Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

AUG 15 2011

11-AMCP-0184

Ms. J. A. Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton
Richland, Washington 99354

Dear Ms. Hedges:

INTERIM STATUS GROUNDWATER MONITORING PLAN FOR THE PLAN FOR THE LOW-LEVEL BURIAL GROUND (LLBG) WASTE MANAGEMENT AREA-3 (WMA-3), DOE/RL-2009-68, REVISION 1

This letter transmits the Interim Status Groundwater Monitoring Plan for the LLBG WMA-3, DOE/RL-2009-68, Revision 1, to the State of Washington Department of Ecology for review and comment. The Low-Level Waste Management Area-3 consists of the 218-W-3A, 218-W-3AE, and 218-W-5 Burial Grounds and is regulated via State of Washington's "Hazardous Waste Management Act" and its implementing requirements in Washington Administrative Code 173-303-400.

If you have any questions, please contact me, or your staff may contact Briant Charboneau, of my staff, on (509) 373-6137.

Sincerely,

Jonathan A. Dowell

Jonathan A. Dowell, Assistant Manager
for the Central Plateau

AMCP:RDH

Attachment

cc: See Page 2

cc w/attach:
G. Bohnee, NPT
L. Buck, Wanapum
D. A. Faulk, EPA
S. Harris, CTUIR
R. Jim, YN
S. L. Leckband, HAB
N. M. Menard, Ecology
K. Niles, ODOE
D. Rowland, YN (4) plus 2 CDs
Administrative Record
Environmental Portal

cc w/o attach:
D. G. Black, CHPRC
D. E. Dooley, CHPRC
R. E. Piippo, MSA
J. G. Vance, MSA

DOE/RL-2009-68
Revision 1

Interim Status Groundwater Monitoring Plan for the LLBG WMA-3

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

U.S. DEPARTMENT OF ENERGY Richland Operations Office

P.O. Box 550
Richland, Washington 99352

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Revision 1

Interim Status Groundwater Monitoring Plan for the LLBG WMA-3

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Executive Summary

The Low-Level Waste Management Area 3 (LLWMA-3) consists of the 218-W-3A, 218-W-3AE, and 218-W-5 Burial Grounds and is regulated via Washington State's "Hazardous Waste Management Act"[1] and its implementing requirements in WAC 173-303-400.[2] The Washington State Department of Ecology has been authorized by the U.S. Environmental Protection Agency[3] to conduct its hazardous waste regulatory program in lieu of the *Resource Conservation and Recovery Act of 1976*.[4]

This document supersedes PNNL-14859,[5] as revised in interim change notices PNNL-14859-ICN-1[6] and PNNL-14859-ICN-2,[7] to incorporate changes that have occurred at LLWMA-3 since the previous plan was written.

This document describes the groundwater monitoring plan for LLWMA-3. The plan addresses the following:

- Number, locations, and depths of wells in the LLWMA-3 groundwater monitoring network
- Sampling and analytical methods for groundwater parameters and hazardous wastes or hazardous waste constituents
- Procedures for evaluating groundwater quality information
- Schedule for groundwater monitoring at the LLWMA

This indicator monitoring plan is the principal controlling document for conducting groundwater monitoring at LLWMA-3.

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[1] RCW 70.105, "Hazardous Waste Management Act," *Revised Code of Washington.*

[2] WAC 173-303-400, "Dangerous Waste Regulations," "Interim Status Facility Standards," *Washington Administrative Code*, Olympia, Washington.

[3] *Authorized State Hazardous Waste Programs*, 42 USC 6926, et seq.

[4] *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq.

[5] PNNL-14859, 2004, *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington*, Pacific Northwest National Laboratory, Richland, Washington.

[6] PNNL-14859-ICN-1, 2006, *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington*, Interim Change Notice 1, Pacific Northwest National Laboratory, Richland, Washington.

[7] PNNL-14859-ICN-2, 2007, *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington*, Interim Change Notice 2, Pacific Northwest National Laboratory, Richland, Washington.

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Terms

amsl	above mean sea level
CCU	Cold Creek unit
DOE	U.S. Department of Energy
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
LLWMA	low-level waste management area
NA	not applicable
NAVD88	North American Vertical Datum of 1988
OU	operable unit
QAPjP	quality assurance project plan
RCRA	*Resource Conservation and Recovery Act of 1976*
TBD	to be determined
TOC	total organic carbon
TOX	total organic halides
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*

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1 Introduction

Low-Level Waste Management Area 3 (LLWMA-3) consists of the 218-W-3A, 218-W-3AE, and 218-W-5 Burial Grounds, which contain 75 unlined and 2 lined trenches. The LLWMA-3 is located in the northwest corner of the Hanford Site's 200 West Area (Figure 1-1) and was used for disposal of low-level radioactive and low-level mixed wastes beginning in 1970. The hazardous chemicals in the low-level mixed waste portions of LLWMA-3 are regulated under WAC 173-303, "Dangerous Waste Regulations." The LLWMA-3 was placed in assessment monitoring in 1989 due to elevated total organic halides (TOX) (a *Resource Conservation and Recovery Act of 1976* [RCRA] indicator parameter) in one well. The LLWMA-3 was subsequently shown not to be the source for the elevated TOX, and indicator evaluation monitoring resumed in 1994; indicator evaluation monitoring has continued at the LLWMA since that time. The objectives for the continued indicator evaluation groundwater monitoring at LLWMA-3, as required by 40 CFR 265.92(d) ("Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Sampling and Analysis") are to determine the following:

- Concentrations of specified groundwater quality parameters annually
- Concentrations of groundwater contamination indicator parameters semiannually
- Elevation of the water table

The scope of this plan is to acquire the necessary groundwater data to satisfy these objectives.

This document replaces the previous groundwater monitoring plan (PNNL-14859, *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington*) and includes several activities that have occurred at LLWMA-3 since that plan was issued. Chapter 2 of this plan summarizes background information and references other documents that contain more detailed information. Chapter 2 also describes the LLWMA and the types of waste present, provides a brief history of groundwater monitoring, and describes the geology and hydrology pertinent to LLWMA-3. This information is summarized as a site conceptual model to aid in development of the groundwater monitoring program.

Chapter 3 describes the RCRA groundwater monitoring program, including the wells in the monitoring network, constituents analyzed, sampling frequency, and sampling protocols. Chapter 4 describes data evaluation and reporting, and Chapter 5 contains the references cited in this plan. Appendix A provides the quality assurance project plan (QAPjP).

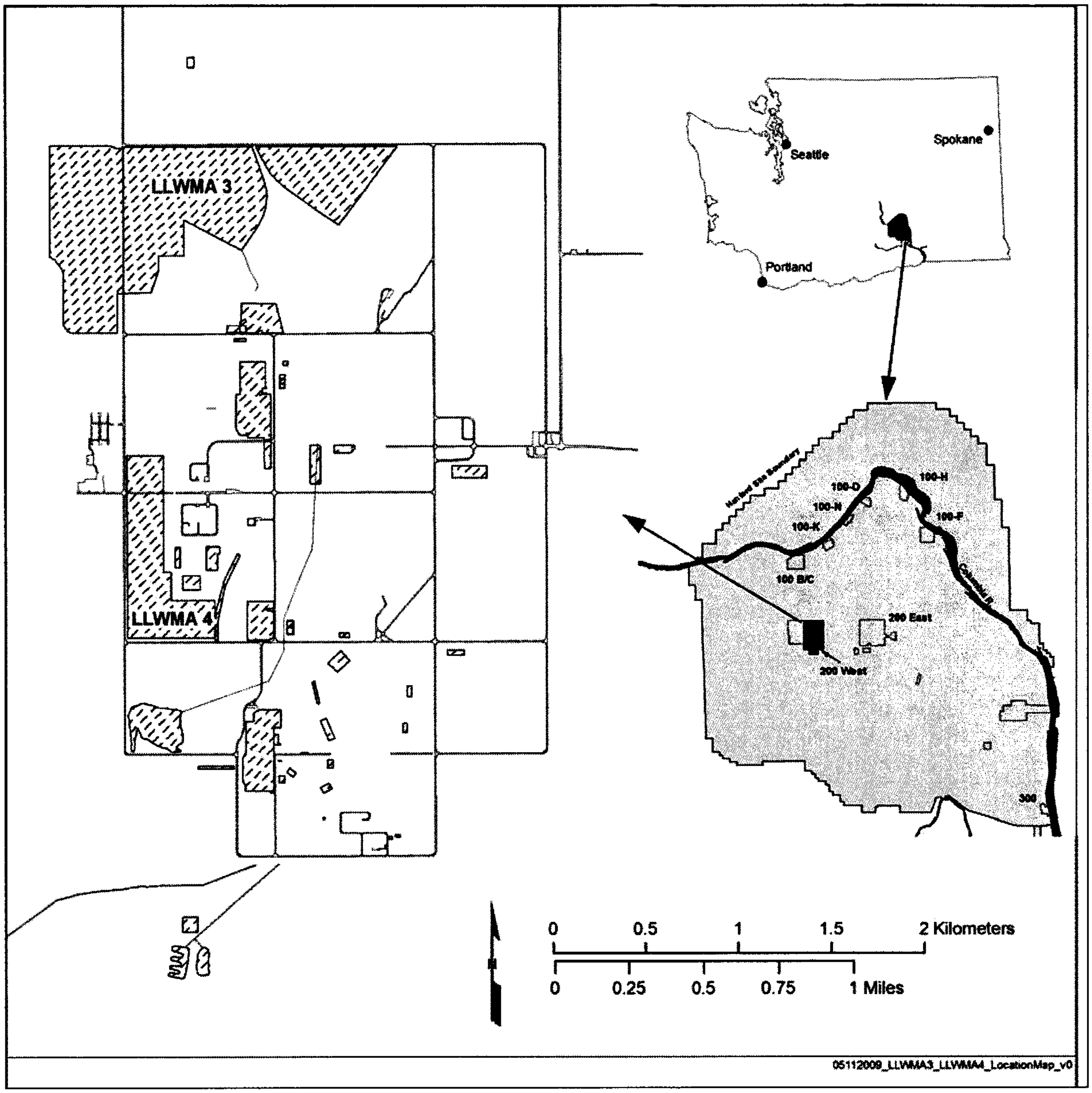

Figure 1-1. Location Map for LLWMA-3

2 Background

This chapter describes the LLWMA-3 facility and operating history, the wastes and waste characteristics associated with the LLWMA, the local geology and hydrology, a summary of previous monitoring, the groundwater and vadose zone contamination at the LLWMA, and the conceptual model for the LLWMA. The discussion in this chapter is summarized from *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington* (PNNL-14859).

2.1 Facility Description and Operating History

The LLWMA-3 is located in the northwest corner of the 200 West Area and consists of the following burial grounds:

- 218-W-3A Burial Ground, approximately 20.4 ha (50.4 ac)
- 218-W-3AE Burial Ground, approximately 20 ha (49.4 ac)
- 218-W-5 Burial Ground, approximately 37.2 ha (91.9 ac)

The locations of the burial grounds are shown in Figure 1-1.

The 218-W-3A Burial Ground contains 57 unlined trenches that vary in length from 120 to 285 m (393.7 to 935 ft). This burial ground began operating in 1970 but has not received waste since 1998.

The 218-W-3AE Burial Ground contains eight unlined trenches varying in length from 325 to 380 m (1,066.3 to 1,246.7 ft), with bottom widths between 5 and 6 m (16.4 and 19.7 ft). The burial ground began operating in 1981 and received waste until July 2004. All filled trenches are thought to contain 2.4 m (7.9 ft) of soil cover.

The 218-W-5 Burial Ground contains 10 unlined trenches and 2 lined trenches. The unlined trenches are between 160 and 350 m (524.9 and 1,148.3 ft) long, 4.5 to 12 m (14.8 to 39.4 ft) wide, and 5 to 6 m (16.4 to 19.7 ft) deep. The lined trenches were constructed in 2000 and are 36 m (118.1 ft) wide at the bottom, 9.1 m (29.9 ft) deep, and 230 m (754.6 ft) long. The burial ground began operating in 1986, and the two double-lined mixed waste trenches are the only trenches that continue to receive waste.

2.2 Regulatory Basis

In May 1987, the U.S. Department of Energy (DOE) issued a final rule (10 CFR 962, "Byproduct Material"), stating that the hazardous waste components of mixed waste are subject to RCRA regulations. In November 1987, the U.S. Environmental Protection Agency (EPA) authorized the Washington State Department of Ecology (Ecology) to regulate these hazardous waste components within the State of Washington (51 FR 24504, "EPA Clarification of Regulatory Authority Over Radioactive Mixed Waste"). In 1996, the Washington State Attorney General determined that the effective date of mixed waste in Washington State was August 19, 1987.

In May 1989, DOE, EPA, and Ecology signed the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al., 1989). This agreement established the roles and responsibilities of the agencies involved in regulating and controlling remedial restoration of the Hanford Site, which includes LLWMA-3. Groundwater monitoring is conducted at LLWMA-3 in accordance with WAC 173-303-400(3), "Interim Status Facility Standards" (and by reference, 40 CFR 265, Subpart F, "Ground-Water Monitoring"), which requires monitoring to determine whether the dangerous waste constituents from the waste site have entered the groundwater. A RCRA groundwater monitoring program for LLWMA-3 was initiated in 1987 (WHC-SD-EN-AP-015, *Revised*

Ground-Water Monitoring Plan for the 200 Areas Low-Level Burial Grounds) based on the interim status monitoring requirements of 40 CFR 265, Subpart F and WAC 173-303-400, and the groundwater monitoring program continues today.

In 1989, TOX in well 299-W7-4 exceeded the statistical comparison value when the well was redefined as a downgradient well due to changes in groundwater flow direction. Total organic carbon (TOC) was also determined to be above the statistical comparison value at downgradient wells 299-W7-5 and 299-W8-1. A groundwater assessment program was initiated (WHC-SD-EN-AP-022, *Interim-Status Ground-Water Quality Assessment Plan for Waste Management Area 3 of the 200 Areas Low-Level Burial Grounds*). Analytical results from three additional upgradient monitoring wells indicated that the elevated TOX came from an upgradient source. An assessment report was prepared (WHC-SD-EN-EV-026, *Result of the Groundwater Quality Assessment Program at Low-Level Waste Management Area 3 of the Low-Level Burial Grounds*) and indicator evaluation monitoring resumed. The interim status groundwater monitoring plan was revised in 2004 (PNNL-14859), in 2006 (PNNL-14859-ICN-1), and in 2007 (PNNL-14859-ICN-2). Interim status indicator evaluation monitoring continues to date.

The upgradient wells have all gone dry, so statistical comparisons have not been performed since fiscal year 2004. The *Hanford Site Groundwater Monitoring for Fiscal Year 2005* (PNNL-15070) discusses this condition.

2.3 Waste Characteristics

The 218-W-3A Burial Ground received shipments described as miscellaneous transuranic and non-transuranic waste from the Three-Mile Island accident cleanup; irradiated fuel elements from the General Electric Company in Vallecitos, California; radioactive soil from a salt waste spill (encased in concrete burial boxes); and industrial waste. Examples of waste disposed in this burial ground include ion-exchange resins, failed equipment, tanks, pumps, ovens, agitators, heaters, hoods, jumpers, vehicles, and accessories. Only a few areas in two trenches received mixed waste after August 19, 1987, the effective date of mixed waste in Washington State.

Waste historically received at 218-W-3AE Burial Ground includes miscellaneous waste (e.g., rags, paper, rubber gloves, disposable supplies, and broken tools), industrial waste (e.g., failed equipment, tanks, pumps, ovens, agitators, heaters, hoods, jumpers, vehicles, and accessories), and radiological waste. Only a few areas in two trenches in this burial ground received mixed waste after August 19, 1987.

The 218-W-5 Burial Ground received packaged waste materials from 200 West Area operations, as well as other wastes from the Hanford Site and offsite. Examples of waste disposed to this burial ground include rags, paper, rubber gloves, disposable supplies, and broken tools. Two lined trenches (Trenches 31 and 34) received mixed waste. Aside from the lined trenches (Trenches 31 and 34), one small area in one unlined trench received mixed waste after August 19, 1987.

2.4 Geology and Hydrogeology

The geology and hydrology of the 200 West Area, including the area of LLWMA-3, is described in detail in the following documents:

- PNL-6820, *Hydrogeology of the 200 Areas Low-Level Burial Grounds – An Interim Report*
- PNL-7336, *Geohydrology of the 218-W-5 Burial Ground*

- PNNL-13858, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-West Area and Vicinity, Hanford Site, Washington*
- PNNL-16887, *Geologic Descriptions for the Solid-Waste Low Level Burial Grounds*
- WHC-SD-EN-AP-015, *Revised Ground-Water Monitoring Plan for the 200 Areas Low-Level Burial Grounds*
- WHC-SD-EN-TI-290, *Geologic Setting of the Low-Level Burial Grounds*

The following discussion summarizes descriptions from these documents. The uppermost aquifer and aquifers hydraulically interconnected beneath the LLWMAs are also discussed.

The LLWMA-3 is underlain from the ground surface to the top of the basalt by the Hanford formation, the Cold Creek unit (CCU), and the Ringold Formation. The Ringold Formation at this location is mostly sand and gravel, with minor units of finer grained sediment. The Ringold lower mud unit is absent beneath the northernmost portion of the area (PNNL-13858).

The suprabasalt sediment ranges in thickness from 145 to 160 m (475.7 to 524.9 ft) and generally dips to the south. The CCU rises to within 6 m (19.7 ft) of the surface along the northern boundary of LLWMA-3 (PNL-7336).

The vadose zone beneath LLWMA-3 is between approximately 74 and 78 m (242.8 and 255.9 ft) thick and consists of the Hanford formation, the CCU, the Taylor Flats member of the Ringold Formation (not everywhere present beneath LLWMA-3), and the upper portion of unit E of the Wooded Island member of the Ringold Formation. The water table is at approximately 134 to 137 m (439.6 to 449.5 ft) elevation and is entirely within the upper Ringold unit E. The saturated thickness of the uppermost aquifer is approximately 60 m (196.8 ft) in the south and 75 m (246.1 ft) in the north where the Ringold lower mud unit is absent (PNNL-13858). There is some evidence that a locally confining layer, or at least a zone of lower permeability, may be present just at the water table.

Water levels in the unconfined aquifer increased as much as 13 m (42.7 ft) above the pre-Hanford natural water table beneath Waste Management Area T (located approximately 400 m [1,312.3 ft] south of LLWMA-3) due to artificial recharge from liquid waste disposal operations between the mid-1940s and 1995. The height of the water table mound beneath LLWMA-3 is not known because there were no wells in the area with water-level measurements prior to initiating RCRA monitoring in the late 1980s. However, discharges to T Pond and U Pond from the 1940 through the 1970s changed the groundwater flow direction beneath the LLWMA from eastward (the pre-Hanford direction) to the north and northwest. More recently, flow direction has returned to the pre-Hanford east or east northeast direction. The State-Approved Land Disposal Site is located about 500 m (1,640.4 ft) north of LLWMA-3 and began operation in 1995. Since that time, more than 880 million L (232 million gal) of effluent have been discharged to the facility. Those discharges have not affected the groundwater flow direction beneath LLWMA-3.

The hydraulic conductivity values derived from aquifer testing in wells completed in the upper portion of the unconfined aquifer at LLWMA-3 varied from 0.02 to 9.8 m/day (0.07 to 32.2 ft/day). Assuming an average effective porosity of aquifer materials between 0.1 and 0.3, and a hydraulic gradient of 0.0014, the average flow rate is calculated at 0.0001 to 0.14 m/day (0.000328 to 0.459 ft/day). A current groundwater elevation map for LLWMA-3 is shown in Figure 2-1.

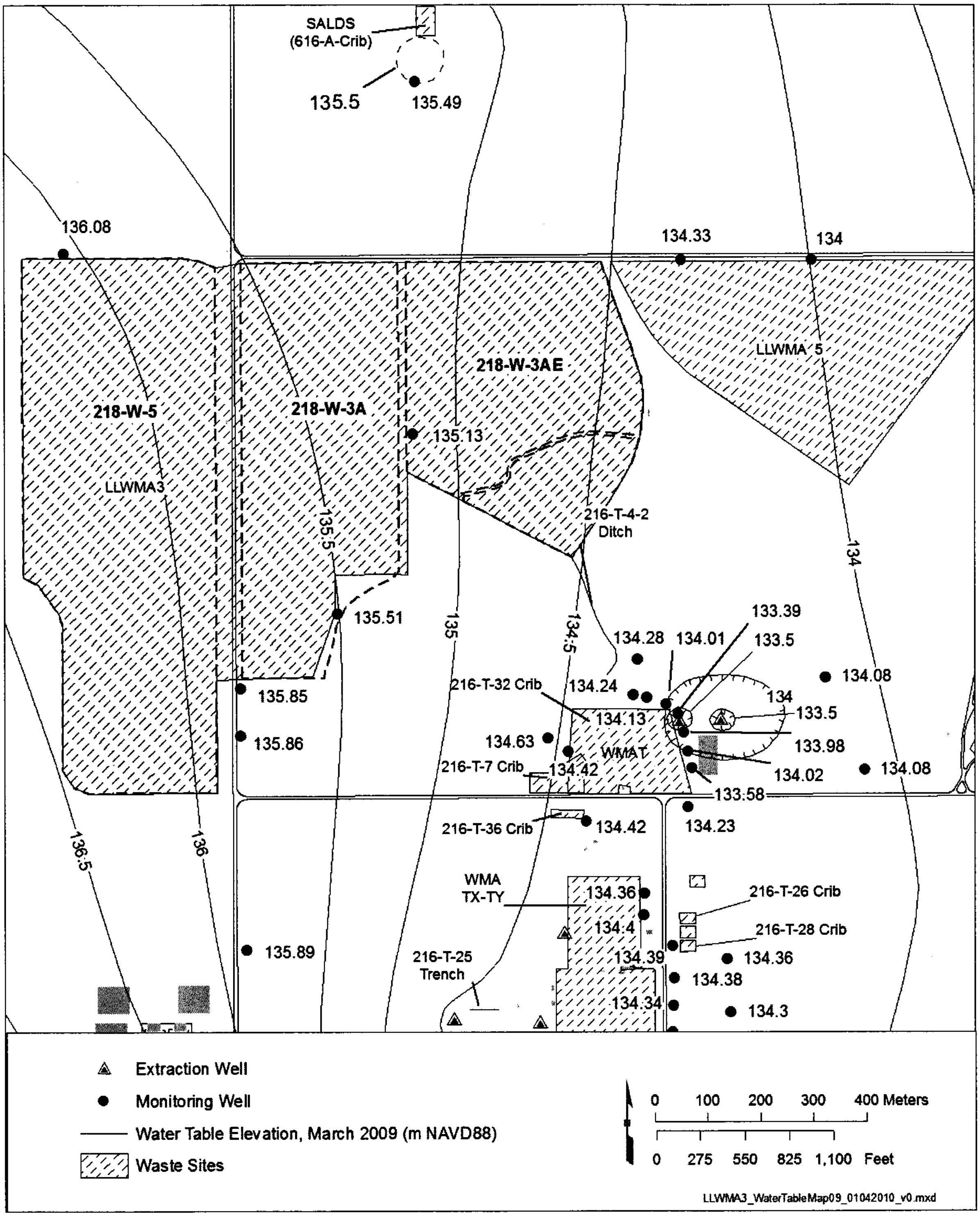

Figure 2-1. Water Table Map for 200 West Area, March 2009

2.5 Summary of Previous Groundwater Monitoring

Groundwater monitoring was initiated at the LLWMA-3 in 1987 in accordance with WHC-SD-EN-AP-015. The LLWMAs are sampled semiannually for geochemical analyses and are included in the annual comprehensive March water-level measurement campaign. Groundwater monitoring results are summarized annually for the LLWMAs in the annual Hanford groundwater monitoring report (e.g., DOE/RL-2010-11, *Hanford Site Groundwater Monitoring and Performance Report for 2009: Volumes 1 & 2*).

The first RCRA monitoring wells at LLWMA-3 were installed in 1987. The initial network contained three upgradient and eight downgradient wells. Additional wells were installed in 1989 (two wells), 1990 (one well), 1991 (two wells), and 1992 (one well). One of the upgradient wells and one downgradient well were completed at the bottom of the unconfined aquifer; all other wells monitored the upper 4.5 to 6 m (14.8 to 19.7 ft) of the unconfined aquifer. All of the wells were dry by 2007, except the two deep wells and two of the original wells monitoring the top of the aquifer. The LLWMA-3 was expanded in the late 1980s so well 299-W7-4, which was originally an upgradient well, became located in the middle of the burial ground and was redefined as a downgradient well. Later, well 299-W7-4 could no longer be sampled due to safety concerns regarding cave-in potential when traveling to the well. Three additional downgradient wells were installed in 2006. New upgradient wells have not been approved in the process of selecting and prioritizing well installation under the Tri-Party Agreement Milestone M-24 series. No new wells are currently planned for LLWMA-3 until the impact of the expanded 200-ZP-1 Groundwater Operable Unit (OU) pump-and-treat system is known.

Background monitoring at LLWMA-3 began in 1988. Critical mean values (WHC-SA-1124-FP, *Statistical Approach on RCRA Groundwater Monitoring Projects at the Hanford Site*) for the indicator parameters TOC, TOX, pH, and specific conductivity were established in 1989 using data from four quarters from upgradient wells 299-W9-1 and 299-W10-13. The critical mean was exceeded for TOX in well 299-W7-4 and for TOC in wells 299-W7-5 and 299-W8-1 in September 1989. Resampling confirmed the elevated TOX, and an interim status groundwater quality assessment program was initiated (WHC-SD-EN-AP-022). Subsequent sampling indicated that the elevated TOC values were erroneous and that the critical mean for TOC was not exceeded.

The groundwater monitoring network at LLWMA-3 was sampled quarterly between 1988 and December 1993, with the exception of the period between June 1990 and June 1991 when laboratory services were unavailable. The additional sampling and groundwater quality assessment indicated that elevated TOX in well 299-W7-4 was due to carbon tetrachloride from upgradient sources. Consequently, LLWMA-3 returned to a background evaluation program in January 1994 to re-establish background and then to indicator evaluation monitoring after one year. The LLWMA-3 has remained in indicator evaluation monitoring since that time.

The groundwater monitoring activities at LLWMA-3 currently consist of water-level monitoring and chemical constituent monitoring. The LLWMA-3 is sampled semiannually, every March and September, from a network of six wells. Samples are analyzed semiannually for the indicator parameters and annually for anions, metals, and phenols. Sitewide water-level measurements are collected every March.

2.6 Conceptual Model

This section describes the LLWMA-3 conceptual model for potential contaminant transport to guide future groundwater monitoring. The conceptual model for contaminant release and transport is based on the following assumptions:

- Engineered barriers are not taken into account, so the model is applicable to unlined trenches but is highly conservative for the newest (lined) mixed waste trenches.
- Average precipitation and net infiltration (5 to 10 cm/yr [2 to 3.9 in./yr]) prevail over the time frame of interest.
- Net infiltration is assumed to occur under gravity drainage.
- Maximum vertical hydraulic conductivity in the vadose zone is assumed to be significantly larger than the net infiltration rate.
- The effective saturated porosity in the vadose zone is equal to the moisture content.
- Leaching of mobile contaminants from buried waste in unsealed containers or contaminated soils in direct contact with the trench are assumed to be the major potential sources for contamination.
- There are no artificial sources of water (e.g., leaking potable or raw water lines) based on Hanford Site drawings.
- Extreme conditions or accidental releases are recognized as factors but would be addressed under emergency response/corrective actions.

2.6.1 Geochemical Considerations

The solubility and subsequent mobility of waste constituents in pore fluid depend on the container, chemical nature of the waste constituents, and natural subsurface geochemical conditions.

Pore fluid in the unsaturated and saturated zones beneath LLWMA-3 is slightly alkaline (7< pH <8), with appreciable amounts of bicarbonate (HCO_3^-) and very little natural organic material. The lack of organic matter means that conditions generally are oxidizing. Calcium carbonate is also abundant in vadose zone sediment. These general conditions favor sorption or retardation of many heavy metals (e.g., lead) and favor formation of anionic species, which enhances mobility for other metals (e.g., hexavalent chromium). Laboratory sorption studies have documented these effects and related mobility issues in Hanford Site media (PNNL-11800, *Composite Analysis of Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*).

2.6.2 Soil Moisture Factors

With the exception of waste in sealed metal or concrete containers (e.g., retrievable waste), direct precipitation is the primary driver for hypothetical leaching of waste constituents from the burial trenches and subsequent transport to groundwater. Contaminants in the soil disposed to the trench or waste in degradable containers (e.g., cardboard boxes or wooden boxes) subject to collapse are assumed to be leachable.

The amount of natural infiltration that can pass through the leachable buried waste and drain to the water table is controlled by the texture of the cover and backfill and by the amount of vegetative cover. Stratigraphic features in the soil column beneath the buried waste can also influence or retard downward migration by spreading soil moisture laterally. Direct observational evidence to assess this effect at LLWMA-3 is lacking. Under the gravity drainage assumption, only a small horizontal gradient component is likely to be available to produce lateral spreading of infiltrating water.

Most of the burial ground trenches are backfilled with natural excavation materials (Hanford formation) consisting of coarse gravel, cobbles, and some interstitial sand. Some amount of vegetation exists on the established backfilled areas and the unused portions of the LLWMA. A coarse, nonvegetated cover material allows a major fraction of the precipitation to infiltrate and potentially drain to groundwater. It is estimated that recharge rates at the Hanford Site range from nearly 0 mm/yr at highly vegetated sites to greater than 50 mm/yr at gravel-covered, nonvegetated sites (PNNL-14702, *Vadose Zone Hydrogeology Data Package for Hanford Assessments*).

2.6.3 Hydrogeologic Considerations

The vadose zone beneath LLWMA-3 is approximately 75 m (246 ft) thick and consists of (from top to bottom) the Hanford formation, the CCU, and the Ringold Formation. The CCU is likely to retard downward movement of moisture and contaminants because of the finer textured sediment and cementing that characterize this stratigraphic feature in the vadose zone. The depth of the CCU increases from north to south beneath the LLWMA, so any lateral spreading on top of the CCU will be toward the south.

If contaminants do break through to groundwater beneath LLWMA-3, the contaminants would move toward the east-northeast. The flow direction has shifted from nearly north to northeast and is slowly changing eastward as the influence of the groundwater mound subsides. Because of the low permeability of the aquifer in this area, the groundwater flow rate is estimated to be between approximately 0.04 to 50 m/yr (0.13 to 164 ft/yr).

2.7 Data Quality Objectives

The data quality objectives (DQO) process is used to ensure that data gathered are of the appropriate quality and quantity to meet specific objectives.

The current groundwater monitoring network for LLWMA-3 is a result of previous investigations and DQO-equivalent studies. Groundwater monitoring is ongoing at LLWMA-3 in accordance with interim status regulations. Table 2-2 provides a matrix of data requirements that are typically determined using the DQO process, the associated interim status regulations applicable to these requirements, and the current and historical documentation specifying how the monitoring program for LLWMA-3 complies with the requirements.

Table 2-1. DQOs at RCRA Sites Monitoring for Indicator Parameters

DQO Parameter	Related Requirements	Plan Criteria and Associated Historical Documentation
Scope	RCRA interim status groundwater monitoring at sites where no impact to groundwater has been identified. Related requirements are found in WAC 173-303-400(3) and 40 CFR 265.90 through 265.94, as modified by WAC 173-303-400(3)(b) and WAC 173-303-400(3)(c)(v).	
Number and location of wells Point(s) of compliance	**40 CFR 265.91, Ground-Water Monitoring System.** (a) A ground-water monitoring system must be capable of yielding ground-water samples for analysis and must consist of: (1) Monitoring wells (at least one) installed hydraulically upgradient (i.e., in the direction of increasing static head) from the limit of the waste management area. Their number, locations, and depths must be sufficient to yield ground-water samples that are: (i) Representative of background ground-water quality in the uppermost aquifer near the facility; and (ii) Not affected by the facility; and (2) Monitoring wells (at least three) installed hydraulically downgradient (i.e., in the direction of decreasing static head) at the limit of the waste management area. Their number, locations, and depths must ensure that they immediately detect any statistically significant amounts of hazardous waste or hazardous waste constituents that migrate from the waste management area to the uppermost aquifer.	This plan, Section 3.2 PNNL-14859, *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington* PNNL-14859-ICN-1 PNNL-14859-ICN-2
Well configuration (depth and length of screened interval; well construction)	**40 CFR 265.91, Ground-Water Monitoring System, and WAC 173-303-400.** (c) All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated, and packed with gravel or sand where necessary, to enable sample collection at depths where appropriate aquifer flow zones exist. The annular space (i.e., the space between the borehole and well casing) above the sampling depth must be sealed with a suitable material (e.g., cement grout or bentonite slurry) to prevent contamination of samples and the ground-water. **Additional requirements from WAC 173-303-400(3)(c)(v)(C).** Ground-water monitoring wells must be designed, constructed, and operated so as to prevent ground-water contamination. WAC 173-160 may be used as guidance in the installation of wells.	This plan, Section 3.2 PNNL-14859, *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington* PNNL-14859-ICN-1 PNNL-14859-ICN-2

Table 2-1. DQOs at RCRA Sites Monitoring for Indicator Parameters

DQO Parameter	Related Requirements	Plan Criteria and Associated Historical Documentation
Frequency of sampling Types of analysis or measurement Method detection limits or accuracy and precision	**40 CFR 265.92 Sampling and Analysis.** (b) The owner or operator must determine the concentration or value of the following parameters in ground-water samples in accordance with paragraphs (c) and (d) of this section: (1) Parameters characterizing the suitability of the ground-water as a drinking water supply, as specified in Appendix III. *[Note: These parameters are not listed because, in accordance with 40 CFR 265.92(c)(1), these analyses are conducted only during the first year, and this site is not in the first year of monitoring.]* (2) Parameters establishing ground-water quality: (i) Chloride (ii) Iron (iii) Manganese (iv) Phenols (v) Sodium (vi) Sulfate *[Comment: These parameters are to be used as a basis for comparison in the event a ground-water quality assessment is required under 40 CFR 265.93(d).]* (3) Parameters used as indicators of ground-water contamination: (i) pH (ii) Specific conductance (iii) Total organic carbon (iv) Total organic halogen (c)(1) For all monitoring wells, the owner or operator must establish initial background concentrations or values of all parameters specified in paragraph (b) of this section. The owner or operator must do this quarterly for one year. (2) For each of the indicator parameters specified in paragraph (b)(3) of this section, at least four replicate measurements must be obtained for each sample and the initial background arithmetic mean and variance must be determined by pooling the replicate measurements for the respective parameter concentrations or values in samples obtained from upgradient wells during the first year.	This plan, Section 3.1 and Appendix A PNNL-14859, *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington* PNNL-14859-ICN-1 PNNL-14859-ICN-2

Table 2-1. DQOs at RCRA Sites Monitoring for Indicator Parameters

DQO Parameter	Related Requirements	Plan Criteria and Associated Historical Documentation
	40 CFR 265.92 Sampling and Analysis. (cont'd) (d) After the first year, all monitoring wells must be sampled and the samples analyzed with the following frequencies: (1) Samples collected to establish ground-water quality must be obtained and analyzed for the parameters specified in paragraph (b)(2) of this section at least annually. (2) Samples collected to indicate ground-water contamination must be obtained and analyzed for the parameters specified in paragraph (b)(3) of this section at least semiannually. (e) Elevation of the ground-water surface at each monitoring well must be determined each time a sample is obtained.	
Methods used to evaluate the collected data`	**40 CFR 265.93 Preparation, Evaluation, and Response.** (b) For each indicator parameter specified in 40 CFR 265.92(b)(3), the owner or operator must calculate the arithmetic mean and variance, based on at least four replicate measurements on each sample, for each well monitored in accordance with 40 CFR 265.92(d)(2), and compare these results with its initial background arithmetic mean. The comparison must consider individually each of the wells in the monitoring system, and must use the Student's t-test at the 0.01 level of significance (see Appendix IV) to determine statistically significant increases (and decreases, in the case of pH) over initial background.	This plan, Section 4.2 and Appendix A PNNL-14859, *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 to 4, RCRA Facilities, Hanford, Washington* PNNL-14859-ICN-1 PNNL-14859-ICN-2

Notes: The references cited in this table are listed in the reference list (Chapter 5) of this plan.

3 Groundwater Monitoring

This chapter lists the wells monitored, constituents analyzed, and sampling frequency. The quality assurance and quality control requirements are provided in the QAPjP in Appendix A.

3.1 Constituent List and Sampling Frequency

Table 3-1 lists the constituents to be analyzed under this plan. All wells will be sampled semiannually and constituents monitored semiannually or annually, as indicated in Table 3-1.

Maintenance problems and sampling logistics sometimes delay scheduled sampling events. If a well is delayed more than 3 months, that event will be cancelled, as it will be near the time for the next scheduled sampling event. Missed sampling events will be reported in the annual groundwater report.

3.2 Monitoring Well Network

Figure 3-1 shows the groundwater monitoring well network for LLWMA-3, and Table 3-1 lists the wells and their respective sampling schedules. Construction details and as-built diagrams for the wells in LLWMA-3 monitoring network are provided in the *Borehole Summary Report for RCRA Groundwater Monitoring Wells at Low-Level Waste Management Areas 3 and 4, FY 2006* (WMP-30613). The wells in the LLWMA-3 monitoring network may also be co-sampled with the 200-ZP-1 OU under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*. Sampling for LLWMA-3 and the 200-ZP-1 OU is coordinated to eliminate duplicate analyses and well trips.

Table 3-2 summarizes well attribute information, including the most recent (March 2009) depth to water in each well. All of the wells in the LLWMA-3 monitoring network are constructed to meet the requirements of WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells." These wells have stainless-steel casing and screen, sand pack in the screened interval, and full annular seal above. Based on the current rate of water table decline (0.3 to 0.4 m/yr [0.98 to 1.3 ft/yr]), none of the downgradient wells in the LLWMA-3 monitoring network are expected to go dry for at least 20 years.

As discussed in Section 2.2, the upgradient wells have all gone dry, so statistical comparisons have not been performed since fiscal year 2004. A new upgradient well is planned to be drilled and completed in 2011 and is included in this monitoring plan revision. Sections 3.4 and 4.4 discuss the issues and plans with regards to constructing new RCRA wells.

3.3 Sampling and Analysis Protocol

Groundwater monitoring at LLWMA-3 follows the conventions of the project, which are described in the QAPjP in Appendix A.

Table 3-1. Sampling Schedule for LLWMA-3

Well Name	Purpose	WAC Compliant	RCRA Required Constituents[a]												Supporting Constituents[b]				
				Contamination Indicator Parameters				Groundwater Quality Parameters											
								Anions[d]		Metals (Filtered and Unfiltered)[d]									
			Water Level[c]	pH[c]	Specific Conductance[c]	TOC	TOX	Chloride	Sulfate	Sodium	Iron	Manganese	Phenols	Temperature[c]	Oxidation-Reduction Potential[c]	Turbidity[c]	Dissolved Oxygen[c]	Alkalinity
299-W9-2[e]	Upgradient	Y	Q	S4	S4	S4	S4	A	A	A	A	A	A	S	S	S	S	S
299-W10-29[e]	Downgradient	Y	S	S4	S4	S4	S4	A	A	A	A	A	A	S	S	S	S	S
299-W10-30[e]	Downgradient	Y	S	S4	S4	S4	S4	A	A	A	A	A	A	S	S	S	S	S
299-W10-31[e]	Downgradient	Y	S	S4	S4	S4	S4	A	A	A	A	A	A	S	S	S	S	S

a. Constituents and parameters required by 40 CFR 265.92, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Sampling and Analysis."

b. Constituents not required by RCRA but needed to support interpretation.

c. Field measurement.

d. For anions, analytes include, but are not limited to, chloride, fluoride, nitrate, nitrite, and sulfate. For metals, analytes include, but are not limited to, calcium, chromium, iron, magnesium, manganese, potassium, and sodium.

e. New upgradient well planned for late fiscal year 2011 construction and will be sampled quarterly for a period of four quarters to establish background statistical comparison values. During this period the three downgradient wells will also be sampled on a quarterly schedule to establish background statistical comparison values.

A = sampled annually

S = sampled semiannually

S4 = sampled semiannually with quadruplicate samples taken

Y = well is constructed to the resource protection well standards of WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"

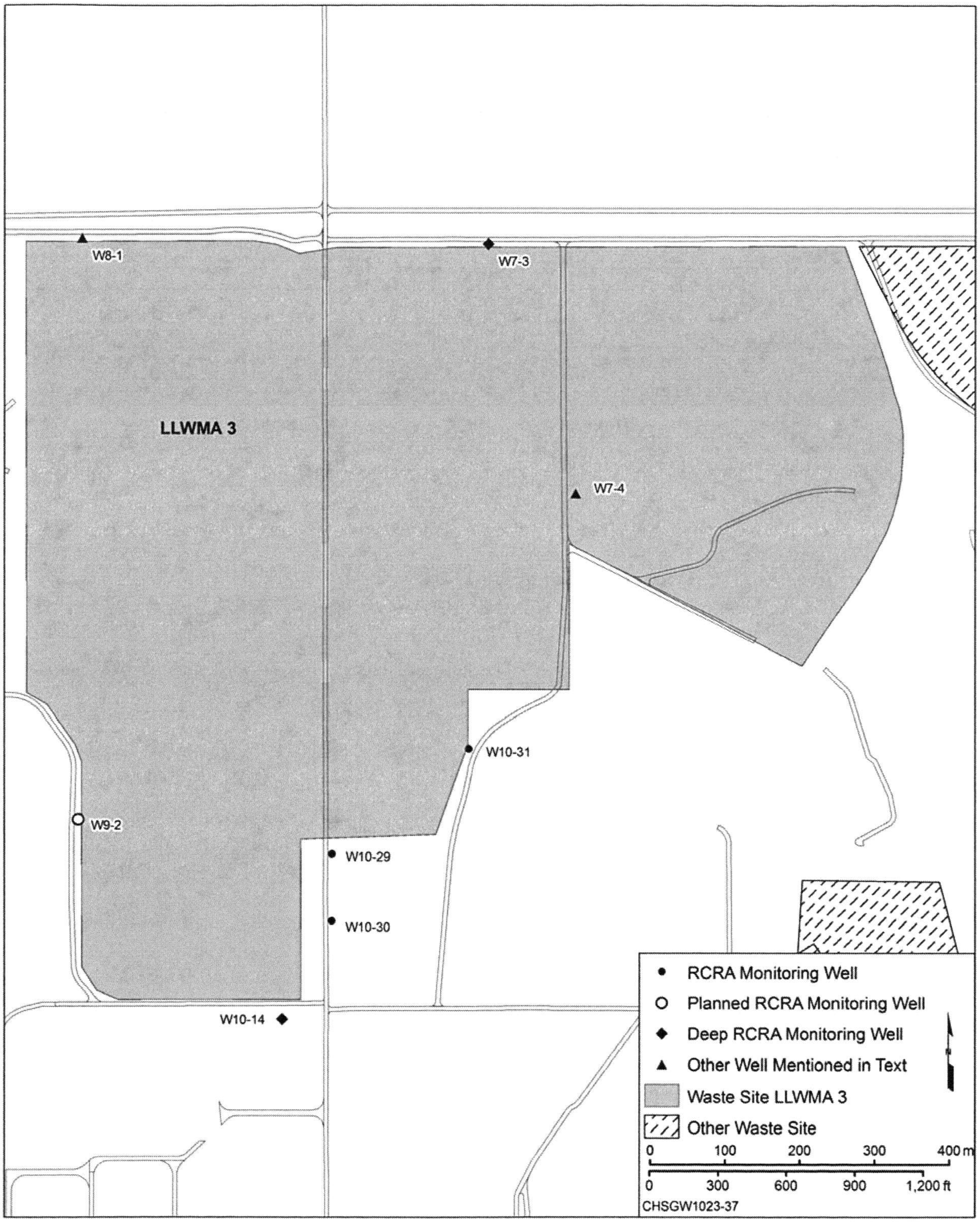

Figure 3-1. Map Showing Locations of RCRA Monitoring Wells at LLWMA-3

Table 3-2. Attributes for Wells in LLWMA-3 Groundwater Monitoring Network

Well Name	Completion Date	Easting[a] (m)	Northing[a] (m)	Surface Elevation (m) (NAVD88)	March 2010 Groundwater Elevation (m) (amsl)	Open Interval Bottom (m) (amsl)	Water Remaining (m)
299-W9-2[b]	TBD	565741.50	136871.60	223.50	NA	TBD	TBD
299-W10-29	3/13/06	566082.98	136828.74	211.62	135.70	126.27	9.43
299-W10-30	4/3/06	566082.78	136738.33	210.86	135.70	126.36	9.34
299-W10-31	5/10/06	566266.44	136968.34	209.67	135.28	125.85	9.43

a. Coordinates are in Washington State Plane (south zone), North American Datum of 1983 (NAD8 3[1983]); 1991 adjustment (NAD83); units are meters.

b. This upgradient well is scheduled to be drilled and constructed in late fiscal year 2011. Location and surface elevation are estimated from current pre-construction location data and may be subject to change.

amsl = above mean sea level

NAVD88 = North American Vertical Datum of 1988

NA = not applicable

TBD = to be determined

3.4 Differences Between This Plan and Previous Plan

There are several differences between this plan and the previous plan (PNNL-14859-ICN-2) in regard to the wells and analytes monitored, including three wells that have been removed from the network and one well that is inaccessible for sampling:

- **Well 299-W9-2:** This new upgradient well is scheduled to be constructed in late fiscal year 2011. Once completed, the well will allow data to be collected to determine upgradient groundwater conditions and will provide for statistical comparisons between upgradient and downgradient wells to resume.
- **Well 299-W7-3 and 299-W10-14:** These two wells are screened deep in the unconfined aquifer, and both have been monitored since 1988. Data from both wells have never been used for statistical comparisons at the LLWMA, and neither well has detected contamination, except for elevated nitrate. For these reasons, both wells have been removed from the monitoring network.
- **Well 299-W8-1:** This well was originally drilled as a downgradient well when groundwater flow direction was toward the north. Flow direction has subsequently changed to the east, and the well is now located cross-gradient from LLWMA-3. For this reason, well 299-W8-1 has been removed from the monitoring network.
- **Well 299-W7-4:** This well was originally drilled as a downgradient well before the 218-W-3AE Burial Ground was expanded. The well is now in the interior of the 218-W-3AE Burial Ground. A decision was made in 2008 to forbid vehicle access to the well due to safety concerns regarding cave-in potential, but in 2010 access was granted and the well was again added to the network. However, in early 2011 the well went dry and will be permanently removed from the network.

Two analytes have been removed from the LLWMA-3 analyte list. Mercury and lead have been removed from the analyte list because 20 years of monitoring for the constituents has shown that neither is a problem at LLWMA-3.

Groundwater quality parameter sampling frequency has been changed from semiannual to annual, which remains in compliance with 40 CFR 265.92(d)(1).

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4 Data Evaluation and Reporting

This chapter discusses data evaluation and reporting for LLWMA-3.

4.1 Data Review

Data review, validation, and verification are discussed in the QAPjP in Appendix A.

4.2 Statistical Evaluation

The goal of RCRA indicator evaluation monitoring is to determine if LLWMA-3 has affected groundwater quality beneath the site. For most RCRA treatment, storage, and disposal facilities at the Hanford Site, this is determined based on the results of specified statistical tests. The sampling procedures and statistical evaluation methods are based on 40 CFR 265, Subpart F (incorporated by reference in WAC 173-303-400). These interim status regulations require using a statistical method that compares mean concentrations of the four general contamination indicator parameters (i.e., TOC, TOX, pH, and specific conductance) in downgradient wells to background levels obtained from upgradient wells. Currently there are no upgradient wells at LLWMA-3, so statistical comparisons are not made for this LLWMA.

Upon completion of upgradient well 299-W9-2 and subsequent sampling, statistical comparisons will become applicable again and the basic procedure is as follows: For each of the four indicator parameters, the owner or operator must calculate the arithmetic mean and variance, based on at least four replicate measurements on each sample, for each well monitored, and then compare these results with the initial background arithmetic mean. The comparison must consider each of the individual wells in the monitoring system and must use the Student's t-test at the 0.01 level of significance to determine statistically significant increases (and decreases, in the case of pH) over initial background. Implementation of the statistical test method at the Hanford Site, including at LLWMA-3, is described in further detail in *Hanford Site Groundwater Monitoring: Setting, Sources, and Methods* (PNNL-13080); *Statistical Approach on RCRA Groundwater Monitoring Projects at the Hanford Site* (WHC-SA-1124-FP); and *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (EPA 530/R-09-007).

If comparisons for an upgradient well show a significant increase (or pH decrease), the information must be submitted in the Hanford Site annual groundwater report. If the comparisons for a downgradient well show a significant increase (or pH decrease), then the well is resampled and split samples are sent to different laboratories to determine if the exceedance of the comparison value was the result of laboratory error. In addition, the original samples may be re-analyzed if laboratory error is suspected.

If the exceedance of the statistical comparison value is confirmed by resampling, written notice is then provided to the regional administrator within 7 days that the facility may be affecting groundwater quality. Within 15 days after the notification, a groundwater quality assessment program must be developed and submitted. In some instances, it is possible to immediately determine that the statistical finding is not the result of contamination from the facility. In that case, the regional administrator is notified and an assessment program is not instituted.

4.3 Interpretation

After the data are validated and verified, acceptable data are used to interpret groundwater conditions at LLWMA-3. Interpretive techniques include the following:

- **Hydrographs:** Graph water levels versus time to determine decreases, increases, seasonal, or manmade fluctuations in groundwater levels.
- **Water table maps:** Use of water table elevations from multiple wells to construct contour maps and to estimate flow directions. Groundwater flow is assumed to be perpendicular to lines of equal potential on the maps.
- **Trend plots:** Graph concentrations of constituents versus time to determine increases, decreases, and fluctuations. May be used in tandem with hydrographs and/or water table maps to determine if concentrations relate to changes in water level or groundwater flow directions.
- **Plume maps:** Mapped distributions of chemical constituent concentrations in the aquifer to determine the extent of contamination. Changes in plume distribution over time assist in determining plume movement and direction of groundwater flow.
- **Contaminant ratios:** Can sometimes be used to distinguish among different sources of contamination.

4.4 Annual Determination of Monitoring Network

The RCRA groundwater monitoring requirements include an annual evaluation of the groundwater monitoring network to determine if the network remains adequate to monitor the LLWMA. The network must include upgradient and downgradient wells in the uppermost aquifer.

The groundwater flow direction beneath LLWMA-3 may change in the future due to discharges at the State-Approved Land Disposal Site (north of the LLWMA) or changes in extraction and injection associated with the 200-ZP-1 OU pump-and-treat system. The 200-ZP-1 pump-and-treat system is currently being expanded and is expected to begin operations in late 2011. The expansion has delayed proposing new monitoring well construction until after the anticipated large effects of the expanded pump-and-treat system are measured. However, an evaluation has determined an upgradient well can be drilled and completed near mixed waste Trenches 31 and 34 that would be functional even with the impact of the expanded 200-ZP-1 pump-and-treat system. This new RCRA well (299-W9-2) has been approved in accordance with Tri-Party Agreement (Ecology et al., 1989) Milestone M-24-00.

Water-level measurements will be collected before each sampling event. A more comprehensive set of water-level measurements is made in the northern portion of the 200 West Area during March of each year, and the data are presented in the annual groundwater monitoring report (e.g., DOE/RL-2010-11).

4.5 Reporting and Notification

The results of indicator evaluation monitoring are reported annually in accordance with the requirements of 40 CFR 265.94, "Recordkeeping and Reporting." Reporting will be made in annual Hanford Site groundwater monitoring reports (e.g., DOE/RL-2010-11).

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Appendix A

Quality Assurance Project Plan

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Contents

Figure

Tables

Terms

CRDL	contract-required detection limit
DOE	U.S. Department of Energy
DQO	data quality objective
DUP	laboratory matrix duplicate
EB	equipment blank
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FTB	full trip blank
FXR	field transfer blank
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Documents*
HEIS	Hanford Environmental Information System
IC	ion chromatography
ICP/MS	inductively coupled plasma/mass spectrometry
LCS	laboratory control sample
MB	method blank
MDA	minimum detectable activity
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Operations Office
RPD	relative percent difference
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSD	treatment, storage, and disposal

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A Quality Assurance Project Plan

The contractor's quality assurance (QA) program describes the contractor's QA structure, requirements, implementation methods, and responsibilities. The contractor's environmental QA program plan provides the requirements for collecting and assessing environmental data in accordance with the following:

- 10 CFR 830, Subpart A, "Nuclear Safety Management," "Quality Assurance Requirements"
- DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents* (HASQARD)
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans*
- U.S. Department of Energy (DOE) O 414.1C, *Quality Assurance*

This quality assurance project plan (QAPjP) establishes the quality requirements for environmental data collection including the planning, implementation, and assessment of sampling, field measurements, and laboratory analyses. Section 6.5 and 7.8 of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al., 1989a), Attachment 2, "Action Plan," require that QA/quality control (QC) and sampling and analysis activities specify the QA requirements for treatment, storage, and disposal (TSD) units, as well as for past-practice processes. The HASQARD requirements (DOE/RL-96-68) also apply to this work.

The content of this QAPjP is patterned after the QA elements of EPA/240/B-01/003. The QAPjP demonstrates conformance to the Part B requirements of *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use* (ANSI/ASQ E4). This QAPjP is divided into four sections (designated in EPA/240/B-01/003) that describe the quality requirements and controls applicable to this investigation. This QAPjP is intended to supplement the contractor's environmental QA program plan.

A1 Project Management

This section addresses the basic aspects of project management and will ensure that the project has defined goals, that the participants understand the goals and the approaches used, and that the planned outputs are appropriately documented.

A1.1 Project/Task Organization

The project organization in regard to planning, sampling, analysis, and data assessment is described in the following subsections and is shown in Figure A-1. For each functional primary contractor role, there is a corresponding oversight role within DOE.

A1.1.1 Regulatory Project Manager

The Washington State Department of Ecology (Ecology) project manager is responsible for oversight of the work being performed under this groundwater monitoring plan. Ecology will work with the DOE Richland Operations Office (RL) to resolve concerns regarding the work as described in this QAPjP. Ecology can request this plan during a regulatory compliance inspection for review.

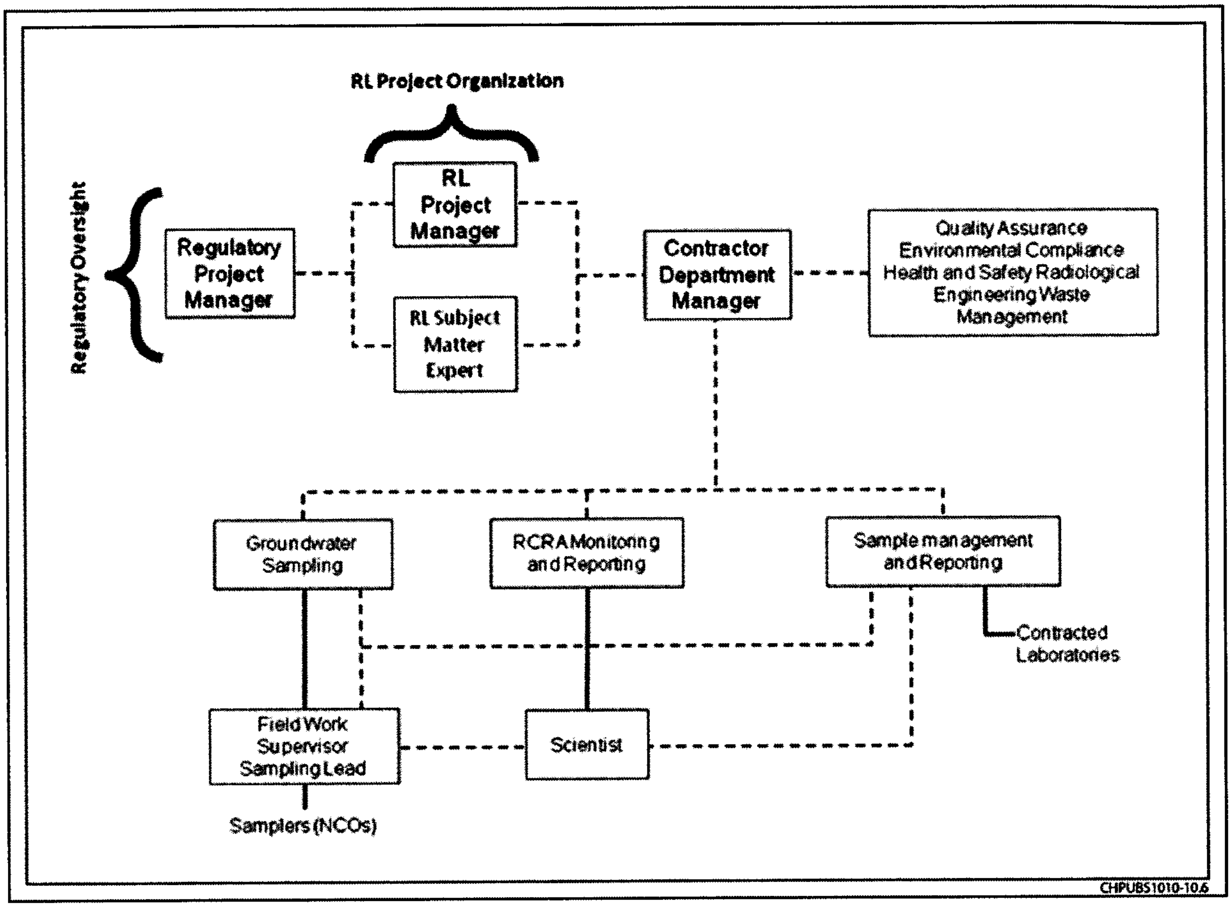

Figure A-1. Project Organization

A1.1.2 U.S. Department of Energy, Richland Operations Office Project Manager

Hanford Site cleanup is the responsibility of RL. The RL project manager is responsible for authorizing the contractor to perform activities under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*; the *Resource Conservation and Recovery Act of 1976* (RCRA); the *Atomic Energy Act of 1954*; and the Tri-Party Agreement for the Hanford Site.

A1.1.3 U.S. Department of Energy, Richland Operations Office Subject Matter Expert

The RL subject matter expert is responsible for day-to-day oversight of the contractor's performance of workscope, for working with the contractor and the regulatory agencies to identify and work through issues, and for providing technical input to the RL project manager.

A1.1.4 Contractor Groundwater Remediation Department Manager

The contractor groundwater remediation department manager provides oversight for all activities and coordinates with DOE, the regulators, and primary contractor management in support of sampling and reporting activities. The remediation department manager also provides support to the RCRA Monitoring and Reporting manager to ensure that work is performed safely and cost effectively.

A1.1.5 Groundwater Sampling Operations

Groundwater sampling operations is responsible for planning and coordinating field sampling resources and provides the field work supervisor for routine groundwater sampling operations. The field work supervisor directs the samplers, who collect groundwater samples in accordance with the sampling and analysis plan, and corresponding standard procedures and work packages. The samplers also complete field logbook and chain-of-custody forms, including any shipping paperwork, and ensure delivery of samples to the analytical laboratory.

A1.1.6 RCRA Monitoring and Reporting

The RCRA Monitoring and Reporting manager is responsible for direct management of activities performed to meet RCRA TSD monitoring requirements. The RCRA Monitoring and Reporting manager coordinates with and reports to DOE and primary contractor management regarding RCRA TSD monitoring requirements. The RCRA Monitoring and Reporting manager assigns scientists to provide technical expertise.

A1.1.7 Sample Management and Reporting Organization

The Sample Management and Reporting organization coordinates laboratory analytical work to ensure that laboratories conform to HASQARD requirements (or their equivalent), as approved by DOE, the U.S. Environmental Protection Agency (EPA), and Ecology. Sample Management and Reporting receives analytical data from the laboratories, performs data entry into the Hanford Environmental Information System (HEIS) database, and arranges for data validation. Sample Management and Reporting is responsible for informing the RCRA Monitoring and Reporting manager of any issues reported by the analytical laboratories.

A1.1.8 Contract Laboratories

The contract laboratories analyze samples in accordance with established procedures and provide necessary sample reports and explanations of results to support data validation. The laboratories must meet site-specific QA requirements and must have an approved QA plan in place.

A1.1.9 Quality Assurance

The QA point of contact is matrixed to the subject matter expert and is responsible for QA issues on the project. Responsibilities include overseeing implementation of the project QA requirements; reviewing project documents, including data quality objective (DQO) summary reports, sampling and analysis plans, and the QAPjP; and participating in QA assessments on sample collection and analysis activities, as appropriate. The QA point of contact must be independent of the unit generating the data.

A1.1.10 Environmental Compliance Officer

The environmental compliance officer provides technical oversight, direction, and acceptance of project and subcontracted environmental work, and also develops appropriate mitigation measures with the goal of minimizing adverse environmental impacts.

A1.1.11 Health and Safety

The Health and Safety organization is responsible for coordinating industrial safety and health support within the project as carried out through health and safety plans, job hazard analyses, and other pertinent safety documents required by federal regulations or by internal primary contractor work requirements.

A1.1.12 Waste Management

Waste Management communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner.

A1.2 Problem Definition/Background

The problem definition, as required by WAC 173-303-400 ("Dangerous Waste Regulations," "Interim Status Facility Standards") and 40 CFR 265, Subpart F ("Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Groundwater Monitoring"), is outlined in the main text discussion of this monitoring plan. The background is also provided in the monitoring plan.

A1.3 Project/Task Description

The project description is provided in Chapters 3 and 4 of this monitoring plan and includes the selection of appropriate dangerous waste or dangerous waste constituents, collection and analyses of groundwater from the monitoring network, interpretation of analytical results, evaluation of the monitoring network, and reporting.

The target analytes, along with the monitoring wells and frequency of sampling, are provided in Chapter 3.

A1.4 Quality Objectives and Criteria

The quality objectives and criteria for groundwater monitoring are defined in the tables provided in this QAPjP in order to meet the evaluation requirements stated in the monitoring plan.

A1.5 Special Training/Certification

Workers receive a level of training that is commensurate with their responsibility of collecting and transporting groundwater samples according to the Dangerous Waste Training Plan maintained for the TSD unit to meet the requirements of WAC 173-303-330, "Personnel Training." The field work supervisor, in coordination with line management, will ensure that all field personnel meet training requirements.

A1.6 Documents and Records

The project scientist is responsible for ensuring that the current version of the groundwater monitoring plan is used and for providing any updates to field personnel. Version control is maintained by the administrative document control process. Significant changes to the plan that affect DQOs will be reviewed and approved by DOE and the regulatory agency prior to implementation. Table A-1 defines the types of changes that may be made to the sampling design and the documentation requirements.

Logbooks and data forms are required for field activities. The logbook must be identified with a unique project name and number. Individuals responsible for the logbooks shall be identified in the front of the logbook, and only authorized individuals may make entries into the logbooks. Logbooks will be controlled in accordance with internal work requirements and processes.

The HEIS database will be identified as a data repository for the Hanford Facility Operating Record unit file. Records may be stored in either electronic or hardcopy format. Documentation and records, regardless of medium or format, are controlled in accordance with internal work requirements and processes that ensure accuracy and retrievability of stored records. Records required by the Tri-Party Agreement will be managed in accordance with the requirements therein.

Table A-1. Actions and Documentation for Regulatory Notification

Type of Change	Action	Documentation
Temporary addition of wells or constituents, or increased sampling frequency	RCRA Monitoring and Reporting manager approval; notify regulatory agency, if appropriate	Project's schedule tracking system
Unintentional impact to groundwater monitoring plan including one-time missed well sampling due to operational constraints, delayed sample collection, broken pump, lost bottle set, missed sampling of indicator parameters, loss of samples in transit, etc.	Electronic notification	RCRA annual report
Planned change to groundwater monitoring activities, including addition or deletion of constituents or wells, change of sampling frequency, etc.	Revise monitoring plan	Revised RCRA groundwater monitoring plan
Anticipated unavoidable changes (e.g., dry wells)	Electronic notification; revise monitoring plan	RCRA annual report and revised groundwater monitoring plan

The results of groundwater monitoring are reported annually in accordance with the requirements of 40 CFR 265.94, "Recordkeeping and Reporting." Reporting will be made in annual Hanford Site groundwater monitoring reports (e.g., DOE/RL-2010-11, *Hanford Site Groundwater Monitoring and Performance Report for 2009: Volumes 1 & 2*).

A2 Data Generation and Acquisition

This section addresses data generation and acquisition to ensure that the project's methods for sampling, measurement and analysis, data collection or generation, data handling, and QC activities are appropriate and documented.

A2.1 Sampling Process Design (Experimental Design)

The sampling design is based on regulatory requirements and judgmental sampling.

A2.1.1 Regulatory Requirements

The groundwater protection regulations of WAC 173-303-400 dictate the groundwater sampling and analysis requirements applicable to interim status TSD units.

A2.1.2 Judgmental Sampling

The selection of sampling and analysis requirements is based on knowledge of the feature or condition under investigation and is also based on professional judgment. The TSD unit monitoring is based on professional judgment. Conclusions depend on the validity and accuracy of professional judgment.

A2.2 Sampling Methods

Sampling is described in the contractor's environmental QA program plan, including the following:

- Field sampling methods
- Sample preservation, containers, and holding times
- Corrective actions for sampling activities
- Decontamination of sampling equipment

The groundwater sampling operations supervisor must ensure that situations that may impair the usability of samples and/or data are documented in field logbooks or on nonconformance report forms in accordance with internal corrective action procedures, as appropriate. The groundwater sampling operations supervisor will note any deviations that occur from the standard procedures for sample collection, contaminants of potential concern, sample transport, or monitoring. The groundwater sampling operations supervisor is also responsible for coordinating all activities related to the use of field monitoring equipment (e.g., dosimeters and industrial hygiene equipment). Field personnel will document in the logbook all noncompliant measurements taken during field sampling. Ultimately, the groundwater sampling operations supervisor is responsible for developing, implementing, and communicating corrective action procedures; for documenting all deviations from procedure; and for ensuring that immediate corrective actions are applied to field activities. Problems with sample collection, custody, or data acquisition that adversely impact data quality or impair the ability to acquire data or failure to follow procedure will be documented in accordance with internal corrective action procedures, as appropriate.

A2.3 Sample Handling and Custody

A sampling and data tracking database is used to track samples from the point of collection through the laboratory analysis process. Laboratory analytical results are entered and maintained in the HEIS database. Each sample is identified and labeled with a unique HEIS sample number. The contractor's environmental QA program plan specifies sample handling information, including the following:

- Container requirements
- Container labeling and tracking process
- Sample custody requirements
- Shipping and transportation

Sample custody during laboratory analysis is addressed in the applicable laboratory's standard operating procedures. Laboratory custody procedures will ensure that sample integrity and identification are maintained throughout the analytical process. Storage of samples at the laboratory will be consistent with laboratory instructions prepared by the Sample Management and Reporting organization.

A2.4 Analytical Methods

Information on analytical methods is provided in Table A-2. These analytical methods are controlled in accordance with the laboratory's QA plan and the requirements of this QAPjP. The primary contractor participates in oversight of offsite analytical laboratories to qualify the laboratories for performing Hanford Site analytical work.

Table A-2. Preservation Techniques, Analytical Methods Used, and Current Method Quantitation Limits for Continuing Constituents

Constituent	Collection and Preservation[a]	Analysis Methods[b]	Method Quantitation Limit (µg/L)[c]
Contamination Indicator Parameters			
Total organic carbon	G/P, HCL to pH <2	SW-846[d] Method 9060	1,000
Total organic halides	G, H_2SO_4 to pH <2, no head space	SW-846[d] Method 9020	20
Metals Analyzed by ICP Method – Unfiltered/Filtered			
Calcium	P, HNO_3 to pH <2	SW-846[d] Method 6010B/C, SW-846 Method 6020[e], or EPA/600 Method 200.8[e]	1,000
Cadmium			5
Sodium			500
Manganese			5
Potassium			4,000
Iron			50
Magnesium			750
Anions by IC			
Bromide	P	EPA/600 Method 300.0[f]	250
Chloride			200
Fluoride			500
Nitrate			250
Nitrite			250
Phosphate			500
Sulfate			500
Other			
Alkalinity	G/P	Standard Method[g] 2320, EPA/600 Method 310.1, EPA/600 Method 310.2	5,000
Conductivity, field	Field measurement	Instrument/meter	1 µohm
Dissolved oxygen, field	Field measurement	Instrument/meter	0 mg/L
pH, field measurement	Field measurement	Instrument/meter	0.1
Phenol	G	SW-846 Method 8040, SW-846 Method 8041, SW-846 Method 8270D	5 5 10

Table A-2. Preservation Techniques, Analytical Methods Used, and Current Method Quantitation Limits for Continuing Constituents

Constituent	Collection and Preservation[a]	Analysis Methods[b]	Method Quantitation Limit (µg/L)[c]
Temperature	Field measurement	Instrument/meter	
Turbidity, field measurement	Field measurement	Instrument/meter	0.1 NTU

a. All samples will be collected in plastic (P) or glass (G) containers and will be cooled to 4°C upon collection.

b. Constituents grouped together are analyzed by the same method, unless otherwise indicated.

c. Detection limit units, unless otherwise indicated.

d. SW-846, *Methods for Evaluation of Solid Waste: Physical/Chemical Methods.*

e. SW-846 Method 6010 is the preferred method; however, Method 6020 or EPA/600 Method 200.8 may be used, as long as the method quantitation limit listed is met.

f. Analytical method adapted from Method 300.0, *Test Methods for Determination of Inorganic Anions in Water by Ion Chromatography* (EPA-600/4-84-017).

g. *Standard Methods for the Examination of Water and Wastewater* (APHA et al., 2005).

Laboratories providing analytical services in support of this QAPjP will report errors to the Sample Management and Reporting project coordinator, who will then initiate a sample disposition record. The error-reporting process is intended to document analytical errors and the resolution of those errors with the project scientist. The corrective action program addresses the following:

- Evaluation of impacts of laboratory QC failures on data quality
- Root-cause analysis of QC failures
- Evaluation of recurring conditions that are adverse to quality
- Trend analysis of quality-affecting problems
- Implementation of a quality improvement process
- Control of nonconforming materials that may affect quality

A2.5 Quality Control

The QC procedures must be followed in the field and laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross-contamination and to provide information pertinent to field variability. Field QC for sampling will require the collection of field replicates (duplicates), trip or field blanks, and equipment blanks. Laboratory QC samples estimate the precision and bias of the analytical data. Field and laboratory QC samples are summarized in Table A-3.

A2.5.1 Field Quality Control Samples

Field QC samples will be collected to evaluate the potential for cross-contamination and field sampling performance. The QC samples and the required frequency for collection are described in this section.

Full trip blanks (FTBs) are prepared by the sampling team prior to traveling to the sampling site. The FTB is filled with high-purity reagent water. The bottles are sealed and transported, unopened, to the field in the same storage containers used for samples collected that day. Collected FTBs are analyzed for the same constituents as the samples. The FTBs are used to evaluate potential contamination of the samples due to the sample bottles, preservative, handling, storage, or transportation.

Table A-3. QC Samples

Sample Type	Primary Characteristics Evaluated	Frequency
Field QC		
Full trip blank	Contamination from containers or transportation	1 per 20 well trips
Field transfer blank	Contamination from sampling site	1 each day; volatile organic compounds sampled
Equipment blank	Contamination from nondedicated equipment	As needed[a]
Replicate/duplicate samples	Reproducibility	1 per 20 well trips
Laboratory QC		
Method blanks	Laboratory contamination	1 per batch
Laboratory duplicates	Laboratory reproducibility	See footnote[b]
Matrix spikes	Matrix effect and laboratory accuracy	See footnote[b]
Matrix spike duplicates	Laboratory reproducibility/accuracy	See footnote[b]
Surrogates	Recovery/yield	See footnote[b]
Laboratory control samples	Method accuracy	1 per batch

a. For portable Grundfos® (registered trademark of Grundfos Pumps Corporation, Colorado Springs, Colorado) pumps, equipment blanks are collected 1 per 10 well trips. Whenever a new type of nondedicated equipment is used, an equipment blank shall be collected every time sampling occurs until it can be shown that less frequent collection of equipment blanks is adequate to monitor the decontamination procedure for the nondedicated equipment.

b. As defined in the laboratory contract or quality assurance plan, and/or analysis procedures.

Field transfer blanks (FXRs) are preserved volatile organic analysis sample bottles that are filled at the sample collection site with high-purity reagent water that has been transported to the field. After collection, FXR bottles are sealed and placed in the same storage containers with the samples from the associated sampling event. The FXR samples are analyzed for volatile organic compounds only. The FXRs are used to evaluate potential contamination caused by conditions in the field.

Equipment blanks (EBs) are samples in which high-purity reagent water is passed through the pump or placed in contact with the sampling surfaces of the equipment to collect blank samples identical to the sample set that will be collected. The EB bottles are placed in the same storage containers with the samples from the associated sampling event. The EB samples are analyzed for the same constituents as the samples from the associated sampling event. The EBs are used to evaluate the effectiveness of the cleaning process to ensure that samples are not cross-contaminated from previous sampling events.

For the field blanks (i.e., FTBs, FXRs, and EBs), results above two times the method detection limit are identified as suspected contamination. However, for common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the limit is five times the method detection limit.

Field duplicates, also known as replicates, are two samples that are collected as close as possible to the same time and same location, and they are intended to be identical. Field duplicates are stored and transported together and are analyzed for the same constituents. The field duplicates are used to determine precision for both sampling and laboratory measurements. The results of the field duplicates must have precision within 20 percent, as measured by the relative percent difference. Only field duplicates with at least one result greater than five times the method detection limit or minimum detectable activity are evaluated.

Double-blind samples contain a concentration of analyte known to the supplier but unknown to the analyzing laboratory. The laboratory is not informed that the samples are QC samples. The project submits double-blind samples to assess analytical precision and accuracy.

A2.5.2 Laboratory Quality Control Samples

The laboratory QC samples (e.g., method blanks, laboratory control sample/blank spikes, and matrix spikes) are defined in Chapter 1 of SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, and will be run at the frequency specified in that reference, unless superseded by agreement.

A2.5.3 Quality Control Requirements

Table A-4 lists the acceptance criteria for QC samples, and Table A-5 lists the acceptable recovery limits for the double-blind standards. These samples are prepared by spiking Hanford Site background well water with known concentrations of constituents of interest. Spiking concentrations range from the detection limit to the upper limit of concentration determined in groundwater on the Hanford Site. Investigations shall be conducted for double-blind standards that are outside of acceptance limits. The results from these standards are used to determine the acceptability of the associated parameter data.

Table A-4. Field and Laboratory QC Elements and Acceptance Criteria

Method[a]	QC Element	Acceptance Criteria	Corrective Action
General Chemical Parameters			
Alkalinity Conductivity pH Total organic carbon Total organic halides	MB[b]	<MDL	Flagged with "C"
	LCS	80-120% recovery[c]	Data reviewed[d]
	DUP	≤20% RPD[c]	Data reviewed[d]
	MS[e]	75-125% recovery[c]	Flagged with "N"
	EB, FTB	<2 times MDL	Flagged with "Q"
	Field duplicate	≤20% RPD[f]	Flagged with "Q"
Anions			
Anions by IC	MB	<MDL	Flagged with "C"
	LCS	80-120% recovery[c]	Data reviewed[d]
	DUP	≤20% RPD[c]	Data reviewed[d]
	MS	75-125% recovery[c]	Flagged with "N"
	EB, FTB	<2 times MDL	Flagged with "Q"
	Field duplicate	≤20% RPD[f]	Flagged with "Q"

Table A-4. Field and Laboratory QC Elements and Acceptance Criteria

Method[a]	QC Element	Acceptance Criteria	Corrective Action
Metals			
ICP metals ICP/MS metals	MB	<CRDL	Flagged with "C"
	LCS	80-120% recovery[c]	Data reviewed[d]
	MS	75-125% recovery[c]	Flagged with "N"
	MSD	≤20% RPD[c]	Data reviewed[d]
	EB, FTB	<2 times MDL	Flagged with "Q"
	Field duplicate	≤20% RPD[f]	Flagged with "Q"

a. Refer to Table A-2 for specific analytical methods.

b. Does not apply to pH.

c. Laboratory-determined, statistically derived control limits may also be used. Such limits are reported with the data.

d. After review, corrective actions are determined on a case-by-case basis. Corrective actions may include a laboratory recheck or flagging the data as suspect ("Y" flag) or rejected ("R" flag).

e. Applies to total organic carbon and total organic halides only.

f. Applies only in cases where one or both results are greater than five times the detection limit.

Data flags:

C = possible laboratory contamination (analyte was detected in the associated method blank)

N = result may be biased (associated matrix spike result was outside the acceptance limits)

Q = problem with associated field QC sample (blank and/or duplicate results were out of limits)

Table A-5. Blind Standard Constituents and Schedule

Constituents	Frequency	Accuracy (%)	Precision (% RSD)[a]
Carbon tetrachloride	Quarterly	±25%	≤25%
Chloroform	Quarterly	±25%	≤25%
Trichloroethylene	Quarterly	±25%	≤25%
Fluoride	Quarterly	±25%	≤25%
Nitrate	Quarterly	±25%	≤25%
Cyanide	Quarterly	±25%	≤25%
Chromium	Annually	±20%	≤25%
TOC[b]	Quarterly	Varies according to spiking compound	Varies according to spiking compound

Table A-5. Blind Standard Constituents and Schedule

Constituents	Frequency	Accuracy (%)	Precision (% RSD)[a]
TOX[c]	Quarterly	Varies according to spiking compound	Varies according to spiking compound

a. If the results are less than five times the required detection limit, then the criterion is that the difference of the results of the replicates is less than the required detection limit.

b. The spiking compound generally used for TOC is potassium phthalate. Other spiking compounds may also be used.

c. Two sets of spikes for TOX will be used. The spiking compound for one set should be 2,4,5-trichlorophenol. The spiking compound for the second set should include the constituents used for the volatile organic compounds sample (carbon tetrachloride, chloroform, and trichloroethylene).

Holding time is the elapsed time period between sample collection and analysis. The contractor's environmental QA program plan provides a table with holding times. Exceeding the required holding times could result in changes in constituent concentrations due to volatilization, decomposition, or other chemical alterations. Recommended holding times depend on the analytical method, as specified in SW-846 or *Methods of Chemical Analysis of Water and Wastes* (EPA/600/4-79/020). Data associated with exceeded holding times are flagged with an "H" in the HEIS database. Data that exceed the holding time shall be maintained but potentially may not be used in statistical analyses.

Additional QC measures include laboratory audits and participation in nationally based performance evaluation studies. The contract laboratories participate in national studies such as the EPA-sanctioned Water Pollution and Water Supply Performance Evaluation studies. The groundwater project periodically audits the analytical laboratories to identify and solve quality problems, or to prevent such problems from occurring. Audit results are used to improve performance, and the summaries of audit results and performance evaluation studies are presented in the annual groundwater monitoring report.

Failure of QC will be determined and evaluated during data validation and the data quality assessment process. Data will be qualified, as appropriate.

A2.6 Instrument/Equipment Testing, Inspection, and Maintenance

Measurement and testing equipment used in the field or in the laboratory that directly affects the quality of analytical data will be subject to preventive maintenance measures to minimize measurement system downtime. Laboratories and onsite measurement organizations must maintain and calibrate their equipment. Maintenance requirements (e.g., documentation of routine maintenance) will be included in the individual laboratory and the onsite organization's QA plan or operating procedures, as appropriate. Maintenance of laboratory instruments will be performed in a manner consistent with SW-846, or with auditable HASQARD and contractual requirements. Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use.

A2.7 Instrument/Equipment Calibration and Frequency

Specific field equipment calibration information is provided in the environmental QA program plan. Standards used for calibration will be certified and traceable to nationally recognized performance standards. Analytical laboratory instruments and measuring equipment are calibrated in accordance with the laboratory's QA plan.

A2.8 Inspection/Acceptance of Supplies and Consumables

Supplies and consumables used to support sampling and analysis activities are procured in accordance with internal work requirements and processes that describe the contractor's acquisition system and the responsibilities and interfaces necessary to ensure that items procured/acquired for contractor meet the specific technical and quality requirements. The procurement system ensures that purchased items comply with applicable procurement specifications. Supplies and consumables are checked and accepted by users prior to use.

Supplies and consumables that are procured by the analytical laboratories are procured, checked, and used in accordance with the laboratory's QA plan.

A2.9 Nondirect Measurements

Nondirect measurements include data obtained from sources such as computer databases, programs, literature files, and historical databases. If evaluation includes data from historical sources, whenever possible such data will be validated to the same extent as the data generated as part of this effort. All data used in evaluations will be identified by source.

A2.10 Data Management

The Sample Management and Reporting organization, in coordination with the RCRA Monitoring and Reporting manager, is responsible for ensuring that analytical data are appropriately reviewed, managed, and stored in accordance with applicable programmatic requirements that govern data management procedures. Electronic data access, when appropriate, will be via a database (e.g., HEIS or a project-specific database). Where electronic data are not available, hardcopies will be provided in accordance with Section 9.6 of the Tri Party Agreement Action Plan (Ecology et al., 1989b). The HEIS database will be identified as a data repository for the Hanford Facility Operating Record unit file.

All field activities will be recorded in the field logbook.

Laboratory errors are reported to the Sample Management and Reporting organization on a routine basis. For reported laboratory errors, a sample disposition record will be initiated in accordance with contractor procedures. This process is used to document analytical errors and to establish resolution of the errors with the RCRA Monitoring and Reporting manager. Sample disposition records become a permanent part of the analytical data package for future reference and for records management.

A3 Assessment and Oversight

The elements discussed in this section address the activities for assessing the effectiveness of project implementation and the associated QA and QC activities. The purpose of the assessment is to ensure that the QAPjP is implemented as prescribed.

A3.1 Assessments and Response Actions

The contractor management, Regulatory Compliance, Quality, and/or Health and Safety organizations may conduct random surveillances and assessments to verify compliance with the requirements outlined in this QAPjP.

Oversight activities in the analytical laboratories, including corrective action management, are conducted in accordance with the laboratory's QA plan. The primary contractor conducts oversight of offsite analytical laboratories to qualify the laboratories for performing Hanford Site analytical work.

A3.2 Reports to Management

Reports to management on data quality issues will be made if and when these issues are identified. Issues reported by the laboratories are communicated to the Sample Management and Reporting organization, which initiates a sample disposition record in accordance with contractor procedures. This process is used to document analytical or sample issues and to establish resolution with the RCRA Monitoring and Reporting manager.

A4 Data Validation and Usability

The elements in this section address the QA activities that occur after the data collection phase of the project is completed. Implementation of these elements determines whether the data conform to the specified criteria, thus satisfying project objectives. These elements are further discussed in the contractor's environmental QA program plan.

A4.1 Data Review, Verification, and Validation

The criteria for verification may include review for completeness (e.g., all samples were analyzed as requested), use of the correct analytical method/procedure, transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct application of conversion factors. Laboratory personnel may perform data verification.

A4.2 Verification and Validation Methods

The work activities shall follow documented procedures and processes for data validation and verification, as summarized below. Validation of groundwater data consists of assessing whether the data collected and measured truly reflect aquifer conditions. Verification means assessing data accuracy, completeness, consistency, availability, and internal control practices to determine overall reliability of the data collected. Other DQOs that shall be met include proper chain-of-custody, sample handling, use of proper analytical techniques as applied for each constituent, and the quality and acceptability of the laboratory analyses conducted.

Groundwater monitoring staff perform checks on laboratory electronic data files for formatting, allowed values, data flagging (i.e., qualifiers), and completeness. Hardcopy results are verified to check for (1) completeness, (2) notes on condition of samples upon receipt by the laboratory, (3) notes on problems encountered during analysis of the samples, and (4) correct reporting of results. If data are incomplete or deficient, staff work with the laboratory to correct the problem found during the analysis.

The data validation process provides the requirements and guidance for validating groundwater data that are routinely collected. Validation is a systematic process of reviewing verified data against a set of criteria (provided in Section A2.5) to determine whether the data are acceptable for their intended use.

Results of laboratory and field QC evaluations, double-blind sample results, laboratory performance evaluation samples, and holding-time criteria are considered when determining data usability. Staff review the data to identify whether observed changes reflect changes in groundwater quality or potential data errors, and they may request data reviews of laboratory, field, or water-level data for usability purposes. The laboratory may be asked to check calculations or re-analyze the sample, or the well may be resampled. Results of the data reviews are used to flag the data appropriately in the HEIS database (e.g., "R" for reject, "Y" for suspect, or "G" for good) and/or to add comments.

A4.3 Reconciliation with User Requirements

The data quality assessment process compares completed field sampling activities to those proposed in corresponding sampling documents and provides an evaluation of the resulting data. The purpose of the data evaluation is to determine if quantitative data are of the correct type and are of adequate quality and quantity to meet project DQOs. The RCRA Monitoring and Reporting manager is responsible for determining if data quality assessment is necessary and for ensuring that, if required, one is performed. The results of the data quality assessment will be used in interpreting the data and determining if the objectives of this activity have been met.

A5 References

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