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Revision 0

FY2019 M-24-00 WELL INSTALLATION WORK INSTRUCTION FOR THE ENVIRONMENTAL RESTORATION DISPOSAL FACILITY AND 324 BUILDING

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

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

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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By Julia Raymer at 7:50 am, Jan 23, 2019

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Contents

1 Introduction 1

2 Facility Description 5

2.1 Environmental Restoration Disposal Facility Waste Site Description and History 5

2.2 324 Building Facility Description and History 5

2.3 Geology 6

3 Well Construction and Geologic Soil Logging 9

3.1 Geologic Soil Logging 9

3.2 Field Screening 11

3.3 Geophysical Logging 11

3.4 Corrective Actions and Deviations 11

3.5 Well Development 11

4 Waste Management 12

5 Quality Assurance 12

6 Health and Safety Plan 13

7 References 14

Figures

Figure 1. Hanford Site Location Map 2

Figure 2. Location Map of ERDF and Planned Groundwater Monitoring Wells 699-36-65 and 699-37-67 3

Figure 3. Location Map of the 324 Building and Planned Groundwater Monitoring Well 399-4-16 4

Figure 4. Stratigraphy of the Hanford Site 7

Figure 5. Generic Groundwater Monitoring Well Design 10

Tables

Table 1. Justification for the Drilling of Groundwater Monitoring Wells 4

Table 2. Estimated Upper Geologic Contacts and Depths to Water at Planned Wells 6

Table 3. Well Construction Information 11

Table 4. Performance Requirements for Field Measurements 12

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Terms

bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CHPRC	CH2M HILL Plateau Remediation Company
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
OU	operable unit
QA	quality assurance
RCRA	*Resource Conservation and Recovery Act of 1976*
TSD	treatment, storage, and disposal
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*

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1 Introduction

At the Hanford Site in southeastern Washington State, the installation of Milestone M-24-00 groundwater monitoring wells is negotiated annually by the Washington State Department of Ecology (Ecology), U.S. Department of Energy (DOE), and U.S. Environmental Protection Agency (EPA) pursuant to Ecology et al. (1989), *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement). The Tri-Party Agreement is a comprehensive cleanup and compliance agreement applicable to *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remedial action and *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and disposal (TSD) units on the Hanford Site.

This document describes the drilling and construction of three groundwater monitoring wells as directed by Tri-Party Agreement Milestone M-24-00. Two of the wells (699-36-65 and 699-37-67) are planned to evaluate subsurface conditions at the Environmental Restoration Disposal Facility (ERDF); the third well (399-4-16) will be constructed in the 300 Area and contribute to cleanup and monitoring efforts at the 324 Building. During drilling and well construction, geologic logging, geophysical logging, and field measurement collection will be performed. Laboratory sample analysis is not within the scope of this work instruction.

The locations of the Hanford Site, ERDF, and 300 Area are shown in Figure 1. The locations of the planned wells at ERDF and the 324 Building are shown in Figures 2 and 3, respectively. Justifications for the proposed wells are presented in Table 1.

Two additional M-24-00 groundwater monitoring wells (699-43-43B and 299-E27-40) will be drilled in the 200 East Area at the 216-B-3 Pond and Waste Management Area-C Tank Farm. A separate plan will address well construction and data collection requirements during drilling. The five planned M-24-00 groundwater monitoring wells are scheduled for construction in fiscal year 2019.

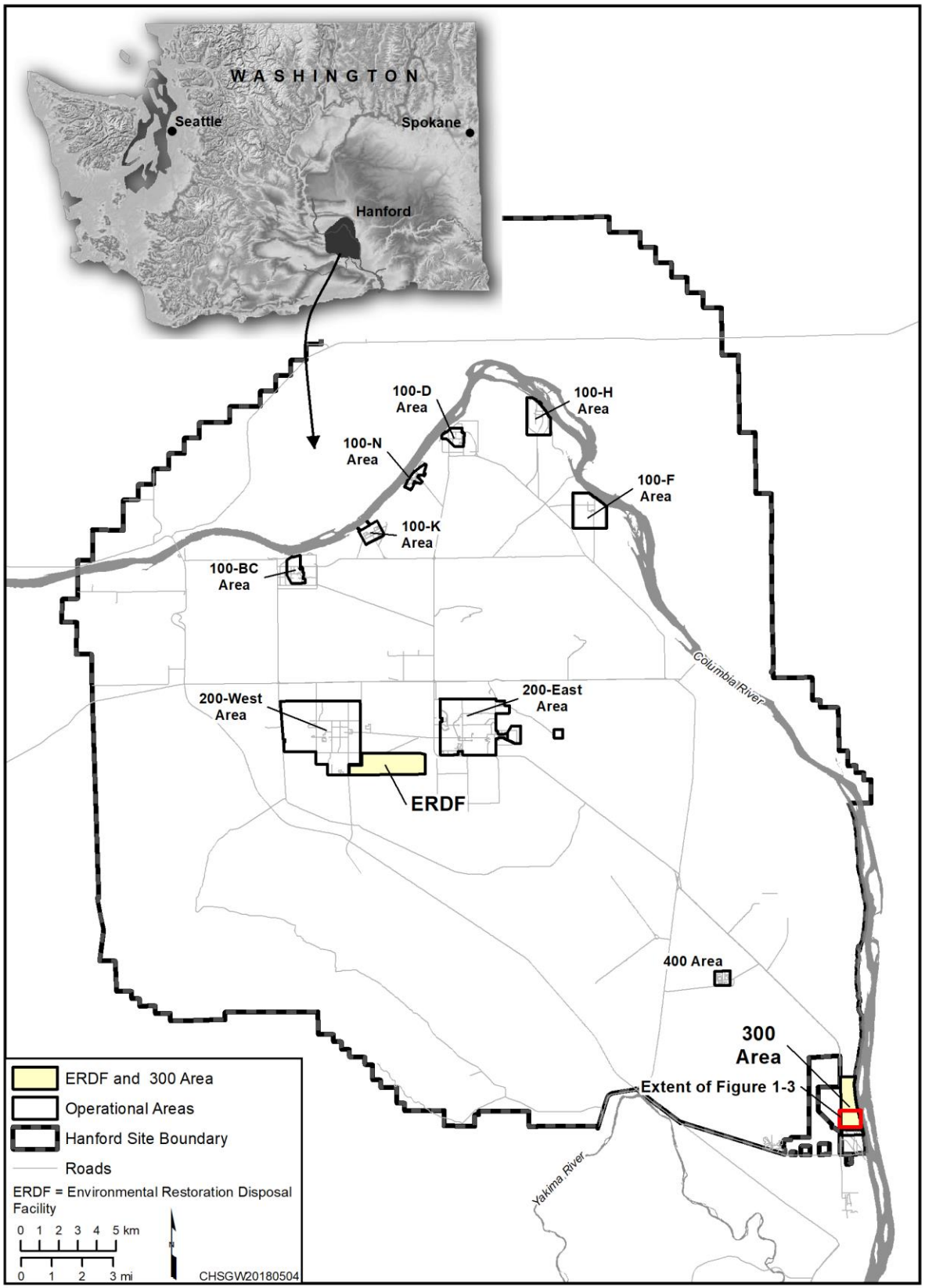


Figure 1. Hanford Site Location Map

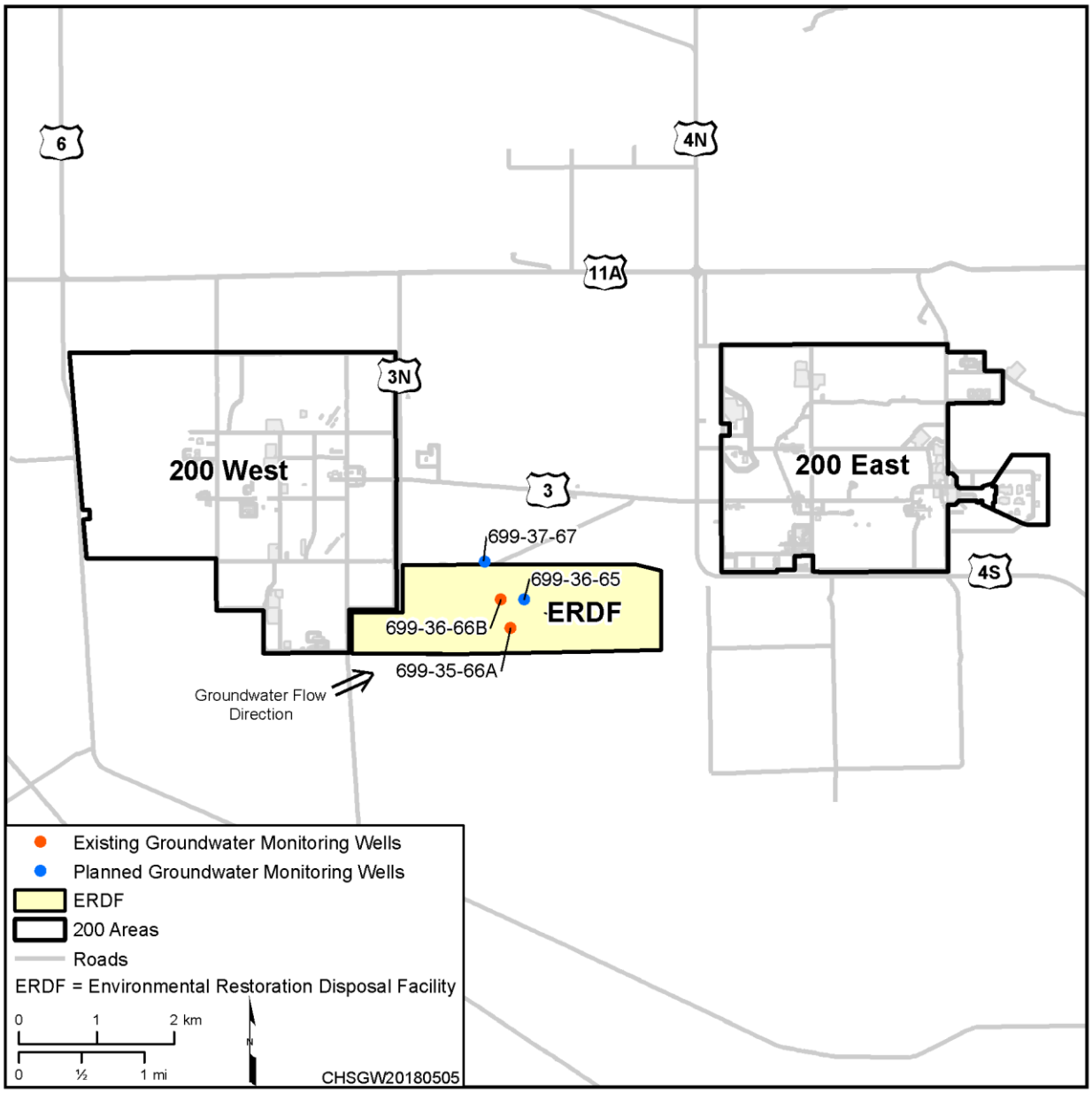


Figure 2. Location Map of ERDF and Planned Groundwater Monitoring Wells 699-36-65 and 699-37-67

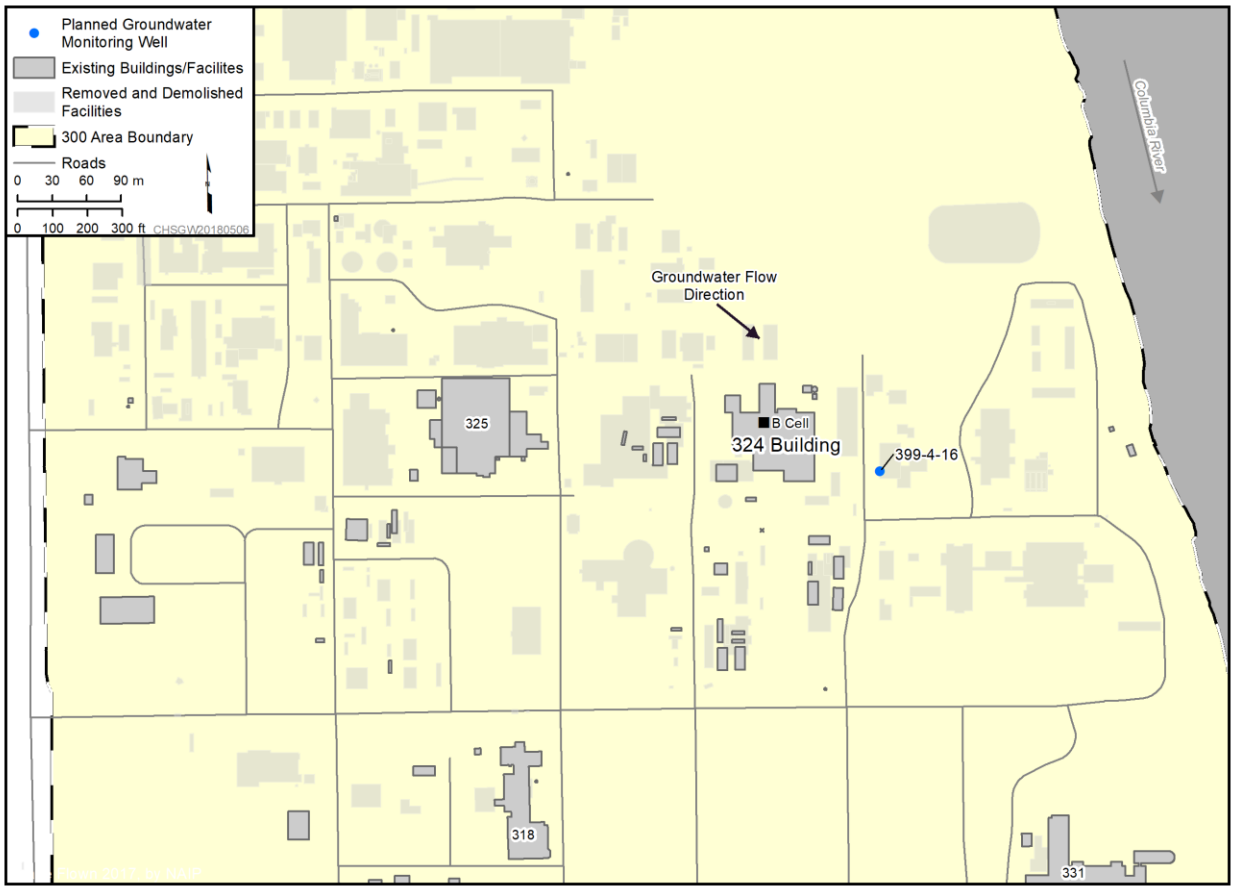


Figure 3. Location Map of the 324 Building and Planned Groundwater Monitoring Well 399-4-16

Table 1. Justification for the Drilling of Groundwater Monitoring Wells

Well		Facility	Justification
Name	ID		
699-36-65	C9871	ERDF	This well replaces well 699-36-66B and supports the expansion of ERDF.
699-37-67	C9953	ERDF	This well replaces noncompliant well 699-35-66A.
399-4-16	C9869	324 Building	In accordance with DOE/RL-2014-42, this well will be used to monitor potential contamination before, during, and after remediation of the 324 Building.

Reference: DOE/RL-2014-42, *300-FF-5 Operable Unit Remedy Implementation Sampling and Analysis Plan*.

ID = identification

ERDF = Environmental Restoration Disposal Facility

2 Facility Description

The facility description and history of ERDF and the 324 Building are presented in the following sections. Geology information relevant to drilling and well construction is also summarized.

2.1 Environmental Restoration Disposal Facility Waste Site Description and History

ERDF is an engineered disposal facility designed for low-level and mixed waste from the remediation of CERCLA past-practice units at the Hanford Site. Over the life of the facility, approval was obtained to allow the disposal of investigation-derived waste, decontamination and decommissioning waste from RCRA past-practice operable units (OUs) and closures, and non-RCRA waste from inactive TSD units.

ERDF began operating in 1996 and was originally designed to be a single 21 m (70 ft) deep trench consisting of two side-by-side cells with final dimensions of 433 m (1,420 ft) long by 219 m (720 ft) wide at the top of the trench. The two disposal cells had a total maximum waste capacity of approximately 2.5 million metric tons (2.8 million tons). In addition to the disposal cells, ERDF contains a transportation staging area, administration building, worker offices and change trailer, waste container staging area, leachate collection tanks, spoils pile used for daily operational cover, employee parking area, truck scale, and haul roads.

Three expansions of ERDF were completed, one each in 2000, 2004, and 2009. Expansions of the facility added six more cells with identical construction to the first two. A fourth and largest expansion of ERDF was completed in January 2011 when two “super cells” were added, each of which was equivalent to a pair of existing cells, expanding ERDF’s waste capacity to 14.9 million metric tons (16.4 million tons). Additional upgrades to the facility included new maintenance facilities, additional dump ramps and additional transfer areas for waste containers. At the 21 m (70 ft) base, ERDF covers the same area as 52 football fields.

One of the key components of ERDF is the RCRA double liner in each cell and leachate collection and recovery system. The liner consists of multiple layers of plastic and other impermeable materials and a system to collect and remove liquids as they drain through the waste materials. ERDF does not accept liquid waste for disposal, but water enters the facility when it rains and snows, and water also is used for dust control during routine operations. The collected water (leachate) is routed to an onsite treatment facility. After treatment, the liquid is clean enough to be returned to the ground with no harm to the environment. ERDF continues to operate to date and does not accept non-Hanford Site waste.

2.2 324 Building Facility Description and History

The 324 Building (Waste Technology Engineering Laboratory) is located in the 300 Area of the Hanford Site. Constructed between 1964 and 1966, the building was designed to allow for a high degree of versatility in completing complex and varied experimentation on highly radioactive materials. These activities included chemical processing and metallurgical engineering studies on highly radioactive materials and development of approaches for waste treatment and storage. The 324 Building operated until 1996. Facility stabilization and deactivation was completed after operation of the building in preparation for the decommissioning and demolition of the building. Environmental contamination will also be cleaned up and monitored.

The 324 Building is 62.5 by 71.6 m (205 by 235 ft) in plan and 13.7 m (45 ft) in height above ground level. The 324 Building has a partial basement and first, second, and partial third floors. The foundation structure is poured-in-place reinforced concrete, and the superstructure is insulated fluted steel industrial panel supported on a structural steel frame. The parapeted roof has a slightly sloped steel deck covered

with concrete with gravel-finished built-up roofing. The building consists of laboratory and administrative areas. The laboratories include two hot cell facilities, the Radiochemical Engineering Complex and the Shielded Materials Facility, and various low-activity analytical laboratories. The hot cells were used for high radiological activities and are heavily shielded and equipped for remote operations. The cells were equipped with cranes; remote manipulators; viewing windows; and various services including air, water, steam, and electrical power. The low-activity analytical laboratories were used for "bench top" or small-scale experiments, nondestructive examinations, and radiological systems or equipment design development. Other support facilities within the 324 Building included the high- and low-level vault areas equipped with tanks for the temporary storage of radioactive liquid wastes, storage vault for storing special nuclear material, craft shops, and administrative areas. To protect against releases of radioactive material from the hot cells to the environment, integral metal liners with sumps (i.e., without drains) were installed in the cells and tank vaults. Confinement of radioactive particulate matter within the shielded cells is provided by a directed airflow through a high-efficiency particulate air filtered ventilation system. As a result of residues and internal facility spills during the conduct of past activities, the facility contains areas with significant fixed and dispersible mixed waste contamination.

2.3 Geology

The geology discussion in this section is largely based on DOE/RL-2002-39, *Standardized Stratigraphic Nomenclature for Post-Ringold-Formation Sediments within the Central Pasco Basin*; Lindsey, 1996, *The Miocene to Pliocene Ringold Formation and Associated Deposits of the Ancestral Columbia River System, South-Central Washington and North-Central Oregon*; PNNL-14753, *Groundwater Data Package for Hanford Assessments*; PNNL-12261, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-East Area and Vicinity, Hanford Site, Washington*; and WHC-MR-0391, *Field Trip Guide to the Hanford Site*. Information specific to the planned construction of groundwater wells is based on the local geology near ERDF and the 324 Building.

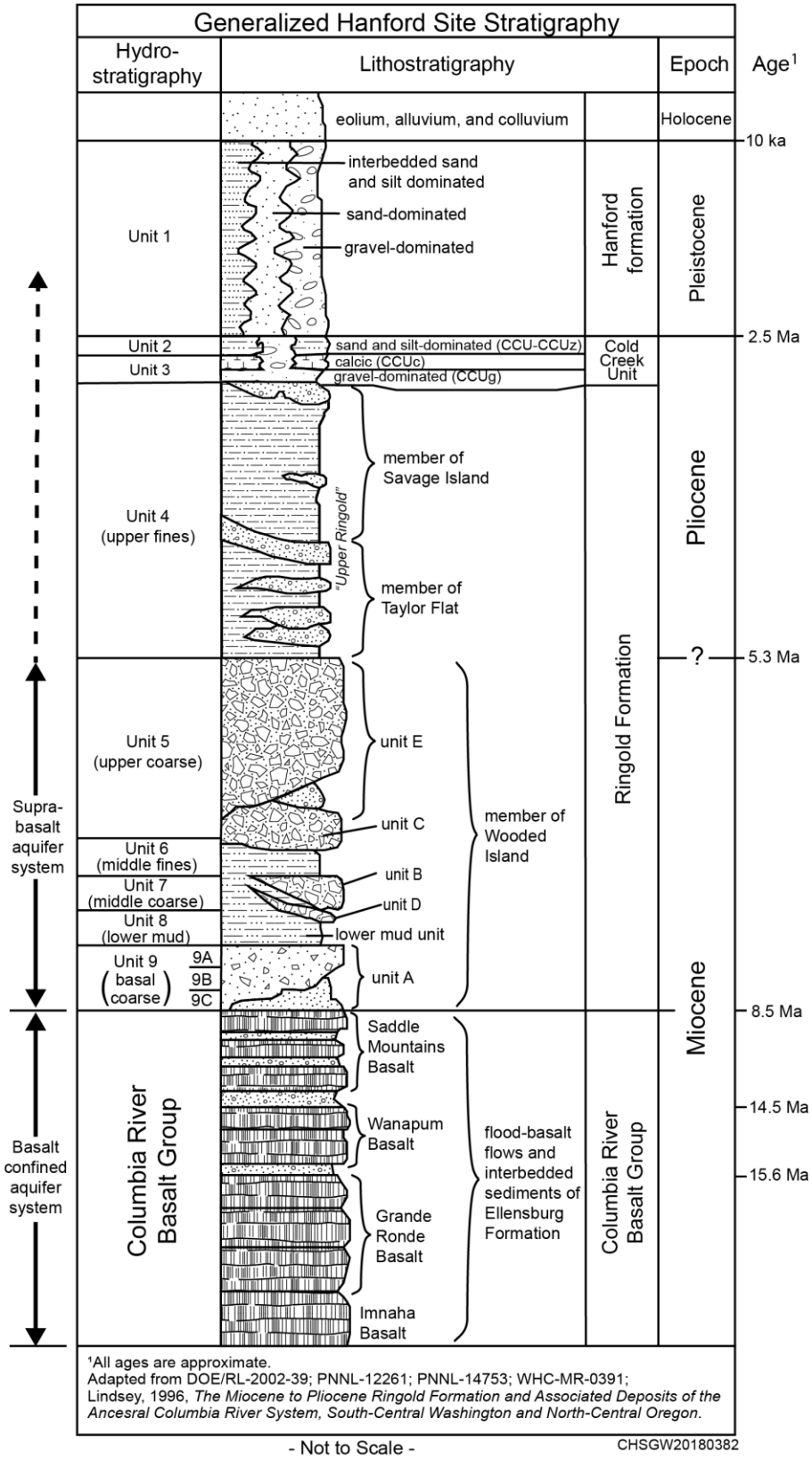
Sedimentary deposits of the Hanford Site (in descending order) include Holocene eolian sand, Hanford formation, Cold Creek unit, and Ringold Formation. These strata overlie basalt of the Columbia River Basalt Group. Stratigraphy and hydrostratigraphic units of the Hanford Site are shown in Figure 4. Estimated stratigraphic contacts and depth to water in the planned groundwater monitoring wells are shown in Table 2.

Table 2. Estimated Upper Geologic Contacts and Depths to Water at Planned Wells

Well Name	Facility	DTW (ft bgs)	Hanford Formation* (ft bgs)	Cold Creek Unit (ft bgs)	Ringold Formation (ft bgs)				Basalt (ft bgs)
					Taylor Flat	Unit E	Ringold Lower Mud	Unit A	
699-36-65	ERDF	302	0	NP	243	262	394	443	561
699-37-67	ERDF	305	0	210	223	256	383	422	535
399-4-16	324 Building	52	0	NP	NP	73	144	NP	189

*Holocene eolian sand may be present at the surface. The gravel- and sand-dominated sequence of the Hanford formation may be present.

bgs = below ground surface
DTW = depth to water
ERDF = Environmental Restoration Disposal Facility
NP = not present



Note: Complete reference citations are provided in Chapter 7.

Figure 4. Stratigraphy of the Hanford Site

Holocene eolian sand is present at the surface over much of the Hanford site. These generally less than 3 m (9.4 ft) thick, wind-blown recent deposits consist of very fine- to medium-grained sand to occasionally silty sand.

Where Holocene sand and exposures of basalt are not present at the surface at the Hanford Site, the Hanford formation is present. The Hanford formation consists of uncemented gravel, sands, and silts deposited by cataclysmic floodwaters 13,000 to 1 million years ago. These basalt-rich glaciofluvial deposits are divided into three sequences: gravel-, sand-, and silt-dominated sequences. The gravel-dominated sequence consists of cross-stratified, coarse-grained sands and granule to boulder gravel that contain minor intercalated silts. The gravels are uncemented and matrix poor. The sand-dominated sequence consists of well-stratified fine- to coarse-grained sand and granule gravel. Silt in this sequence is variable and may be interbedded with the sand. Where the silt content is low, an open-framework texture is common. The silt-dominated sequence consists of interbedded silts and fine- to coarse-grained sand forming well-stratified graded rhythmites and is not present beneath ERDF and the 300 Area.

Formally known as the Plio-Pleistocene Unit/Early Palouse Soil, the Cold Creek unit underlies the Hanford formation in the vicinity of ERDF. This unit is not present in the 300 Area. Deposited 1 to 3.9 million years before present, the Cold Creek unit consists of very hard rock that formed during soil development as precipitation evaporate. This calcrete facies is locally referred to as the “caliche layer” and is a major impediment to vertical migration of water. This unit may also consist of wind-blown unconsolidated muddy fine sand to fine sandy mud.

The Ringold Formation underlies the Cold Creek unit beneath ERDF. Where the Cold Creek unit is not present (east of ERDF and in the 300 Area), the Ringold Formation underlies the Hanford formation. The Ringold Formation is an interstratified sequence of unconsolidated clay, silt, sand, gravel-to-cobble gravel deposited by the ancestral Columbia River. Deposited 3.9 to 10 million years before present, the Ringold Formation consists of up to four major units beneath ERDF: overbank-dominated deposits of the member of Taylor Flat, fluvial gravels of unit E, paleosol and lacustrine muds of the lower mud unit, and fluvial gravels of unit A.

The Ringold Formation member of Taylor Flat consists of an abundance of well-sorted sand to muddy sand and gravelly sand. Deposition of this unit represents transition to a lower energy fluvial environment compared to unit E. Ringold Formation units E and A consist mostly of coarse-grained gravel and sand deposited in a high-energy fluvial environment. The Ringold Formation lower mud unit represents the base of the unconfined aquifer. This unit consists predominantly of silt with approximately equal amounts of sand and clay.

The four units of the Ringold Formation described above are present beneath ERDF (Table 2). Only unit E and the lower mud unit are present in the 300 Area. Three additional units of the Ringold Formation (units B, C, and D) are present on the Hanford Site. Units B, C, and D are likely not present at the three planned groundwater monitoring wells.

The Elephant Mountain Member of the Columbia River Basalt Group is the uppermost basalt unit (i.e., bedrock) beneath ERDF and the 300 Area. The Elephant Mountain Member is dated about 10.5 million years before present.

The water table intersects the Hanford formation about 15.8 m (52 ft) below ground surface (bgs) at the planned well in the 300 Area. Ringold unit E intersects the water table surface about 93 m (305 ft) bgs at the planned wells at ERDF.

3 Well Construction and Geologic Soil Logging

Well drilling and construction will be performed in accordance with WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells." All three wells will be constructed as 10.2 cm (4 in.) diameter monitoring wells with stainless steel casing and screens.

The screened intervals for each groundwater monitoring well are anticipated to be 9.1 m (30 ft) long and set 1.52 m (5 ft) above the water table. The screened intervals are anticipated to extend a maximum of 7.6 m (25 ft) below the water table. In consultation with the OU project technical lead, buyer's technical representative, and field geologist/hydrogeologist, the well design technical lead will determine the final well design details prior to construction based on the geologic and geophysical logs, sieve analyses, and contaminant data. The design of the typical groundwater monitoring well is shown in Figure 5. The preliminary design of the groundwater monitoring wells described in this document is presented in Table 3.

3.1 Geologic Soil Logging

Soil samples shall be logged throughout the borehole by the field geologist according to CH2M HILL Plateau Remediation Company (CHPRC) procedures. The field geologist will collect drill cuttings every 1.5 m (5 ft) and at changes in lithology from surface to total depth for storage. Archive samples will be collected in pint-sized glass jars, and representative interval samples will be saved in chip trays. If representative samples cannot be collected, notes describing the condition of the samples will be entered into the field geologist's log. Archive samples will not be collected if contamination is encountered. The field geologist will collect grab samples for archives, examine material from the boreholes, and prepare borehole logs as specified in GRP-EE-01-7.0, *Geologic Logging*.

Sediment samples for sieve analyses will be collected during drilling at 1.5 m (5 ft) intervals below the water table and composited into a single sample for analysis. Sieve analyses will be performed to support the selection of the correct filter pack mesh size and corresponding screen slot size. The field geologist will collect grab samples and conduct sieve analyses in accordance with GRP-EE-05-1.21, *Particle Size Distribution of Sediment – Wet Sieve Analysis*.

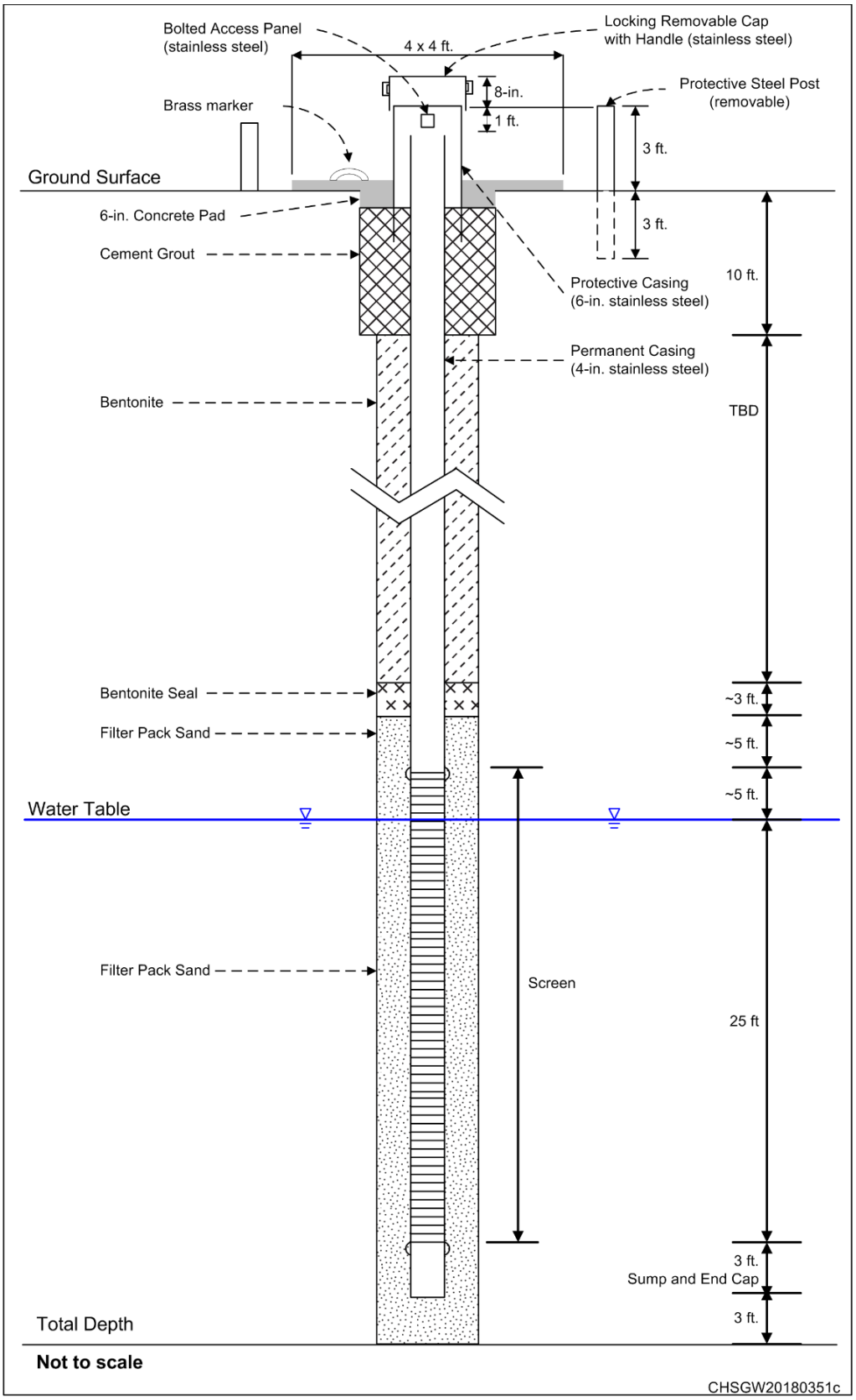


Figure 5. Generic Groundwater Monitoring Well Design

Table 3. Well Construction Information

Well Name	Facility	Northing (m)	Easting (m)	Surface Elevation (m)	Depth to Water (ft bgs)	Drill Depth (ft bgs)	Perm. Well Diameter (in.)	Screen Interval (ft bgs)	Sump and End Cap Interval (ft bgs)
699-36-65	ERDF	134,469	570,035	222	302	336	4	300-330	330-333
699-37-67	ERDF	134,957.5	569,520.2	222	305	336	4	300-330	330-333
399-4-16	324 Building	115,756.7	594,342.6	121.3	52	83	4	47-77	77-80

bgs = below ground surface
ERDF = Environmental Restoration Disposal Facility

3.2 Field Screening

Field screening (radiological and industrial hygiene) will be performed by the radiological control technician, industrial hygiene technician, and other qualified personnel in accordance with approved methods and the applicable site health and safety plan. The radiological control technicians will record field measurements, noting the depth of the sample and the instrument reading on a radiological survey report. Measurements will be communicated to the field geologist for inclusion in the field logbook or operational records daily, or as applicable. Coverage is typically provided twice a day in uncontaminated areas. More frequent coverage is provided in contaminated areas.

3.3 Geophysical Logging

Boreholes will be logged with the high-resolution spectral gamma logging system, and neutron moisture logging system to determine the vertical distribution and concentration of gamma-emitting radionuclides, soil moisture variations, and borehole lithology changes. The boreholes will be geophysically logged before downsizing each temporary casing string and/or at total drill depth and prior to well construction. The driller will assist the logging engineer by providing borehole access, depth to current water table, and hoisting support, as appropriate, to access the borehole when the logging crew is onsite. Logging is performed according to CHPRC procedures.

3.4 Corrective Actions and Deviations

The project manager, buyer's technical representative, or designee must document deviations from procedures or other issues related to sample collection. Examples of deviations include samples not collected because of field conditions, changes in sample locations due to physical obstructions, or additional samples taken.

As appropriate, such deviations or issues will be documented in the field logbook in accordance with internal procedures. The project manager, field team lead, or designee will be responsible for communicating field corrective action requirements and for ensuring that immediate corrective actions are applied to field activities.

3.5 Well Development

The objectives of well development are to settle the filter pack, prevent uncontrolled infiltration of fines, and ensure communication of the well with the surrounding formation. Well development will be conducted during well construction and final development after the wells are completed. Initial

development will be performed during well construction in conjunction with placement of the filter pack with the use of a dual surge block to both settle the filter pack and to develop communication across the borehole wall.

Final development is performed after well completion. Final well development with a submersible pump will occur after the fines are removed. If the well screen is greater than 6.1 m (20 ft) in length, the development pump intake shall be placed at two equally spaced intervals along the length of the screen to adequately develop the screened interval. The upper and lower intervals can be pumped at up to 132 L/min (35 gal/min), assuming that drawdown is not excessive.

Water samples will be collected for analysis of turbidity, temperature, pH, and conductivity using field instruments. Development will continue until the well produces clear water (<5 nephelometric turbidity units) and the temperature, pH, and conductivity have stabilized (at least three consecutive measurements within 10% of each other). The field geologist will determine when development is complete. Performance requirements for field instrumentation/measurements is provided in Table 4.

Table 4. Performance Requirements for Field Measurements

CAS Number	Analyte	Matrix	Analytical Method
pH – 150.1	pH	Water	150.1 – pH – Field
Temp – 170.1	Temperature (°C)	Water	170.1 – Temperature – Field
Cond – 120.1	Specific conductance (µS/cm)	Water	120.1 – Conductivity – Field
TURBIDITY – 180.1	Turbidity	Water	TURBIDITY_FLD

CAS = Chemical Abstracts Service

Analysis for general water chemistry will not be performed during development to evaluate changes throughout the purging process. The locations of the proposed wells have been characterized with regards to geology and water elevations allowing for placement of the well in the uppermost aquifer without the need to evaluate the presence of perched water.

4 Waste Management

Waste generated from well drilling, well construction, sampling activities, and well development is managed in accordance with approved waste control plans and associated Tri-Party Agreement Change Notices, as applicable. Wastes associated with the ERDF wells shall be managed according to DOE/RL-2016-13, *Waste Management Plan for the 200-UP-1 Groundwater Operable Unit*. The wastes associated with 300-FF-5 OU will be managed according to DOE/RL-2000-56, *Waste Management Plan for the 300-FF-5 Operable Unit*. Uncontaminated materials will be segregated to minimize radiological waste. Purge water will be managed in accordance with DOE/RL-2009-80, *Investigation Derived Waste Purgewater Management Work Plan*, and DOE/RL-2011-41, *Hanford Site Strategy for Management of Investigation Derived Waste*.

5 Quality Assurance

CHPRC quality assurance (QA) requirements are conveyed in DOE O 414.lD, *Quality Assurance*, and 10 CFR 830.121, “Nuclear Safety Management,” “Quality Assurance Program (QAP).” The Tri-Party Agreement (Ecology et al., 1989) and DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document (HASQARD)*, apply to CHPRC environmental QA program plans. All CHPRC

employees and subcontractors performing environmental cleanup activities are responsible for performing work in accordance with CHPRC requirements.

All work performed under this document will be performed in compliance with Project Hanford Management System overall QA program design and Soil & Groundwater Remediation Project has a specific QA Program plan for the scope as presented in Appendix B of CHPRC-00189, *Environmental Quality Assurance Program Plan*.

All operations including drilling, sampling, well completion and decommissioning, testing, and associated documentation are subject to surveillance by CHPRC or its authorizing agent or owner. This surveillance shall in no way relieve the contractor of any contractual responsibilities. Note the term "surveillance" as used here may include inspection, survey, and/or assessment.

The surface of the ground adjacent to the borehole will be used as the "ground surface" reference for depth measurements. The elevation of the brass marker on the concrete well pad and the top of the protective casing will be surveyed after the well has been completed. A correlation of the measurements made while drilling to the surveyed elevation will be included in the final report.

6 Health and Safety Plan

The health and safety program for hazardous waste operations is implemented for employees involved in hazardous waste site activities. The program was developed to comply with the requirements of 29 CFR 1910.120, "Occupational Safety and Health Standards," "Hazardous Waste Operations and Emergency Response," and 10 CFR 835, "Occupational Radiation Protection," to ensure the safety and health of workers during hazardous waste operations.

The health and safety program was developed to define the chemical, radiological, and physical hazards and to specify controls and requirements for day-to-day work activities on the Hanford Site. The program incorporates applicable core functions and guiding principles outlined in the Integrated Safety Management System and governs minimal personal training; control of industrial safety and radiological hazards; personal protective equipment; site control; and general emergency response to spills, fire, accidents, injury, and incident reporting.

Project field staff will be required to comply with the health and safety program at all times. Unescorted site visitors must have completed the required health and safety training before entering the work area. Escorted visitors are briefed on health and safety concerns and must be escorted by the site superintendent (or designee) at all times in the work area.

During operations, emergency response will be covered by the health and safety program. The health and safety program specifies primary emergency response actions for site personnel, area alarms, implementation of the emergency action plan and emergency equipment at the task site, emergency coordinators, emergency response, and spill containment.

7 References

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