ft further N)
0 149
30 150
60 148

Attempt #10 (10 ft further S)
0 147
30 148
60 148

Attempt #11 (20 ft further E)
0 143
30 144
~~60~~ SJ 11/15/10

Attempt #12 (10 ft further N)
0 144
30 147
~~60~~ SJ 11/15/10

Attempt #13 (10 ft further S)
0 145 120 149
30 148
60 148
90 149

Attempt #14 (20 ft W)
0 141
30 157
60 152

Attempt #15 (20 ft W)
0 150 46.63981827 (Trimble)
30 147 -119.65019910
60 145 1.57" ft accuracy

Decon per SAI at 15:30. 15:15 call to Roy - no samp

1420 Call between B. Tiller and Steve Lowe determined that if a conductivity of 170 was reached - a sample could be taken. This call and the transfer of the information from B. Tiller to the sampling team took place between attempts 11 and 12.

1500 Due to an expected release from Priest Rapids it was determined by Steve Lowe and B. Tiller to abort any further attempts. Continued on Page N/A

SIGNATURE [signature] DATE 11/15/10 WITNESSED & UNDERSTOOD BY [signature] DATE 12/28/2010
CONFIDENTIAL

38 Book No. 25 ~~HNF-701~~ HNF-N-701 I

Title POREWATER SAMPLING Project No. 41274/216575

From Page No. 0/A 11/16/2010

Shannan Johnson (EAS) [signature], Rob Curet (EAS), Chris Smith (CMA), and Mark Biser (CMA) on EAS Vessel #2

Neil Sullivan (EAS) and Alan Predmore (EAS) on Vessel #1 (Pilot Boat).

0745 Tailgate meeting held at APEL: working in windy conditions.

Weather: Partly Cloudy, windy [signature]

CHPRC 2010				Date: 11-16-10	
Trident Probe Conductivity Calibration Check					
Standard	Mfr.	Lot #	Expiration Date	Porewater Probe	Surface Probe
100.5 uS	Control Co.	CC8596	04/30/11	103	102
447	Oakton	205259	05/31/11	459	456

Myron L Ultrameter II Calibration Check: SN 6227090					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
pH*	7	Myron L Company	1001397 EB	09/09/11	6.99
	4	Myron L Company	2003077 JM	08/03/11	3.94
Cond.	100.5	Control Co.	CC8596	04/30/11	98.98
	447	Oakton	205259	05/31/11	446.6

*ORP is calibrated using results of pH cal. Check

YSI Dissolved Oxygen Meter Calibration Check: SN 09F100411					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
D.O.	Zero	Hanna	1427	March of 2014	0.09
HANNA Turbidimeter Calibration Check: SN 08292360					
	Standard	Mfr.	Lot #	Expiration Date	Actual Reading
Turbidity(NTU)	< 0.10	Hanna	0279	09/30/12	0.05
Turbidity(NTU)	15	Hanna	0286	10/31/12	15
Turbidity(NTU)	100	Hanna	0277	09/30/12	100
Turbidity(NTU)	750	Hanna	0285	10/31/12	750

DI Water from Apel Lab 151/153			
Property of	Mfr.	Model	megohm-cm
Applied Process Engineering Laboratory	Barnstead	E-pure	17.5

To Page No.

SIGNATURE	DATE	WITNESSED & UNDERSTOOD BY	DATE
[signature]	11/16/10	[signature]	12/28/2010

CONFIDENTIAL

Book No. HNF-N-701 I 39

Title PORE WATER SAMPLING
Project No. 41274/216575

From Page No. 38

River Flows

Time	KCFS
0100	75
0200	74
0300	73
0400	79
0500	83
0600	82

Decon per SAI 0945

2A-A QC Station Start Time: 1015. End Time: 1020
Staff Guage: .7
Conductivity 305.3
~~T100BC3C~~ 11/16/10 Station: T100BC3C
Column 1 - mL / Column 2 - conductivity

Trimble

Attempt #1 ~~46.639889~~ 11/16/10 46.63989959
~~-119.65030~~ -119.65027221

0	138
30	145
60	146
90	146

1020 18ft depth ± 1.94 ft

Attempt #2

0	144
30	164
60	164
90	161
120	157.

1040 19ft depth 46.63993122
-119.65026194
± 2.3ft.

Phone call to B. Tiller confirms it is acceptable to bottle 168.

Substrate: Lg/med boulders Water Depth: 19ft

Signature [signature] 11/16/10 [signature] 12/28/2010

40

Title: PORE WATER SAMPLING

Book No. HNF-N-701 1

Project No. 41274/216575

From Page No. 39

Purge/Initial PW Readings

mL	Conductivity	Temp (C°)
0	144	12.290
30	157	12.299
60	162	12.347
90	169	12.410
120	169	12.410
150	168	12.384

INITIAL Porewater Readings Date: 11/16/10

Water quality results (after purge water)

Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
163.6	12.423	213	8.14	8.93
Turbidity[d] 1000				

SurfacewaterReadings

Water quality results (after purge water)

Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
139.0	13.1	223	7.8	8.72
Turbidity[d] 2.60				

COMPOSITE Porewater Sample

Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83	±2.04 ft accuracy
T100BC3C	F11-016	before: .7 after: .7	Start: 1121 End: 12:10	E-119.65023444	N46.63994520

Probe Tip Depth (Inches) (6"-12"): 8" (wgs)

Water quality results (Composite)

Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
173.7	12.432	232	7.78	8.79
Turbidity[d] ~~2.60~~ 650				

HEIS Sample No.(s)	Volume (mL)	Duplicate? Tied To:	# Bottles/Notes:
B29886	~550 mLs	Y B29B83	1 (+1 Dup)

FINAL Porewater Readings

Water quality results

Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
188.4	~~19~~ 12.437	240	7.66	8.72
Turbidity[d] 1000.0				

a) Myron
b) Trident
c) YSI
d) Hanna Meter

Signature: [signature] Date: 11/16/10 Read and Understood By: [signature] Date: 12/28/2010

Book No. HDF-N-701 / 41

Title PORE WATER SAMPLING

Project No. 41274/216575

From Page No. 40

1237 Left msg with Roy Plunkett telling him we were on 2nd sample (for sample relinquishment purposes).
1315 J Hogan calls. He will have the team meet us at the Vernita boat launch.

INITIAL Porewater Readings				Date: 11/16/10
Water quality results (after purge water)				
Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
183.1	12.436	239	7.68	8.65
Turbidity[d] 6.00				

SurfacewaterReadings				
Water quality results (after purge water)				
Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
139.1	~~12.438~~ 274	246	7.50	9.21
Turbidity[d] 3.10				

COMPOSITE Porewater Sample					
Station ID:	SAF#	Staff Guage (m.m)	Sample Time	Coordinates (deg.deg)NAD83	±2.04 ft accuracy
T100BC3E	F11-016	before: .7 after: .65	Start: 12:21 End: 12:51	E -119.65023444	N 46.68994520
Probe Tip Depth (Inches) (6"-12")	Water quality results (Composite)				
8 (bgs)	Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
	231.7	12.433	231	7.82	7.55
	Turbidity[d] 4.50				
HEIS Sample No.(s)	Volume (mL)		Duplicate? Tied To:	# Bottles/Notes:	
B29B83	~550 mL		N/A / B29B86	1	

FINAL Porewater Readings				
Water quality results				
Conductivity (µS/cm)[a]	Temp (C°)[b]	ORP[a]	pH[a]	D.O.[c]
260.3	12.435	235	7.85	6.91
Turbidity[d] 11.0		TDS 124.7		

a) Myron
b) Trident
c) YSI
d) Hanna Meter

To Page No. 42

Signature [signature] Date 11/16/10 Witnessed & Understood by [signature] Date 12/28/2010

42 Book No. HDF-U-761 1

Title PORE WATER SAMPLING Project No. 41274/216575

From Page No. 41

1400 Per call to Brett Tiller an additional sample will be collected.
1420 Left msg with J. Hogan notifying changes.
1530 Flow stopped-discussed options with Brett.
Drove ~~Hit~~ 11/16/10 the beetle 3x and lost conductivity number.

Continued to pump to acquire conductivity values, but was unable to ~~due~~ SJ 11/16/10 do so. Thus, the third sample was not collected. per telephone call with Brett at 1630.
1635 Call to J. Hogan re: sample relinquishment.
1645 Sample equipment deconned per SAI.

1735 Call made to J. Hogan re: sample relinquishment.

1800 Samples relinquished to CHPRC reps sent ~~accompanied~~ SJ 11/16/10 by J. Hogan.

~~1800~~ SJ 11/16/10 Final 2A-A QC Start Time: ~~15 10~~ JS 11/16/2010 17:10 End Time ~~15 15~~ JS 11/16/10 17:15
Staff Gauge: .6
Conductivity: 304.8

SJ 11/16/10

N/A

SIGNATURE [signature] DATE 11/16/10 WITNESSED & UNDERSTOOD BY [signature] 12/28/2010

CONTINUE ON PAGE

Appendix E

Coastal Monitoring Associates Pore Water Field Log

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COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS

Lat N 46.64078

Long W -119.63627

VESSEL GPS

Lat N ____

Long W ____

Accuracy (ft) ____

TIME (on station) Start 1230

End ____

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) — Frame circled

Station ID J100BC47

SURVEY DATE 10-28-2010

PROJECT PHASE CH Fall 2010

WATER DEPTH 3.2

BOTTOM TYPE

Surface Cobble/gravel

Layer ____

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	9"	
Temperature [C]	14.820	14.373
Conductivity [mS/cm]	279	150

Purge the volume of tubing prior to sample collection (circle one) YES NO

File Information

CMA Computer # 7

Data file name (.dat)	BC10_28_2010	Start Time	1312
Station gauge reading	.7	Averaging Time	1
Field Logbook #		End Time	1313

Pump start time	1307
Pump end time	
Picture ID	[illegible]

Sample time ____

Sample Number ____

Porewater Purge Pumping Data

ml	Cond	Temp
0	144	14.286
30	160	14.394
60	285	14.690
90	282	14.796
120	279	14.820

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity
Sample values	6.60	7.61	278	139.8	288.4
Surface Water	9.30	7.88	286	66.77	139.4

Comments/Observations QC check point

Recorder RP

Sample Collector

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100BC

TRIDENT GPS

~~Lat N~~ 119.690781W

~~Long W~~ LAT 46.64453

VESSEL GPS

Lat N ______

Long W ______

Accuracy (ft) ______

TIME (on station) Start 1305 End 1501

BOAT 2

Porewater Sampling Method Frame 3
(Frame, Trident/Handheld, Release Point)

Station ID BC1051

SURVEY DATE 11-4-10

PROJECT PHASE —

WATER DEPTH 4.1

BOTTOM TYPE
Surface med to large cobble

Layer ______

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	10"	1' AGS
Temperature [C]	14.200	14.174
Conductivity [mS/cm]	210	142

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

Porewater Purge Pumping Data

ml	Cond	Temp
0	138	14.208
30	199	14.207
60	203	14.204
90	205	14.201
120	209	14.197

File Information

CMA Computer # 6

Data file name (.dat)	BC1051.dat	Start Time	1327
Station gauge reading	0.7	Averaging Time	60 sec
Field Logbook #	HNF-N-701-1	End Time	1328

Pump start time	1320
Pump end time	1453
Picture ID	12343

Sample time 1453

Sample Number B29896

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity	Turbidity
Composite Sample values	7.89	7.34	281	98.11	204.3	38.0 ntu
Surface Water	10.01	7.48	277	69.92	195.5	0.70 ntu

Comments/Observations ______

R Paulson QA 11-25-2010

Recorder C Smith

Sample Collector Zeke Simmons

RP 11-25-2010

Coastal Monitoring Assosciates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-4-10
Site ID BC1051		Start Time 1320

Porewater Sampling Data

Time	Volume	Cond	Temp
1320	0	210	14.2
1350	300	208	14.206
1420	600	190	14.306
1447	900	219	14.345

Porewater Sampling Data

Time	Volume	Cond	Temp

AP 11-25-2010

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS

Lat N 46.63753

Long W 119.65533

~~VESSEL GPS~~ Submeter Trimble

Lat N 46.63757212

Long W 119.65534518

Accuracy (ft) 1.69'

TIME (on station) Start 1333 End 1602

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) 3

Station ID BC2A-A

SURVEY DATE 11-5-10

PROJECT PHASE

WATER DEPTH 1.9'

BOTTOM TYPE

Surface Sandy Silt

Layer

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	12" bsg	12" Abg
Temperature [C]	14.272	13.930
Conductivity [mS/cm]	308	147

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

Porewater Purge Pumping Data

ml	Cond	Temp
0	141	14.0
30	153	13.985
60	256	14.303
90	293	14.469
120	306	14.572

File Information

CMA Computer # 6

Data file name (.dat)	100BC2A-A	Start Time	1430
Station gauge reading	0.67 at 1330	Averaging Time	1
Field Logbook #	HNF-N-701_1	End Time	1431

Pump start time 1432

Pump end time 1547

Picture ID 12342

Sample time 1547

Sample Number B29883

DO & Ultrameter

	DO	pH	ORP	~~TDS~~	Conductivity
composite Sample values	8.38	7.15	313		304.7
Surface Water	10.27	7.48	291		145.9

Turbidity 5.00 ntu

Comments/Observations

QC R Paulsen 2010

Recorder C. Smith

Sample Collector Dale Simmons

Coastal Monitoring Assosciates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-5-10
Site ID 2A-A		Start Time 1232

Porewater Sampling Data

Time	Volume	Cond	Temp
0	0	308	14.097
30	200	313	15.001
60	450	313	14.986
69	600	313	14.973
END Sample			

Porewater Sampling Data

Time	Volume	Cond	Temp

RP
11-25-10

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS
Lat N 46.63897
Long W 119.64545

VESSEL GPS Trimble
Lat N 46.63896000
Long W 119.64548718
Accuracy (ft) 1.4'

TIME (on station) Start 1505 End 1710

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) — Frame circled, 3

Station ID T100BC4A

SURVEY DATE 11-7-10

PROJECT PHASE

WATER DEPTH 1.9

BOTTOM TYPE
Surface Medium/small cobble
Layer

Porewater Purge Pumping Data

ml	Cond	Temp
0	198	14.197
30	215	14.291
60	272	14.642
90	290	14.917
120	315	15.005

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	12" bsg	12" bsg
Temperature [C]	14.841	13.907
Conductivity [mS/cm]	340	145

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

File Information

CMA Computer # 6

Data file name (.dat)	T100BC4A	Start Time	1538
Station gauge reading	0.20	Averaging Time	1
Field Logbook #	HNF-N-701-1	End Time	1539

Pump start time 1540
Pump end time 1654
Picture ID 164203
164242

Sample time 1540

Sample Number B29889

DO & Ultrameter

	DO	pH	ORP	~~TDS~~	Conductivity
Comp Sample values	9.03	7.65	323		340.5
Surface Water	10.05	8.02	284		143.6

Turbidity ~~[illegible]~~ 11.0
2.00 ntu

Comments/Observations
QA R Paulsen 11 25 2010

Recorder C Smith

Sample Collector Zeke Simmons

Coastal Monitoring Associates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-7-10
Site ID 100		Start Time 1540

Porewater Sampling Data

Time	Volume	Cond	Temp
0	0	340	14.302
30	200	353	15.181
60	500	354	15.131
72	600	354	15.130

1654 end sampling

Porewater Sampling Data

Time	Volume	Cond	Temp

RP

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

11-7-10

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS
Lat N 46.64005 N
Long W 119.66445 W

VESSEL GPS Trimble
Lat N 46.64002920
Long W 119.66450409
Accuracy (ft) 1.9'

TIME (on station) Start 1122 End 1323

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) — (Frame) circled, 3

Station ID 100BCN52

SURVEY DATE 11-?-10

PROJECT PHASE

WATER DEPTH 1.6'

BOTTOM TYPE
Surface Medium Cobble
Layer

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	9" bsg	12" ASB
Temperature [C]	13.833	13.633
Conductivity [mS/cm]	284	156

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

Porewater Purge Pumping Data

ml	Cond	Temp
0	147	13.516
30	232	13.676
[illegible]	267	13.852
[illegible]	[illegible]	[illegible]
60	[illegible]	[illegible]
90	272	13.877
120	277	13.899

File Information

CMA Computer # 6

Data file name (.dat)	100BCN52	Start Time	1157
Station gauge reading	0.20	Averaging Time	1
Field Logbook #	HNF-N-701_1	End Time	1158

Pump start time 1156
Pump end time 1308
Picture ID [illegible] — 2010/11/07 12:46:31

Sample time 1196 Start Time?

Sample Number B29897

DO & Ultrameter

	DO	pH	ORP	~~TDS~~	Conductivity
Composite Sample values	8.22	7.22	313		281.1
Surface Water	9.76	7.56	283		152

Turbidity 8.60 NTU
1.20

Comments/Observations
Dc R Paulson 11-25-2010

Recorder C. Smith

Sample Collector Dale Simmons

Coastal Monitoring Assosciates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-7-10
Site ID BCN52		Start Time 1156

Porewater Sampling Data

Time	Volume	Cond	Temp
0	0	284	13.883
30	200	285	13.945
60	415	285	14.003
90	600	284	14.026
END Sample			

Porewater Sampling Data

Time	Volume	Cond	Temp

QC R Paulson 11-25-2010

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS
Lat N 46.63938
Long W 119.64330

TIME (on station) Start 1045 End 1240

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) 3

Station ID T100BC6J10 6J10

SURVEY DATE 11-8-10
PROJECT PHASE
WATER DEPTH 2.1'

BOTTOM TYPE
Surface Small/Med cobble
Layer

VESSEL GPS
Lat N 46.63940585
Long W 119.64330461
Accuracy (ft) 2.04'

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	11" bsg	12" Asg
Temperature [C]	13.659	13.200
Conductivity [mS/cm]	323	142

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

File Information

CMA Computer # 6

Data file name (.dat)	T100BC6J10	Start Time	1104
Station gauge reading	0.3	Averaging Time	1
Field Logbook #	HNF-N-701-1	End Time	1105

Porewater Purge Pumping Data

ml	Cond	Temp
0	140	
30	238	
60	272	
90	293	
120	309	
150	319	

Pump start time 1108
Pump end time 1224
Picture ID 123456 123610

Sample time 1108
Sample Number B29892

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity	Turbidity
Composite Sample values	8.42	7.78	306	160.5	329.9	23.0 ntu
Surface Water	9.82	7.90	312	67.49	141.4	0.80 ntu

Comments/Observations

Recorder C Smith

Sample Collector Zeke Simmons

QC R Poulsen 11252010

Coastal Monitoring Associates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-8-10
Site ID T100BC6J10		Start Time 1108

Porewater Sampling Data

	Time	Volume	Cond	Temp
1108	0	0	319	13.414
1138	30	225	341	13.774
1208	60	550	342	13.797
1224	76	650	343	13.825
	End Sample			

Porewater Sampling Data

Time	Volume	Cond	Temp

RB-RP 11-25-2010

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS
Lat N 46.63727
Long W 119.65335

VESSEL GPS Trimble
Lat N 46.63725932
Long W 119.65336601
Accuracy (ft) 1.76'

TIME (on station) Start 1330 End 1540

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) 3

Station ID T100BCJ51

SURVEY DATE 11-8-10

PROJECT PHASE

WATER DEPTH 13.3'

BOTTOM TYPE
Surface sandy mud
Layer

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	12" bsg	12" bsg
Temperature [C]	13.815	13.246
Conductivity [mS/cm]	312	143

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

Porewater Purge Pumping Data

ml	Cond	Temp
0	149	13.812
30	221	13.851
60	276	13.877
90	295	13.910
120	299	13.990
130	311	13.991

File Information

CMA Computer # 6

Data file name (.dat)	T100BCJ51.dat	Start Time	1353
Station gauge reading	0.5 at 1542	Averaging Time	1
Field Logbook #	HNF-N-701-1	End Time	1354

Pump start time 1355
Pump end time 1513
Picture ID 161353 161400

Sample time 1355

Sample Number B29884

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity	
composite Sample values	6.34	7.07	-25	143.3	295.3	Turbidity 60.0
Surface Water	9.81	7.47	160	72.44	150.8	0.60 ntu

Comments/Observations

Recorder C. Smith

Sample Collector Zelle Simmons

QA R Poulson 11-25-2010

Coastal Monitoring Assosciates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-9-10
Site ID T100BC131		Start Time 1355

Porewater Sampling Data

	mins Time	Volume	Cond	Temp
1355	0	0	311	13.548
	30	225	319	14.094
	60	550	320	13.741
1513	78	640	320	13.66
	END SAMPLE			

Porewater Sampling Data

Time	Volume	Cond	Temp

RP 11252010

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington
OPERABLE UNIT 100BK
TRIDENT GPS
Lat N 46.63913
Long W 119.64728

VESSEL GPS
Lat N 46.63914266
Long W 119.64727433
Accuracy (ft) 1.5'

TIME (on station) Start 1422
End
BOAT 2
Porewater Sampling Method (Frame) Trident/Handheld, Release Point) — Frame circled
3
Station ID J100BC21

SURVEY DATE 11-9-10
PROJECT PHASE
WATER DEPTH 11.4
BOTTOM TYPE
Surface Med/large cobble
Layer

Porewater Purge Pumping Data

ml	Cond	Temp
0	~~[illegible]~~ 147	
30	154	
60	176	
90	191	
120	201	
150	213	
180	218	

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	8" bsg	12" asg
Temperature [C]	13.230	12.964
Conductivity [mS/cm]	222	143

Purge the volume of tubing prior to sample collection (circle one) YES (circled) NO

File Information CMA Computer # 6

Data file name (.dat)	J100 BC 21	Start Time	1508
Station gauge reading	0.75	Averaging Time	1
Field Logbook #	HNF-N-701-1	End Time	1509

Pump start time 1500
Pump end time 1755
Picture ID 61223

Sample time 1500
Sample Number B29888

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity	Turbidity
Composite Sample values	~~[illegible]~~ 10.69	7.38	283	117.9	243.6	~~[illegible]~~ 75.0
Surface Water	10.17	7.43	284	68.78	142.1	1.80

Comments/Observations
Co R Paulson 11 25 2010 -shallow

Recorder C Smith
Sample Collector 2Oke Simmons

Coastal Monitoring Associates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100BC		Date 11-9-10
Site ID T100BC21		Start Time 1500

Porewater Sampling Data

	Time	Volume	Cond	Temp
1500	0	0	218	13.220
1530	~~40~~ 30	100	232	13.053
1600	60	200	252	13.022
1630	90	250	249	12.996
1700	120	350	254	12.974
1730	150	480	258	12.969
1800	180	500	260	12.970
	End Sample			

Porewater Sampling Data

Time	Volume	Cond	Temp

QC RP 11 25 2010

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100K

TRIDENT GPS

Lat N 46.63778

Long W 119.65350

VESSEL GPS

Lat N 46.6377800

Long W 119.65349785

Accuracy (ft) 2.08'

TIME (on station) Start 1115 End 1400

BOAT 2

Porewater Sampling Method (Frame) Trident/Handheld, Release Point) — Frame circled, 3

Station ID 7100KC 1J5

SURVEY DATE 11-9-10

PROJECT PHASE

WATER DEPTH 16.5

BOTTOM TYPE Surface Mud/silt

Layer

Porewater Purge Pumping Data

ml	Cond	Temp
0	143	12.769
30	190	12.949
60	268	13.514
90	292	13.722
120	303	14.011
~~150~~ 145	306	14.127

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	12" bsg	12" asg
Temperature [C]	14.122	12.730
Conductivity [mS/cm]	309	141

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

File Information CMA Computer # 6

Data file name (.dat)	7100KC1J5	Start Time	1158
Station gauge reading	0.75	Averaging Time	1
Field Logbook #	HNF-N-701-1	End Time	1159

Pump start time 1200

Pump end time 1320

Picture ID 1244

Sample time 1200

Sample Number B29885

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity	Turbidity
Composite Sample values	8.62	7.23	289	147.4	303.7	19.0
Surface Water	10.21	7.77	281	66.71	138.4	0.50 ntu

Comments/Observations

Recorder C Smith

Sample Collector Zoke Simmons

[signature] 10 25 2010

Coastal Monitoring Assosciates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-9-10
Site ID T100BC/J5		Start Time 1200

Porewater Sampling Data

	Time	Volume	Cond	Temp
1200	0	0	309	14.122
1230	30	200	315	14.214
1300	60	400	316	14.354
1330	90	600	314	13.863

Porewater Sampling Data

Time	Volume	Cond	Temp

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington
OPERABLE UNIT 100 BC
TRIDENT GPS
Lat N 46.64082
Long W 119.63597

6 tries to get Ho #

TIME (on station) Start 1050 End 1630
BOAT 2
Porewater Sampling Method (Frame, Trident/Handheld, Release Point)
Station ID J100BC47

SURVEY DATE 11-10-10
PROJECT PHASE
WATER DEPTH 2.9'
BOTTOM TYPE
Surface SAND
Layer

VESSEL GPS
Lat N 46.64083715
Long W 119.63597471
Accuracy (ft) 2.26'

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	12" b59	12" A59
Temperature [C]	14.613	12.829
Conductivity [mS/cm]	352	142

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

Porewater Purge Pumping Data

ml	Cond	Temp
0	148	12.840
30	160	13.176
60	306	13.718
90	322	14.213
120	335	14.379
150	345	14.566

File Information

CMA Computer # 6

Data file name (.dat)	J100BC47	Start Time	1305
Station gauge reading	0.8	Averaging Time	1
Field Logbook #	HNF-N-701_1	End Time	1306

Pump start time 1302
Pump end time 1613
Picture ID Taken

Sample time 1305
Sample Number B29895 1 Liter
B29894 500ml

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity
Composite Sample values	10.20	7.72	232	172.7	354.7
Surface Water	10.42	7.82	259	67.31	139.8

Turbidity
5.60
1.50 ntu

Comments/Observations
Recorder L. Smith
Sample Collector Zeke Simmons

[signature] 11 25 2010

Coastal Monitoring Assosciates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 1/10 2010
Site ID J100BC47		Start Time 1305

Porewater Sampling Data

	Time	Volume	Cond	Temp
1305	0	0	345	14.556
1335	30	200	361	14.981
1405	60	400	363	15.003
1435	90	600	363	14.917
1505	120	800	364	14.956
1535	150	1000	363	14.527
1605	180	*	364	14.879
	END Sample			
	* Did volume/flow check			
	estimate 1800 mls			

Porewater Sampling Data

Time	Volume	Cond	Temp

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS
Lat N 46.63980
Long W 119.64260

VESSEL GPS Trimble
Lat N 46.6398027
Long W 119.6425966
Accuracy (ft) 1.62'

TIME (on station) Start 1245 End 1450

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) 3

Station ID J100BC23

SURVEY DATE 11-14-10

PROJECT PHASE

WATER DEPTH 8.2

BOTTOM TYPE
Surface Small/Med Cobble
Layer

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	10" bgq	12" bgq
Temperature [C]	13.041	12.650
Conductivity [mS/cm]	218	143

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

File Information CMA Computer # 6

Data file name (.dat)	J100BC23	Start Time	13.17
Station gauge reading	0.15	Averaging Time	1
Field Logbook #	HNF-N-701-1	End Time	13.18

Porewater Purge Pumping Data

ml	Cond	Temp
0	144	12.746
30	183	12.810
60	234	12.991
90	228	13.005
120	222	13.016

Pump start time 1317
Pump end time 1437
Picture ID [illegible]

Sample time 1317
Sample Number B29893

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity	Turbidity
composite Sample values	9.69	7.64	261	99.60	207.4	45.0
Surface Water	9.93	7.32	284	68.05	142.2	0.95

Comments/Observations

Recorder C Smith

Sample Collector Zeke Simmons

R Paulson 11 25 2010

Coastal Monitoring Associates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-14-10
Site ID J100BC23		Start Time 1317

Porewater Sampling Data

	Time	Volume	Cond	Temp
1317	0	0	212	12.998
1347	30	200	214	12.915
1417	60	500	211	12.958
1437	87	600	214	12.928
	END SAMPLE			

Porewater Sampling Data

Time	Volume	Cond	Temp

QC R Paulson 11252010

Coastal Monitoring Assosciates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-14-10
Site ID 180 BZ 5C		Start Time 1545

Porewater Sampling Data

	Time	Volume	Cond	Temp
1545	0	0	170	12,875
1615	30	200	167	12,804
1645	60	650	156	12,740
	END Station			

QC R Poulson 11252010

Porewater Sampling Data

Time	Volume	Cond	Temp

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100BC

TRIDENT GPS
Lat N 46.64100
Long W 119.64440

VESSEL GPS
Lat N 46.64101069
Long W 119.64436901
Accuracy (ft) 1.74'

TIME (on station) Start 1505 ✓ End ____

BOAT 3

Porewater Sampling Method (Frame, Trident/Handheld, Release Point): Trident (circled)

Station ID 100BC5C

SURVEY DATE 11-14-10

PROJECT PHASE ____

WATER DEPTH 10.2

BOTTOM TYPE
Surface small/medium cobble
Layer ____

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	9" avg	12" Avg
Temperature [C]	12.829	12.688
Conductivity [mS/cm]	170	144

Purge the volume of tubing prior to sample collection (circle one) YES (circled) NO

Porewater Purge Pumping Data

ml	Cond	Temp
0	142	12.878
30	151	12.794
60	166	12.929
90	166	12.827
120	169	12.914

File Information

CMA Computer # 6

Data file name (.dat)	T100BC5C	Start Time	1400
Station gauge reading	0.15	Averaging Time	2
Field Logbook #	HNF-N-701-1	End Time	1401

Pump start time	~~1537~~ 1545
Pump end time	
Picture ID	– T100BC5C_11142010

Sample time 1545

Sample Number B29891

DO & Ultrameter

	DO ✓	pH ✓	ORP ✓	TDS ✓	Conductivity ✓
Sample values					
Surface Water	9.74	7.66	382	68.3	142.6

Turbidity 1.60

Comments/Observations ____

QA R Poulson 11 25 2010 – see notes

Recorder C. Smith

Sample Collector Zeke Simmons

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS

Lat N ~~119.6502~~ 46.63992

Long W 119.65027

VESSEL GPS

Lat N 46.63994520

Long W 119.65023444

Accuracy (ft) 2.04

TIME (on station) Start 1010

End

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) — Trident/Handheld circled

Station ID T100BC3C

SURVEY DATE 11-16-10

PROJECT PHASE

WATER DEPTH 19

BOTTOM TYPE

Surface mud/large boulders

Layer

Porewater Purge Pumping Data

ml	Cond	Temp
0	144	12.290
30	157	12.299
60	162	12.347
90	169	12.410
120	169	12.410
150	168	12.384

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	8" long	12" long
Temperature [C]	12.358	12.190
Conductivity [mS/cm]	170	142

Purge the volume of tubing prior to sample collection (circle one) **YES** (circled) NO

File Information

CMA Computer # 6

Data file name (.dat)	T100BC3C	Start Time	1114
Station gauge reading	0.70	Averaging Time	1
Field Logbook #	HNF-N-701_1	End Time	1115

Pump start time	1121
Pump end time	1218
Picture ID	Taken

Sample time 1121

Sample Number B29886

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity	Turbidity
Composite Sample values	8.79	7.78	232	82.74	173.7	650
Surface Water	8.72	7.8	223	66.19	139	2.60

Comments/Observations

Recorder C Smith

Sample Collector S. Johnson

QA R Paulsen 11 25 2010

Coastal Monitoring Associates Porewater Sampling Sheet		page 2
Operable Unit 100 BC	Hanford Site	
Site ID T100BC3C		Date 11-16-10
		Start Time 11:21

Porewater Sampling Data

	Time	Volume	Cond	Temp
1121	0	0	171	12.4x
1151	30	300	179	12.424
~~[illegible]~~ 1214	60	550	186	12.432

Porewater Sampling Data

Time	Volume	Cond	Temp

[illegible] 11 25 2010

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS

Lat N 46.63992

Long W 119.65027

VESSEL GPS

Lat N 46.63994520

Long W 119.65023444

Accuracy (ft) 2.04

TIME (on station) Start 1220

End

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) 2

Station ID T100BC3C (Duplicate) 1

SURVEY DATE 11-16-10

PROJECT PHASE

WATER DEPTH 19

BOTTOM TYPE

Surface med/large boulders

Layer

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	8" bsg	72" bsg
Temperature [C]	12.436	12.265
Conductivity [mS/cm]	185	142

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

Porewater Purge Pumping Data

ml	Cond	Temp

File Information

CMA Computer # 6

Data file name (.dat)	T100BC3C duplicate	Start Time	1220
Station gauge reading	0.70 end 0.65	Averaging Time	1
Field Logbook #	HNF-N-701_1	End Time	1221

Pump start time 1221

Pump end time 1351

Picture ID use original

Sample time 1221

Sample Number B29883

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity
Sample values (Composite)	7.55	7.82	231		231.7
Surface Water	9.21	7.50	246	66.05	139.1

Turbidity 450

3.10

Comments/Observations

Recorder C. Smith

Sample Collector S. Johnson

[signature] 11252010

Duplicate 1

Coastal Monitoring Assosciates Porewater Sampling Sheet		page 2
Hanford Site		
Operable Unit 100 BC		Date 11-16-10
Site ID T100BC3C		Start Time 1221

Porewater Sampling Data

	Time	Volume	Cond	Temp
1221	0	0	189	12.434
1251	30	250	252	12.467
1321	60	450	258	12.434
1350	88	550	264	12.435
	End Sample			

Porewater Sampling Data

Time	Volume	Cond	Temp

COASTAL MONITORING ASSOCIATES POREWATER FIELD LOG SHEET

SITE: Hanford, Washington

OPERABLE UNIT 100 BC

TRIDENT GPS
Lat N 46.63992
Long W 119.65027

VESSEL GPS Trimble
Lat N 46.639994520
Long W 119.65023444
Accuracy (ft) 2.04

TIME (on station) Start 1400
End

BOAT 2

Porewater Sampling Method (Frame, Trident/Handheld, Release Point) 3

Station ID T100BC3C Duplicate 2

SURVEY DATE 11-16-10
PROJECT PHASE
WATER DEPTH 19

BOTTOM TYPE
Surface med/large cobble
Layer

Survey Data Table

	TRIDENT PROBE	REFERENCE PROBE
Sensor Depth [in]	8" bsq	12" Asq
Temperature [C]	12.390	12.297
Conductivity [mS/cm]	267	142

Purge the volume of tubing prior to sample collection (circle one) (YES) NO

Porewater Purge Pumping Data

ml	Cond	Temp

File Information

CMA Computer # 6

Data file name (.dat)	T100BC3C	Start Time	1426
Station gauge reading 0.165		Averaging Time	1
Field Logbook #		End Time	1427

Pump start time 1408
Pump end time
Picture ID

Sample time 1408
Sample Number

DO & Ultrameter

	DO	pH	ORP	TDS	Conductivity	Turbidity
Composite Sample values						
Surface Water	9.33	7.13	265	88.41	142.7	1.40

Comments/Observations
Co R. Poulsen 11 25 2010

Recorder C. Smith
Sample Collector