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Date: **MAR 29 2011**  
Refer To: EP2011-0018

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**Subject: Submittal of the Reliability Assessment for Well R-47i**

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the Reliability Assessment for Well R-47i.

If you have questions, please contact Steve Paris at (505) 606-0915 (smparis@lanl.gov) or Woody Woodworth at (505) 665-5820 (lwoodworth@doeal.gov).

Sincerely,

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LA-UR-11-0933  
March 2011  
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# Reliability Assessment for Well R-47i



Prepared by the Environmental Programs Directorate

Los Alamos National Laboratory, operated by Los Alamos National Security, LLC, for the U.S. Department of Energy under Contract No. DE-AC52-06NA25396, has prepared this document pursuant to the Compliance Order on Consent, signed March 1, 2005. The Compliance Order on Consent contains requirements for the investigation and cleanup, including corrective action, of contamination at Los Alamos National Laboratory. The U.S. government has rights to use, reproduce, and distribute this document. The public may copy and use this document without charge, provided that this notice and any statement of authorship are reproduced on all copies.

# Reliability Assessment for Well R-47i

March 2011

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Appendix A	Water-Quality Data Used in This Assessment
Appendix B	Groundwater Data for R-47i (on CD included with this document)
Appendix C	Field Notes and Observations (on CD included with this document)

## 1.0 INTRODUCTION

In a letter dated July 2, 2010, the New Mexico Environment Department (NMED) requested Los Alamos National Laboratory (LANL) perform a reliability assessment for well R-47i (LANL 2010, 109188; NMED 2010, 110438). This assessment was required to determine whether well R-47i is capable of producing representative groundwater samples and to identify any potential effects of well installation on sample quality. LANL submitted a letter work plan delineating the process to be used to perform the reliability assessment on August 9, 2010 (LANL 2010, 110512). The agreed-upon sampling of R-47i was completed between December 2009 and December 2010.

A principal purpose of well R-47i is to monitor the groundwater in the vicinity of Consolidated Unit 16-021(c)-99, which is also known as the 260 Outfall (Figure 1.0-1). This outfall discharged water contaminated with high explosives (HE), barium, and other constituents to a drainage channel and from there to Cañon de Valle. HE, barium, and other constituents from the 260 Outfall have migrated to downgradient water bodies, including springs, surface waters, alluvial groundwater, intermediate-depth groundwater, and the regional aquifer; at some locations, these constituents are at levels greater than cleanup and screening levels specified in the Compliance Order on Consent (hereafter the Consent Order). More details on contamination associated with the 260 Outfall and on previous cleanup activities associated with the site are provided in a series of plans and reports (LANL 2002, 073706; LANL 2003, 077965; LANL 2006, 093798; LANL 2007, 098192; LANL 2007, 098734; LANL 2007, 095787; LANL 2010, 109252 and references therein).

### 1.1 Purpose and Objectives of Reliability Assessment

The corrective measures evaluation (CME) for intermediate and regional groundwater associated with Consolidated Unit 16-021(c)-99 will evaluate remedial alternatives for HE present in the deep groundwater at LANL's Technical Area 16 (TA-16) (LANL 2006, 093798; LANL 2007, 098734). A key component of any remedial alternative for intermediate or regional groundwater is a comprehensive and effective groundwater monitoring network (LANL 2007, 095787; LANL 2007, 100113). Well R-47i is located east (down the hydrologic gradient) of the 260 Outfall and thus represents a potentially important location for monitoring groundwater associated with the 260 Outfall.

As part of any remedy or corrective action selected by the NMED, the Laboratory must demonstrate that groundwater wells along flow paths downgradient of the 260 Outfall (the monitoring network) are capable of reliably detecting contaminants for which the outfall may have been a source in a timely fashion (rapidly enough so that remedies may be implemented before any plume has widely dispersed or approached production wells). This document complements a previous reliability assessment of the TA-16 monitoring network (LANL 2007, 095787; LANL 2007, 100113) and provides a lead-in to an upcoming broader network evaluation to be produced in late 2011.

Thus, the principal objective of this document is to determine the reliability of well R-47i as a component of the TA-16 monitoring network. The key specific question to be resolved concerning well R-47i before it can be included within the TA-16 monitoring network is whether the well screen in R-47i is of adequate quality to reliably monitor for contaminants associated with the 260 Outfall, particularly those constituents present in intermediate or regional groundwater at levels above cleanup and screening levels. Specifically, are data for key contaminants present at the 260 Outfall reliable and representative of formation waters?

For this study, the representativeness of groundwater collected from well R-47i is evaluated using the methodology described in section 3. The methodology is applied to water-quality samples from the four

post-development sampling events conducted at this well between December 2009 and December 2010. Supporting information for the assessment is provided in three appendixes.

- Appendix A provides details of the assessment methodology and the data used in the assessment.
- Appendix B is on CD and contains the full set of data for each of the four sampling events at R-47i. Table B-1 provides time-series field parameters monitored during purging, and Table B-2 provides final field parameters and analytical data for the water-quality samples.
- Appendix C is on CD and contains field notes, groundwater sampling logs, and sample collection logs for each sampling event.

## **2.0 BACKGROUND**

### **2.1 Well Description**

Well R-47i was installed at TA-14 from September to November 2009 (LANL 2010, 109188) (Figure 1.0-1). The well was originally planned as a regional well to be called R-47 to augment the TA-16 monitoring well network. However, as a result of problems encountered during installation of the regional well, the regional target was abandoned and an intermediate-depth well (R-47i) was opportunistically installed in the borehole. R-47i was completed with a single 20-ft screen within a perched zone between 840.0 and 860.6 ft below ground surface (bgs) in sediments of the upper Puye Formation. The depth to intermediate perched water after well installation and well development (November 18, 2009) was 832.2 ft bgs, and the depth to the regional aquifer, as determined during the initial phase of drilling, was approximately 1242 ft bgs (Figure 2.1-1). Well development was completed November 24, 2009, and a dedicated sampling system was installed in well R-47i December 18, 2009.

Because the original target depth of well R-47 was 1350.5 ft bgs within the regional aquifer, drilling fluids including AQF-2 foaming agent and potable water were used in the depth interval of the screen in R-47i. In addition, bentonite sealant may have entered the formation near the screened interval because bentonite may have been present on the walls of the borehole in this zone due to the construction activities associated with the original regional well screen (LANL 2010, 109188; NMED 2010, 110438). The issues associated with drilling and the decision to complete a perched intermediate well within the R-47 borehole warrant an assessment of the reliability of data from R-47i.

### **2.2 Regulatory Context**

Investigation and remediation actions at the Laboratory are subject to the Consent Order. Pursuant to the Consent Order, the reliability assessment supplements recent regulatory documents for the TA-16 260 Outfall, including the "Investigation Report for Intermediate and Regional Groundwater, Consolidated Unit 16-021(c)-99" (LANL 2006, 093798); the "Evaluation of the Suitability of Wells Near Technical Area 16 for Monitoring Contaminant Releases from Consolidated Unit 16-021(c)-99, Revision 1" (LANL 2007, 100113); and the "Corrective Measures Evaluation Report, Intermediate and Regional Groundwater, Consolidated Unit 16-021(c)-99" (LANL 2007, 098734).

## **3.0 CONDITIONS OF R-47i**

To varying extents, geochemical evidence of perturbation (i.e., nonrepresentativeness) has been observed in early groundwater samples collected from nearly all perched intermediate and regional wells

(also called deep wells) following completion and development. In the case of well R-47i, effects from materials used downhole were of particular concern because of (a) the use of AQF-2 foaming agent in the screened interval, (b) suspended particulates in the screened interval following emplacement of the annular-seal bentonite and the overlying filter sand pack, and (c) potential diffusion of soluble constituents into the screened interval from the bentonite seal during its normal settling and compaction. Although not unique to well R-47i, the potential effects of these geochemical perturbations might be expected to be more prominent and persistent in this well as a consequence of the low hydraulic conductivity (0.21 ft/d) of the formation in the vicinity of the screened interval (LANL 2010, 109188, section 5.2). Such low hydraulic conductivities are also present in wells PCI-2 and R-21, which are also screened in the Puye Formation (Table A-3.0-1). Well PCI-2 was not able to attain the turbidity stabilization criterion of <5 nephelometric turbidity units (NTU) during well development, nor could this well sustain a recharge rate sufficient to conduct an aquifer test.

### 3.1 Assessment Methodology

Analytical data are presently available for R-47i for four post-development sampling events: December 21, 2009, April 8, 2010, September 23, 2010, and December 2, 2010. The September 23 event involved an extended purge of 6 casing volumes (CVs), with samples collected every 1 CV; the other three events followed the standard protocol of 3 CVs purge volumes before sampling. For each event, the assessment methodology involves examination of the following water-quality parameters as the most likely to detect geochemical effects of perturbation:

- time-series data for field parameters monitored during purging and final field parameter values for each sampling event (section 3.2);
- trends in concentrations of key indicators for the presence of the specific materials used in the screened interval (AQF-2 and annular-fill bentonite) (section 3.3);
- trends in relative concentrations of major ions, as plotted on a standard trilinear graph (section 3.3);
- comparison of concentrations with upper tolerance limits (UTLs) for background groundwater (section 3.3); and
- comparison of dissolved concentrations with those in groundwater from other deep wells screened in the Puye Formation (Tpf) or the Cerro Toledo interval of the Bandelier Tuff (Qct), and at which effects from downhole materials or local contaminants are absent (section 3.3).

Data used for the assessment are presented in tables and figures in Appendix A. For this analysis, additional insights are also obtained from examination of detected organics and time-series concentrations of area-specific chemicals of potential concern (COPCs) (section 3.4).

### 3.2 Field Parameters

Time-series data for field parameters monitored during purging before sample collection are examined for attainment of stable values by the end of purging. Stabilization criteria are prescribed in Standard Operating Procedure (SOP) 5232, Groundwater Sampling. Examination of tabulated data and time-series plots in Appendix A yields the following observations.

- Stabilization criteria are met for all four sampling events after purging 3 CVs.
- Field parameters for the first sampling event stabilized at higher values for specific conductance and turbidity, and at a lower dissolved oxygen concentration, than did those for the subsequent

three events (Figure A-1.0-1), suggesting that groundwater in the screened interval had re-equilibrated to predrilling conditions after April 8, 2010.

- Field parameters for the last three events stabilize at similar levels after 3 CVs purge volumes. The repeatability of these values supports the finding that they are representative of formation water at this location.
- Final field parameter values fall between the 25th and 75th percentiles for background perched intermediate groundwater (LANL 2010, 110535, Table 4.2-1), consistent with the conclusion that these field parameters are likely representative of formation water.
- Final field parameters are also comparable to those measured for other deep wells screened in the Tpf or Qct.

### 3.3 Analysis of Well-Screen Conditions

The presence of residual materials used in the screened interval is assessed by examining concentrations of key geochemical indicators for these materials. Concentrations of total organic carbon (TOC), sodium, and sulfate are used as indicators for the potential presence of AQF-2 foaming agent. Sulfate is a biodegradation product of sulfonate surfactants in the AQF-2 foaming agent, and sodium is present as a counterion for these anionic surfactants. Indicators for the potential presence of bentonite in the screen interval include turbidity, sodium, sulfate, and selected trace metals associated with bentonite, primarily aluminum, iron, manganese, and molybdenum. An important caveat to note is that geochemical effects of residual bentonite in the screened interval are difficult to distinguish from those arising from the effects of disturbing formation solids during drilling and development.

The following geochemical trends are observed in the data summarized and plotted in Appendix A (section A-2.0).

- Sodium and sulfate concentrations are highest in the first sampling event but decrease steadily for the subsequent two events. This trend suggests the possible presence of small amounts of inorganic ions associated with residual downhole products in the earliest samples.
- TOC is detected at low concentrations between 0.5 and 1.5 mg/L in the first three samples, suggesting the absence of residual organic product in the immediate vicinity of the screened interval.
- Major ion concentrations attain relatively stable values for the two most recent events. Furthermore, for the extended purge event September 23, 2010, major ion concentrations are within 10% of one another in samples collected at purge volumes of 3 CVs, 4 CVs, 5 CVs, and 6 CVs. This stability suggests that groundwater is relatively well mixed within the volume of the formation accessed during sampling, and hence little is to be gained by purging more than 3 CVs.
- Concentrations for the majority of trace metals remain fairly stable for all sampling events. Notable exceptions are total iron, total aluminum, and manganese. Concentrations for these three trace metals are highest in the first post-development samples (December 2009) and generally decrease in subsequent samples.
- Initially high concentrations of iron and manganese are not indicative of in-situ reducing conditions at this location because the persistent presence of perchlorate, nitrate, and dissolved oxygen indicate in-situ conditions are oxidizing, consistent with groundwater background. Other locations in or around TA-16 and in groundwaters in the Puye Formation are known to have high naturally occurring concentrations of iron and manganese; the source of these high concentrations is unknown, but they may be due to colloidal materials.

Representativeness is assessed with greater specificity by comparing dissolved major ion concentrations with those in groundwater from other deep wells screened in Tpf or Qct and at which effects from downhole materials or local contaminants are absent or negligible. Six screens in five wells meet these conditions: intermediate perched wells PCI-2 and R-26 screen 1 and regional wells R-17 screens 1 and 2, R-21, and R-27. With the single exception of well R-26, in which a Westbay sampling system is installed, these wells serve as background locations in the “Groundwater Background Investigation Report, Revision 4” (LANL 2010, 110535). The following trends are observed from such a comparison.

- Figure 3.3-1 shows that relative major ion concentrations in groundwater from the Tpf-Qct screens cluster in a distinct and well-defined field on a trilinear (Piper) plot, a common graphical tool used to identify waters with similar chemistries. Data points for well R-47i fall outside the cluster of points for the Tpf-Qct wells, but obviously trend toward it, consistent with the possible presence of a small, decreasing component of residual sodium and sulfate in the vicinity of the screened interval.
- Figure 3.3-2 compares major ion concentrations in groundwater from well R-47i with the ranges observed in groundwater from the six Tpf-Qct screens. Calcium and magnesium concentrations are relatively constant throughout the four sampling events. However, concentrations of sodium and sulfate (as well as chloride to a lesser extent) extend above the range observed for the Tpf-Qct screens, again consistent with the possible presence of a small component of residual downhole material in the vicinity of the screened interval.
- Figure 3.3-3 compares trace metal concentrations in filtered groundwater from well R-47i with the range in groundwater from the six Tpf-Qct screens. Figure 3.3-4 provides an analogous comparison for unfiltered samples. Other than for the first sampling event, these two figures show that total as well as dissolved concentrations of aluminum and iron fall within the range observed for groundwater collected from other intervals screened in Tpf-Qct. Following the extended-purge event at R-47i, manganese and molybdenum remain the only trace metals with concentrations above the range observed in the other Tpf-Qct screens.

The absence of residual organic product in the screened interval of R-47i is supported by the observation that toluene and diethylphthalate are the only volatile or semivolatile organics detected (once each). The detected concentrations are at or below the practical quantitation limit (PQL) and are thus validated as J (estimated values), indicating that the reported concentrations are regarded as uncertain. Toluene is detected at 0.504 µg/L (PQL = 1 µg/L) in the sample collected April 8, 2010, and is also detected in the field trip blank (0.386 µg/L) for that event. Diethylphthalate is reported at 10.1 µg/L (PQL = 10 µg/L) in the sample collected September 23, 2010. These analytes are not detected in any other post-development samples from R-47i.

### 3.4 COPCs for the 260 Outfall CME/Corrective Measures Implementation

The primary constituents associated with the 260 Outfall are HE and barium. The principal COPCs for intermediate and regional groundwater include RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), trinitrotoluene (TNT), other HE, and HE byproducts and degradation products. Organic solvents, particularly trichloroethene (TCE), are also detected in groundwater and springs downgradient of the 260 Outfall and other TA-16 sources.

Based upon the assessment summarized in sections 3.2 and 3.3, well R-47i appears fully capable of providing reliable and representative data for these COPCs. Water-quality data for HE compounds and volatile organic compounds (VOCs) such as TCE and other solvents are expected to be reliable and representative because conditions are oxic, residual organics are absent, and no compelling evidence

exists for the presence of large amounts of residual bentonite in the screened interval after the first post-development sampling event on December 21, 2009. Barium concentrations also appear to be reliable and representative; for the most recent two sampling events, dissolved concentrations of barium (8.5 µg/L and 7.9 µg/L, respectively) are similar to those measured at perched intermediate wells PCI-2 (average, 8.6 µg/L) and R-26 screen 1 (average, 7.9 µg/L).

### 3.5 Other Well Issues

The top of the filter sand and fine sand collar (832 ft bgs) extends above the well screen to within approximately 2 ft of the static water level (830 ft bgs), indicating at least partial dewatering of the filter pack is possible at any viable pumping rate (LANL 2010, 109188, p. E-12). During aquifer testing, pumping at 0.71 gpm for 40 min resulted in a drawdown of 4.5 ft and pumping at 0.91 gpm for 40 min resulted in a drawdown of 6.5 ft (LANL 2010, 109188, Table E-9.5-1). However, there is no obvious evidence that the groundwater data from R-47i are affected by this situation.

## 4.0 CONCLUSIONS AND RECOMMENDATIONS

Geochemical effects arising from drilling and construction of well R-47i are apparent in the first water-quality sample collected following development. However, the geochemical trends from subsequent sampling show steady improvement. For the most recent two sampling events, residual effects appear to be limited to a few inorganic constituents: sodium, sulfate, chloride, manganese, and molybdenum.

Based on analyses presented herein, it appears that well R-47i is able to provide reliable and representative data for the key contaminants associated with the 260 Outfall, particularly RDX and other HE, barium, and VOCs.

It is recommended that the sampling program at R-47i be continued using the routine sampling protocol that involves purging of 3 CVs and stabilization of parameters per SOP 5232. Stabilization of field parameters and analytical results for the extended purge event September 23, 2010, indicate that no significant benefit is gained by purging more than 3 CVs.

## 5.0 REFERENCES AND MAP DATA SOURCES

### 5.1 References

*The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.*

*Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.*

LANL (Los Alamos National Laboratory), July 2002. "Interim Measure Report for Potential Release Site 16-021(c)-99," Los Alamos National Laboratory document LA-UR-02-4229, Los Alamos, New Mexico. (LANL 2002, 073706)

- LANL (Los Alamos National Laboratory), September 2003. "Phase III RFI Report for Solid Waste Management Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-03-5248, Los Alamos, New Mexico. (LANL 2003, 077965)
- LANL (Los Alamos National Laboratory), August 2006. "Investigation Report for Intermediate and Regional Groundwater, Consolidated Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-06-5510, Los Alamos, New Mexico. (LANL 2006, 093798)
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- LANL (Los Alamos National Laboratory), April 2010. "Completion Report for Intermediate Aquifer Well R-47i," Los Alamos National Laboratory document LA-UR-10-2207, Los Alamos, New Mexico. (LANL 2010, 109188)
- LANL (Los Alamos National Laboratory), April 2010. "Long-Term Monitoring and Maintenance Plan for the Corrective Measures Implementation at Consolidated Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-10-2196, Los Alamos, New Mexico. (LANL 2010, 109252)
- LANL (Los Alamos National Laboratory), August 2010. "Groundwater Background Investigation Report, Revision 4," Los Alamos National Laboratory document LA-UR-10-4827, Los Alamos, New Mexico. (LANL 2010, 110535)
- LANL (Los Alamos National Laboratory), August 9, 2010. "Submittal of the Response to the Approval with Direction for the Completion Report for Intermediate Aquifer R-47i," Los Alamos National Laboratory letter (EP2010-0355) to J.P. Bearzi (NMED-HWB) from M.J. Graham (LANL) and G.J. Rael (DOE-LASO), Los Alamos, New Mexico. (LANL 2010, 110512)
- NMED (New Mexico Environment Department), July 2, 2010. "Approval with Direction, Completion Report for Intermediate Aquifer Well R-47i," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 110438)

## **5.2 Map Data Sources**

Data sources for all figures are provided below unless otherwise indicated on the figures themselves.

Paved and Dirt Road Arcs, Existing and Former Structures, Security and Industrial Fences and Gates, Water and Gas Lines: Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating, and Mapping Section; 06 January 2004; Development Edition of 05 January 2005.

Potential Release Sites: Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2005-0748; 1:2,500 Scale Data; 22 November 2005.

Material Disposal Areas: Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2004-0221; 1:2,500 Scale Data; 23 April 2004.

Hypsography, 10, 20, and 100 Foot Contour Intervals: Los Alamos National Laboratory, Environmental Stewardship Remediation Services Project; 1991.

ER Location ID Points: Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1:2,500 Scale Data; 10 November 2005.

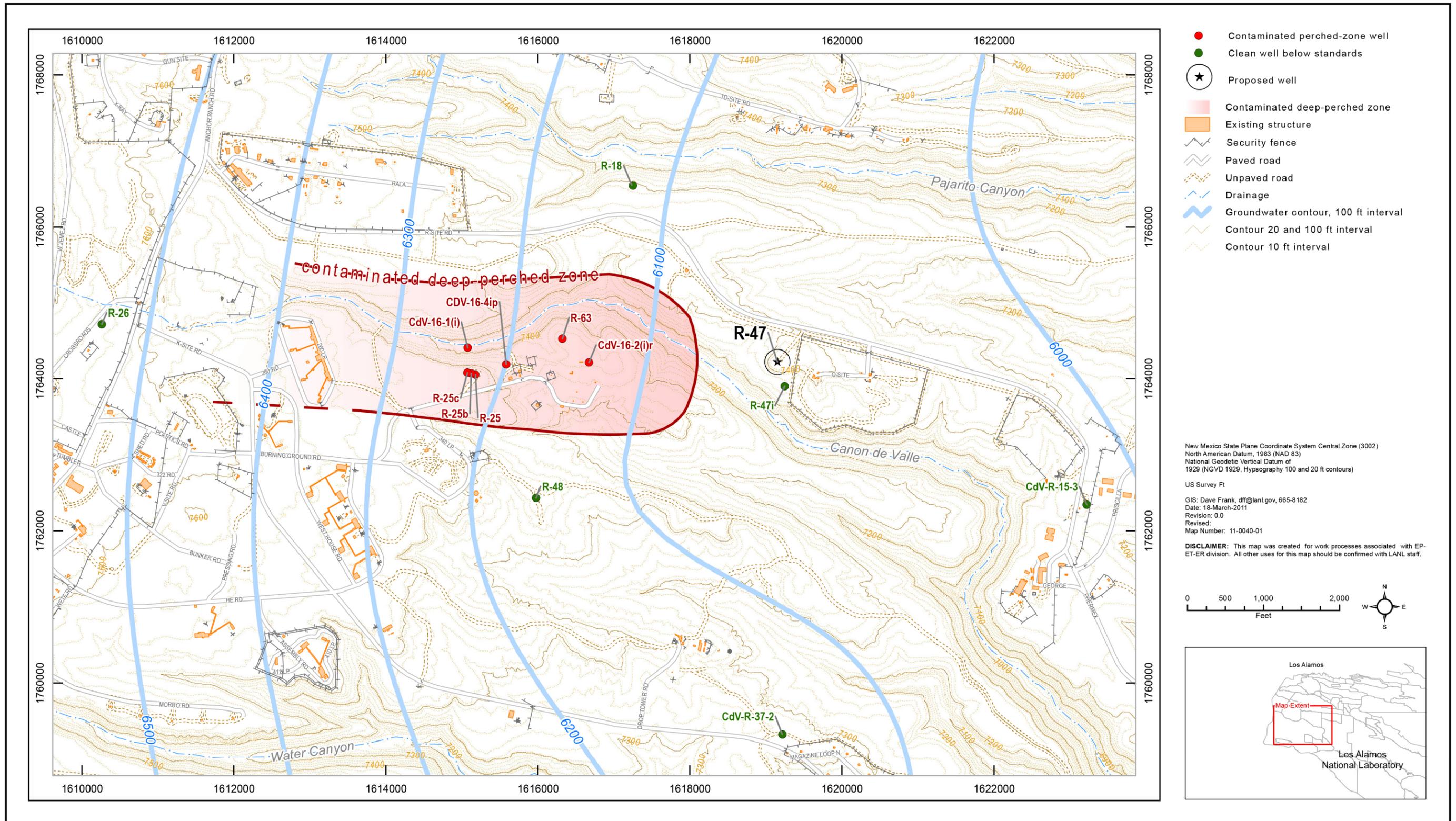
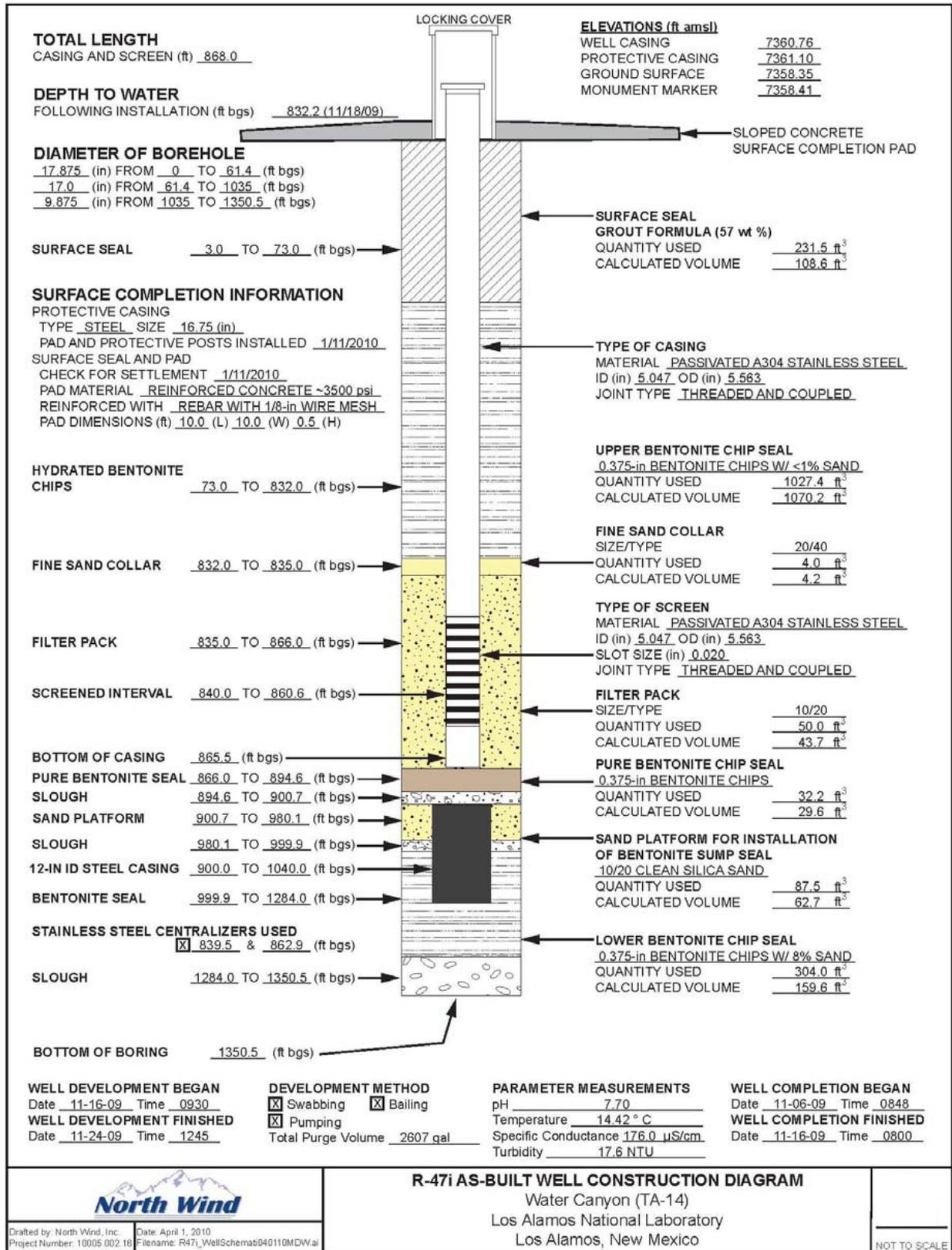
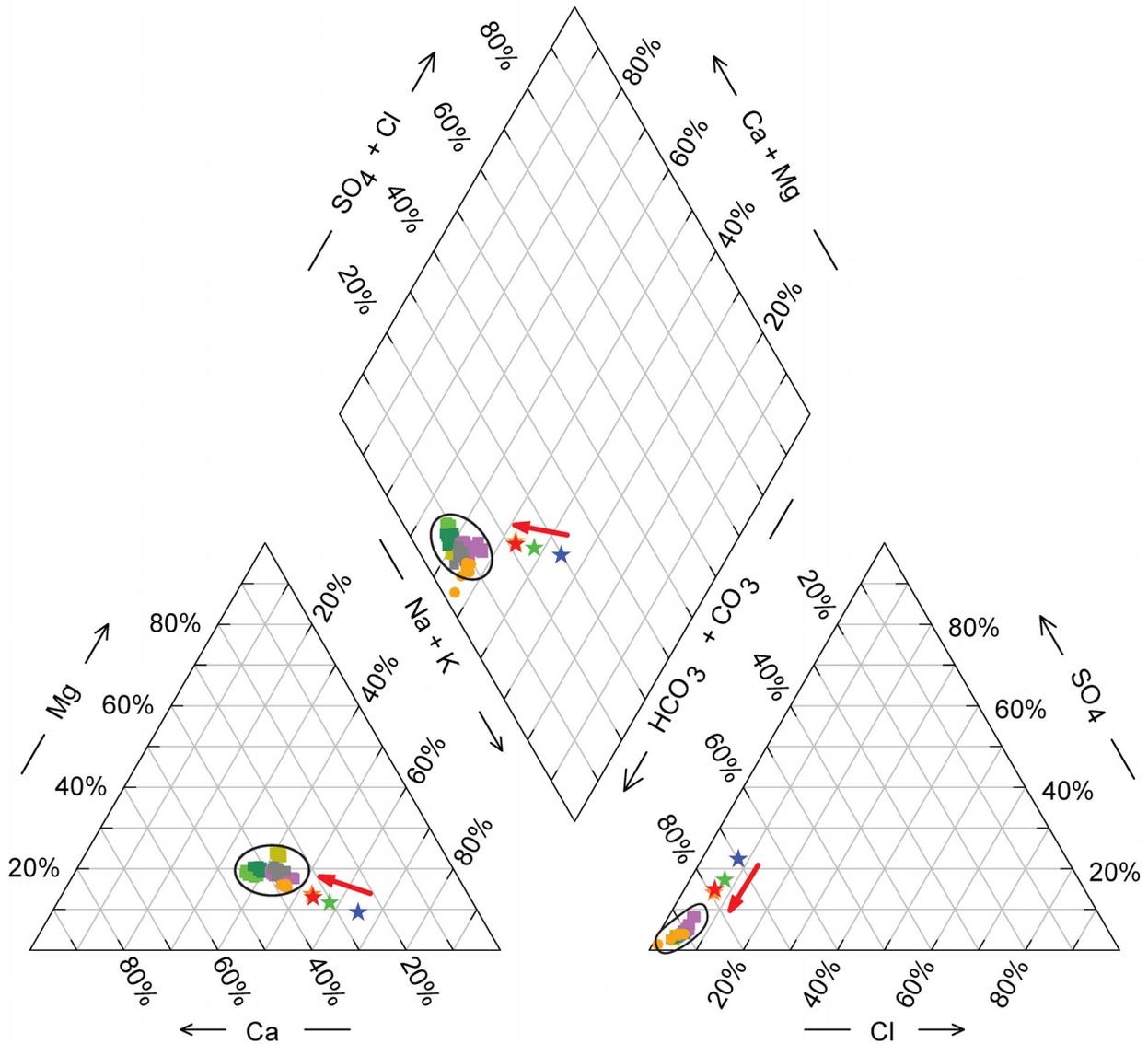


Figure 1.0-1 Locations of monitoring wells associated with the TA-16 260 Outfall monitoring network



Source: LANL 2010, 109188, Figure 7.2-1.

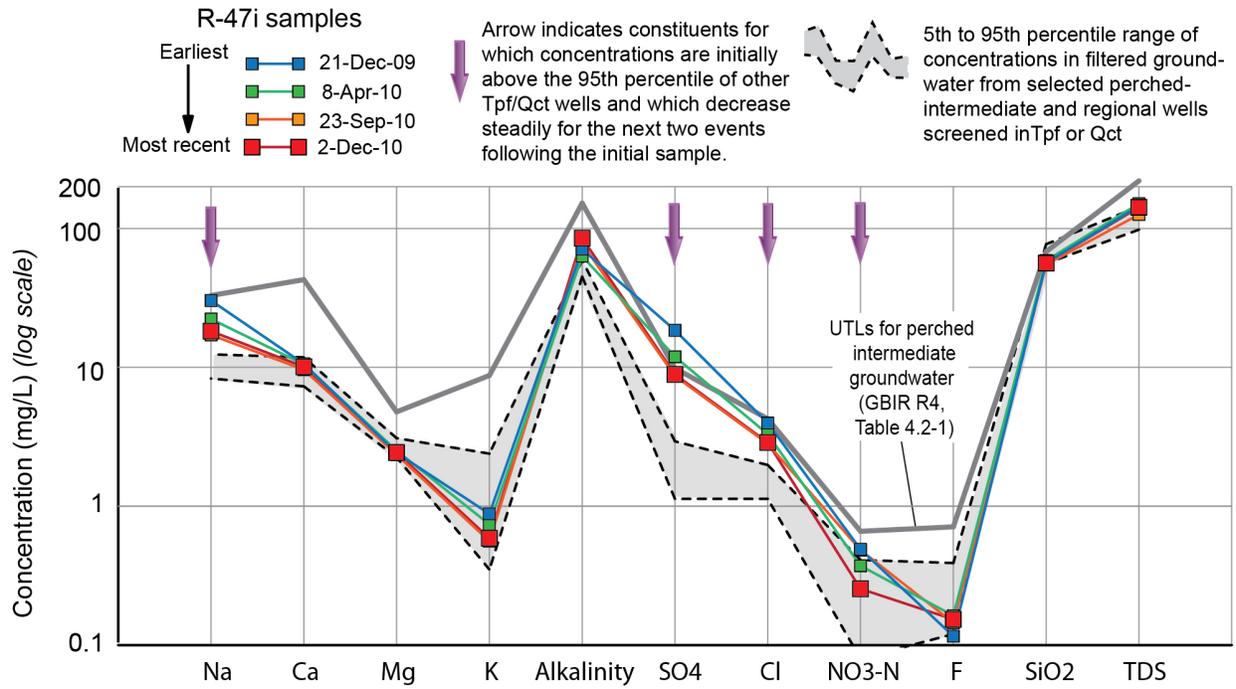
Figure 2.1-1 Well construction diagram for well R-47i



<p>R-47i</p> <p>Earliest ★ 21-Dec-09</p> <p>↓ 8-Apr-10</p> <p>★ 23-Sep-10</p> <p>Most recent ★ 2-Dec-10</p> <p>Arrows on the trilinear plot indicate temporal trends</p>		<p>Selected intermediate and regional wells screened in the Puye Formation (Tpf) or the Cerro Toledo interval of the Bandelier Tuff (Qct)</p>	
<p><i>Perched intermediate</i></p> <p>■ R-26 screen 1 (Qct)</p> <p>● PCI-2 (Tpf)</p>	<p><i>Regional aquifer</i></p> <p>■ R-21 (Tpf)</p> <p>■ R-27 (Tpf)</p> <p>■ R-17 screen 1 (Tpf)</p> <p>■ R-17 screen 2 (Tpf)</p>	<p>○ Observed range for selected intermediate and regional wells screened in Tpf or Qct</p>	

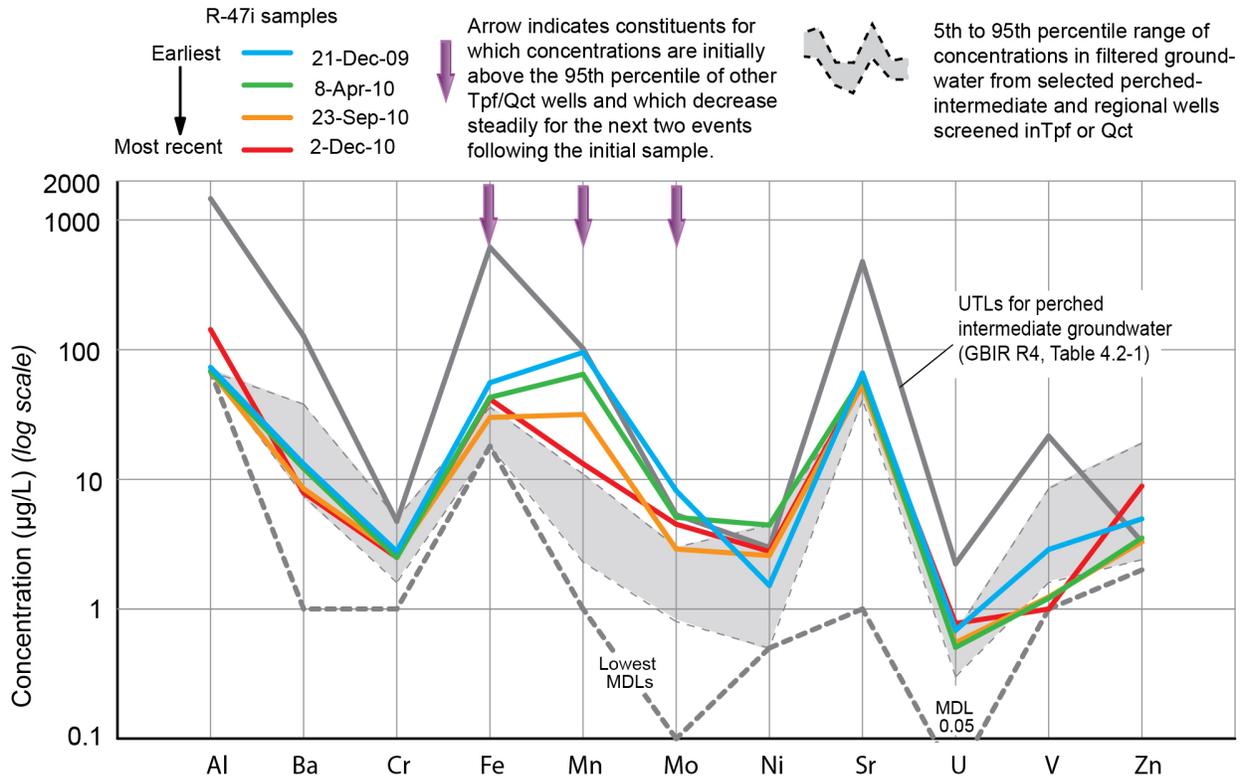
Source: Appendix A

**Figure 3.3-1** Trilinear plot showing relative distribution of major ions in groundwater from well R-47i and selected intermediate and regional wells also screened in the Puye Formation or the Cerro Toledo interval of the Bandelier Tuff



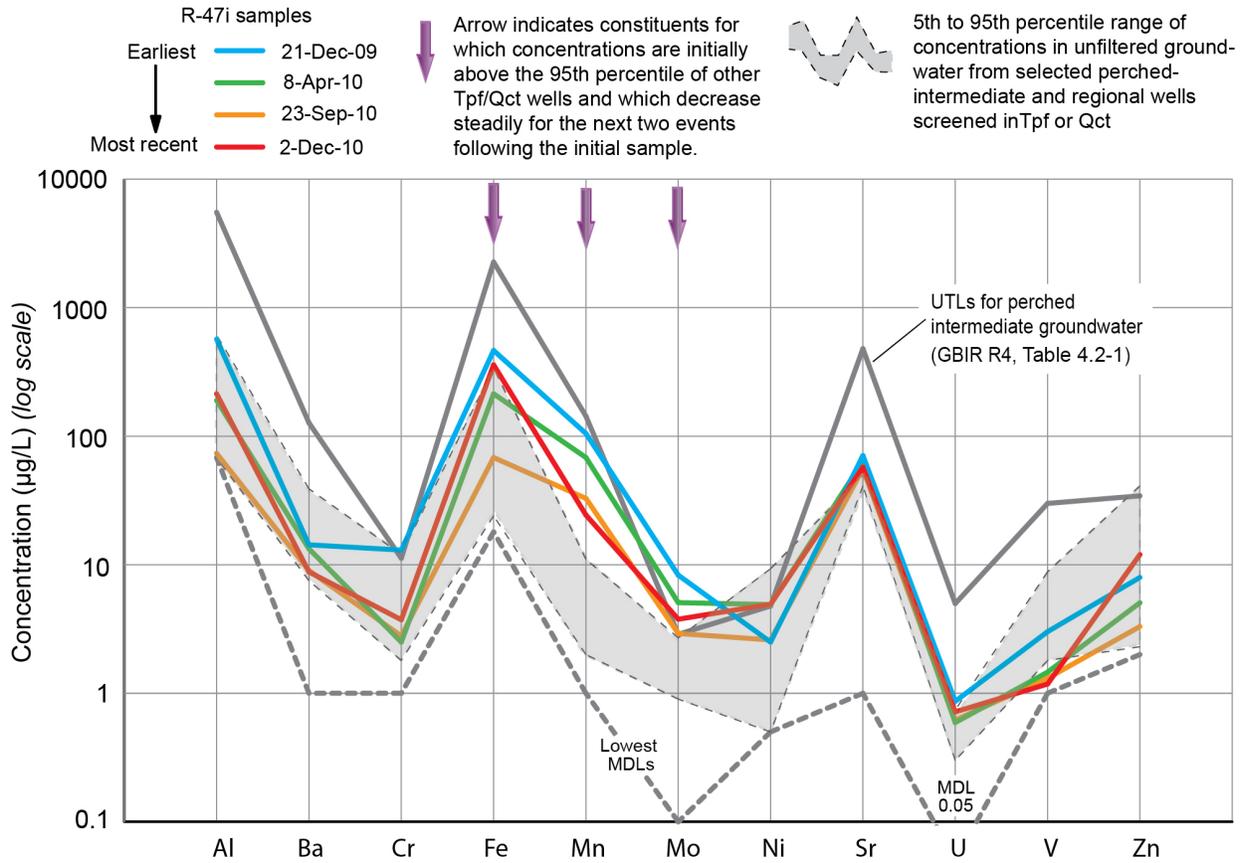
Source: Table A-2.0-1 (R-47i data) and Table A-3.0-2 (5th and 95th percentile concentrations for other wells)  
 GBIR R4 = Groundwater Background Investigation Report, Revision 4 (LANL 2010, 110535)

**Figure 3.3-2 Major ion and silica concentrations in filtered groundwater samples from R-47i compared with 5th to 95th percentile ranges for other wells screened in the Puye Formation or the Cerro Toledo interval of the Bandelier Tuff**



Source: Table A-2.0-3 (R-47i data) and Table A-3.0-3 (5th and 95th percentile concentrations for other wells)  
 GBIR R4 = Groundwater Background Investigation Report, Revision 4 (LANL 2010, 110535)

**Figure 3.3-3 Trace metal concentrations in filtered groundwater samples from R-47i compared with the 5th to 95th percentile range for other wells screened in the Puye Formation or the Cerro Toledo interval of the Bandelier Tuff**



Source: Table A-2.0-3 (R-47i data) and Table A-3.0-3 (5th and 95th percentile concentrations for other wells)  
 GBIR R4 = Groundwater Background Investigation Report, Revision 4 (LANL 2010, 110535)

**Figure 3.3-4 Trace metal concentrations in unfiltered groundwater samples from R-47i compared with the 5th to 95th percentile range for other wells screened in the Puye Formation or the Cerro Toledo interval of the Bandelier Tuff**

# **Appendix A**

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*Water-Quality Data Used in This Assessment*

The purpose of this assessment is to identify water-quality data that may not be reliable and representative of predrilling groundwater conditions at this location if residual effects are present in the screened interval. The evaluation encompasses all post-development groundwater samples.

### A-1.0 FIELD PARAMETERS

Time-series data for field parameters monitored during purging before sample collection are examined for attainment of stable values by the end of purging. Stabilization criteria are prescribed in Standard Operating Procedure 5232, Groundwater Sampling. The most sensitive indicator parameters are dissolved oxygen (DO) and turbidity. Other parameters such as water temperature, specific conductance, pH, and oxidation-reduction potential (ORP) are also monitored, but are considered less sensitive indicators of formation water. Water-quality indicator parameters are monitored at 5- to 30-min intervals until stability has been achieved for at least three consecutive measurements a minimum of 5 min apart. Stabilization is defined as the point at which measured values are within the criteria listed below for all parameters for three consecutive readings:

- <5 nephelometric turbidity units (NTU) if possible or, if turbidity remains, >5 NTU,  $\pm 10\%$  of the reading;
- DO  $\pm 0.3$  mg/L;
- pH  $\pm 0.1$  pH unit;
- specific conductance  $\pm 3\%$ ; and
- temperature  $\pm 0.2^\circ\text{C}$ .

Examination of time-series data collected during purging (Appendix B) shows that stabilization criteria are met for all four sampling events after purging three casing volumes (CVs). Field parameters for the first sampling event stabilized at higher values for specific conductance and turbidity, and at lower DO concentrations and ORP values than did those for the subsequent three events (Table A-1.0-1; Figure A-1.0-1). This indicates that groundwater in the screened interval had not fully re-equilibrated to predrilling conditions when the first sample was collected. In contrast, field parameters for the last two events stabilized at similar levels (Table A-1.0-1; Figure A-1.0-1); the repeatability of these values supports the expectation that they are largely representative of formation water at this location.

Table A-1.0-2 and Figure A-1.0-2 show that final field parameter values generally fall between the 25th and 75th percentiles for background perched intermediate groundwater (LANL 2010, 110535). This is consistent with the conclusion that these field parameters are likely representative of formation water. Additional insight concerning the representativeness of the final field parameters is provided by a comparison of these values with values measured for other wells in similar settings (Figure A-1.0-2). Data that provide the basis for this comparison are discussed in section A-3.0.

### A-2.0 WATER-QUALITY DATA FOR R-47i

To evaluate general geochemical trends at R-47i, Figures A-2.0-1 and A-2.0-2 present geochemical trending plots that show the evolution of selected geochemical indicators used to identify possible residual effects from products and materials used downhole in R-47i, as compared with relevant guideline concentrations that are based on background groundwater statistics.

*Major ion trends.* Concentrations for most major ions remain fairly stable for all sampling events (Table A-2.0-1; Figure A-2.0-1). Notable exceptions are sodium and sulfate concentrations, which are

approximately twice as high in the first sample (December 21, 2009), as compared with the two most recent samples (September 23, 2010, and December 2, 2010). The decreasing trends for sodium and sulfate suggest the possible presence of small amounts of soluble inorganic ions associated with residual AQF-2 foaming agent or annular-fill bentonite in the earliest samples.

For the most recent two events, major ion concentrations are essentially constant (Table A-2.0-1; Figure A-2.0-1). For the extended purge event September 23, 2010, major ion concentrations are within 10% of one another in samples collected at 3CVs, 4CVs, 5CVs, and 6CVs (Table A-2.0-2). In concert with the low total organic carbon (TOC) concentrations (<1 mg/L) measured for samples throughout the extended-purge event, the stability of major ion concentrations suggests the water in the formation is relatively well mixed and homogeneous within the volume of the formation accessed by extended purging.

*Trace metal trends.* Concentrations for the majority of trace metals remain more or less stable for all sampling events (Tables A-2.0-3 and A-2.0-4). Notable exceptions are total iron, total aluminum, and manganese. Concentrations for these three trace metals are highest in the first sample (December 21, 2009) and generally decrease in subsequent samples (Figure A-2.0-2). Initially high concentrations of iron and manganese are not indicative of in situ reducing conditions at this location because the persistent presence of perchlorate, nitrate, and DO indicate in situ conditions are oxic, consistent with groundwater background. Dissolution of iron- or manganese-bearing minerals is judged to be unlikely because these minerals are generally stable under oxic conditions. Elevated concentrations of these particular trace metals (aluminum, iron, and manganese) most likely reflect potentially minor contributions from normal settling of formation fines dislodged during drilling or of residual bentonite from the emplacement of the annular bentonite seal below the filter-pack sand.

*Organic analytes.* In the four events, toluene and diethylphthalate are only two listed organics detected (once each) (Appendix B). The detected concentrations are at or below the practical quantitation limit (PQL) and are thus validated as J (estimated values), indicating that the reported concentrations are regarded as more uncertain than usual. Toluene is detected at 0.504 µg/L (PQL = 1 µg/L) in the sample collected April 8, 2010, and is also detected in the field trip blank (0.386 µg/L) for that event. Diethylphthalate is reported at 10.1 µg/L (PQL = 10 µg/L) in the sample collected September 23, 2010. These analytes are not detected in any other samples from R-47i.

### **A-3.0 WATER-QUALITY DATA FOR OTHER DEEP WELLS COMPLETED IN THE PUYE FORMATION OR CERRO TOLEDO INTERVAL OF THE BANDELIER TUFF**

Representativeness is assessed with greater specificity by comparing concentrations of major ions and trace metals in R-47i samples with those in groundwater from other perched intermediate and regional wells completed in the Puye Formation (Tpf) or the Cerro Toledo interval of the Bandelier Tuff (Qct) and at which effects from downhole materials or local contaminants are absent. Six screens in five wells meet these conditions: intermediate perched wells PCI-2, R-26 screen 1, regional wells R-17 screens 1 and 2, R-21, and R-27 (Figure A-3.0-1). Information about these screened intervals is summarized in Table A-3.0-1. With the exception of well R-26, which has a Westbay sampling system, these wells serve as background locations in the "Groundwater Background Investigation Report, Revision 4" (LANL 2010, 110535).

The selection of these six screens as appropriate points of comparison for groundwater from R-47i is supported by examining trends in the relative major ion concentrations of the groundwater. These trends are shown on a trilinear (Piper) plot (Figure 3.3-1), which is commonly used to identify waters with similar chemistries that plot in a distinct position on the plot and to identify potential mixing between end members. Relative percentages of major cations and major anions (expressed in milliequivalents [meq]

per liter) are plotted on the two ternary plots in the lower corners of the Piper plot. Major cations are calcium, magnesium, and sodium + potassium; major anions are generally chloride, sulfate, and bicarbonate + carbonate. Points plotted on the two ternary plots are then projected upward where they intersect on the central diamond. This graphical presentation shows the major ion chemistries for the last two events are indistinguishable from one another. Samples that plot along straight lines formed between two end members in all three fields of the trilinear diagram potentially represent mixing between these end members. On Figure 3.3-1, the water chemistry of R-47i is observed to trend toward the field defined by other deep wells completed in Tpf or Qct, which is expected if a small component of residual sodium and sulfate is present in groundwater near the screened interval.

Figure A-3.0-2 presents a line graph showing the average major ion, silica, and total dissolved solids (TDS) concentrations in the six screened intervals as well as 5th and 95th percentiles of the concentrations for this group as a whole. The range of concentrations bounded by these percentiles calculated for screened intervals with lithology similar to that at R-47i is much more restricted than that bounded by upper tolerance limits (UTLs) calculated for the full set of background locations. Hence, this line graph provides a visual means of identifying major ion concentrations that may be nonrepresentative of groundwater at well R-47i (Figure 3.3-2). In Figure 3.3-2, it is observed that concentrations for most major ions, silica, and TDS fall within the range of the Tpf-Qct wells. However, concentrations for sodium, sulfate, and chloride, although greatly decreased from their initial concentrations and apparently stable for the most recent events, nonetheless still extend above the range observed for the other Tpf-Qct screened intervals. This observation is consistent with the finding in the preceding paragraph that a small component of residual sodium and sulfate—as well as an even smaller component of chloride—is present in groundwater near the screened interval.

Figure A-3.0-3 and Figure A-3.0-4 present analogous line graphs plotting average trace metal concentrations for groundwater from the set of six Tpf-Qct screens. Figure A-3.0-3 shows the 5th and 95th percentiles of the filtered concentrations for this group; Figure A-3.0-4 shows the 5th and 95th percentiles of trace metal concentrations in unfiltered samples. These two plots are used in Figures 3.3-3 and 3.3-4 to identify trace metal constituents that appear to be nonrepresentative of groundwater at well R-47i. These two figures show that total as well as dissolved concentrations of aluminum and iron for the most recent two samples fall within the range observed for groundwater collected from other intervals screened in Tpf-Qct. Following the extended-purge event at R-47i, manganese and molybdenum remain the only trace metals with concentrations (dissolved as well as total) significantly above the range observed in these other wells. Both trace metals are most likely present as negatively charged anions and, as such, are unaffected by adsorption onto reactive-mineral surfaces near the screen. This observation is consistent with the finding in section A-2.0 that elevated concentrations of these trace metals are minor contributions attributable to diffusion out of the bentonite seal or released from formation fines disturbed during drilling.

#### **A-4.0 SUMMARY**

In summary, geochemical effects arising from drilling and construction of well R-47i are apparent in the first water-quality sample collected following development. However, the geochemical trends from subsequent sampling show steady improvement. Extended purging accelerated flushing of these constituents from the screened interval. For the most recent two sampling events, residual effects appear to be limited to a few inorganic constituents: sodium, sulfate, chloride, manganese, and molybdenum. Continued flushing of these constituents from the screened interval by natural groundwater flow and purging is likely limited by the low hydraulic conductivity of the formation and by the slow rates at which these constituents diffuse out of low-permeability materials in the vicinity of the screen. Because of these

rate-limiting processes, it is unlikely that another extended purge would significantly reduce these residual effects of drilling and construction. However, none of the residual constituents impact the capability of well R-47i to provide reliable and representative water-quality data for chemicals of potential concern relevant to the 260 Outfall.

## A-5.0 REFERENCES

*The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.*

*Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.*

Kleinfelder, June 6, 2003. "Characterization Well R-21 Completion Report," report prepared for Los Alamos National Laboratory, Project No. 22461, Albuquerque, New Mexico. (Kleinfelder 2003, 090047)

Kleinfelder, January 25, 2005. "Final Well R-26 Completion Report, Revision No. 1," report prepared for Los Alamos National Laboratory, Project No. 37151, Albuquerque, New Mexico. (Kleinfelder 2005, 087846)

Kleinfelder, May 2006. "Final Completion Report, Characterization Well R-17," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092493)

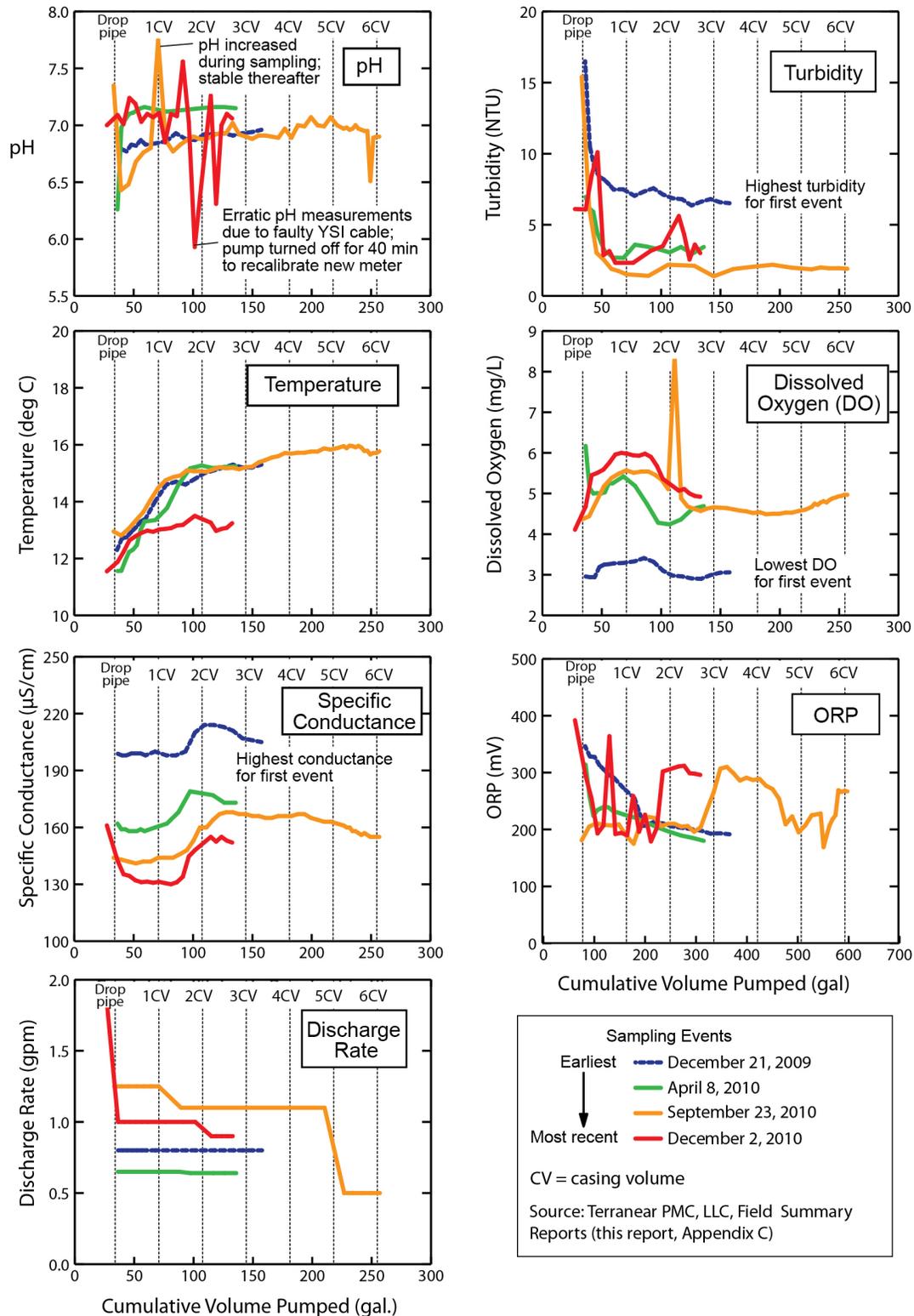
Kleinfelder, March 2006. "Final Completion Report, Characterization Well R-27," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092488)

LANL (Los Alamos National Laboratory), September 2009. "Completion Report for Intermediate Aquifer Well PCI-2," Los Alamos National Laboratory document LA-UR-09-5489, Los Alamos, New Mexico. (LANL 2009, 107342)

LANL (Los Alamos National Laboratory), April 2010. "Completion Report for Intermediate Aquifer Well R-47i," Los Alamos National Laboratory document LA-UR-10-2207, Los Alamos, New Mexico. (LANL 2010, 109188)

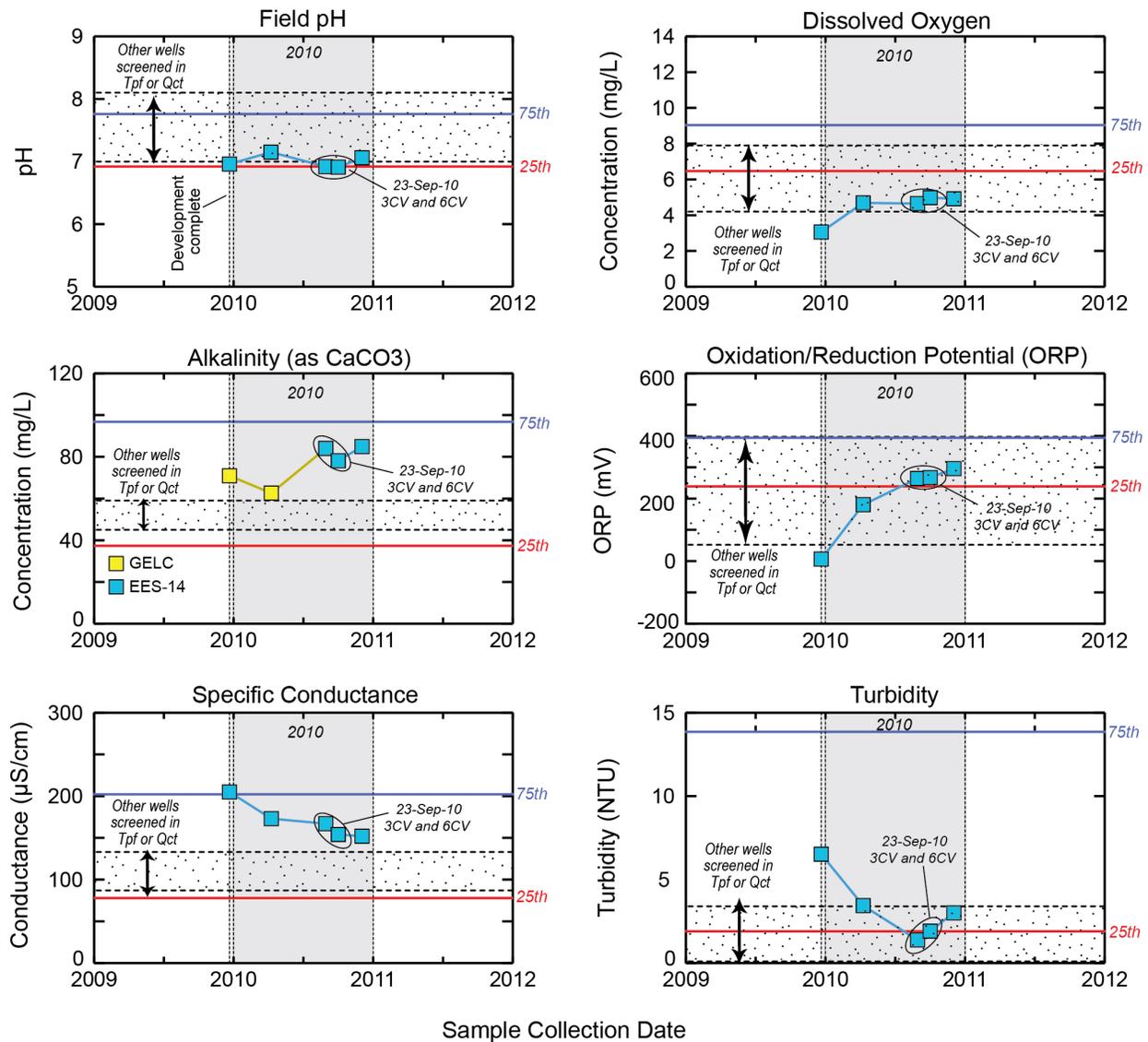
LANL (Los Alamos National Laboratory), June 2010. "2010 Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-10-1777, Los Alamos, New Mexico. (LANL 2010, 109830)

LANL (Los Alamos National Laboratory), August 2010. "Groundwater Background Investigation Report, Revision 4," Los Alamos National Laboratory document LA-UR-10-4827, Los Alamos, New Mexico. (LANL 2010, 110535)



Notes: Cumulative purge volumes shown on these plots are estimated by multiplying the pump rate by the time elapsed between field parameter measurements (Appendix B). These volumes are not precise and may underestimate the actual purge volume.

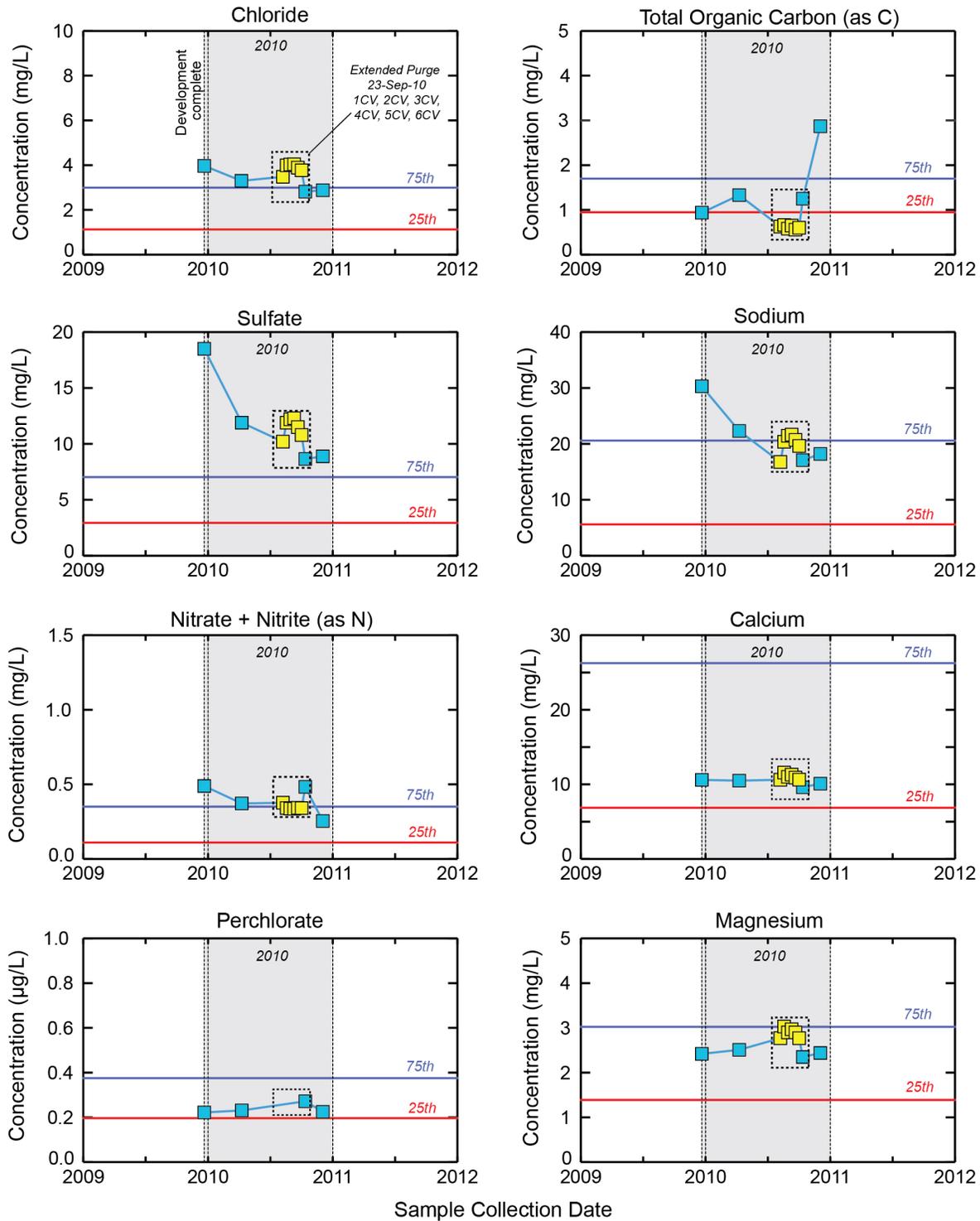
**Figure A-1.0-1 Time-series purge data for field parameters at well R-47i, December 2009 to December 2010**



■ R-47i	Well development completed 24-Nov-09; pump installed 18-Dec-09
▨ 5th to 95th percentile range for other wells screened in Tpf or Qct (Tables A-3.0-2 and A-3.0-4)	Background in perched intermediate zone (GBIR R4, Table 4.2-1):
	— 75th = 75th percentile — 25th = 25th percentile
	Data source: WQDB; R-47i well completion report (LANL 2010, 109188)

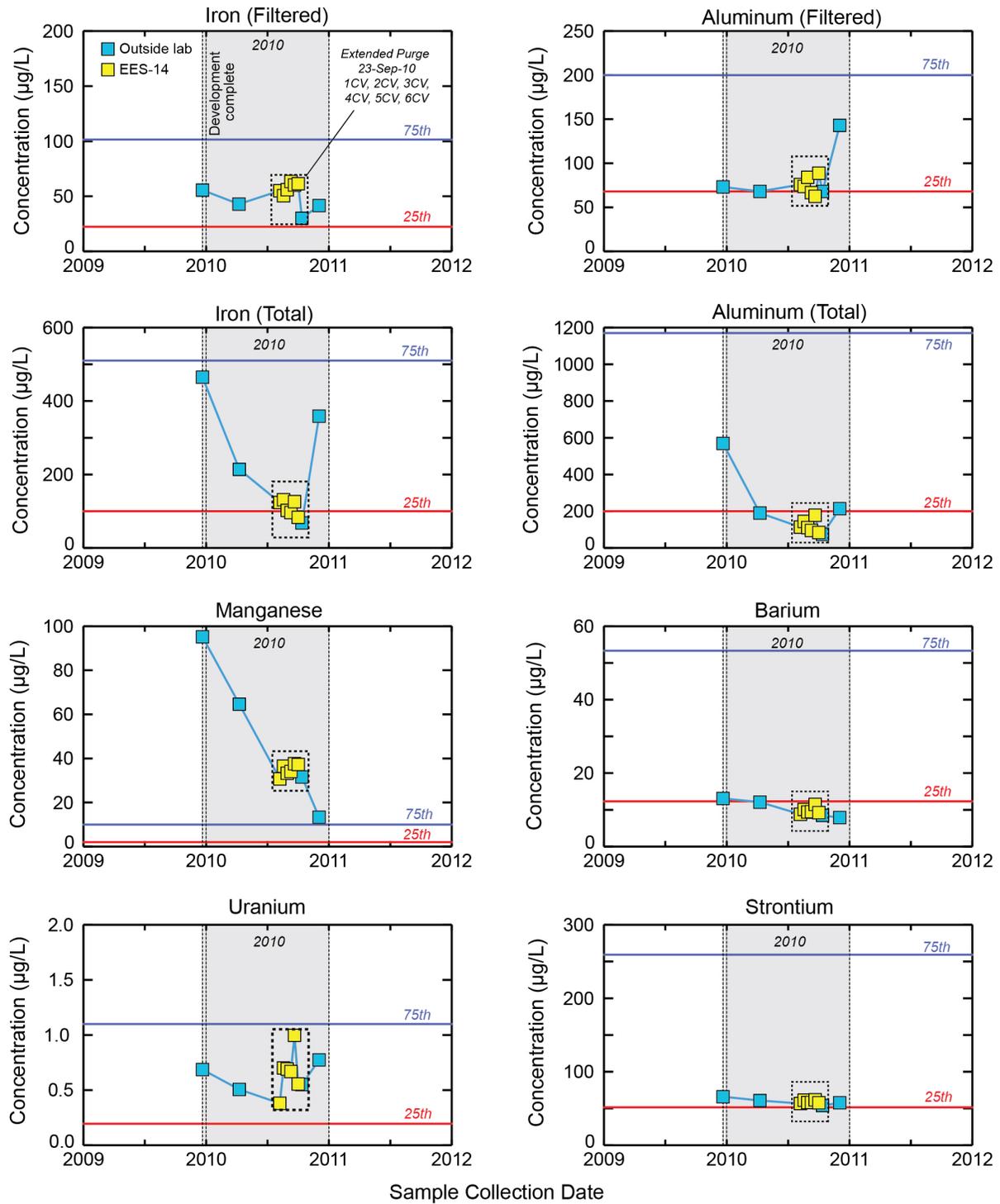
Tpf = Puye Formation; Qct = Cerro Toledo interval of the Bandelier Tuff; GBIR R4 = LANL 2010, 110535

**Figure A-1.0-2 Final field parameters and carbonate alkalinity at well R-47i, December 2009 to December 2010**



R-47i Well completion dates: Drilling 4-Sep-09; construction 16-Nov-09; development 24-Nov-09  
 ■ Outside lab data (GELC) 75th = 75th percentile for background in perched intermediate zone (GBIR R4)  
 ■ EES-14 data 25th = 25th percentile for background in perched intermediate zone (GBIR R4)  
 ▭ Extended purge event (23-Sep-10) GBIR R4 = Groundwater Background Investigation Report Revision 4 (LANL 2010, 110535)  
 Data source: Appendix B (this report; R-47i well completion report (LANL 2010, 109188))

Figure A-2.0-1 Trends for concentrations of major ions and TOC in groundwater from well R-47i, December 2009 to December 2010



R-47i	Well completion dates: Drilling 4-Sep-09; construction 16-Nov-09; development 24-Nov-09
■ Outside lab data (GELC)	75th = 75th percentile for background in perched intermediate zone (GBIR R4)
■ EES-14 data	25th = 25th percentile for background in perched intermediate zone (GBIR R4)
⋯ Extended purge event (23-Sep-10)	GBIR R4 = Groundwater Background Investigation Report Revision 4 (LANL 2010, 110535)
	Data source: WQDB; R-47i well completion report (LANL 2010, 109188)

Figure A-2.0-2 Trends for trace metal concentrations in groundwater from well R-47i, December 2009 to December 2010

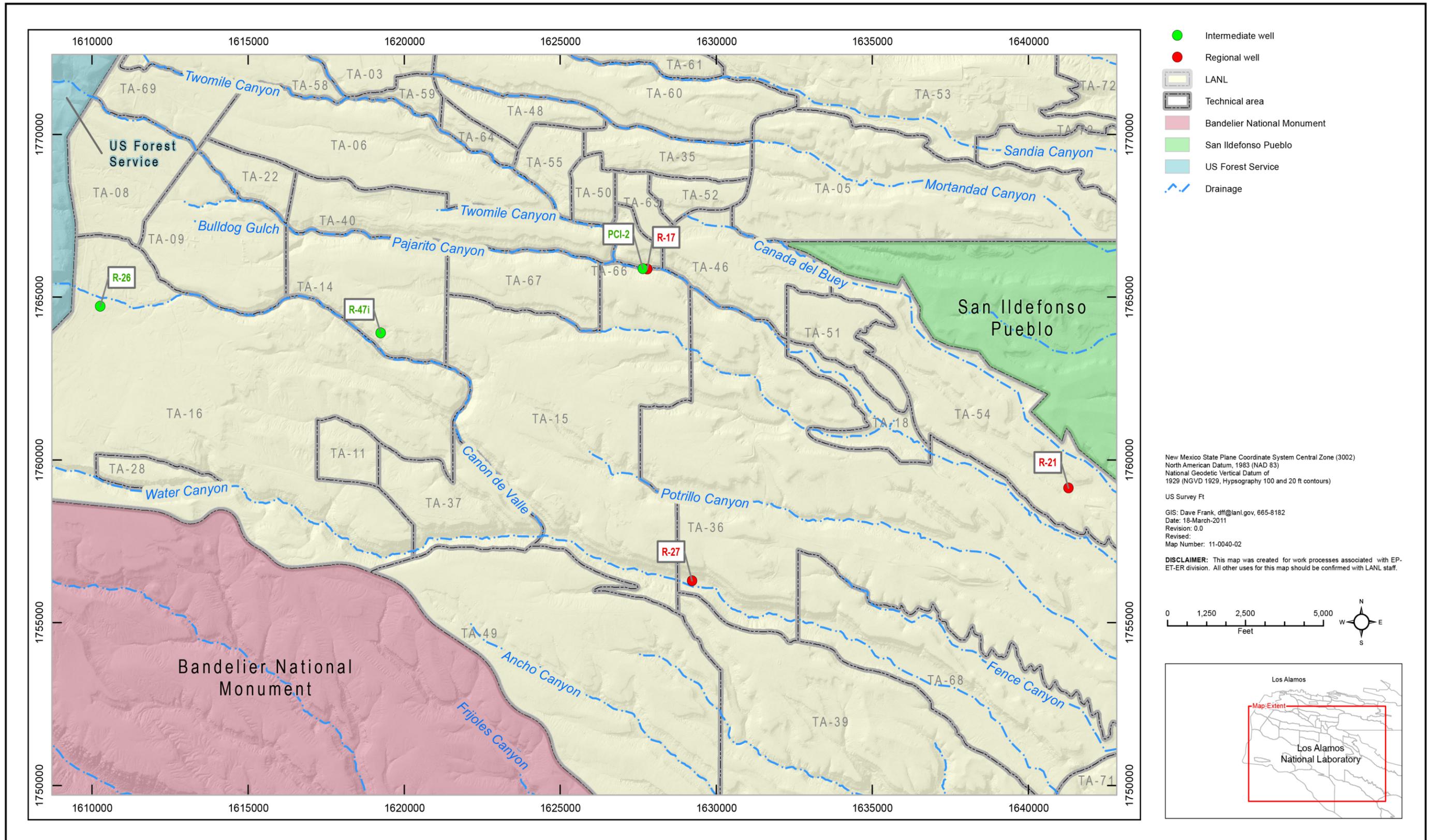
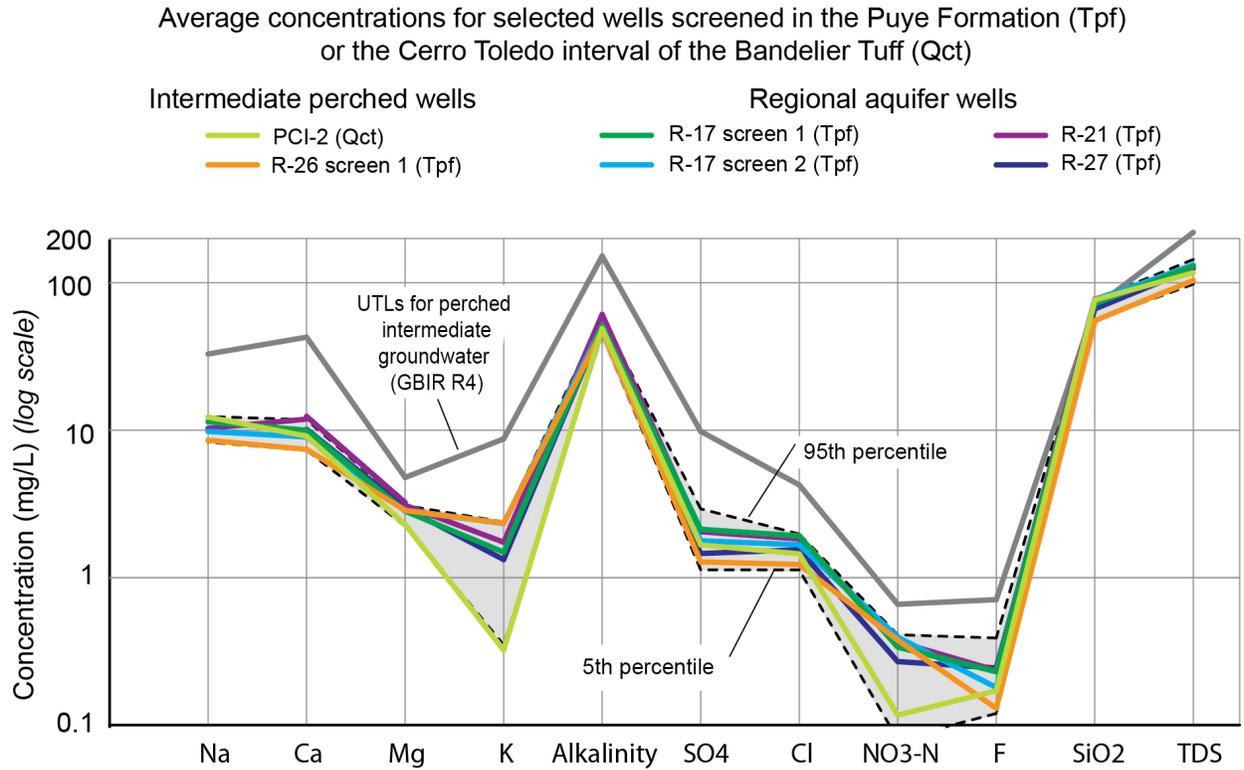


Figure A-3.0-1 Locations of well R-47i and selected perched intermediate and regional wells screened in the Puye Formation (Tpf) or the Cerro Toledo interval of the Bandelier Tuff (Qct)



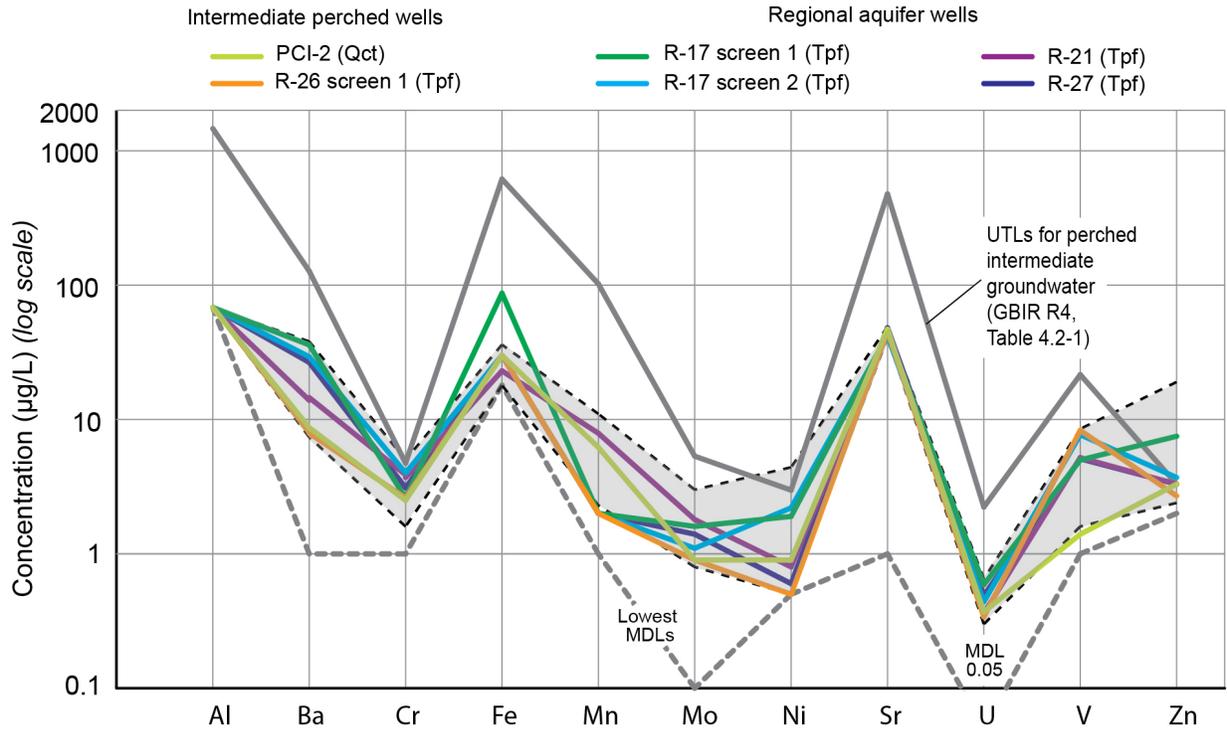
Source: Table A-3.0-2

GBIR R4 = Groundwater Background Investigation Report, Revision 4 (LANL 2010, 110535)

5th to 95th percentile range of concentrations

**Figure A-3.0-2 Average major ion and silica concentrations in filtered groundwater from selected perched intermediate and regional wells screened in Tpf or Qct**

Average concentrations for selected wells screened in the Puye Formation (Tpf) or the Cerro Toledo interval of the Bandelier Tuff (Qct)



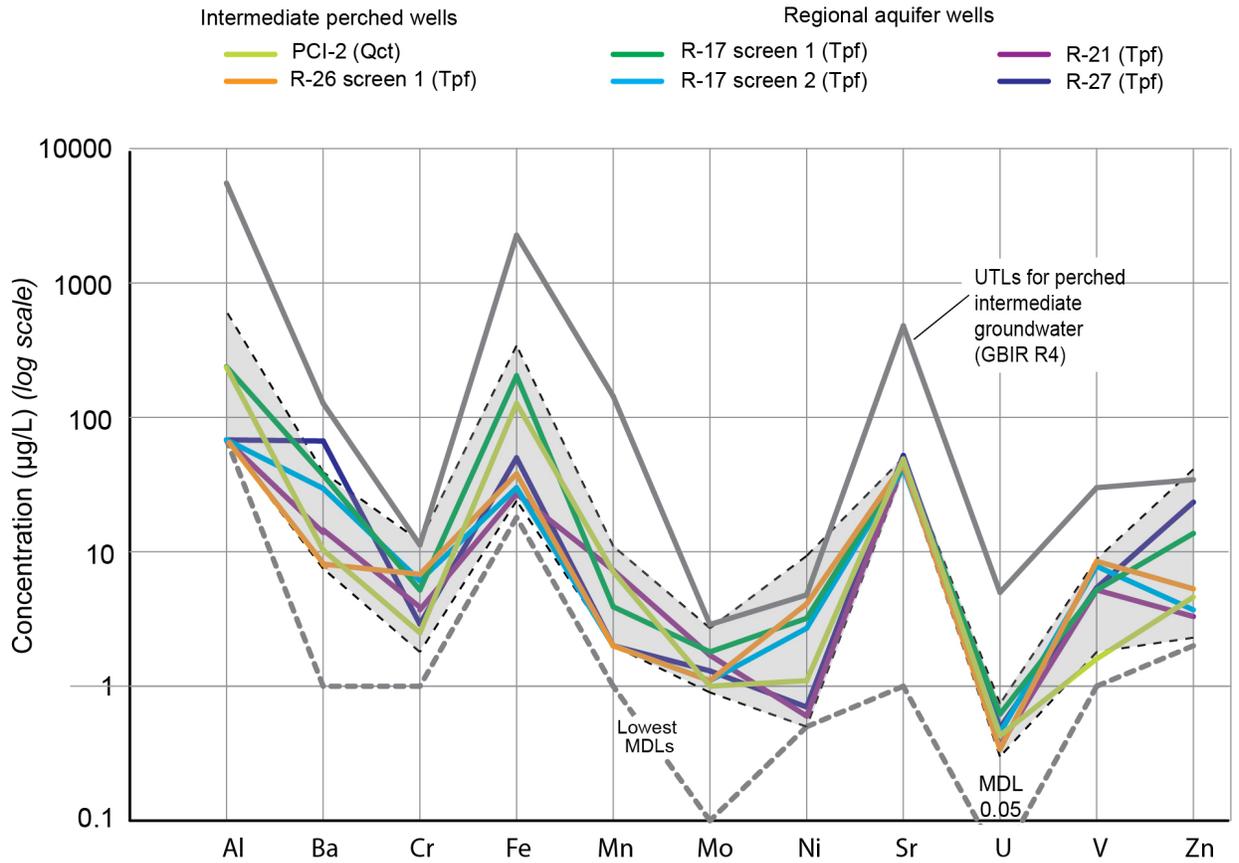
Source: Table A-3.0-3

GBIR R4 = Groundwater Background Investigation Report, Revision 4 (LANL 2010, 110535)

5th to 95th percentile range of concentrations

**Figure A-3.0-3 Average trace metal concentrations in filtered groundwater from selected perched intermediate and regional wells screened in Tpf or Qct**

Average concentrations for selected wells screened in the Puye Formation (Tpf) or the Cerro Toledo interval of the Bandelier Tuff (Qct)



Source: Table A-3.0-3

GBIR R4 = Groundwater Background Investigation Report, Revision 4 (LANL 2010, 110535)

5th to 95th percentile range of concentrations

**Figure A-3.0-4 Average trace metal concentrations in unfiltered groundwater from selected perched intermediate and regional wells screened in Tpf or Qct**

**Table A-1.0-1**  
**Well Purging Volumes and Associated Final Field Water-Quality Parameters for R-47i**

Date	Purge Volume <sup>a</sup> (gal.)	Pump Rate (gpm)	Turbidity (NTU)	pH	ORP <sup>b</sup> (mV)	Dissolved Oxygen (mg/L)	Specific Conductance ( $\mu$ S/cm)	Temperature ( $^{\circ}$ C)
<b>Final Field Parameters at End of Well Development and Aquifer Testing (LANL 2010, 109188, section 5.2 and Table B-1.2-1)</b>								
24-Nov-09	2607	1.5	17.6	7.7	-26	3.08	176	14.4
5-Dec-09	1381	0.9	7.16	7.76	-50	1.65	78	12.1
<b>Final Field Parameters during Post-Development Sampling Events (Water-Quality Database and Field Notes from Appendix C)</b>								
21-Dec-09	166	0.8	6.52	6.96	6.5	3.06	205	15.3
8-Apr-10	150	0.65	3.44	7.15	180	4.69	173	15.2
23-Sep-10	112 (3 CVs) <sup>c</sup>	1.1	1.38	6.92	264	4.65	167	15.2
23-Sep-10	223 (6 CVs)	0.5	1.91	6.91	267	4.98	154	15.7
2-Dec-10	112	0.9	3.01	7.06	295	4.92	152	13.2

Source: Appendixes B (data) and C (purge volumes).

<sup>a</sup> Purge volume = Formation water purged before sampling; excludes the volume of the pump drop pipe. In general, the target purge volume is 3 CVs (3 x 37.2 gal. = 112 gal.). For the extended purge event on 23-Sep-10, the target purge volume was 6 CVs (3 x 37.2 gal. = 223 gal.), with samples collected for every 1 CV.

<sup>b</sup> ORP values can be converted to Eh (mV) by adding a temperature-sensitive correction factor, which is 208.9 mV for a temperature of 15 $^{\circ}$ C.

<sup>c</sup> Field parameters at 3 CVs are shown for the 23-Sep-10 extended purge event to allow comparison with the 3 CVs parameter values for the other three sampling events.

**Table A-1.0-2**  
**Well Purging Volumes and Associated Final Field Water-Quality Parameters for Extended Purge Event at R-47i on September 23, 2010**

Start Time for Sample Collection	Last Field Measurement before Sample Collection							
	Purge Volume + Drop Pipe* (gal.)	Pump Rate (gpm)	Turbidity (NTU)	pH	ORP (mV)	Dissolved Oxygen (mg/L)	Specific Conductance ( $\mu$ S/cm)	Temperature ( $^{\circ}$ C)
1 CV @ 12:00	71	1.25	1.52	7.75	189	5.57	144	14.5
2 CVs @ 12:32	111	1.1	2.19	6.88	210	8.36	160	15.1
3 CVs @ 13:06	150	1.1	1.38	6.88	307	4.65	166	15.2
4 CVs @ 13:40	188	1.1	2.05	7.00	277	4.49	167	15.7
5 CVs @ 14:14	221	1.1	1.98	7.00	207	4.60	162	15.9
6 CVs @ 15:22	257	0.5	1.91	6.90	267	4.97	155	15.8

Source: Appendixes B (data) and C (purge volumes)

\*Drop pipe volume = 34 gal. for this event.

**Table A-2.0-1**  
**Concentrations of Major Ions, Silica, Selected Anions, TDS, and TOC for R-47i (Validated Data)**

Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	SO <sub>4</sub> (mg/L)	Cl (mg/L)	F (mg/L)	NO <sub>3</sub> +NO <sub>2</sub> -N (mg/L)	ClO <sub>4</sub> (µg/L)	SiO <sub>2</sub> (mg/L)	TDS (mg/L)	TOC (mg/L)	ALK (mg/L as CaCO <sub>3</sub> )	pH <sup>b</sup>
21-Dec-09	30.3	0.882	10.6	2.42	18.5	3.97	0.12	0.489	0.222	56	145	0.94	71	7.0
8-Apr-10	22.3	0.739	10.5	2.51	11.9	3.3	0.16	0.372	0.231	59	151	1.33	63	7.2
23-Sep-10	17.1	0.56	9.61	2.35	8.65	2.82	0.15	0.483	0.272	55	126	1.25	78	7.2
2-Dec-10	18.2	0.588	10.1	2.44	8.89	2.88	0.15	0.254	0.225	56	142	2.87	85	7.2

Source: Appendix B

\*ALK = Carbonate alkalinity. Alkalinity concentrations for the first two events (21-Dec-09 and 8-Apr-10) were measured by an outside analytical laboratory. Alkalinity concentrations for the events on 23-Sep-10 and 2-Dec-10 were measured by an on-site laboratory (Earth Systems Evaluation Group [EES-14]). The corresponding pH values shown are those measured in the field for the first two events, and those measured at the on-site laboratory (EES-14) for the last two events.

**Table A-2.0-2**  
**Concentrations of Major Ions, TDS, and TOC for R-47i during Extended-Purge on September 23, 2010 (EES-14 Data)**

Sample	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	SO <sub>4</sub> (mg/L)	Cl (mg/L)	F (mg/L)	NO <sub>3</sub> -N (mg/L)	SiO <sub>2</sub> (mg/L)	TOC (mg/L)	Alkalinity – CO <sub>3</sub> +HCO <sub>3</sub> (mg/L as CaCO <sub>3</sub> )	pH
R-47i @ 1 CV	16.77	0.564	10.62	2.77	10.2	3.48	0.12	0.377	66	0.63	71	7.1
R-47i @ 2 CVs	20.37	0.615	11.58	3.03	11.9	3.99	0.22	0.342	64	0.66	84	7.3
R-47i @ 3 CVs	21.46	0.631	11.00	2.90	12.2	4.03	0.22	0.338	65	0.58	84	7.2
R-47i @ 4 CVs	21.66	0.689	11.31	2.97	12.3	4.04	0.23	0.336	65	0.65	84	7.2
R-47i @ 5 CV s	20.72	0.716	10.90	2.90	11.5	3.89	0.22	0.343	67	0.56	81	7.3
R-47i @ 6 CVs	19.65	0.689	10.64	2.77	10.8	3.77	0.23	0.341	66	0.60	78	7.1

Source: Appendix B.

**Table A-2.0-3**  
**Concentrations of Selected Trace Metals for R-47i (Validated Data)**

Sample	Al (µg/L)	Ba (µg/L)	Cr (µg/L)	Fe (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Sr (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
MDL <sup>a</sup>	68	1	2.5	30	2	0.1	0.5	1	0.05	1	3.3
PQL <sup>a</sup>	200	5	10	100	10	0.5	2	5	0.2	5	10
<b>Filtered Samples</b>											
21-Dec-09	73.1	13.1	2.78	55.6	95.2	8.16	1.52	66	0.686	<2.88	4.95
8-Apr-10	ND <sup>b</sup>	12.1	ND	42.9	64.6	5.09	4.44	60.8	0.506	1.21	3.53
23-Sep-10	ND	8.48	2.64	ND	31.6	2.9	2.58	54	0.55	1.24	ND
2-Dec-10	143	7.88	ND	41.6	13.3	4.51	2.78	57.7	0.774	ND	8.87
<b>Unfiltered Samples</b>											
21-Dec-09	569	14.3	ND <sup>c</sup>	465	105	8.29	ND	70.7	0.864	<3.01	7.96
8-Apr-10	190	13.3	ND	214	68.2	5.07	4.9	63.9	0.591	1.46	5.06
23-Sep-10	73.5	9.02	2.79	68.2	32.8	2.92	2.6	55.9	0.618	1.31	ND
2-Dec-10	214	8.79	3.73	359	24.4	3.77	4.93	57.4	0.716	1.18	12

Source: Appendix B.

<sup>a</sup> Method detection limits (MDLs) and PQLs are from the 2010 Interim Facility-Wide Groundwater Monitoring Plan (LANL 2010, 109830, Appendix B) unless noted otherwise.

<sup>b</sup> ND = Not detected.

<sup>c</sup> Analytical limits reported for Cr for this sample are higher than usual: MDL = 13 µg/L and PQL = 50 µg/L.

**Table A-2.0-4**  
**Concentrations of Selected Trace Metals for**  
**R-47i during Extended-Purge on September 23, 2010 (EES-14 Data)**

Sample	Al (µg/L)	Ba (µg/L)	Cr (µg/L)	Fe (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Sr (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
<b>MDL*</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>10</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0.2</b>	<b>1</b>	<b>1</b>
<b>Filtered Samples</b>											
R-47i @ 1 CV	75.8	8.8	2.83	55.1	30.7	1.87	4.94	56.8	0.380	1.82	5.44
R-47i @ 2 CVs	73.7	10.1	3.00	50.6	36.5	3.82	3.39	61.3	0.701	1.88	5.94
R-47i @ 3 CVs	84.0	9.4	2.76	56.0	33.3	3.52	3.29	58.0	0.691	1.77	4.14
R-47i @ 4 CVs	66.7	9.5	2.76	63.4	34.1	3.75	3.12	58.2	0.668	1.71	8.48
R-47i @ 5 CVs	62.5	11.5	4.60	60.2	37.6	2.70	4.85	61.7	0.997	2.84	3.79
R-47i @ 6 CVs	88.7	9.2	2.49	61.4	37.3	2.55	4.04	57.7	0.555	1.71	6.35
<b>Unfiltered Samples</b>											
R-47i @ 1 CV	113.5	9.0	2.95	123.8	31.9	1.87	4.39	57.2	0.434	1.83	5.30
R-47i @ 2 CVs	144.2	10.4	3.61	131.1	38.0	3.97	5.61	63.8	0.790	2.02	7.32
R-47i @ 3 CVs	110.9	9.8	3.66	102.3	34.9	3.76	3.73	59.7	0.770	1.93	6.67
R-47i @ 4 CVs	95.4	12.0	4.35	96.6	43.1	3.19	3.69	70.0	0.828	2.39	6.70
R-47i @ 5 CVs	178.4	9.4	2.61	126.1	34.2	3.06	3.08	56.7	0.646	1.69	5.47
R-47i @ 6 CVs	84.05	8.5	1.95	83.2	31.9	2.56	3.47	53.5	0.529	1.51	5.58

Source: Appendix B.

\*MDL = Method detection limit (EES-14).

**Table A-3.0-1**  
**Selected Perched Intermediate and Regional Wells Completed in Tpf or Qct**

Well	Screened Interval					Post-Completion Activities		Sampling Events Used in this Report <sup>a</sup>	
	Depth (ft bgs)	Completion Zone	Unit	k <sup>b</sup> (ft/d)	Specific Capacity (gpm/ft)	End of Development	Sampling System Installed	Earliest Sample	Most Recent Sample (as of Dec 10)
PCI-2	512	Intermediate	Tpf	na <sup>c,d</sup>	na <sup>d</sup>	20-Apr-09	9-Jun-09	11-Jun-09	11-Oct-10
R-17 screen 1	1057	Regional	Tpf	1.7	0.3	24-Feb-06	12-Dec-06	22-Feb-07	22-Oct-10
R-17 screen 2	1124	Regional	Tpf	147	8.3	24-Feb-06	12-Dec-06	22-Feb-07	22-Oct-10
R-21	889	Regional	Tpf	na	0.2	5-Dec-02	14-Feb-03	6-Jun-05	11-Oct-10
R-26 screen 1	659	Intermediate	Qct	2	na	16-Nov-03	16-Jul-04	13-Apr-05	13-Aug-10
R-27 <sup>e</sup>	852	Regional	Tpf	5	na	14-Nov-05	16-Sep-06	2-Feb-07	14-Sep-10
R-47i	840	Intermediate	Tpf	0.2	0.7	24-Nov-09	18-Dec-09	21-Dec-09	2-Dec-10

Sources: Well completion reports (LANL 2009, 107342; Kleinfelder 2006, 092493; Kleinfelder 2003, 090047; Kleinfelder 2005, 087846; Kleinfelder 2006, 092488; LANL 2010, 109188); LANL water-quality database.

<sup>a</sup> Dates listed for wells PCI-2, R-17, R-26, and R-27 indicate the range of sampling events for which water-quality data are included in the statistical summaries presented in this appendix (Tables A-3.0-2 and A-3.0-4).

<sup>b</sup> k = Hydraulic conductivity.

<sup>c</sup> na = Not available.

<sup>d</sup> Because of the low pumping and recharge rates observed during well development, no aquifer testing was conducted at PCI-2.

<sup>e</sup> A dedicated pump was first installed in well R-27 on 3-Aug-06 but had to be pulled for repairs. The pump was reinstalled on 16-Sep-06.

**Table A-3.0-2**  
**Average Concentrations of Major Ions and Total Dissolved Solids for**  
**Selected Perched Intermediate and Regional Wells Completed in Tpf or Qct, 2005–2010**

Location	No. of Events	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	SO <sub>4</sub> (mg/L)	Cl (mg/L)	F (mg/L)	NO <sub>3</sub> -N (mg/L)	SiO <sub>2</sub> (mg/L)	ALK <sup>a</sup> (mg/L as CaCO <sub>3</sub> )	TDS (mg/L)
<b>Perched Intermediate Wells</b>												
PCI-2	7	11.9	0.33	8.7	2.21	1.48	1.30	0.20	0.10	70	49	122
R-26 screen 1	13	8.5	2.20	7.4	2.91	1.18	1.17	0.14	0.35	57	46	104
<b>Regional Aquifer Wells</b>												
R-17 screen 1	17	12.0	1.55	9.8	2.85	2.60	1.92	0.27	0.24	72	56	130
R-17 screen 2	17	10.1	2.36	8.8	2.85	1.73	1.64	0.22	0.34	76	54	129
R-21	19	10.1	1.67	11.5	2.98	2.07	1.82	0.28	0.33	71	57	138
R-27	10	10.1	1.33	10.1	2.98	1.45	1.55	0.24	0.27	67	51	125
<b>Summary Statistics, All Wells (Total = 81 events)</b>												
Average	n/a <sup>b</sup>	10.4	1.71	9.6	2.85	1.85	1.63	0.23	0.28	69	53	127
±1 Std dev	n/a	±1.2	±0.57	±1.4	±0.23	±0.60	±0.29	±0.08	±0.10	±6	±6	±20
5th Percentile	n/a	8.3	0.35	7.3	2.25	1.13	1.13	0.12	0.08	56	45	98
95th Percentile	n/a	12.4	2.39	11.8	3.09	2.93	1.98	0.39	0.41	77	59	144

Source: Calculated from data extracted from the LANL water-quality database.

<sup>a</sup> ALK = Carbonate alkalinity.

<sup>b</sup> n/a = Not applicable.

**Table A-3.0-3**  
**Average Concentrations of Trace Metals for Selected**  
**Perched Intermediate and Regional Wells Completed in Tpf or Qct, 2005–2010**

Location	Al (µg/L)	Ba (µg/L)	Cr (µg/L)	Fe (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Sr (µg/L)	U (µg/L)	V (µg/L)	Zn (µg/L)
MDL <sup>a</sup>	68	1	2.5	30	2	0.1	0.5	1	0.05	1	3.3
PQL <sup>a</sup>	200	5	10	100	10	0.5	2	5	0.2	5	10
<b>Filtered Samples</b>											
PCI-2	ND <sup>b</sup>	8.7	ND	ND	6.2	0.9	0.9	47	0.37	1.4	ND
R-17 screen 1	ND	35.9	2.6	87	ND	1.6	1.9	43	0.59	5.0	7.5
R-17 screen 2	ND	29.3	4.0	ND	ND	1.1	2.2	42	0.44	7.7	3.7
R-21	ND	13.9	3.7	23	7.9	1.8	0.8	45	0.36	5.2	ND
R-26 screen 1	ND	7.9	2.6	ND	ND	0.9	ND	45	0.34	8.3	2.7
R-27	ND	26.6	3.1	ND	ND	1.4	0.6	48	0.49	5.1	ND
<b>Statistics<sup>c</sup> for Filtered Samples (All Wells)</b>											
Total count	82	82	81	82	82	82	81	82	82	82	82
Detects	1	82	53	11	33	53	50	82	74	78	29
Detection rate	1%	100%	65%	13%	40%	65%	62%	100%	90%	95%	35%
Average detect	ND	22	3.3	ND	6.5	1.4	1.5	45	0.44	5.9	7.3
±1 Std dev	n/a <sup>c</sup>	±11	±1.1	n/a	±3.6	±0.6	±1.8	±3	±0.11	±2.0	±12
5th Percentile	ND	7.4	1.6	ND	2.3	0.8	0.5	41	0.30	1.6	2.4
95th Percentile	NC <sup>c</sup>	38	5.0	36	11	3.0	4.4	49	0.65	8.5	19
Maximum detect	77	39	6.5	234	18	3.5	10	51	0.75	9.5	66
<b>Unfiltered Samples</b>											
PCI-2	235	10.3	ND	127	7.1	1.0	1.1	49	0.43	1.6	4.6
R-17 screen 1	238	37.2	5.2	204	3.9	1.8	3.2	44	0.62	5.2	13.7
R-17 screen 2	ND	29.6	6.1	ND	ND	1.1	2.7	42	0.45	7.8	3.7
R-21	ND	13.9	3.7	27	7.3	1.7	0.6	45	0.36	5.2	ND
R-26 screen 1	ND	8.1	6.8	38	2.0	1.1	4.1	45	0.34	8.5	5.3
R-27	ND	66.7	2.9	50	ND	1.3	0.7	52	0.49	5.4	23.4
<b>Statistics<sup>c</sup> for Unfiltered Samples (All Wells)</b>											
Total count	81	81	80	81	81	81	81	81	81	81	81
Detects	12	81	55	35	35	54	56	81	71	75	41
Detection rate	15%	100%	69%	43%	43%	67%	69%	100%	88%	93%	51%
Average detect	ND	23	4.9	111	6.0	1.4	2.4	45	0.45	6.1	10
±1 Std dev	n/a	±12	±3.8	±246	±3.3	±0.6	±3.5	±3	±0.13	±1.9	±16
5th Percentile	ND	7.5	1.8	24	2.0	0.9	0.5	41	0.30	1.8	2.3
95th Percentile	212	39	12	341	11	2.7	9.3	50	0.74	8.8	41
Maximum detect	641	42	25	1430	14	3.5	19	52	0.77	9.4	80

Source: Calculated from data extracted from the LANL water-quality database.

<sup>a</sup> MDLs and PQLs are from the 2010 Interim Facility-Wide Groundwater Monitoring Plan (LANL 2010, 109830, Appendix B)

<sup>b</sup> ND = Not detected. Note that an average detect of ND does not necessarily indicate ND for all data for that analyte.

<sup>c</sup> n/a = Not applicable. Statistics are calculated for those analytes with detection rates ≥35% and when the number of samples ≥8. When these criteria are not met, the average detect and the 5th percentile are both presented as ND, and the std dev (standard deviation) is indicated as n/a (not applicable). When the number of detects is ≥8, 95th percentiles are calculated using the full data sets (detects and nondetects); if <8 detects, the 95th percentile is NC (not calculated)..

**Table A-3.0-4**  
**Average Final Field Parameters for Selected**  
**Perched Intermediate and Regional Wells Screened in Tpf or Qct, 2005–2010**

Location	Start Date	End Date	No. of Events	Turbidity (NTU)	pH	ORP (mV)	Dissolved Oxygen (mg/L)	Sp Cond <sup>a</sup> (µS/cm)	Temp (°C)
<b>Perched Intermediate Wells</b>									
PCI-2	11-Jun-09	11-Oct-10	7	3.6	7.0	211	7.6	100	13
R-26 screen 1	27-Jul-05	13-Aug-10	11	0.5	7.9	173 <sup>b</sup>	5.9	104	17
<b>Regional Aquifer Wells</b>									
R-17 screen 1	22-Feb-07	22-Oct-10	16	1.9	7.8	254	6.3	118	21
R-17 screen 2	22-Feb-07	22-Oct-10	16	0.4	7.8	253	5.8	111	21
R-21	6-Jun-05	11-Oct-10	19	0.4	7.9	140	5.2	122 <sup>c</sup>	21
R-27	2-Feb-07	14-Sep-10	10	0.7	7.7	118	6.1	117	18
<b>Summary Statistics (All Wells)</b>									
Count	n/a <sup>d</sup>	n/a	79	79	79	61	74	77	78
Average	n/a	n/a	n/a	1.0 ± 1.8	7.8 ± 0.4	192 ± 109	6.0 ± 1.3	113 ± 15	20 ± 3
5th Percentile	n/a	n/a	n/a	0.1	7.0	52	4.2	87	13
95th Percentile	n/a	n/a	n/a	3.4	8.1	397	7.9	133	23
Minimum	n/a	n/a	n/a	0.1	6.6	-111	0.5	77	11
Maximum	n/a	n/a	n/a	14.3	8.6	434	9.1	156	25

Source: Calculated from data extracted from the LANL water-quality database.

<sup>a</sup> Sp Cond = Specific conductance.

<sup>b</sup> ORP data are available only for one event for this location.

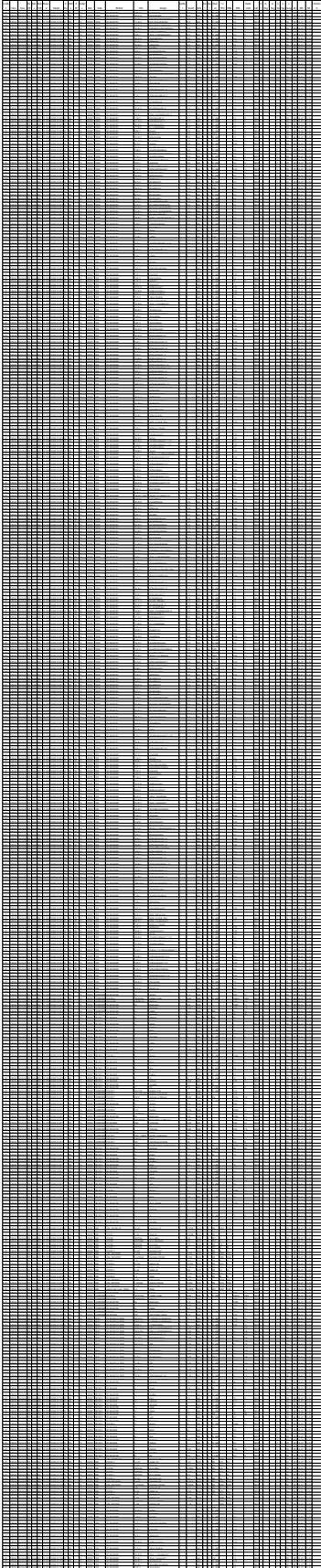
<sup>c</sup> Two outliers are excluded from statistical summaries for this field parameter.

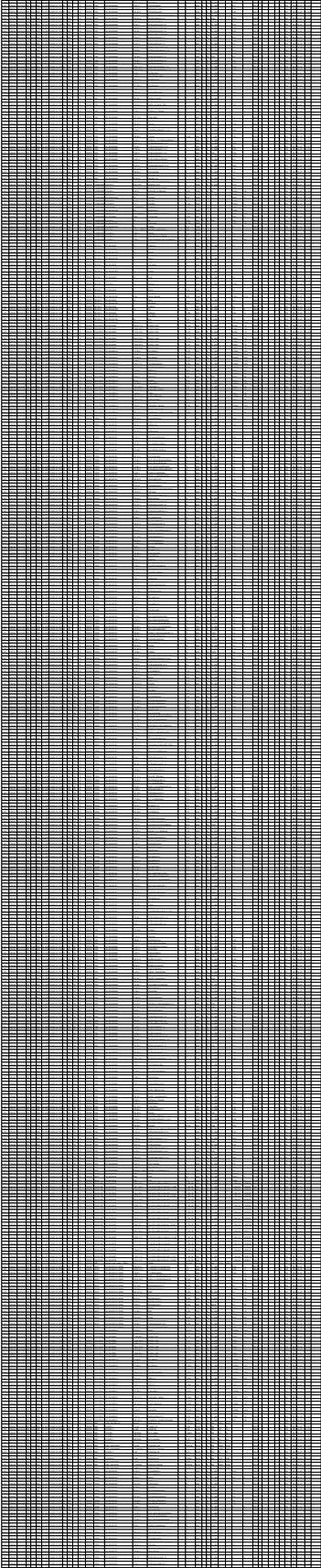
<sup>d</sup> n/a = Not applicable.

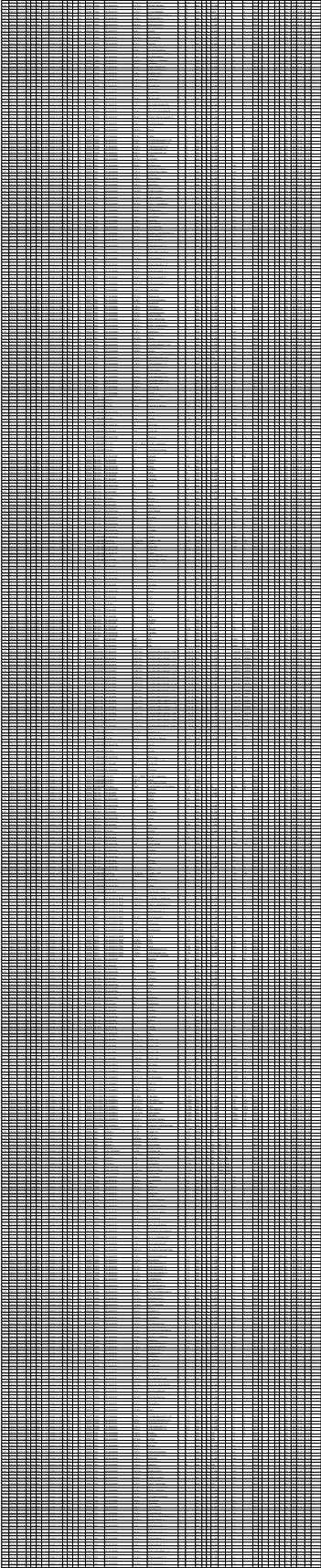
## **Appendix B**

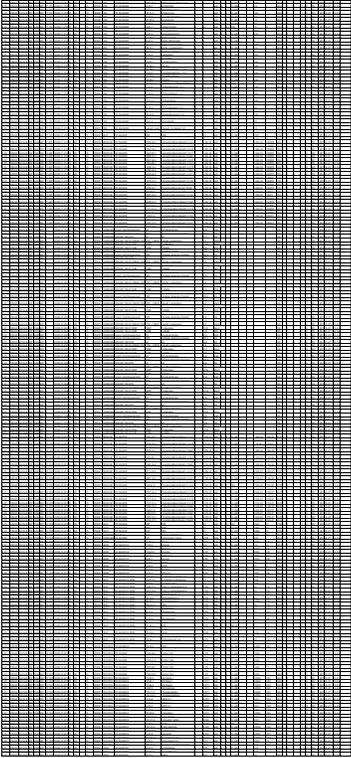
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*Groundwater Data for R-47i  
(on CD included with this document)*









Well Name: R-47i  
 Well Inside Diameter (in.): 5  
 Well Depth (FT BGS) 865.5  
 Casing/Tubing Type: sis  
 Date: 2-Dec-10  
 Initial Water Level (FT MSL): 6529.01  
 Measuring Point (FT MSL): LSD=7358

1 Casing Volume (gal): 36.8  
 3 Casing Volumes (gal): 110.5  
 Drop Pipe (gal): 34  
 3 CVs plus DP (gal): 144.5

Pump On: 10:20, 12:30  
 Water at Surface: 10:20  
 Begin Sampling: 12:55  
 End Sampling: 13:04  
 Pump Off: 11:50, 13:04

Total Purgewater (GAL): 153.5

Time (MST)	pH	Temp (°C)	Sp. Cond. (µS/cm)	Dis. O2 (mg/L)	Turb (NTU)	ORP (mV)	Water Level (FT MSL)	Discharge Rate (GPM)	Notes
10:35:15	7.00	11.55	161.0	4.11	6.11	392	6519.48	1.8	no odor, slight effervescence
10:40:15	7.09	11.88	142.4	4.68	6.08	294	6519.26	1.0	flow reduced
10:45:15	7.01	12.23	135.3	5.45	8.45	254	6521.82	1.0	effervescent
10:50:15	7.24	12.64	134.4	5.51	10.10	193	6522.65	1.0	effervescent, no odor
10:55:15	7.19	12.78	132.1	5.59	2.87	207	6523.02	1.0	effervescent, no odor
11:00:15	7.03	12.90	131.1	5.76	3.15	364	6523.20	1.0	effervescent, no odor
11:05:15	7.10	12.98	131.4	5.96	2.33	192	6523.27	1.0	effervescent, no odor
11:10:15	7.07	12.94	130.8	6.00	-	194	-	-	-
11:15:15	7.11	13.02	131.3	5.98	-	190	-	-	-
11:20:15	6.85	13.04	130.6	5.94	2.33	259	6523.30	1.0	less effervescent
11:25:15	7.10	13.07	130.0	5.93	-	196	-	-	-
11:30:15	7.08	13.16	131.1	5.98	-	226	-	-	-
11:35:15	7.56	13.18	134.0	5.90	3.18	179	6523.28	1.0	minimal effervescence
11:40:15	7.03	13.34	144.7	5.68	-	203	-	-	-
11:45:15	5.93	13.50	147.9	5.36	3.50	302	6523.26	1.0	pump off to calibrate new meter
12:35:00	7.26	13.26	155.0	5.07	5.61	311	6525.46	0.9	slight effevescence
12:40:00	6.31	12.97	152.5	5.11	4.31	312	6525.01	0.9	slight effevescence
12:45:00	7.00	13.04	155.0	5.00	2.56	299	6524.85	0.9	slight effevescence
12:50:00	7.10	13.08	153.0	4.94	3.61	298	6524.71	0.9	slight effevescence
12:55:00	7.06	13.24	152.0	4.92	3.01	296	6524.54	0.9	slight effevescence

Notes:  
 Ball valve reducer used to restrict flow

Entered By: D. Woody  
 Reviewed By: C. Kassel

Well Name: R-47i  
 Well Inside Diameter (in.): 5  
 Well Depth (FT BGS) 865.5  
 Casing/Tubing Type: sis  
 Date: 23-Sep-10  
 Initial Water Level (FT MSL): 6528.99  
 Measuring Point (FT MSL): 7358

1 Casing Volume (gal): 37.2  
 6 Casing Volumes (gal): 223.2  
 Drop Pipe (gal): 34  
 6 CVs plus DP (gal): 257.2

Pump On: 11:02  
 Water at Surface: 11:05  
 Begin Sampling: See note below  
 End Sampling: See note below  
 Pump Off: 15:35

Total Purge Water (GAL): 260

Time (MST)	pH	Temp (°C)	Sp. Cond. (µS/cm)	Dis. O2 (mg/L)	Turb (NTU)	ORP (mV)	Water Level (FT MSL)	Discharge Rate (GPM)	Notes
11:28:36	7.35	12.95	144	4.36	15.4	181	6523.15	1.25	odor, effervescent
11:33:36	6.43	12.81	143	4.44	6.21	205	6522.93	1.25	odor less strong, effervescent
11:38:36	6.48	13.04	142	4.81	3.03	211	6522.68	1.25	odor less strong, effervescent
11:43:36	6.68	13.34	141	5.18	2.53	208	6522.51	1.25	odor less strong, effervescent
11:48:36	6.76	13.63	142	5.38	1.90	207	6522.33	1.25	odor less strong, effervescent
11:53:36	6.80	14.07	142	5.49	1.74	209	6522.17	1.25	odor less strong, effervescent
11:58:36	7.75	14.48	144	5.57	1.52	189	6521.85	1.25	pH increased during sampling
12:03:36	6.87	14.75	144	5.51	-	175	-	-	-
12:08:36	6.77	14.86	144	5.54	-	213	-	-	-
12:13:36	6.83	14.92	146	5.54	1.41	222	6522.10	1.1	decreased discharge
12:18:36	6.87	15.10	148	5.46	-	220	-	-	-
12:23:36	6.90	15.07	153	5.34	-	206	-	-	-
12:28:36	6.88	15.07	160	5.11	2.19	210	6522.37	1.1	odor, effervescent
12:29:29	6.88	15.05	160	8.36	-	210	-	-	-
12:34:29	6.91	15.13	164	4.88	-	205	-	-	-
12:39:29	6.93	15.21	167	4.68	-	206	-	-	-
12:44:29	6.93	15.17	168	4.62	2.12	196	6522.30	1.1	odor, effervescent
12:49:29	7.02	15.19	168	4.57	-	204	-	-	-
12:54:29	6.92	15.14	167	4.63	-	236	-	-	-
12:59:29	6.90	15.21	167	4.66	1.38	266	6522.26	1.1	odor, effervescent
13:04:29	6.88	15.23	166	4.65	-	307	-	-	-
13:09:29	6.91	15.38	166	4.64	-	310	-	-	-
13:14:29	6.91	15.46	165	4.61	1.89	299	6522.15	1.1	odor, effervescent
13:19:29	6.90	15.55	165	4.58	-	286	-	-	-
13:24:29	6.89	15.60	166	4.56	-	291	-	-	-
13:29:29	6.97	15.71	166	4.52	2.05	287	6522.09	1.1	odor, effervescent
13:34:29	6.89	15.69	166	4.54	-	289	-	-	-
13:39:29	7.00	15.72	167	4.49	-	277	-	-	-
13:44:29	6.99	15.72	167	4.50	2.19	271	6521.95	1.1	odor, effervescent
13:49:29	7.07	15.76	165	4.50	-	254	-	-	-
13:54:29	7.00	15.76	164	4.53	-	209	-	-	-
13:59:29	6.99	15.87	163	4.53	1.98	223	6521.93	1.1	odor, effervescent
14:04:29	7.07	15.83	163	4.57	-	195	-	-	-
14:09:29	7.00	15.88	162	4.60	-	207	-	-	-

14:14:29	6.97	15.95	161	4.67	1.87	225	6522.47	0.5	reduced flow
14:19:29	6.98	15.88	160	4.75	-	226	-	-	-
14:24:29	6.96	15.97	160	4.72	-	227	-	-	-
14:29:29	6.97	15.95	158	4.78	2.00	228	6522.86	0.5	effervescent
14:34:29	7.00	15.91	158	4.81	-	169	-	-	-
14:39:29	6.97	15.96	157	4.78	-	189	-	-	-
14:44:29	6.96	15.90	156	4.84	1.94	207	6523.04	0.5	effervescent
14:49:29	6.95	15.78	157	4.88	-	218	-	-	-
14:54:29	6.95	15.79	156	4.90	-	225	-	-	-
14:59:29	6.51	15.66	155	4.93	1.95	269	6523.15	0.5	effervescent
15:04:29	6.89	15.71	155	4.94	-	266	-	-	-
15:09:29	6.90	15.71	155	4.97	-	268	-	-	-
15:14:29	6.90	15.77	155	4.97	1.91	267	6523.22	0.5	effervescent

Notes:

Sample 1 CV of 6 CV. Collect parameters every 15 minutes through 6 CV's.  
 Begin Sampling: 1CV - 12:00; 2CV - 12:32; 3CV - 13:06; 4CV - 13:40; 5CV - 14:14; 6CV - 15:22  
 End Sampling: 1CV - 12:03; 2CV - 12:37; 3CV - 13:13; 4CV - 13:49; 5CV - 14:20; 6CV - 15:35

Entered By: D. Fellenz  
 Reviewed By: D. Woody

**Well Name:** R-47i  
**Well Inside Diameter (in.):** 5  
**Well Depth (FT BGS)** 865.5  
**Casing/Tubing Type:** ss  
**Date:** 8-Apr-10  
**Initial Water Level (FT MSL):** 6528.97  
**Measuring Point (FT MSL):** 7358

**Pump On:** 9:28  
**Water at Surface:** 9:23  
**Begin Sampling:** 13:18  
**End Sampling:** 13:33  
**Pump Off:** 9:27, 13:33

**Total Purgewater (GAL):** 150

Time (MST)	pH	Temp (°C)	Sp. Cond. (µS/cm)	Dis. O2 (mg/L)	Turb (NTU)	ORP (mV)	Water Level (FT MSL)	Discharge Rate (GPM)	Notes
10:16	6.26	11.56	162	6.17	6.96	314.0	6525.84	0.65	manual Q
10:21	6.98	11.57	159	5.14	6.15	259.0	6525.81	0.65	effervescent
10:26	7.05	11.92	159	5.00	5.91	224.1	6525.79	0.65	effervescent
10:31	7.10	12.23	158	5.01	4.46	233.90	6525.78	0.65	effervescent
10:36	7.11	12.31	158	5.00	3.75	237.30	-	0.65	effervescent
10:41	7.13	12.47	158	5.03	3.13	240.7	6525.80	0.65	manual Q; less effervescent
10:46	7.15	13.01	159	5.25	2.98	238.4	6525.77	0.65	slight effervescent
11:00	7.16	13.30	158	5.25	2.70	232.9	6525.74	0.65	slight effervescent
11:15	7.14	13.35	160	5.42	2.67	226.5	6525.58	0.65	manual Q
11:30	7.12	13.77	162	5.19	3.60	220.9	6525.35	0.65	slightly effervescent
11:45	7.13	14.60	168	4.76	3.47	212.0	6525.26	0.65	slightly effervescent
12:00	7.14	15.17	179	4.28	3.29	203.1	6525.14	0.64	manual Q
12:15	7.15	15.27	178	4.24	3.06	196.0	6525.06	0.64	slight effervescent
12:30	7.16	15.18	177	4.36	3.44	189.5	6525.03	0.64	slight effervescent
12:45	7.16	15.22	173	4.62	2.97	185.3	6524.98	0.64	ysi turned off
13:00	7.15	15.24	173	4.69	3.44	180.1	6524.92	0.64	clear, no odor/effervescence

Entered By: William Shaw  
 Reviewed By: Chris Cantrell

**Well Name:** R-47i  
**Well Inside Diameter (in.):** 5  
**Well Depth (FT BGS)** 865.5  
**Casing/Tubing Type(s):** SS  
**Date:** 21-Dec-09  
**Initial Water Level (FT MSL):** not available  
**Measuring Point (FT MSL):** not available

**Pump On:** 10:23  
**Water at Surface:** 10:26  
**Begin Sampling:** 13:40  
**End Sampling:** 14:00  
**Pump Off:** 14:00

**Total Purgewater (GAL):** 166

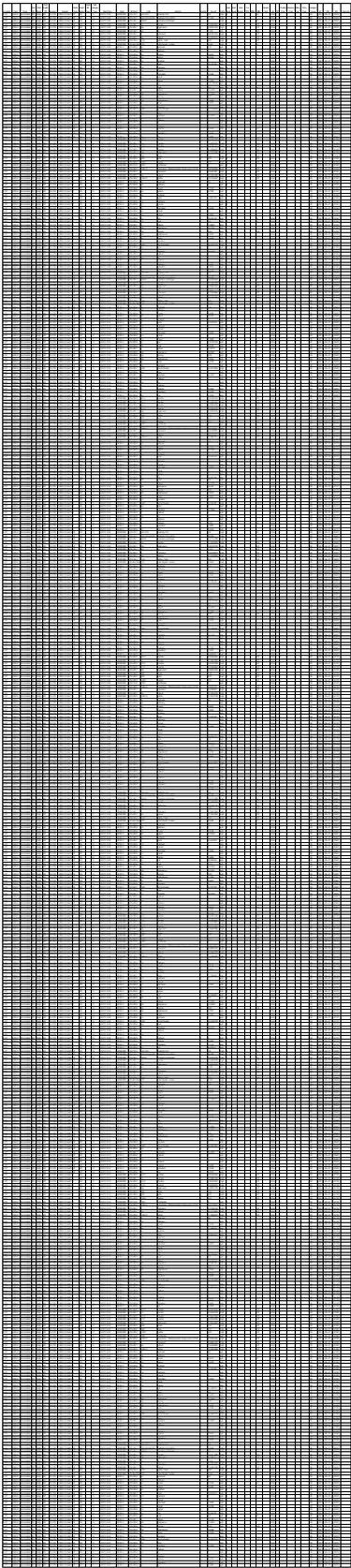
Time	pH	Temp (°C)	Spec. Cond. (µS/cm)	Dis. O <sub>2</sub> (mg/L)	Turb (NTU)	ORP (mV)	Water Level (ft msl)	Discharge Rate (GPM)	Notes
11:08	6.74	12.3	199	2.96	16.5	346.4	23.24	0.80	manual Q
11:13	6.79	12.7	198	2.94	10.5	328.4	23.25	0.80	clear/effervescent
11:18	6.77	12.8	198	2.94	8.95	327.5	23.25	0.80	clear/effervescent
11:23	6.83	12.9	199	3.19	8.37	313.2	23.23	0.80	clear/effervescent
11:28	6.82	13.1	199	3.25	8.18	304.7	23.20	0.80	clear/effervescent
11:33	6.87	13.3	199	3.26	7.86	295.8	23.16	0.80	clear/effervescent
11:38	6.83	13.4	198	3.28	7.48	291.3	23.15	0.80	clear/effervescent
11:48	6.84	14.0	200	3.29	7.50	273.5	23.00	0.80	clear/effervescent
12:00	6.86	14.6	198	3.33	7.04	254.7	22.94	0.80	clear/effervescent
12:10	6.93	14.7	198	3.41	7.34	206.5	22.88	0.80	YSI auto shutoff
12:20	6.88	14.6	200	3.32	7.57	212.9	22.70	0.80	clear/effervescent
12:30	6.87	14.8	210	3.10	7.13	210.6	22.70	0.80	manual Q
12:40	6.92	15.0	214	2.98	6.87	205.3	22.49	0.80	clear/effervescent
12:50	6.92	15.1	214	2.96	6.80	202.9	22.50	0.80	clear/effervescent
13:00	6.93	15.2	213	2.91	6.36	200.6	22.37	0.80	clear/effervescent
13:10	6.91	15.3	211	2.90	6.62	198.0	22.37	0.80	clear/effervescent
13:20	6.93	15.2	207	2.99	6.81	192.7	22.30	0.80	clear/effervescent
13:30	6.94	15.2	206	3.05	6.59	193.3	22.28	0.80	clear/effervescent
13:40	6.96	15.3	205	3.06	6.52	191.6	21.58	0.80	clear/effervescent

**Note:** Characterization Sampling  
 New well, transducer not set to feet msl  
 Instead reads water column above transducer

Entered by: David Woody  
 Reviewed by: Hal Wershow

Location	Class	Zone	Port ID	Port Name	Port Depth (ft)	Request	Sample	Field Prep	Field Matrix	Field QC Type	Lab Sample Type	Date	Suite	Method	CAS	Analyte	Symbol	Result	Units	Lab Qual	2nd Qual	2nd Reason	1-s TPU	MDA	MDL	Quant Limit	Lab	DF	Prelim Flag	Release Flag	Web Flag	Prov Flag	Sample Usage	ULI	URI	USI	Comments	
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6910	UF	WG	CS	12/21/2009	VOA	SW-846.82608	1912-24-9	Airazine	<	10.9	µg/L	U	R	SV7b			3.3	11	GELC	1	N	Y	Y	N	INV	29221	25066591	1360981			
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6910	UF	WG	CS	12/21/2009	VOA	SW-846.82608	75-05-8	Acetonitrile	<	25	µg/L	U	R	V7b			6.3	25	GELC	1	N	Y	Y	Y	N	INV	29221	25069001	1360981		
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6910	UF	WG	CS	12/21/2009	VOA	SW-846.82608	107-02-8	Acetolitrile	<	5	µg/L	U	R	V7b			1.3	5	GELC	1	N	Y	Y	Y	N	INV	29221	25067161	1360981		
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6910	UF	WG	CS	12/21/2009	VOA	SW-846.82608	75-83-1	Isobutyl alcohol	<	50	µg/L	U	R	V7b			13	50	GELC	1	N	Y	Y	Y	N	INV	29221	25066591	1360981		
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6910	UF	WG	CS	12/21/2009	VOA	SW-846.82608	107-12-0	Propionitrile	<	5	µg/L	U	R	V7b			1.5	5	GELC	1	N	Y	Y	Y	N	INV	29221	25068801	1360981		
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6912	UF	WG	FD	CS	12/21/2009	SVQA	SW-846.8270C	1912-24-9	Airazine	<	10.9	µg/L	U	R	SV7b			3.3	11	GELC	1	N	Y	Y	Y	N	QC	29221	25065161	1364661	
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6912	UF	WG	FD	CS	12/21/2009	VOA	SW-846.82608	75-05-8	Acetonitrile	<	25	µg/L	U	R	V7b			6.3	25	GELC	1	N	Y	Y	Y	N	QC	29221	25064001	1364661	
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6912	UF	WG	FD	CS	12/21/2009	VOA	SW-846.82608	107-02-8	Acetolitrile	<	5	µg/L	U	R	V7b			1.3	5	GELC	1	N	Y	Y	Y	N	QC	29221	25067171	1364661	
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6912	UF	WG	FD	CS	12/21/2009	VOA	SW-846.82608	107-12-0	Isobutyl alcohol	<	50	µg/L	U	R	V7b			13	50	GELC	1	N	Y	Y	Y	N	QC	29221	25066171	1364661	
R-47i	SINGLE	Intermediate	8921	Single	840	10-1049	CAWA-10-6912	UF	WG	FD	CS	12/21/2009	VOA	SW-846.82608	107-12-0	Propionitrile	<	5	µg/L	U	R	V7b			1.5	5	GELC	1	N	Y	Y	Y	N	QC	29221	25068111	1364661	
R-47i	SINGLE	Intermediate	8921	Single	840	10-2707	CAWA-10-15220	UF	WG	CS	4/8/2010	VOA	SW-846.82608	75-05-8	Acetonitrile	<	25	µg/L	U	R	V7b			6.3	25	GELC	1	N	Y	Y	Y	N	INV	29221	25932691	1375361		
R-47i	SINGLE	Intermediate	8921	Single	840	10-2707	CAWA-10-15220	UF	WG	CS	4/8/2010	VOA	SW-846.82608	71-36-3	Butanol[1-]	<	50	µg/L	U	R	V7b			15	50	GELC	1	N	Y	Y	Y	N	INV	29221	25925251	1375361		
R-47i	SINGLE	Intermediate	8921	Single	840	10-2707	CAWA-10-15220	UF	WG	CS	4/8/2010	VOA	SW-846.82608	78-83-1	Isobutyl alcohol	<	50	µg/L	U	R	V7b			13	50	GELC	1	N	Y	Y	Y	N	INV	29221	25937601	1375361		
R-47i	SINGLE	Intermediate	8921	Single	840	10-2708	CAWA-10-15223	UF	WG	FD	CS	4/8/2010	VOA	SW-846.82608	75-05-8	Acetonitrile	<	25	µg/L	U	R	V7b			6.3	25	GELC	1	N	Y	Y	Y	N	QC	29221	26021201	1377321	
R-47i	SINGLE	Intermediate	8921	Single	840	10-2708	CAWA-10-15223	UF	WG	FD	CS	4/8/2010	VOA	SW-846.82608	71-36-3	Butanol[1-]	<	50	µg/L	U	R	V7b			15	50	GELC	1	N	Y	Y	Y	N	QC	29221	26014071	1377321	
R-47i	SINGLE	Intermediate	8921	Single	840	10-2708	CAWA-10-15223	UF	WG	FD	CS	4/8/2010	VOA	SW-846.82608	78-83-1	Isobutyl alcohol	<	50	µg/L	U	R	V7b			13	50	GELC	1	N	Y	Y	Y	N	QC	29221	26017471	1377321	
R-47i	SINGLE	Intermediate	8921	Single	840	10-4721	CAWA-10-29908	UF	WG	CS	9/23/2010	SVQA	SW-846.8270C	1912-24-9	Airazine	<	10	µg/L	U	R	SV7b			3	10	GELC	1	N	Y	Y	Y	N	QC	29221	27388411	1398181		
R-47i	SINGLE	Intermediate	8921	Single	840	10-4721	CAWA-10-29908	UF	WG	CS	9/23/2010	VOA	SW-846.82608	75-05-8	Acetonitrile	<	25	µg/L	U	R	V7b			6.3	25	GELC	1	N	Y	Y	Y	N	INV	29221	27301161	1398181		
R-47i	SINGLE	Intermediate	8921	Single	840	10-4721	CAWA-10-29908	UF	WG	CS	9/23/2010	VOA	SW-846.82608	107-02-8	Acetolitrile	<	5	µg/L	U	R	V7b			1.3	5	GELC	1	N	Y	Y	Y	N	INV	29221	27390611	1398181		
R-47i	SINGLE	Intermediate	8921	Single	840	10-4721	CAWA-10-29908	UF	WG	CS	9/23/2010	VOA	SW-846.82608	78-83-1	Isobutyl alcohol	<	50	µg/L	U	R	V7b			13	50	GELC	1	N	Y	Y	Y	N	INV	29221	27399891	1398181		
R-47i	SINGLE	Intermediate	8921	Single	840	10-4721	CAWA-10-29908	UF	WG	CS	9/23/2010	VOA	SW-846.82608	107-12-0	Propionitrile	<	5	µg/L	U	R	V7b			1.5	5	GELC	1	N	Y	Y	Y	N	INV	29221	27382041	1398181		





## **Appendix C**

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*Field Notes and Observations  
(on CD included with this document)*

## **Appendix C**

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*Field Notes and Observations  
(on CD included with this document)*



# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2464

EVENT NAME: R-47i Characterization Sampling

SAMPLE ID: CAWA-10-6910

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		12/21/09	MEDIA: <u>WGI</u>	OK
TIME COLLECTED (HH:MM)		1340	SUB-MEDIA: <u>UA</u>	
PRS ID: <u>C-00-016</u>		OK	SAMPLE TECH CODE: <u>GSP</u>	
LOCATION ID: <u>R-47i</u>			FIELD QC TYPE: <u>NA</u>	
LOCATION TYPE: <u>MON</u>			FIELD PREP: <u>UF</u>	
TOP DEPTH:			SAMPLE USAGE: <u>INV</u>	
BOTTOM DEPTH:			SCREEN/PORT DESC:	
FIELD MATRIX: <u>WG</u>		↓	EXCAVATED: YES/NO <u>(NA)</u>	↓
COMPOSITE TYPE: <u>NA</u>			COMPOSITE TIME INTERVAL: <u>NA</u>	
			WATER FLOWING: YES/NO <u>(NA)</u>	
BOREHOLE: YES/NO <u>(NA)</u>			BOREHOLE DECLINATION: <u>NA</u>	
			BOREHOLE DIRECTION: <u>NA</u>	

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
3		WSP-8081A-Pest	1 LITER AMBER GLASS	Ice	Y	15-day turnaround
3		WSP-8082-PCB	1 LITER AMBER GLASS	Ice	Y	15-day turnaround
2		WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (Hydrogen Chloride)	Y	10-day turnaround
3		WSP-8270C-SVOA	1 LITER AMBER GLASS	Ice	Y	15-day turnaround
2		WSP-8290-D/F	1 LITER AMBER GLASS	Ice	Y	
3		WSP-8321A-NMED HEXP	1 LITER AMBER GLASS	Ice	Y	10-day turnaround
1		WSP-CN(T)	250 ML POLY	Sodium Hydroxide	Y	10-day turnaround pH > 12
2		WSP-D2H+O18O16	40 ML SEPTUM AMBER GLASS	Ice	Y	
1		WSP-GrossA/B	1 LITER POLY	None	Y	
2		WSP-HEXMOD	1 LITER AMBER GLASS	Ice	Y	10-day turnaround.
1		WSP-LL-H-3	1 LITER POLY	None	Y	15-day turnaround.
1		WSP-Met+B+SN+SR+U	1 LITER POLY	Nitric Acid	Y	15-day turnaround pH < 2
1		WSP-RAD	1 GAL POLY	Nitric Acid	Y	15-day turnaround pH < 2
1		WSP-TKN+TOC	500 ML AMBER GLASS	Sulfuric Acid (Hydrogen Sulfate)	Y	10-day turnaround pH < 2
1		Ra226+228	1 GAL POLY	Nitric Acid	Y	15-day turnaround
3		WSP-8151A-Herb	1 LITER AMBER GLASS	Ice	Y	15-day turnaround
1		WSP-H-3	250 ML AMBER GLASS	Ice	Y	Analysis by direct count, 10-day turnaround.

SAMPLE DESC:

SAMPLE COMMENTS: First full suite (characterization) sample.

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2464

EVENT NAME: R-47i Characterization Sampling

LOCATION DESC:

**FIELD SCREENING/MEASUREMENT RESULTS:**

<u>pH (Stu)</u>	<u>Temp (°C)</u>	<u>EC <math>\mu\text{S}/\text{cm}</math></u>	<u>DO mg/L</u>	<u>ORP mV</u>	<u>Q gpm</u>
6.96	15.29	205	3.06	6.52	.8

COLLECTED BY (PRINT)

REVIEWED BY (PRINT) J Berryhill

J Berryhill, K Crawford, W Shaw, D Woody

<b>RELINQUISHED BY</b> (Printed Name) <u>D. Woody</u> (Signature) <u>[Signature]</u>	<b>Date/Time</b> <u>12/21/09</u> <u>1515</u>	<b>RECEIVED BY</b> (Printed Name) <u>K. Greene</u> (Signature) <u>[Signature]</u>	<b>Date/Time</b> <u>12/21/09</u> <u>3:15</u>
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

CWA-10-6910

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2464

EVENT NAME: R-47i Characterization Sampling

SAMPLE ID: CAWA-10-6911

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		12/21/09	MEDIA: WGI	OK
TIME COLLECTED (HH:MM)		1340	SUB-MEDIA: UA	
PRS ID: C-00-016		OK	SAMPLE TECH CODE: GSP	
LOCATION ID: R-47i			FIELD QC TYPE: NA	
LOCATION TYPE: MON			FIELD PREP: F	
TOP DEPTH:			SAMPLE USAGE: INV	
BOTTOM DEPTH:			SCREEN/PORT DESC:	
FIELD MATRIX: WG		↓	EXCAVATED: YES/NO/NA	↓
COMPOSITE TYPE: N/A			COMPOSITE TIME INTERVAL: N/A	WATER FLOWING: YES/NO/NA
BOREHOLE: YES/NO/NA			BOREHOLE DECLINATION: N/A	BOREHOLE DIRECTION: N/A

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-GENINORG	1 LITER POLY	Ice	Y	10-day turnaround
1		WSP-Met+B+SN+SR+U	1 LITER POLY	Nitric Acid	Y	15-day turnaround pH < 2
2		WSP-N14N15	40 ML SEPTUM AMBER GLASS	Ice	Y	
1		WSP-NH3+NO3/NO2+PO4	500 ML AMBER GLASS	Sulfuric Acid (Hydrogen Sulfate)	Y	10-day turnaround pH < 2

SAMPLE DESC:

SAMPLE COMMENTS: First full suite (characterization) sample.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

} See CAWA-10-6910

COLLECTED BY (PRINT)

J. Berryhill, W. Shaw, D. Woody, K. Crawford

REVIEWED BY (PRINT)

J. Berryhill

<b>RELINQUISHED BY</b> (Printed Name) Kelon Crawford (Signature) <i>Kelon Crawford</i>	<b>Date/Time</b> 12/21/09 1515	<b>RECEIVED BY</b> (Printed Name) K. Green (Signature) <i>[Signature]</i>	<b>Date/Time</b> 12/21/09 1515
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2464

EVENT NAME: R-47i Characterization Sampling

SAMPLE ID: CAWA-10-6912

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		12/21/09	MEDIA: WGI	OK
TIME COLLECTED (HH:MM)		1340	SUB-MEDIA: UA	
PRS ID: C-00-016		OK	SAMPLE TECH CODE: G-51	
LOCATION ID: R-47i			FIELD QC TYPE: ED	
LOCATION TYPE: MON			FIELD PREP: UF	
TOP DEPTH:			SAMPLE USAGE: QC	
BOTTOM DEPTH:		↓	SCREEN/PORT DESC:	↓
FIELD MATRIX: WG			EXCAVATED: YES/NO (NA)	
COMPOSITE TYPE: NA			COMPOSITE TIME INTERVAL: NA	
			WATER FLOWING: YES/NO (NA)	
BOREHOLE: YES/NO (NA)			BOREHOLE DECLINATION: NA	
			BOREHOLE DIRECTION: NA	

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
2		WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (Hydrogen Chloride)	Y <i>OK 12/21/09</i>	15-day turnaround <i>PH &lt; 2</i>
3		WSP-8270C-SVOA	1 LITER AMBER GLASS	Ice	Y	15-day turnaround

SAMPLE DESC: QC Sample of CAWA-10-6910

SAMPLE COMMENTS: First full suite (characterization) sample.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

see CAWA-10-6910

COLLECTED BY (PRINT)  
*J. Berryhill, K. Crawford, W. Shaw, D. Woolly*

REVIEWED BY (PRINT) *J. Berryhill*

<b>RELINQUISHED BY</b> (Printed Name) <i>D. Woolly</i> (Signature) <i>D. Woolly</i>	Date/Time 12/21/09 1515	<b>RECEIVED BY</b> (Printed Name) <i>K. Crawford</i> (Signature) <i>[Signature]</i>	Date/Time 12/21/09 1515
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	Date/Time	<b>RECEIVED BY</b> (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2464

EVENT NAME: R-47i Characterization Sampling

SAMPLE ID: CAWA-10-6913

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		12/21/09	MEDIA: WGI	OK
TIME COLLECTED (HH:MM)		1340	SUB-MEDIA: UA	
PRS ID: C-00-016		OK	SAMPLE TECH CODE: 651	
LOCATION ID: R-47i			FIELD QC TYPE: FTB	
LOCATION TYPE: MON			FIELD PREP: UF	
TOP DEPTH:			SAMPLE USAGE: QC	
BOTTOM DEPTH:			SCREEN/PORT DESC:	
FIELD MATRIX: WG			EXCAVATED: YES/NO/NA	
COMPOSITE TYPE: NA			COMPOSITE TIME INTERVAL: NA	WATER FLOWING: YES/NO/NA
BOREHOLE: YES/NO/NA			BOREHOLE DECLINATION: NA	BOREHOLE DIRECTION: NA

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1	NW	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (Hydrogen Chloride)	Y	10-day turnaround

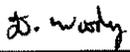
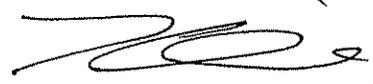
SAMPLE DESC: QC Sample of CAWA-10-6910

SAMPLE COMMENTS: First full suite (characterization) sample.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) J berryhill, K Crawford, W Shaw, D Wasky      REVIEWED BY (PRINT) J berryhill

<b>RELINQUISHED BY</b> (Printed Name) <u>D. Wasky</u> (Signature) 	<b>Date/Time</b> 12/21/09 1515	<b>RECEIVED BY</b> (Printed Name) <u>K. Crawford</u> (Signature) 	<b>Date/Time</b> 12/21/09 1515
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

**GroundWater Sampling Log**

Project: IFWGMP	LSD: <sup>new well</sup> not available	Well Diameter: 5"	Date: 12/21/09
Canyon: CDV	Water Level: not available	Casing Type: SS	See Notes/logbook page 96 for Rich Koch's instructions and transducer logic.
Well No: R-47i	TD: 865.5' bgs	Tubing Type(Alluvials): NA	
Sampling Device: GSF	DTW: 828.44	Water Column: 37.01'	
Measuring Point: NA	Screen Length: 840-860' bgs	1CV: 37.75 gal	
Completion Depth: TD	Drop Pipe/gal: 33.97	3CV: 113.25 gal	
Sampling Personnel: J Berryhill, D Woody, K Crawford, W Shaw (escort C. Penbras)			

DTW = (LSD - Water Level).....Water Column = (TD - DTW).....Drop Pipe = (DTW x Appropriate Drop Pipe Multiplier)

1CV = (Water Column x Appropriate Well Diameter Multiplier)..... 3 CV = (1CV x 3)

1023 generator/pump on 1026 water to surface 1041 manual Q = .8 gpm

TIME	pH	TEMP	COND	DO	Turb	ORP	Water	Discharge	NOTES	
MST	stu	°C	µs/cm	mg/l	ntu	mV	Level	Rate	manual Q	
1108	6.74	12.30	199	2.46	16.5	346.4	23.24	.8 gpm	Y above transducer fired	
1113	6.79	12.70	148	2.44	10.5	328.4	23.25	"	clear, effervescent	
1118	6.77	12.75	148	2.44	8.95	327.5	23.25	"	"	
1123	6.83	12.93	199	3.19	8.37	313.2	23.23	"	"	
1128	6.82	13.11	199	3.25	8.18	304.7	23.20	"	"	
1133	6.87	13.32	199	3.26	7.86	295.8	23.16	"	"	
1138	6.83	13.41	198	3.28	7.48	291.3	23.15	"	"	
1148	6.84	14.02	200	3.24	7.50	273.5	23.00	"	"	
1200	6.86	14.57	198	3.33	7.04	254.7	22.94	"	"	
1210	6.93	14.73	198	3.41	7.34	266.5	22.88	"	YSI turned off	
1220	6.88	14.59	200	3.32	7.57	212.9	22.70	"	effervescent	
1230	6.87	14.83	210	3.10	<sup>0.8 gpm</sup> 7.56	210.6	22.70	0.8	manual Q effervescent	
1240	6.92	15.00	214	2.48	6.87	205.3	22.49	"	effervescent	
1250	6.92	15.09	214	2.46	6.80	202.9	22.50	"	"	
1300	6.93	15.20	213	2.91	6.36	200.6	22.37	"	"	
1310	6.91	15.30	211	2.90	6.62	198.0	22.37	"	"	
1320	6.93	15.19	207	2.99	6.81	192.7	22.30	"	"	
1330	6.94	15.22	206	3.05	6.59	193.3	22.28	"	"	
1340	6.96	15.24	205	3.06	6.52	191.6	21.58	"	"	
1340	Begin sample despite turbidity's not being below 5.00 (per M. Benak)									
	End sampling							23.91		

**WASTE**

Contact:	1 gal.	Drum#	10130546
Purge Water (Minus Drop Pipe):	166 gal.	Drum#s	10130539
Total Waste Volume:	<sup>0.8 gpm</sup> 167 gal.		

12/21/09

0700 Health and Safety tailgate, TA-64, J Berryhill

0730 Calibrate, TA-59, K Crawford

0800 POW (plan of the week) meeting, VI Alexander

0930 Check in at access control

0953 on site R-47.

Personnel J Berryhill & Crawford (C. Pendas, escort)  
D. Woody Wshaw

Weather: 30's, clear

Objective: 1 urge/sample R-47, per SOPs

Safety: snow/ice cleared

LSD: No <sup>sub</sup> not available

IT: transducer set to DTW  
not available

TD: 865.5 (sump bottom) bgs

DTW:  $\frac{\text{transducer bottom}}{\text{recalibrating transducer}} = (855.7 - 27.21) = 828.49$

WC = TD - DTW = 865.5 - (bottom of transducer - recalibrating) = 865.5 - (855.7 - 27.21)

1 CV = WC (1.02  $\frac{\text{gal}}{\text{ft}^3}$ ) = 37.75 gal

= 37.01'

3 CV = 113.25 gal

DI = DTW (.04  $\frac{\text{gal}}{\text{ft}^3}$ ) = 33.47 gal

Total = 147.22

1005 Electrician, A. Lucero, on site to set up temporary electrical box

1010 A Vigil, T Romero deliver 55 gal tank/container

Flow meter not used due to low flow (restrictor sets Q to .8 gpm)

1023 Generator + pump on

1026 water to surface Q = 2 gpm (dialed back), .6 gpm (go for .8 gpm)

and 12/21/09

Time pH (STU) Temp (°C) S ( $\frac{\mu\text{S}}{\text{cm}}$ ) DO ( $\frac{\text{mg}}{\text{L}}$ ) Turb (NTU) ORP (mV)  $\frac{\text{I above transducer}}{\text{bgs}}$  Q gpm Notes

Field crew will watch drawdown to keep DTW above top of screen (840' - 860')

1041 Q = .8 gpm, suggested Q from R Koch. (1100 = DP cleared)

Time	pH (STU)	Temp (°C)	S ( $\frac{\mu\text{S}}{\text{cm}}$ )	DO ( $\frac{\text{mg}}{\text{L}}$ )	Turb (NTU)	ORP (mV)	$\frac{\text{I above transducer}}{\text{bgs}}$	Q gpm	Notes
1108	6.74	12.30	199	2.96	16.5	346.4	23.24	.8	manual & effervescent
1113	6.79	12.70	198	2.94	10.5	320.4	23.25	"	clear effervescent
1118	6.77	12.75	198	2.94	8.95	327.5	23.25	"	"
1123	6.83	12.43	199	3.19	8.37	313.2	23.23	"	"
1128	6.82	13.11	199	3.25	8.18	304.7	23.20	"	"
1133	6.87	13.32	199	3.26	7.86	295.8	23.16	"	"
1138	6.83	13.41	198	3.28	7.48	291.3	23.15	"	"
1148	6.84	14.02	200	3.29	7.50	273.5	23.00	"	"
1200	6.86	14.57	198	3.33	7.04	254.7	22.94	"	"
1210	6.93	14.73	198	3.41	7.34	206.5	22.98	"	YSE turned off
1220	6.88	14.59	200	3.32	7.57	212.9	22.70	"	effervescent
1230	6.87	14.83	210	3.10	7.56	210.6	22.70	.8	manual
1240	6.92	15.00	214	2.98	6.87	205.3	22.49	"	effervescent
1250	6.92	15.09	214	2.96	6.80	202.9	22.50	"	"
1300	6.93	15.26	213	2.91	6.36	200.6	22.37	.8	"

R-47i continued from pg 96

97

12/21/09

Time	pH (stn)	Temp (°C)	SC (µS/cm)	DO (mg/L)	Turb (NTU)	ORP (mV)	∑ above transducer	Q <sub>gen</sub>	Notes
1310	6.41	15.30	211	2.90	6.62	198.0	22.37'	"	effervescent
1320	6.43	15.19	207	2.99	6.81	192.7	22.30'	"	"
1324	4 NME0 on site D. Martinez, C Perlini + 2 (M. Dale, Kim								
1330	6.44	15.22	206	3.05	6.59	193.3	22.28'	"	"
1340	6.46	15.29	205	3.06	6.52	191.6	21.53'	"	"

Turbidity is NOT below 5.00. for M. Benak, sample.

1340 Begin sampling

2) 1400 End sampling (final ∑ above transducer 23.51')

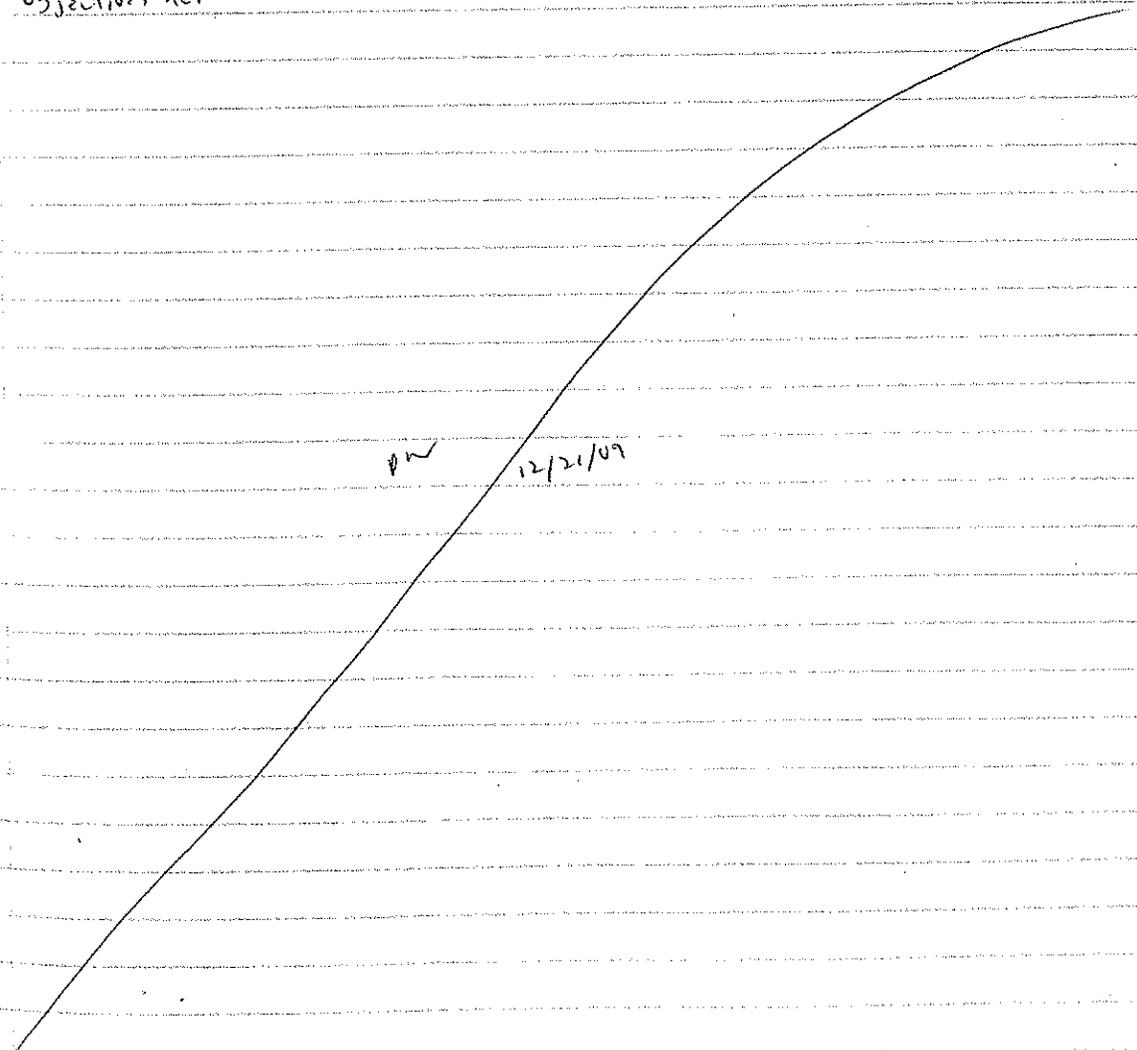
Waste:	contact	1 gal	10130540
	purge	200 gal	10130539

1424

Off site

Objectives met

PN 12/21/09



# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2710

EVENT NAME: Water/CdV Watershed Sampling SE2, April 2010, IFWGMP 2009

SAMPLE ID: CAWA-10-15220

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		<u>04/03/2010</u>	MEDIA: <u>WGR</u>	<u>OK</u>
TIME COLLECTED (HH:MM)		<u>1318</u>	SUB-MEDIA: <u>UA</u>	
PRS ID: <u>C-00-016</u>		<u>OK</u>	SAMPLE TECH CODE: <u>GSP</u>	
LOCATION ID: <u>R-47i</u>			FIELD QC TYPE: <u>NA</u>	
LOCATION TYPE: <u>MON</u>			FIELD PREP: <u>UE</u>	
PORT: <u>SINGLE COMPLETION</u>			SAMPLE USAGE: <u>INV</u>	
		↓	SCREEN/PORT DESC:	↓
FIELD MATRIX: <u>WG</u>			EXCAVATED: YES/NO/ <u>NA</u>	
COMPOSITE TYPE: <u>N/A</u>			COMPOSITE TIME INTERVAL: <u>N/A</u>	WATER FLOWING: YES/NO/ <u>NA</u>
BOREHOLE: YES/NO/ <u>NA</u>			BOREHOLE DECLINATION: <u>N/A</u>	BOREHOLE DIRECTION: <u>N/A</u>

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
2		WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (Hydrogen Chloride)	Y	pH 2
3		WSP-8321A-NMED HEXP	1 LITER AMBER GLASS	Ice	Y	N/A
2		WSP-HEXMOD	1 LITER AMBER GLASS	Ice	Y	N/A
1		WSP-Met+B+SN+SR+U	1 LITER POLY	Nitric Acid	Y	pH 2
3		WSP-8081A-Pest	1 LITER AMBER GLASS	Ice	Y	N/A
3		WSP-8082-PCB	1 LITER AMBER GLASS	Ice	Y	N/A
3		WSP-8270C-SVOA	1 LITER AMBER GLASS	Ice	Y	N/A
2		WSP-8290-D/F	1 LITER AMBER GLASS	Ice	Y	N/A
1		WSP-CN(T)	250 ML POLY	Sodium Hydroxide	Y	pH 7.2 4/8/10
2		WSP-D2H+O18O16	40 ML SEPTUM AMBER GLASS	Ice	Y	pH N/A
1		WSP-GrossA/B	1 LITER POLY	None	Y	pH 4/8/10 N/A
1		WSP-LL-H-3	1 LITER POLY	None	Y	pH 4/8/10 N/A
1		WSP-RAD	1 GAL POLY	Nitric Acid	Y	pH 2
1		WSP-TKN+TOC	500 ML AMBER GLASS	Sulfuric Acid (Hydrogen Sulfate)	Y	pH 2

SAMPLE DESC:

SAMPLE COMMENTS: 2nd full suite sample.

LOCATION DESC:

Generator w/ DW 75 ft

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2710

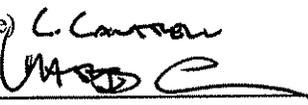
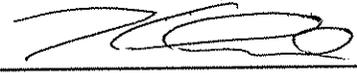
EVENT NAME: Water/CdV Watershed Sampling SE2, April 2010, IFWGMP 2009

**FIELD SCREENING/MEASUREMENT RESULTS:**

pH	Temp C°	SC $\frac{ug}{L}$	DO $\frac{mg}{L}$	TURB $\frac{NTU}{L}$	ORP mV	Q gpm
7.15	15.24	170	4.69	3.44	180.1	0.65

COLLECTED BY (PRINT) A. STOKETZ

REVIEWED BY (PRINT) D. WOODY

<p><b>RELINQUISHED BY</b></p> <p>(Printed Name) <u>C. Carson</u></p> <p>(Signature) </p>	<p><b>Date/Time</b></p> <p><u>4/8/10</u></p> <p><u>16:15</u></p>	<p><b>RECEIVED BY</b></p> <p>(Printed Name) <u>K. Greene</u></p> <p>(Signature) </p>	<p><b>Date/Time</b></p> <p><u>4/8/10</u></p> <p><u>4:15</u></p>
<p><b>RELINQUISHED BY</b></p> <p>(Printed Name)</p> <p>(Signature)</p>	<p><b>Date/Time</b></p>	<p><b>RECEIVED BY</b></p> <p>(Printed Name)</p> <p>(Signature)</p>	<p><b>Date/Time</b></p>

CAWA-10-15220

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2710

EVENT NAME: Water/CdV Watershed Sampling SE2, April 2010, IFWGMP 2009

SAMPLE ID: CAWA-10-15222

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		04/08/2010	MEDIA: WGR	OK
TIME COLLECTED (HH:MM)		1318	SUB-MEDIA: UA	↓
PRS ID: C-00-016		OK	SAMPLE TECH CODE: G6P	↓
LOCATION ID: R-471		↓	FIELD QC TYPE: NA	↓
LOCATION TYPE: MON		↓	FIELD PREP: E	↓
PORT: SINGLE COMPLETION		↓	SAMPLE USAGE: INV	↓
FIELD MATRIX: WG		↓	SCREEN/PORT DESC:	↓
COMPOSITE TYPE: N/A			EXCAVATED: YES/NO/NA	↓
COMPOSITE TIME INTERVAL: N/A				
BOREHOLE: YES/NO/NA			WATER FLOWING: YES/NO/NA	NA
BOREHOLE DECLINATION: N/A				
BOREHOLE DIRECTION: N/A				

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-Met+B+SN+SR+U	1 LITER POLY	Nitric Acid	Y	pH 4.2
1		WSP-GENINORG	1 LITER POLY	Ice	Y	N/A
1		WSP-NH3+NO3/NO2+PO4	500 ML AMBER GLASS	Sulfuric Acid (Hydrogen Sulfate)	Y	pH 2.2
2		WSP-N14N15	40 ML SEPTUM AMBER GLASS	Ice	Y	N/A

SAMPLE DESC:

SAMPLE COMMENTS: 2nd full suite sample.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

SEE CAWA-10-15220

COLLECTED BY (PRINT) A. Stoller REVIEWED BY (PRINT) D. Wasy

RELINQUISHED BY (Printed Name) <u>Chris Carson</u> (Signature) <u>[Signature]</u>	Date/Time <u>4/8/10</u> <u>16:15</u>	RECEIVED BY (Printed Name) <u>K. Green</u> (Signature) <u>[Signature]</u>	Date/Time <u>4/8/10</u> <u>4:15</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2710

EVENT NAME: Water/CdV Watershed Sampling SE2, April 2010, IFWGMP 2009

SAMPLE ID: CAWA-10-15223

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		04/08/2010	MEDIA: WGR	ok
TIME COLLECTED (HH:MM)		1318	SUB-MEDIA: UA	↓
PRS ID: C-00-016		OK	SAMPLE TECH CODE: GSP	
LOCATION ID: R-47i			FIELD QC TYPE: ED	
LOCATION TYPE: MON			FIELD PREP: UF	
PORT: SINGLE COMPLETION			SAMPLE USAGE: QC	
			SCREEN/PORT DESC:	
FIELD MATRIX: WG			EXCAVATED: YES/NO/NA	
COMPOSITE TYPE: N/A			COMPOSITE TIME INTERVAL: N/A	WATER FLOWING: YES/NO/NA
BOREHOLE: YES/NO/NA			BOREHOLE DECLINATION: N/A	BOREHOLE DIRECTION: N/A

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
2		WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (Hydrogen Chloride)	Y	pH 4.2
3		WSP-8270C-SVOA	1 LITER AMBER GLASS	Ice	Y	N/A

SAMPLE DESC: QC Sample of CAWA-10-15220

SAMPLE COMMENTS: 2nd full suite sample.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

SEE CAWA-10-15220

COLLECTED BY (PRINT) A. Stocker

REVIEWED BY (PRINT) D. Worry

RELINQUISHED BY (Printed Name) <u>Chris Cameron</u> (Signature)	Date/Time 4/8/10 16:15	RECEIVED BY (Printed Name) <u>K. Greene</u> (Signature)	Date/Time 4/8/10 4:15
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 2710

EVENT NAME: Water/CdV Watershed Sampling SE2, April 2010, IFWGMP 2009

SAMPLE ID: CAWA-10-15221

WORK ORDER:

<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):	04/08/2010	MEDIA:	WGR
TIME COLLECTED (HH:MM)	1318	SUB-MEDIA:	UA
PRS ID: C-00-016	ok	SAMPLE TECH CODE:	GSP
LOCATION ID: R-471	↓	FIELD QC TYPE:	FTB
LOCATION TYPE: MON	↓	FIELD PREP:	UF
PORT: SINGLE COMPLETION	↓	SAMPLE USAGE:	QC
	↓	SCREEN/PORT DESC:	↓
FIELD MATRIX: WG		EXCAVATED: YES/NO/NA	(NA)
COMPOSITE TYPE: N/A		COMPOSITE TIME INTERVAL: N/A	
BOREHOLE: YES/NO/NA		BOREHOLE DECLINATION: N/A	
		BOREHOLE DIRECTION: N/A	

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1	2	BW 04/05/10	WSP-8260B-VOA 40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (Hydrogen Chloride)	Y	pH 4.2

SAMPLE DESC: QC Sample of CAWA-10-15220

SAMPLE COMMENTS: 2nd full suite sample.

SEE CAWA-10-15220

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) A. Stoker      REVIEWED BY (PRINT) D. Waddy

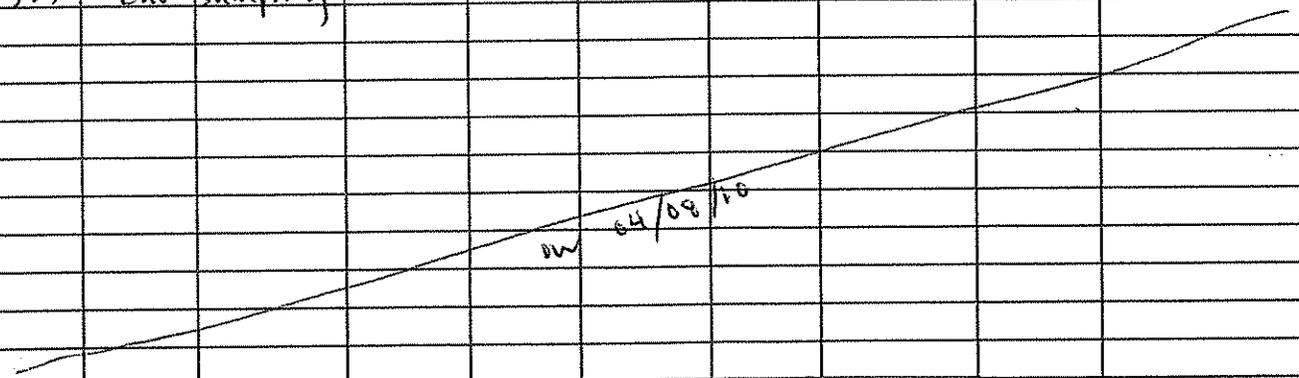
RELINQUISHED BY (Printed Name) <u>Curtis Cantrell</u> (Signature) <u>[Signature]</u>	Date/Time 4/8/10 16:15	RECEIVED BY (Printed Name) <u>V. Green</u> (Signature) <u>[Signature]</u>	Date/Time 4/8/10 4:15
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

Rev. 2.  
1/21/10

GroundWater Sampling Log			
Project: IFWGMP	LSD: 7358.0 ft. msl.	Well Diameter: 5 inches	Date: 04/08/10
Canyon:	* Water Level: 6528.97' msl	* Top of Screen: NA	Notes: transducer disconnected many times
Well No: R-47i	*TD: 865.5' bgs	* Bottom of Screen: NA	
Sampling Device: GSP	*DTW: 829.03' bgs	Water Column: 36.47'	
Measuring Point: LSD	Drop Pipe: 33,94 gal.	1CV: 37.20 gal.	
* Completion Depth: TD		3CV: 111.6 gal.	Baski Packer Pressure
Sampling Personnel: C Cantrell, J. Woody, A Stocker, escort = D. Clark			Before: NA After: NA

[\* ft. BTOC / BTIC / BGS / MSL ] Note height of TOC/TIC on MP for Alluvials  
 DTW = (LSD - Water Level)..... Water Column = (TD - DTW)..... Drop Pipe = (DTW x Appropriate Drop Pipe Multiplier)  
 1CV = (Water Column x Appropriate Well Diameter Multiplier)..... 3 CV = (1CV x 3)  
 0928 pump on (0931 water See logbook pg 114 for pump on/off history (electrician was aliveating system)

TIME	pH	TEMP	SPEC COND	DO	Turb	ORP	Water Level	Discharge Rate (gpm)	NOTES
MST	stu	°C	µs/cm	mg/l	ntu	mV			
1016	6.26	11.56	162	6.17	6.96	314.0	6525.84	.65	manual Q
1021	6.98	11.57	159	5.14	6.15	259.0	6525.81	"	effervescent
1026	7.05	11.92	159	5.00	5.91	224.1	6525.79	"	"
1031	7.10	12.23	158	5.01	4.46	233.9	6525.78	"	"
1036	7.11	12.31	158	5.00	3.75	237.3	NA	"	"
1041	7.13	12.47	158	5.03	3.13	240.7	6525.80	.65	manual Q less effervescent
1046	7.15	13.01	159	5.25	2.98	238.4	6525.77	"	slight effervescent
1100	7.16	13.30	158	5.25	2.70	232.9	6525.74	"	"
1115	7.14	13.35	160	5.42	2.67	226.5	6525.58	.65	manual Q
1130	7.12	13.77	162	5.19	3.60	220.9	6525.35	"	slightly effervescent
1145	7.13	14.60	168	4.76	3.47	212.0	6525.26	"	"
1200	7.14	15.17	179	4.28	3.29	203.1	6525.14	.64	manual Q
1215	7.15	15.27	178	4.24	3.06	196.0	6525.06	"	slight effervescence
1230	7.16	15.18	177	4.36	3.44	189.5	6525.03	"	"
1245	7.16	15.22	173	4.62	2.97	185.3	6524.98	"	VE turned off
1300	7.15	15.24	173	4.69	3.44	180.1	6524.92	"	clear, no odor/efferv.
1318	Begin sampling		-	-	-	-	-	-	-
1333	End sampling		-	-	-	-	6524.74	-	-



WASTE			
Contact:	1	gal.	Drum# 10130540
*Purge Water:	DW 04/08/10 146.150	gal.	Drum#'s 10130539
Total Waste Water:	160	gal.	

\*Purge: Formation water purged prior to sampling.  
 NOT drop pipe volume.  
 NOT water during sampling.

114

R-47i (pg 1 of 2) - (cont on 115 pg)

04/08/10

DST 0625 Calibrate TA-59, D. Woody, YSI #3  
 0700 Health & Safety meeting, TA-64, L. Ansay  
 0850 Onsite R-47i

Weather: light wind, 40's, Sun

 $\bar{V}$ : 6528.97' mslPersonnel: Cantrell A. Stucker  
D. Woody D. ClarkDTW:  $LSO - \bar{V} = 829.03'$  hgs

Safety: electrical

LSB: 7358.0' msl

Object: sample R-47i per SOP's

TD: 865.5' hgs

WC:  $TD - DTW = 36.47'$ DP:  $(.041 \frac{gal}{ft}) DTW = 33.99 gal$ ICV:  $(1.02 \frac{gal}{ft}) WC = 37.20 gal$ 

ZCV: = 111.6 gal

\* Note: Crew checked in with TA-15 @ 0840

0905 A. Lucero on site to program electrical box (A.L + 1)

\* Note: Transducer is intermittent - error message appears (see below)

0920 Pump on 0923 water to surface / manual Q, restrictor only 2 gpm

0927 Pump off - box trips (water sulfurous + effervescent) - (water dark gray)

\* Note: crew's restricting flow at tree valve caused pump to trip

0928 Pump on, Flow restricted via tree valves 1.5 gpm, 1.0 gpm, .6 gpm,

 $\bar{V}$  @ 1.0 gpm = 6525.87' msl (water dark gray) - (water clearing)

Error for transducer unable to connect to device name

Original error [81000004] serial port read failed

0948  $\bar{V}$  @ .65 gpm = 6525.80' msl; 6525.89' msl; 6525.94  
Parameters to begin @ 1020 approx. (0957) (1004)

\* NOTE: Error above recurs with disconnection of transducer

Lot #s for ambers: 0225401T .5 L

0325401T 1 L

Time (DST)	pH (STV)	Temp (°C)	SC ( $\frac{mS}{cm}$ )	DO ( $\frac{mg}{L}$ )	Turb (NTU)	ORP (mV)	$\bar{V}$ (msl)	Q (gpm)	Notes
1016	6.26	11.56	162	6.17	6.96	314.0	6525.84	.65	manual Q
1021	6.98	11.57	159	5.14	6.15	259.0	6525.81	"	effervescent
1026	7.05	11.92	159	5.00	5.91	224.1	6525.79	"	"
1031	7.10	12.23	158	5.01	4.46	233.9	6525.78	"	"
* NOTE: Transducer continues to disconnect									
1036	7.11	12.31	158	5.00	3.75	237.3	NA	"	"
1041	7.13	12.47	158	5.03	3.13	240.7	6525.80	.65	manual Q less effervescent
1046	7.15	13.01	159	5.25	2.98	238.4	6525.77	"	slight effervescent

\* NOTE: Field team allows turbidity sample to out-gas for 1-2 minutes

(continues to next page)

For morning activities and preparations, please see pg 114

Time (BST)	pH (STU)	Temp (°C)	SC ( $\frac{\mu S}{cm}$ )	DD ( $\frac{mg}{l}$ )	Turb (NTU)	ORP (mV)	VI (m/s)	Q (gpm)	Notes
1100	7.16	13.30	158	5.25	2.70	232.9	6525.74	"	"
1115	7.14	13.35	160	5.42	2.67	226.5	6525.58	.65	manual Q
1130	7.12	13.77	162	5.19	3.60	220.9	6525.35	"	slightly effervescent
1145	7.13	14.60	168	4.76	3.47	212.0	6525.26	"	"
1200	7.14	15.17	179	4.28	3.29	203.1	6525.14	.64	"
1215	7.15	15.27	178	4.24	3.06	196.0	6525.06	"	slight effervescence
1230	7.16	15.18	177	4.36	3.44	189.5	6525.03	"	"
1245	7.16	15.22	173	4.62	2.97	185.3	6524.98		YSI = off
1300	7.15	15.24	173	4.69	3.44	180.1	6524.92		clear, no color, efferv.

1318 Begin sampling

1333 End sampling, pump + generator off

Waste: contact 1 10130540

urge 150

total 160

} 10130539

to 75

\*NOTE

Comments: Sampling occurred within 50 feet of diesel generator  
Well does not have enough history to compare parameters with prior values  
Restrictor does NOT reduce flow to .8 gpm

DW 04/09/10

Q  
scent

Q  
vescent  
effervescent

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26672

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA: <u>WGI</u>	<sup>me</sup> 9/23/10 <del>WSP</del> <u>OK</u>
TIME COLLECTED (HH:MM)		1300	SUB-MEDIA: <u>UA</u>	
PRS ID: <u>Water</u>		<u>OK</u>	SAMPLE TECH CODE: <u>6SP</u>	
LOCATION ID: <u>R-47i</u>			FIELD QC TYPE: <u>NA</u>	
LOCATION TYPE: <u>MON</u>			FIELD PREP: <u>UF</u>	
PORT: <u>SINGLE COMPLETION</u>			SAMPLE USAGE: <u>INV</u>	
		↓	SCREEN/PORT DESC: <u>NA</u>	↓
FIELD MATRIX: <u>WG</u>			EXCAVATED: YES/NO ( <u>NA</u> )	
COMPOSITE TYPE: <u>NA</u>			COMPOSITE TIME INTERVAL: <u>NA</u>	WATER FLOWING: YES/NO/ <u>NA</u>
BOREHOLE: YES/NO/ <u>NA</u>			BOREHOLE DECLINATION: <u>NA</u>	BOREHOLE DIRECTION: <u>NA</u>

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6-ALK	125 ML POLY	Ice	Y	<u>NA</u>
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	↓	↓
1		WSP-EES6-NH3	250 ML POLY	Sulfuric Acid (Hydrogen Sulfate)	↓	↓
1		WSP-EES6-SULFIDE	15 ML POLY	Sodium Hydroxide	↓	↓
2		WSP-EES6-TOC	40 ML SEPTUM AMBER GLASS	Ice	↓	↓

SAMPLE DESC: NA

SAMPLE COMMENTS: Sample 1 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC: *Samples collected with soft of running diesel generator*

**FIELD SCREENING/MEASUREMENT RESULTS:**

$\frac{pH}{7.71}$    
  $\frac{temp}{14.47}$    
  $\frac{SC_{water}}{144}$    
  $\frac{Dough}{5.55}$    
  $\frac{Turbidity}{1.52}$    
  $\frac{ORP_{mV}}{172.5}$    
  $\frac{Q_{rpm}}{1.25}$

*Note: parameters collected during sampling, pH increased, ORP decreased.*

COLLECTED BY (PRINT) W. Shaw

REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <i>[Signature]</i>	Date/Time <u>9/23/10</u> <u>1600</u>	RECEIVED BY (Printed Name) <u>Sheffi Sherwood</u> (Signature) <i>[Signature]</i>	Date/Time <u>9-23-10</u> <u>1600</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26673

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA:	WGI	ok
TIME COLLECTED (HH:MM)		1300	SUB-MEDIA:	UA	
PRS ID: <u>Water</u>		ok	SAMPLE TECH CODE:	6SP	
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE:	NA	
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP:	E	
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE:	INV	
		↓	SCREEN/PORT DESC:	NA	↓

FIELD MATRIX: WG

EXCAVATED: YES/NO/NA

COMPOSITE TYPE: NA COMPOSITE TIME INTERVAL: NA WATER FLOWING: YES/NO/NA

BOREHOLE: YES/NO/NA BOREHOLE DECLINATION: NA BOREHOLE DIRECTION: NA

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6 -ANIONS	250 ML POLY	Ice	Y	NA ↓
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	↓	↓

SAMPLE DESC: see CAWA-10-26672

SAMPLE COMMENTS: Sample 1 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) W. Shaw

REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1600</u>	RECEIVED BY (Printed Name) <u>Sherri Sherwood</u> (Signature) <u>[Signature]</u>	Date/Time <u>9.23.10</u> <u>1600</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26674

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA: <u>WGI</u>	<u>OK</u>
TIME COLLECTED (HH:MM)		1332	SUB-MEDIA: <u>UA</u>	
PRS ID: <u>Water</u>		<u>OK</u>	SAMPLE TECH CODE: <u>68P</u>	
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE: <u>NA</u>	
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP: <u>UF</u>	
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE: <u>INV</u>	↓
FIELD MATRIX: <u>WG</u>		↓	SCREEN/PORT DESC: <u>NA</u>	
COMPOSITE TYPE: <u>NA</u>			EXCAVATED: YES / NO <u>(NA)</u>	
BOREHOLE: YES / NO / <u>(NA)</u>			COMPOSITE TIME INTERVAL: <u>NA</u>	WATER FLOWING: YES / NO / <u>(NA)</u>
BOREHOLE DECLINATION: <u>NA</u>			BOREHOLE DIRECTION: <u>NA</u>	

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6-ALK	125 ML POLY	Ice	Y	<u>NA</u>
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	↓	↓
1		WSP-EES6-NH3	250 ML POLY	Sulfuric Acid (Hydrogen Sulfate)	↓	↓
1		WSP-EES6-SULFIDE	15 ML POLY	Sodium Hydroxide	↓	↓
2		WSP-EES6-TOC	40 ML SEPTUM AMBER GLASS	Ice	↓	↓

SAMPLE DESC: NA

SAMPLE COMMENTS: Sample 2 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC: diesel generator running within 50 ft of sampling

**FIELD SCREENING/MEASUREMENT RESULTS:**

$\frac{pH}{6.87}$    
  $\frac{Temp^{oc}}{15.07}$    
  $\frac{SC^{ug/L}}{161}$    
  $\frac{DO^{mg/L}}{5.20}$    
  $\frac{Turb^{ntu}}{2.19}$    
  $\frac{ORP^{mV}}{209.8}$    
  $\frac{Q^{gpm}}{1.1}$

COLLECTED BY (PRINT) W. Shaw

REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1600</u>	RECEIVED BY (Printed Name) <u>SHERI SHEPWOOD</u> (Signature) <u>[Signature]</u>	Date/Time <u>9-23-10</u> <u>1600</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26675

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA: <u>WGI</u>	6K
TIME COLLECTED (HH:MM)		1332	SUB-MEDIA: <u>UA</u>	
PRS ID: <u>Water</u>		6K	SAMPLE TECH CODE: <u>6SP</u>	
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE: <u>NA</u>	
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP: <u>E</u>	
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE: <u>INV</u>	↓
FIELD MATRIX: <u>WG</u>		↓	SCREEN/PORT DESC: <u>NA</u>	
COMPOSITE TYPE: <u>NA</u>		↓	EXCAVATED: YES/NO <u>(NA)</u>	
BOREHOLE: YES/NO/ <u>NA</u>		↓	COMPOSITE TIME INTERVAL: <u>NA</u>	WATER FLOWING: YES/NO/ <u>(NA)</u>
BOREHOLE DECLINATION: <u>NA</u>		↓	BOREHOLE DIRECTION: <u>NA</u>	

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6-ANIONS	250 ML POLY	Ice	Y	NA ↓
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	↓	↓

SAMPLE DESC: see CAWA-10-26674

SAMPLE COMMENTS: Sample 2 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) W. Shaw

REVIEWED BY (PRINT) M. Green

<b>RELINQUISHED BY</b> (Printed Name) <u>m. green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1600</u>	<b>RECEIVED BY</b> (Printed Name) <u>Steph Sheppard</u> (Signature) <u>[Signature]</u>	Date/Time <u>9-23-10</u> <u>1600</u>
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	Date/Time	<b>RECEIVED BY</b> (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26676

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA:	WGI
TIME COLLECTED (HH:MM)		1406	SUB-MEDIA:	UA
PRS ID: <u>Water</u>		GK	SAMPLE TECH CODE:	GSP
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE:	NA
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP:	UF
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE:	INV
FIELD MATRIX: <u>WG</u>		↓	SCREEN/PORT DESC:	NA
COMPOSITE TYPE: <u>NA</u>		↓	EXCAVATED: YES/NO/ <u>NA</u>	
BOREHOLE: YES/NO/ <u>NA</u>		↓	COMPOSITE TIME INTERVAL: <u>NA</u>	WATER FLOWING: YES/NO/ <u>NA</u>
BOREHOLE DECLINATION: <u>NA</u>		↓	BOREHOLE DIRECTION: <u>NA</u>	

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6-ALK	125 ML POLY	Ice	Y	NA
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	↓	↓
1		WSP-EES6-NH3	250 ML POLY	Sulfuric Acid (Hydrogen Sulfate)	↓	↓
1		WSP-EES6-SULFIDE	15 ML POLY	Sodium Hydroxide	↓	↓
2		WSP-EES6-TOC	40 ML SEPTUM AMBER GLASS	Ice	↓	↓

SAMPLE DESC: NA

SAMPLE COMMENTS: Sample 3 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC: Diesel generator running within 50 ft of sampling

FIELD SCREENING/MEASUREMENT RESULTS:  
 pH 6.92    temp °C 15.22    Sulfur 167    DO mg/L 4.65    Turb NTU 1.38    ORP mV 264.0    Q rpm 1.1

COLLECTED BY (PRINT) W. Shaw      REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1600</u>	RECEIVED BY (Printed Name) <u>SHERI SHERWOOD</u> (Signature) <u>[Signature]</u>	Date/Time <u>9-23-10</u> <u>1600</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26677

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA:	WGI
TIME COLLECTED (HH:MM)		1406	SUB-MEDIA:	UA
PRS ID: <u>Water</u>		OK	SAMPLE TECH CODE:	68P
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE:	NA
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP:	E
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE:	INV
			SCREEN/PORT DESC:	NA
FIELD MATRIX: <u>WG</u>			EXCAVATED: YES/NO/NA	NA
COMPOSITE TYPE: <u>NA</u>			COMPOSITE TIME INTERVAL: <u>NA</u>	WATER FLOWING: YES/NO/NA
BOREHOLE: YES/NO/NA			BOREHOLE DECLINATION: <u>NA</u>	BOREHOLE DIRECTION: <u>NA</u>

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6 -ANIONS	250 ML POLY	Ice	Y ↓	NA ↓
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	Y ↓	Y ↓

SAMPLE DESC: *see CAWA-10-26676*

SAMPLE COMMENTS: Sample 3 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) W. Shaw      REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <i>[Signature]</i>	Date/Time 9/23/10 1600	RECEIVED BY (Printed Name) <u>STEPHEN STEERWOOD</u> (Signature) <i>[Signature]</i>	Date/Time 9.23.10 1600
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26678

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA:	WGI
TIME COLLECTED (HH:MM)		1440	SUB-MEDIA:	UA
PRS ID: <u>Water</u>		OK	SAMPLE TECH CODE:	68P
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE:	NA
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP:	UF
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE:	INV
FIELD MATRIX: <u>WG</u>		↓	SCREEN/PORT DESC:	NA
COMPOSITE TYPE: <u>NA</u>		↓	EXCAVATED: YES/NO	(NA)
COMPOSITE TIME INTERVAL: <u>NA</u>		↓	WATER FLOWING: YES/NO	(NA)
BOREHOLE: YES/NO <u>(NA)</u>		↓	BOREHOLE DECLINATION: <u>NA</u>	BOREHOLE DIRECTION: <u>NA</u>

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6-ALK	125 ML POLY	Ice	Y	NA
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	↓	↓
1		WSP-EES6-NH3	250 ML POLY	Sulfuric Acid (Hydrogen Sulfate)	↓	↓
1		WSP-EES6-SULFIDE	15 ML POLY	Sodium Hydroxide	↓	↓
2		WSP-EES6-TOC	40 ML SEPTUM AMBER GLASS	Ice	↓	↓

SAMPLE DESC: NA

SAMPLE COMMENTS: Sample 4 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC: Samples collected within 50ft of running diesel generator

**FIELD SCREENING/MEASUREMENT RESULTS:**

pH    temp °C    SC<sub>25</sub>/m    DO<sub>negh</sub>    Turb NTU    ORP<sub>mV</sub>    Q<sub>99</sub>p  
 6.83    15.70    166    4.52    2.05    287.3    1.1

COLLECTED BY (PRINT) W. Shaw

REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1600</u>	RECEIVED BY (Printed Name) <u>Sheila Sheerwood</u> (Signature) <u>[Signature]</u>	Date/Time <u>9-23-10</u> <u>1600</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26679

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA:	WGI	6K
TIME COLLECTED (HH:MM)		1440	SUB-MEDIA:	UA	
PRS ID: <u>Water</u>		OK	SAMPLE TECH CODE:	68P	
LOCATION ID: <u>R-47i</u>			FIELD QC TYPE:	NA	
LOCATION TYPE: <u>MON</u>			FIELD PREP:	E	
PORT: <u>SINGLE COMPLETION</u>			SAMPLE USAGE:	INV	
		↓	SCREEN/PORT DESC:	NA	↓
FIELD MATRIX: <u>WG</u>			EXCAVATED: YES/NO/NA	NA	
COMPOSITE TYPE: <u>NA</u>			COMPOSITE TIME INTERVAL: <u>NA</u>		WATER FLOWING: YES/NO/NA
BOREHOLE: YES/NO/NA			BOREHOLE DECLINATION: <u>NA</u>		BOREHOLE DIRECTION: <u>NA</u>

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6 -ANIONS	250 ML POLY	Ice	↓	NA
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	↓	↓

SAMPLE DESC: SEE CAWA-10-26678

SAMPLE COMMENTS: Sample 4 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) W. Shaw      REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1600</u>	RECEIVED BY (Printed Name) <u>Sherril Sherwood</u> (Signature) <u>[Signature]</u>	Date/Time <u>9.23.10</u> <u>1600</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26680

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA:	WGI	GK
TIME COLLECTED (HH:MM)		1514	SUB-MEDIA:	UA	
PRS ID: <u>Water</u>		GK	SAMPLE TECH CODE:	GSP	
LOCATION ID: <u>R-47i</u>			FIELD QC TYPE:	NA	
LOCATION TYPE: <u>MON</u>			FIELD PREP:	UF	
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE:	INV	↓
FIELD MATRIX: <u>WG</u>		↓	SCREEN/PORT DESC:	NA	
COMPOSITE TYPE: <u>NA</u>		↓	EXCAVATED: YES/NO/NA	NA	
BOREHOLE: YES/NO/NA			COMPOSITE TIME INTERVAL: <u>NA</u>		WATER FLOWING: YES/NO/NA
BOREHOLE DECLINATION: <u>NA</u>			BOREHOLE DIRECTION: <u>NA</u>		

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6-ALK	125 ML POLY	Ice	Y	NA
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice		
1		WSP-EES6-NH3	250 ML POLY	Sulfuric Acid (Hydrogen Sulfate)		
1		WSP-EES6-SULFIDE	15 ML POLY	Sodium Hydroxide		
2		WSP-EES6-TOC	40 ML SEPTUM AMBER GLASS	Ice	↓	↓

SAMPLE DESC: NA

SAMPLE COMMENTS: Sample 5 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC: Diesel generator running within 50 ft of sampling

FIELD SCREENING/MEASUREMENT RESULTS:

PH	temp <sup>o</sup> C	SC <sup>us/cm</sup>	DO <sup>mg/L</sup>	Turb <sup>NTU</sup>	ORP <sup>mV</sup>	Q <sup>gph</sup>
6.86	15.96	161	4.63	1.87	225.6	0.5

COLLECTED BY (PRINT) W. Shaw      REVIEWED BY (PRINT) m. green

RELINQUISHED BY (Printed Name) <u>m. green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1600</u>	RECEIVED BY (Printed Name) <u>Sherrill Sherwood</u> (Signature) <u>[Signature]</u>	Date/Time <u>9-23-10</u> <u>1600</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26681

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA: WGI	ok
TIME COLLECTED (HH:MM)		1514	SUB-MEDIA: UA	
PRS ID: <u>Water</u>		ok	SAMPLE TECH CODE: 6SP	
LOCATION ID: <u>R-47i</u>			FIELD QC TYPE: NA	
LOCATION TYPE: <u>MON</u>			FIELD PREP: E	
PORT: <u>SINGLE COMPLETION</u>			SAMPLE USAGE: INV	
			SCREEN/PORT DESC: NA	
FIELD MATRIX: <u>WG</u>			EXCAVATED: YES/NO/NA	

COMPOSITE TYPE: NA COMPOSITE TIME INTERVAL: NA WATER FLOWING: YES/NO/NA NA  
 BOREHOLE: YES/NO/NA NA BOREHOLE DECLINATION: NA BOREHOLE DIRECTION: NA

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6 -ANIONS	250 ML POLY	Ice	Y	NA
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	Y	NA

SAMPLE DESC:

See CAWA-10-26680

SAMPLE COMMENTS: Sample 5 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) W. Shaw

REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1600</u>	RECEIVED BY (Printed Name) <u>Shelli Sherwood</u> (Signature) <u>[Signature]</u>	Date/Time <u>9-23-10</u> <u>1600</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26683

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/2010	MEDIA: WGI	ok
TIME COLLECTED (HH:MM)		1622	SUB-MEDIA: UA	
PRS ID: Water		ok	SAMPLE TECH CODE: GSP	
LOCATION ID: R-47i			FIELD QC TYPE: NA	
LOCATION TYPE: MON			FIELD PREP: UF	
PORT: SINGLE COMPLETION			SAMPLE USAGE: INV	
FIELD MATRIX: WG			SCREEN/PORT DESC:	
COMPOSITE TYPE: N/A			EXCAVATED: YES/NO/NA	
BOREHOLE: YES/NO/NA			COMPOSITE TIME INTERVAL: N/A	
BOREHOLE DECLINATION: N/A			BOREHOLE DIRECTION: N/A	
BOREHOLE: YES/NO/NA			WATER FLOWING: YES/NO/NA	

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6-ALK	125 ML POLY	Ice	Y	N/A
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice		
1		WSP-EES6-NH3	250 ML POLY	Sulfuric Acid (Hydrogen Sulfate)		
1		WSP-EES6-SULFIDE	15 ML POLY	Sodium Hydroxide		
2		WSP-EES6-TOC	40 ML SEPTUM AMBER GLASS	Ice	↓	↓

SAMPLE DESC:

N/A

SAMPLE COMMENTS: Sample 6 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

LOCATION DESC:

N/A

FIELD SCREENING/MEASUREMENT RESULTS:

Time	pH	T°C	SC <sup>mg/l</sup>	DO <sup>mg/l</sup>	Turb(NTU)	ORP(mV)	Q(gpm)
1615	6.91	15.74	154	4.88	1.91	267.4	0.5

COLLECTED BY (PRINT)

W. Shaw

REVIEWED BY (PRINT)

M. Green

RELINQUISHED BY (Printed Name) M. Green (Signature)	Date/Time 9/23/10 1600	RECEIVED BY (Printed Name) SHELLI SHERWOOD (Signature)	Date/Time 9.23.10 1600
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3089

EVENT NAME: R-47i 6 CV Extended Purge Event, September 2010

SAMPLE ID: CAWA-10-26682

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/2010	MEDIA: WGI	OK
TIME COLLECTED (HH:MM)		1622	SUB-MEDIA: UA	
PRS ID: Water		OK	SAMPLE TECH CODE: GSP	
LOCATION ID: R-47i			FIELD QC TYPE: NA	
LOCATION TYPE: MON			FIELD PREP: F	
PORT: SINGLE COMPLETION			SAMPLE USAGE: INV	
			SCREEN/PORT DESC:	
FIELD MATRIX: WG			EXCAVATED: YES/NO/NA	
COMPOSITE TYPE: N/A			COMPOSITE TIME INTERVAL: N/A	
BOREHOLE: YES/NO/NA			BOREHOLE DECLINATION: N/A	
			BOREHOLE DIRECTION: N/A	

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-EES6-ANIONS	250 ML POLY	Ice	Y	N/A
1		WSP-EES6-MET	125 ML POLY	Nitric Acid Ice	Y	UA

SAMPLE DESC:

SAMPLE COMMENTS: Sample 6 CV of 6 CVs. Collect parameters every 15 minutes through 6 CVs.

SEE CAWA-10-26683

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) W. Shaw REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <u>[Signature]</u>	Date/Time 9/23/10 1600	RECEIVED BY (Printed Name) <u>SHERI SHERWOOD</u> (Signature) <u>[Signature]</u>	Date/Time 9-23-10 1600
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3049

EVENT NAME: Water/CdV Watershed Sampling Q1, September 2010, IFWGMP2010

SAMPLE ID: CAWA-10-25908

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA:	WGI	OK
TIME COLLECTED (HH:MM)		1622	SUB-MEDIA:	UA	
PRS ID: <u>Water</u>		OK	SAMPLE TECH CODE:	GSP	
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE:	NA	
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP:	UF	
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE:	INV	↓
FIELD MATRIX: <u>WG</u>			SCREEN/PORT DESC:	NA	
COMPOSITE TYPE: <u>NA</u>			EXCAVATED: YES / NO / NA	NA	
COMPOSITE TIME INTERVAL: <u>NA</u>					
BOREHOLE: YES / NO / NA			BOREHOLE DECLINATION: <u>NA</u>		
			BOREHOLE DIRECTION: <u>NA</u>		

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
2		WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (Hydrogen Chloride)	Y	NA
2-3		WSP-8270C-SVOA	1 LITER AMBER GLASS	Ice	↓	↓
2-3		WSP-8321A-NMED HEXP	1 LITER AMBER GLASS	Ice	↓	↓
1		WSP-CN(T)	250 ML POLY	Sodium Hydroxide	↓	↓
1		WSP-EES6-ALK	125 ML POLY	Ice	↓	↓
1		WSP-GrossA/B	1 LITER POLY	None	↓	↓
2		WSP-HEXMOD	1 LITER AMBER GLASS	Ice	↓	↓
1		WSP-Met+B+SN+SR+U	1 LITER POLY	Nitric Acid	↓	↓
1		WSP-RAD	1 GAL POLY	Nitric Acid	↓	↓
1		WSP-TKN+TOC	500 ML AMBER GLASS	Sulfuric Acid (Hydrogen Sulfate)	↓	↓
1		WSP-LL-H-3	1 LITER POLY	None	↓	↓
2		WSP-D2H+O18O16	40 ML SEPTUM AMBER GLASS	Ice	↓	↓
2-3		WSP-8081A-Pest	1 LITER AMBER GLASS	Ice	↓	↓
2-3		WSP-8082-PCB	1 LITER AMBER GLASS	Ice	↓	↓
2		WSP-8290-D/F	1 LITER AMBER GLASS	Ice	↓	↓

SAMPLE DESC: NA

SAMPLE COMMENTS: 3rd Full suite sample.

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3049

EVENT NAME: Water/CdV Watershed Sampling Q1, September 2010, IFWGMP2010

LOCATION DESC: Samples collected within 50 ft of running diesel generator

**FIELD SCREENING/MEASUREMENT RESULTS:**

pH	Temp °C	SL ug/L	DO mg/L	turb NTU	ORP mV	Q gpm
6.91	15.74	154	4.98	1.91	267.4	0.5

COLLECTED BY (PRINT) W. Shaw

REVIEWED BY (PRINT) M. Green

<p><b>RELINQUISHED BY</b>                      (Printed Name) <u>M. Green</u>                      (Signature) </p>	<p><b>Date/Time</b>  <u>9/23/10</u>  <u>1600</u></p>	<p><b>RECEIVED BY</b>                      (Printed Name) <u>SHERI SHEWOOD</u>                      (Signature) </p>	<p><b>Date/Time</b>  <u>9-23-10</u>  <u>1600</u></p>
<p><b>RELINQUISHED BY</b>                      (Printed Name)                      (Signature)</p>	<p><b>Date/Time</b></p>	<p><b>RECEIVED BY</b>                      (Printed Name)                      (Signature)</p>	<p><b>Date/Time</b></p>

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3049

EVENT NAME: Water/CdV Watershed Sampling Q1, September 2010, IFWGMP2010

SAMPLE ID: CAWA-10-25907

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>	<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA: <u>WGI</u>	OK
TIME COLLECTED (HH:MM)		1622	SUB-MEDIA: <u>UA</u>	
PRS ID: <u>Water</u>		OK	SAMPLE TECH CODE: <u>GSP</u>	
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE: <u>NA</u>	
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP: <u>E</u>	
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE: <u>INV</u>	↓
FIELD MATRIX: <u>WG</u>		↓	SCREEN/PORT DESC: <u>NA</u>	
COMPOSITE TYPE: <u>NA</u>		↓	EXCAVATED: YES/NO/ <u>(NA)</u>	
BOREHOLE: YES/NO/ <u>(NA)</u>		↓	COMPOSITE TIME INTERVAL: <u>NA</u>	
BOREHOLE DECLINATION: <u>NA</u>		↓	WATER FLOWING: YES/NO/ <u>(NA)</u>	
BOREHOLE DIRECTION: <u>NA</u>		↓		

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1		WSP-GENINORG	1 LITER POLY	Ice	Y	NA
1		WSP-Met+B+SN+SR+U	1 LITER POLY	Nitric Acid	↓	↓
1		WSP-NH3+NO3/NO2+PO4	500 ML AMBER GLASS	Sulfuric Acid (Hydrogen Sulfate)	↓	↓
2		WSP-N14N15	40 ML SEPTUM AMBER GLASS	Ice	↓	↓

SAMPLE DESC: see CAWA-10-25908

SAMPLE COMMENTS: 3rd Full suite sample.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:



COLLECTED BY (PRINT) W-shaw

REVIEWED BY (PRINT) M green

RELINQUISHED BY (Printed Name) <u>M green</u> (Signature) <u>[Signature]</u>	Date/Time <u>9/23/10</u> <u>1800</u>	RECEIVED BY (Printed Name) <u>SHERI SHEPWOOD</u> (Signature) <u>[Signature]</u>	Date/Time <u>9.23.10</u> <u>1800</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3049

EVENT NAME: Water/CdV Watershed Sampling Q1, September 2010, IFWGMP2010

SAMPLE ID: CAWA-10-25909

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		9/23/10	MEDIA:	WGI	OK
TIME COLLECTED (HH:MM)		1622	SUB-MEDIA:	UA	
PRS ID: Water		OK	SAMPLE TECH CODE:	GSP	
LOCATION ID: R-47i		↓	FIELD QC TYPE:	ETB	
LOCATION TYPE: MON		↓	FIELD PREP:	UE	
PORT: SINGLE COMPLETION		↓	SAMPLE USAGE:	QC	↓
FIELD MATRIX: WG		↓	SCREEN/PORT DESC:	NA	
COMPOSITE TYPE: NA		↓	EXCAVATED: YES/NO/NA	NA	

COMPOSITE TIME INTERVAL: NA WATER FLOWING: YES/NO (NA)

BOREHOLE: YES/NO (NA) BOREHOLE DECLINATION: NA BOREHOLE DIRECTION: NA

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1/2		WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (Hydrogen Chloride)		

SAMPLE DESC: QC Sample of CAWA-10-25908

see CAWA-10-25908

SAMPLE COMMENTS: 3rd Full suite sample.

LOCATION DESC:

FIELD SCREENING/MEASUREMENT RESULTS:

COLLECTED BY (PRINT) W. Shaw

REVIEWED BY (PRINT) M. Green

RELINQUISHED BY (Printed Name) <u>M. Green</u> (Signature) <u>[Signature]</u>	Date/Time 9/23/10 1800	RECEIVED BY (Printed Name) <u>Shelli Sherwood</u> (Signature) <u>[Signature]</u>	Date/Time 9-23-10 1650
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

GroundWater Sampling Log									
Project: IFWGMGP		LSD: 7358.0 ft. msl		Well Diameter: 5 inches		Date: 9/23/18			
Canyon: CDV		Water Level: 6528.99 ft. msl		Top of Screen: 6518.0 ft. bgs		Notes: Need male to male tee adapter. Special GC sampling.			
Well No: R-471		*TD: 865.5' bgs		Bottom of Screen: NA					
Sampling Device: GSP		*DTW: 829.0' bgs		Water Column: 36.5 ft					
Measuring Point: LSD		Drop Pipe: 34.0 gal.		1CV: 37.2 gal.					
* Completion Depth: TD				6.8CV: 223.2 gal.		Baski Packer Pressure			
Sampling Personnel: W. Shaw, M. Green						Before: NA psi		After: NA psi	
[* ft. BTOC / BTIC / BGS / MSL ]						Note height of TOC/TIC on MP for Alluvials			
DTW = (LSD - Water Level).....						Water Column = (TD - DTW).....			
Drop Pipe = (DTW x Drop Pipe Diameter Multiplier)						1CV = (Water Column x Well Diameter Multiplier).....			
3 CV = (1CV x 3)									
TIME	pH	TEMP	SPEC COND	DO	Turb	ORP	Water Level*	Discharge	NOTES
MST / DST	stu	°C	µs/cm	mg/l	ntu	mV	ft msl	Rate (gpm)	
1230	7.35	12.95	144	4.36	15.4	180.7	6523.15	1.25	strong odor + effervescent
1235	6.43	12.83	143	4.46	6.21	206.2	6522.93	"	less odor effervescent
1240	6.52	13.03	142	4.85	3.03	210.7	6522.68	"	"
1245	6.68	13.35	141	5.19	2.53	207.6	6522.51	"	"
1250	6.76	13.63	142	5.37	1.90	206.7	6522.33	"	"
1255	6.76	14.06	142	5.49	1.74	208.2	6522.17	"	"
1300	7.71	14.49	144	5.55	1.52	132.5	6521.85	"	pH increased during sampling
1300	Begin sampling 1CV, 1303 sampling complete								
1315	6.83	14.44	146	5.55	1.41	222.3	6522.10	1.1	decreased discharge
1330	6.87	15.07	161	5.20	2.19	209.8	6522.37	"	effervescent odor
1332	Begin 2CV sampling, 1337 sampling complete								
1345	6.95	15.17	168	4.62	2.12	194.4	6522.30	"	"
1400	6.92	15.22	167	4.65	1.38	264.0	6522.26	"	"
1415	6.91	15.98	165	4.63	1.89	215.2	6522.15	"	"
1406	Begin 3CV sampling, 1413 sampling complete								
1430	6.83	15.70	166	4.52	2.05	287.3	6522.09	"	"
1440	Begin 4CV sampling								
1445	7.30	15.76	165	4.50	2.19	175.6	6521.95	"	"
1500	7.68	15.89	163	4.55	1.98	264.4	6521.93	"	"
1515	6.86	15.96	161	4.63	1.87	225.6	6522.47	0.5	reduced flow
1514	Begin 5CV sampling, 1520 sampling complete								
1530	7.03	15.90	158	4.80	2.00	193.70	6522.86	"	effervescent
1545	6.81	15.89	156	4.85	1.94	217.1	6523.04	"	"
1600	6.69	15.66	155	4.93	1.95	277.0	6523.15	"	"
1615	6.91	15.74	154	4.98	1.91	267.4	6523.22	"	"
1622	Begin 6CV + full suite sampling								
mg 9/23/18									
<b>WASTE</b>									
Contact:				1 gal.	Drum# 10130540		*Purge: Formation water purged prior to sampling.		
*Purge Water:				223 gal.	Drum#'s 100 gal → 10143033		NOT drop pipe volume.		
Total Waste Water:				260 gal.	160 gal → 10130539		NOT water during sampling.		

R-47i

9/23/10

- 0710 S. Schmeier leads H + S trailgate @ TA-64
- 0830 M. Green calibrates meter #4 @ TA-59
- 1100 onsite @ R-47i, to purge and sample R-47i, per SOPs - special  
 6CV sampling event  
 weather: Warm, sunny, windy, 80s  
 Safety: Buffer solution, DX consideration (shot @ 1300)  
 personnel: W. Shaw, M. Green + 1  
 $\bar{V} = 6528.99 \text{ 'msl}$        $LSD: 7358.0 \text{ 'msl}$   
 $TD: 865.5 \text{ 'bgs}$        $DTW = LSD - \bar{V} = 829.0 \text{ 'bgs}$   
 $WL = TD - DTW = 36.5 \text{ '}$   
 $DP = (0.041 \frac{\text{gal}}{\text{min}}) \frac{1.48 \text{ mg}}{\text{gal}} \frac{1}{1000} \text{ DTW} = 34.0 \text{ gal}$   
 $1CV = (1.02 \frac{\text{gal}}{\text{min}}) WL = 37.2 \text{ gal}$   
 $2CV = 74.5 \text{ gal}, 3CV = 111.6 \text{ gal}, 4CV = 148.8 \text{ gal}, 5CV = 186.0 \text{ gal}, 6CV = 223.2 \text{ gal}$   
 special samples will be collected @ 1-gal casing volumes with a full  
 suite collected after 6CVs have been purged. Pump rate will  
 be restricted to prevent drawdown of WL (per T. Greening)  
 $Top\ of\ screen = 840 \text{ 'bgs} = 6518.0 \text{ 'msl}$
- 1202 Pump on, <sup>1205</sup>Water to surface, Flow restricted using ball valve on tree  
 to stabilize WL @ 6523.00' msl, initial Q = 1.7 gpm (manual),
- 1209 WL drops again, Flow restricted to Q = 1.1 gpm
- 1220 A 1.25 gpm flow seems to stabilize WL around 6523.7' msl
- 1230 DP clear, begin collecting parameters on VSI #4 + groundwater log
- 1300 collect 1CV samples, 1303 sampling complete
- 1315 Discharge slowed to 1.1 gpm
- 1332 Begin 2CV sampling, 1337 sampling complete
- 1406 Begin 3CV sampling, 1413 sampling complete
- 1440 Begin sampling, 1449 sampling complete (4CV)
- 1535 ~~1535~~ Reduced flow to 0.5 gpm
- 1544 ~~1544~~ Begin sampling 5 CV, 1520 sampling complete
- 1535 ~~1535~~ <sup>1535</sup> Begin 6CV and full suite sampling
- 1635 ~~1635~~ Pump off, sampling complete. Final  $\bar{V} = 6524.188 \text{ 'msl}$   
 collect waste: 1 gal, drum # 10130540  
 purge waste: 100 gal, drum # 10143033, 160 gal, drum # 10130539
- 1715 off site, objectives met
- 1800 Samples relinquished @ SMO c/o K. Green

9/23/10

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3234

EVENT NAME: Water/CdV Watershed Sampling Q2, Dec. 2010, IFWGMP 2010

SAMPLE ID: CAWA-11-2122

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		12/2/10	MEDIA:	WGI	OK
TIME COLLECTED (HH:MM)		1255	SUB-MEDIA:	UA	
PRS ID: <u>Water</u>		OK	SAMPLE TECH CODE: <u>GSP</u>		
LOCATION ID: <u>R-47i</u>			FIELD QC TYPE: <u>NA</u>		
LOCATION TYPE: <u>MON</u>			FIELD PREP: <u>UF</u>		
PORT: <u>SINGLE COMPLETION</u>			SAMPLE USAGE: <u>INV</u>		
		↓	SCREEN/PORT DESC:		↓
FIELD MATRIX: <u>WG</u>			EXCAVATED: YES/NO <u>NA</u>		
COMPOSITE TYPE: <u>NA</u>			COMPOSITE TIME INTERVAL: <u>NA</u>		WATER FLOWING: YES/NO <u>NA</u>
BOREHOLE: YES/NO <u>NA</u>			BOREHOLE DECLINATION: <u>NA</u>		BOREHOLE DIRECTION: <u>NA</u>

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
23	NA	WSP-8081A-Pest	1 LITER AMBER GLASS	Ice	Y	10-day turnaround on all analyses. Atk 11/29/10
23		WSP-8082-PCB	1 LITER AMBER GLASS	Ice		
2		WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (HCL)		Atk 11/29/10
23		WSP-8270C-SVOA	1 LITER AMBER GLASS	Ice		NA
2		WSP-8290-D/F	1 LITER AMBER GLASS	Ice		
23		WSP-8321A-NMED HEXP	1 LITER AMBER GLASS	Ice		
1		WSP-CN(T)	250 ML POLY	Sodium Hydroxide (NaOH)		
2		WSP-D2H+O18O 16	40 ML SEPTUM AMBER GLASS	Ice		
1		WSP-EES6-ALK	125 ML POLY	Ice		
1		WSP-GrossA/B	1 LITER POLY	None		
2		WSP-HEXMOD	1 LITER AMBER GLASS	Ice		
1		WSP-LL-H-3	1 LITER POLY	None		
1		WSP-Met+B+SN +SR+U	1 LITER POLY	Nitric Acid (HNO3)		
1		WSP-RAD	1 GAL POLY	Nitric Acid (HNO3)		
1		WSP-TKN+TOC	500 ML AMBER GLASS	Sulfuric Acid (H2SO4)	↓	↓

SAMPLE DESC:

NA

SAMPLE COMMENTS: 4th full suite sample. ~~request 10-day turnaround on analyses Atk 11/29/10.~~  
 Samples collected within 75' of running diesel generator + within 50' of running gas generator.

Atk 11/29/10

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3234

EVENT NAME: Water/CdV Watershed Sampling Q2, Dec. 2010, IFWGMP 2010

LOCATION DESC:

NA

**FIELD SCREENING/MEASUREMENT RESULTS:**

pH	Temp <sup>°C</sup>	SC <sup>µS/cm</sup>	DO <sup>mg/L</sup>	Turb <sup>(ntu)</sup>	ORP <sup>mV</sup>	Q <sup>gph</sup>	Comments
7.06	13.24	152	4.92	3.01	295.4	0.9	Slight Effervescence

COLLECTED BY (PRINT) D. Fellenz

REVIEWED BY (PRINT) H. Wershow

<b>RELINQUISHED BY</b> (Printed Name) <u>Hal Wershow</u> (Signature) <u><i>Hal Wershow</i></u>	<b>Date/Time</b> <u>12/7/10</u> <u>1555</u>	<b>RECEIVED BY</b> (Printed Name) <u>STEVEN SPERWOOD</u> (Signature) <u><i>Steven Sperwood</i></u>	<b>Date/Time</b> <u>12/2/10</u> <u>1555</u>
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3234

EVENT NAME: Water/CdV Watershed Sampling Q2, Dec. 2010, IFWGMP 2010

SAMPLE ID: CAWA-11-2121

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		12/2/10	MEDIA:	WGI	OK
TIME COLLECTED (HH:MM)		1255	SUB-MEDIA:	UA	
PRS ID: <u>Water</u>		OK	SAMPLE TECH CODE:	NA	
LOCATION ID: <u>R-47i</u>			FIELD QC TYPE:	FTB	
LOCATION TYPE: <u>MON</u>			FIELD PREP:	UF	
PORT: <u>SINGLE COMPLETION</u>			SAMPLE USAGE:	QC	
			SCREEN/PORT DESC:		
FIELD MATRIX: <u>WG</u>			EXCAVATED: YES/NO/NA	NA	
COMPOSITE TYPE: <u>NA</u>			COMPOSITE TIME INTERVAL: <u>NA</u>		WATER FLOWING: YES/NO/NA
BOREHOLE: YES/NO <u>NA</u>			BOREHOLE DECLINATION: <u>NA</u>		BOREHOLE DIRECTION: <u>NA</u>

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1	DEF 12/2/10	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (HCL)	Y	<del>10 day turnaround</del> <u>AK 11/29/10</u>

SAMPLE DESC: QC Sample of CAWA-11-2122

SAMPLE COMMENTS: 4th full suite sample. ~~Request 10 day turnaround on analyses~~ AK 11/29/10  
 See CAWA-11-2122 AK 11/29/10

LOCATION DESC: NA

FIELD SCREENING/MEASUREMENT RESULTS:  
See CAWA-11-2122

COLLECTED BY (PRINT) D. Fellenz REVIEWED BY (PRINT) H. Wershow

RELINQUISHED BY (Printed Name) <u>Hal Wershow</u> (Signature) <u>Hal Wershow</u>	Date/Time <u>12/2/10</u> <u>1555</u>	RECEIVED BY (Printed Name) <u>Sherrin Sherwood</u> (Signature) <u>Sherrin Sherwood</u>	Date/Time <u>12/2/10</u> <u>1555</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

# SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3234

EVENT NAME: Water/CdV Watershed Sampling Q2, Dec. 2010, IFWGMP 2010

SAMPLE ID: CAWA-11-2120

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
DATE COLLECTED(MM/DD/YYYY):		12/02/10	MEDIA:	WGI	OK
TIME COLLECTED (HH:MM)		1255	SUB-MEDIA:	UA	
PRS ID: <u>Water</u>		OK	SAMPLE TECH CODE: <u>GSP</u>		
LOCATION ID: <u>R-47i</u>		↓	FIELD QC TYPE: <u>NA</u>		
LOCATION TYPE: <u>MON</u>		↓	FIELD PREP: <u>E</u>		
PORT: <u>SINGLE COMPLETION</u>		↓	SAMPLE USAGE: <u>INV</u>		
FIELD MATRIX: <u>WG</u>		↓	SCREEN/PORT DESC:		↓
COMPOSITE TYPE: <u>NA</u>			EXCAVATED: YES/NO <u>NA</u>		
COMPOSITE TIME INTERVAL: <u>NA</u>			WATER FLOWING: YES/NO <u>NA</u>		
BOREHOLE: YES/NO <u>NA</u>			BOREHOLE DECLINATION: <u>NA</u>		
BOREHOLE DIRECTION: <u>NA</u>					

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
1	NA	WSP-GENINORG	1 LITER POLY	Ice	Y	<del>10-day turnaround on</del> <i>Atk 11/29/10</i>
1	↓	WSP-Met+B+SN +SR+U	1 LITER POLY	Nitric Acid (HNO3)	↓	<del>cell analysis</del> <i>Atk 11/29/10</i>
2	↓	WSP-N14N15	40 ML SEPTUM AMBER GLASS	Ice	↓	↓
1	↓	WSP-NH3+NO3/NO2+PO4	500 ML AMBER GLASS	Sulfuric Acid (H2SO4)	↓	↓

SAMPLE DESC:

NA

SAMPLE COMMENTS: 4th full suite sample. *Request 10-day turnaround on analysis Atk 11/29/10*  
*See CAWA-11-2122 Atk 11/29/10*

LOCATION DESC:

NA

FIELD SCREENING/MEASUREMENT RESULTS:

See CAWA-11-2122

COLLECTED BY (PRINT) D. Fellenz REVIEWED BY (PRINT) H. Wershow

RELINQUISHED BY (Printed Name) <u>Hal Wershow</u> (Signature) <i>[Signature]</i>	Date/Time <u>12/2/10</u> <u>1555</u>	RECEIVED BY (Printed Name) <u>SHERI STEERWOOD</u> (Signature) <i>[Signature]</i>	Date/Time <u>12/2/10</u> <u>1555</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

### GroundWater Sampling Log

Project: IFWGM '10	LSD: 7358.41 ft. msl	Well Diameter: 5 inches	Date: 12/2/10
Canyon: CdV	Water Level: 6529.01 ft. msl	Top of Screen: 840 ft. bgs	Notes: Ball valve reduced used to restrict flow
Well No: R-476	*TD: 865.5' bgs	Bottom of Screen: 860.6 ft. bgs	
Sampling Device: GSP	*DTW: 829.40' bgs	Water Column: 36.1 ft	
Measuring Point: L50	Drop Pipe: 39 gal.	1CV: 36.8 gal.	
* Completion Depth: TD		3CV: 110.5 gal.	Baski Pack Pressure

Sampling Personnel: H. Wershow, D. Fellenz  
 [\* ft. BTOC / BTIC / BGS / MSL] Note height of TOC/TIC on MP for Alluvials  
 Before: ~~NA~~ psi  
 After: NA psi

DTW = (LSD - Water Level)..... Water Column = (TD - DTW)..... Drop Pipe = (DTW x Drop Pipe Diameter Multiplier)  
 1CV = (Water Column x Well Diameter Multiplier)..... 3 CV = (1CV x 3)  
 Top of screen = 6518.41' msl Initial Q = 2.9 gpm

TIME	pH	TEMP	SPEC COND	DO	Turb	ORP	Water Level*	Discharge	NOTES
MST / DST	stu	°C	µs/cm	mg/l	ntu	mV	ft msl	Rate (gpm)	
1035	7.00	11.55	161	4.11	6.01	391.6	6519.48	1.8	Slight effervescent
1040	7.14	11.88	142	4.68	6.08	292.8	6519.26	1.0	Flow reduced
1045	7.30	12.27	135	5.45	8.45	239.0	6521.82	1.0	Effervescent
1050	7.43	12.64	134	5.51	10.1	196.0	6522.65	"	" No odor
1055	7.20	12.78	132	5.59	2.87	195.7	6523.02	"	" "
1100	7.37	12.90	131	5.76	3.15	174.1	6523.20	"	" "
1105	7.07	12.96	131	5.98	2.33	189.1	6523.27	"	" "
1120	6.65	13.03	131	5.94	2.33	257.8	6523.30	"	Less Effervescent
1135	7.62	13.20	134	5.88	3.18	164.0	6523.28	"	Minimal effervescence
1145	5.91	13.50	148	5.35	3.50	301.6	6523.26	"	"
1150	Pump off to calibrate		2nd		12/2/10				
1230	Pump on		12/2/10		12/2/10				
1235	7.26	13.26	155	5.07	5.61	310.6	6525.46	0.9	Little slight Effervescent
1240	6.28	12.97	153	5.10	4.31	309.0	6525.01	"	"
1245	6.99	13.04	155	4.94	2.56	300.1	6524.85	"	"
1250	7.11	13.09	153	4.94	3.61	298.0	6524.71	"	"
1255	7.06	13.24	152	4.92	3.01	295.4	6524.54	"	"
1255	Begin sampling		Parameters stable, >		3CV's pumped (111.5 gal)				
1304	End sampling				6524.72				

HW 12/2/10

WASTE			
Contact:	1/2 gal.	Drum#	10155674
*Purge Water:	111.5 gal.	Drum#s	10155673
Total Waste Water:	153.5 gal.		

\*Purge: Formation water purged prior to sampling.  
 NOT drop pipe volume.  
 NOT water during sampling.

40  
12/2/10

# R-47i

0705 W. Shaw conducts H&S Tailgate @ TA-64  
0900 Field crew (H. Wershow + D. Fellenz) + escort J. Davis  
check in @ TA-15 Access Control

0910 Field crew onsite to purge & sample R-47i  
Weather: Warm (50°F) & sunny, no clouds in sky  
2 min safety: Caution with 2nd crew (tailings pond  
evaporation pump) <sup>offsite</sup> near well  
NOTE: Well head has small thread piping on it,  
to connect to ball valve reducer. Field crew  
must have 1' ball valve reducer with narrow thread  
to connect to well head & normal thread to connect  
to sampling tree.

LSD: 7358.41' msl V: 6529.01' msl TD: 865.5' bgs ID: 5" 155

DTW: LSD - V = 829.40' bgs WC: DTW - TD = 36.1' "

Drop Pipe Volume: DTW · (0.041 gal/ft) = 34 gal

1 Casing Volume: WC · (1.020 gal/ft) = 36.8 gal

3 CV's = 110.5 gal

NOTE: Ball valve reducer will be used to reduce  
flow so that drawdown will stabilize

1017 Pump On 1020 Water to surface, Q = 2.9 gpm <sup>Manual</sup>

~~Drop pipe cleared, begin logging parameters~~ NW 12/2/10

1026 Flow restricted gradually, drawdown continues

1031 Flow restricted, drawdown reverses, Q = 1.8 gpm

1035 Drop Pipe cleared, begin logging parameters (44 gal purged)

1040 Flow reduced again due to drawdown (Q = 1.0 gpm) (53 gal purged)

1145 Field crew notices that pH is jumping sharply. Upon  
closer inspection, pH jumps are correlated to twisting  
the YSI cable. Parameter values continue to behave  
erratically. Field crew will calibrate a 2nd meters  
cable is tested on 2nd meter, twisting induces similarly  
erratic behavior (values of -3 appear on screen).

1150 Pump off to calibrate new meter (123 gal purged)

1230 Pump On, Q = 0.9 gpm

1235 Begin logging parameters on YSI #3

NOTE: D. Fellenz calibrated meter #5 @ 0915.

H. Wershow calibrated meter #3 @ 1158

# R-47i (cont)

12/2/10

1255 Begin sampling, parameters stable, 111.5 gal purged + 34 gal drop pipe

1304 End sampling, Final  $\Phi$  = 6524.72' msl

1307 Samples preserved by D. Fellenz

NOTE: LANL field crew (F. Fernandez + 1) operating generator with hose in tailings pond  $\approx$  50' away from well for duration of purge & sampling event.

ALL OBJECTIVES MET

Contact Waste:	1/2 gal, #10155674
Waste Water:	153.5, #10155673

1310 Offsite to R-25 (XO objective)

Final Parameters	pH	TOC	SC <sup>mg/l</sup>	DO <sup>mg/l</sup>	Turb <sup>NTU</sup>	ORP <sup>mV</sup>	Odor	Notes
	7.06	13.24	152	4.92	3.01	295.4	0.9	Efferescent

1555 Samples relinquished @ SMO, c/o S. Sherwood

Sample ID #'s: CAWA-11-2120  $\rightarrow$  2122

Event ID: 3234

HW  
12/2/10

