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SGW-57811
Revision 0

Description of Work for the Installation of Five Groundwater Monitoring Wells to Support M-24 TPA Work in FY 2014

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

WMA - A-AX

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Document Type: RPT

J. Hocking
GRAM Inc

Date Published
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APPROVED
By Lee Ann Snyder at 7:37 am, Jul 22, 2014

Release Approval _____ Date _____

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Terms

bgs	below ground surface
BTR	Buyer's Technical Representative
CCU	Cold Creek Unit
CFR	*Code of Federal Regulations*
CHPRC	CH2M HILL Plateau Remediation Company
DOE	U.S. Department of Energy
DOW	Description of Work
OU	Operable Unit
PVC	polyvinyl chloride
RCRA	*Resource Conservation and Recovery Act of 1976*
RLM	Ringold Lower Mud
SST	single-shell tank
TD	total depth
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989)
WAC	*Washington Administrative Code*
WMA	Waste Management Area (Tank Farm)

METRIC CONVERSION

Into Metric Units			Out of Metric Units		
If you know	*Multiply by*	*To get*	*If you know*	*Multiply by*	*To get*
Length			**Length**		
inches	25.40	millimeters	millimeters	0.0394	Inches
inches	2.54	centimeters	centimeters	0.394	Inches
feet	0.305	meters	Meters	3.281	Feet
yards	0.914	meters	Meters	1.094	Yards
miles (statute)	1.609	kilometers	kilometers	0.621	miles (statute)
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.0929	sq. meters	sq. meters	10.764	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.591	sq. kilometers	sq. kilometers	0.386	sq. miles
acres	0.405	hectares	hectares	2.471	Acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.349	grams	Grams	0.0353	ounces (avoir)
pounds	0.454	kilograms	kilograms	2.205	pounds (avoir)
tons (short)	0.907	ton (metric)	ton (metric)	1.102	tons (short)
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.034	ounces (U.S., liquid)
tablespoons	15	milliliters	Liters	2.113	Pints
ounces (U.S., liquid)	29.573	milliliters	Liters	1.057	quarts (U.S., liquid)
cups	0.24	liters	Liters	0.264	gallons (U.S., liquid)
pints	0.473	liters	cubic meters	35.315	cubic feet
quarts (U.S., liquid)	0.946	liters	cubic meters	1.308	cubic yards
gallons (U.S., liquid)	3.785	liters			
cubic feet	0.0283	cubic meters			
cubic yards	0.764	cubic meters			
Temperature			**Temperature**		
Fahrenheit	(°F-32)*5/9	Centigrade	Centigrade	(°C*9/5)+32	Fahrenheit
Radioactivity			**Radioactivity**		
picocurie	37	millibecquerel	millibecquerel	0.027	Picocurie

1 Introduction and Scope of Work

This Description of Work (DOW) describes the drilling, construction, development, and sampling activities associated with the installation of four monitoring wells as well as one optional monitoring well in connection with Ecology et al., (1989), *Hanford Federal Facility Agreement and Consent Order* (hereinafter referred to as the Tri-Party Agreement) M-24 *Resource Conservation and Recovery Act of 1976* (RCRA) compliance monitoring within the 200-BP-5 Operable Unit (OU), 200-PO-1 OU, and the 200-UP-1 OU during fiscal year 2014 (Figure 1).

Wells 299-W18-260 (C8925) and 299-W22-113 (C8943) will be installed in the 200 West Area; C8925 will be installed near the Waste Management Area (WMA) U and C8943 will be installed near WMA S-SX. Both wells are replacements for monitoring wells that have gone dry or are nearly dry due to the declining water table. Wells C8925 will replace 299-W18-30 (A4942) and C8943 will replace 299-W22-49 (B8813).

Wells 299-E33-360 (C8923) and 299-E33-361 (C8924) will be installed in the 200 East Area; 299-E33-360 will be installed north of WMA BY and C8924 will be installed southeast of WMA BY. 299-E33-360 is a replacement well for Well 299-E33-18, which was decommissioned in July of 2013 for three reasons: it was *Washington Administrative Code* (WAC) non-compliant, it extended through the contaminated perched water horizon, and it was considered a possible accelerated conduit for contaminated perched water to the unconfined aquifer approximately 10 ft below. 299-E33-361 is a new multi-purpose well that is being installed to provide data to track the RCRA dangerous waste constituent cyanide, as well as track past practice contaminants technetium-99 and nitrate.

Well 299-E25-237 (C8922) is an option well that will be installed south of WMA A-AX near the 242-A Evaporator providing funding for the well continues to be available. The well is a replacement well for Well 299-E25-236.

The installation of these monitoring wells supports the *Tri-Party Agreement* and will be in compliance with the requirements of the RCRA as well as the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*. Activities to be carried out during the installation of the new wells will include well drilling, soil and water sampling, well-construction, and development in accordance with DOE/RL-2014-30, *Sampling and Analysis Plan for Installation of Single-Shell Tank Waste Management Area S-SX RCRA Monitoring Well 299-W22-113 and Single-Shell Tank Waste Management Area U RCRA Monitoring Well 299-W18-260*, DOE/RL-2004-18, *Waste Control Plan for the 200-PO-1 Operable Unit*, and SGW-57810, *Sampling Instruction for Conceptual Model Refinement during the Drilling of Wells 299 E25 237, 299-E33-360, and 299-E33-361 in 200 East.*

A project site map with locations of the four proposed monitoring wells and the one optional monitoring well is shown in Figure 2. The location coordinates and elevations for each well are summarized in Table 1.

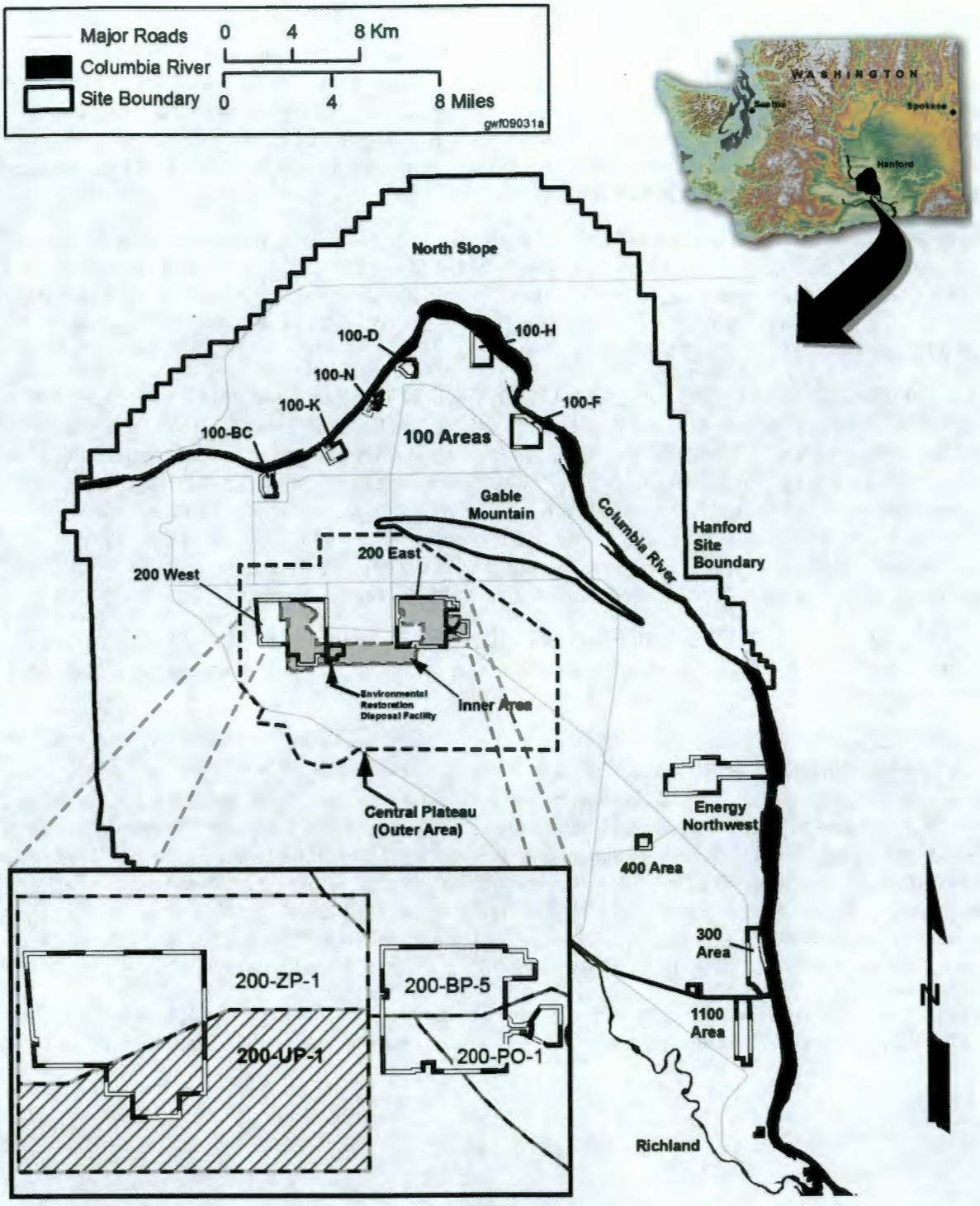

Figure 1. Hanford Site Map

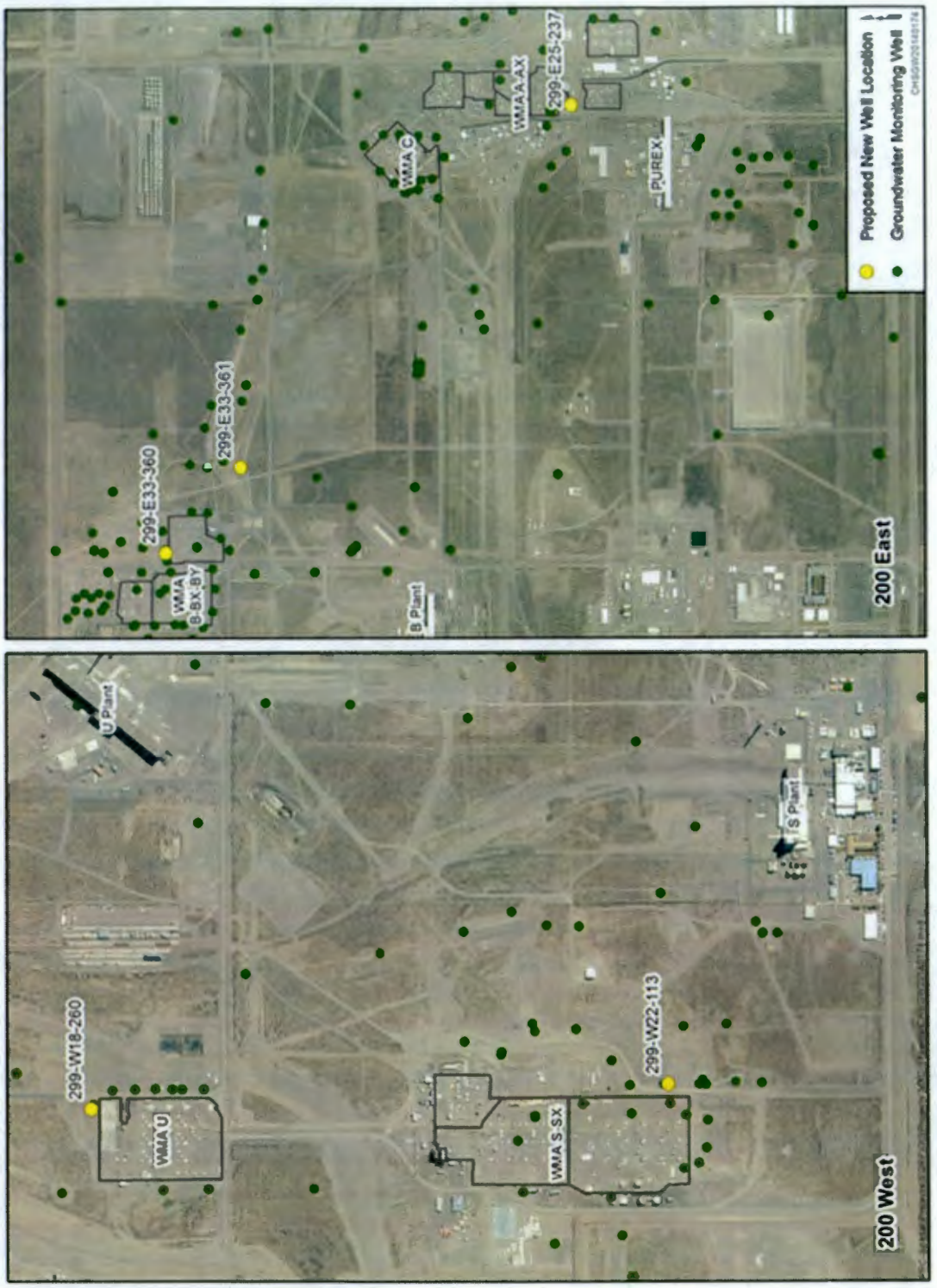

Figure 2. Location of Proposed Wells

Table 1. Well Identification and Location Summary

Well Name	Well ID	Type	Northing (m)	Easting (m)	Elevation (m)
299-W18-260	C8925	Monitoring	135197.12	566862.43	204.8
299-W22-113	C8943	Monitoring	134193.02	566904.62	203.9
299-E25-237	C8922*	Monitoring	135965.27	575323.92	211.7
299-E33-360	C8923	Monitoring	137386.89	573772.02	198.7
299-E33-361	C8924	Monitoring	137122.25	574069.24	199.3

* Optional Well

All drilling, decommissioning (as needed), and well construction will be performed by a drilling subcontractor. Sampling and testing will be performed by CH2M HILL Plateau Remediation Company (CHPRC) and its affiliates.

This document follows the requirements of CHPRC procedure GRP-EE-01-1.4, *Description of Work for Well Drilling and Decommissioning*.

2 Background

This section briefly discusses previous work activities and regulatory decisions associated with the 200-UP-1, the 200-PO-1, and the 200-BP-5 OUs. General summaries of hydrogeology, contaminants of interest, and conceptual models of relevant factors associated with the planned work activities are presented.

2.1 Site History and Previous Work Activities/Remediation Goals

Established in the 1940s to produce weapons-grade plutonium, the 586 square mile Hanford Site includes buildings, disposal sites, and environmental research park, and its surrounding habitat/buffer zone. Plutonium production during World War II, increased during the Cold War period, and expanded nuclear research and development activities led to the disposal of approximately 450 billion gallons of both chemical and radioactive liquid waste into the ground. Much of these contaminants lie in the vadose zone (the area between the ground surface and the top of the high water table), but some have reached the groundwater and pose a risk to the Columbia River.

2.1.1 200 West Area

The 200 West Area is approximately 3 square miles in size and is located near the middle of the Hanford Site (Figure 1). The 200 West Area is approximately 5 miles south of the Columbia River and 7 miles from the nearest Hanford Site boundary. The 200 West Area is located on an elevated, flat area that is often referred to as the Central Plateau, with no wetlands, perennial streams, or floodplains present. The 200 West Area contains waste management facilities and former irradiated fuel reprocessing facilities that have been grouped into two OUs: 200-ZP-1 and 200-UP-1.

2.1.1.1 WMA S-SX (200-UP-1 OU)

WMA S-SX is composed of two separate single-shell tank (SST) farms; twelve 75-ft diameter underground tanks are located in the S Tank Farm each with a 758,000 gallon capacity and 15 similar tanks are located in the SX Tank Farm with a 1,000,000 gallon capacity, each. The WMA is located in the

southern portion of the 200 West Area, near the Reduction-Oxidation Plant. The tanks have stored hazardous, high-level radioactive mixed wastes for several decades.

WMA SX tanks were the first tanks designed for self-boiling (i.e., self-concentrating) waste; however, the WMA S tanks also received self-boiling waste from the Reduction-Oxidation Plant. The WMA S-SX tanks were constructed with cascade overflow lines in three-tank series to allow gravity flow of liquid waste between the tanks. These cascade lines were not used in the SX Tank Farm. Ten of the 15 SSTs in the SX Tank Farm and one of the 12 SSTs in the S Tank Farm are classified as assumed leakers.

WMA S-SX was placed in the RCRA groundwater monitoring assessment in 1996, because of elevated specific conductance and high-levels of technetium-99 in down gradient monitoring wells. Technetium-99, nitrate, chromium, gross beta, tritium, and carbon tetrachloride are constituents to have exceeded drinking water standards. The carbon tetrachloride does not originate from the U Tank Farm, but rather liquid waste disposal sites at the Plutonium-Finishing Plant (PFP) located northwest of the U Farm location. Tritium and some of the nitrate also originates from an upgradient source, the 216-S-25 Crib, located west of the tank farm.

2.1.1.2 WMA U (200-UP-1 OU)

WMA U is composed of a single SST farm; twelve 75-ft diameter underground tanks each with a 530,000 gallon capacity. The tank farm is located in the central portion of 200 West Area, near the U Plant. The tank farm has stored hazardous, radioactive mixed wastes for several decades. In addition, there are four 20-ft diameter tanks each with a 55,000 gallon capacity within the farm.

The WMA U tanks were designed with a dish-shaped bottom and the larger diameter tanks are constructed with cascade overflow lines in a 3-tank series that allow gravity flow of liquid waste between the tanks. Four SSTs of the 12 larger diameter tanks are classified assumed or confirmed leakers.

WMA U was placed in the RCRA groundwater monitoring assessment in 2000, because of elevated specific conductance in down gradient groundwater monitoring wells as compared to the up gradient groundwater monitoring wells. Contamination in the groundwater under the U Tank Farm primarily consists of nitrate, technetium-99, and carbon tetrachloride. The carbon tetrachloride does not originate from the U Tank Farm, but rather liquid waste disposal sites at the PFP located northwest of the U farm location. Some of the nitrate also originates from former pump-and-treat system injection wells upgradient from the farm.

2.1.2 200 East Area

The 200 East Area is approximately 8 square miles in size and is located near the middle of the Hanford Site (Figure 1). The 200 East Area is approximately 5 miles from the Columbia River and 7 miles from the nearest Hanford Site boundary. 200 East is also located on an elevated, flat area that is often referred to as the Central Plateau, with no wetlands, perennial streams, or floodplains present. 200 East contains waste management facilities and former nuclear material separation facilities that have been grouped into two OUs: the 200-BP-5 and the 200-PO-1.

2.1.2.1 WMA B-BX-BY (200-BP-5 OU)

WMA B-BX-BY is composed of three SST farms; B Tank Farm is comprised of twelve 75 ft diameter underground tanks each with a 530,000 gallon capacity and four 20 ft diameter underground tanks each with a 55,000 gallon capacity, BX Tank Farm is comprised of twelve 75 ft diameter underground tanks each with a 530,000 gallon capacity, BY Tank Farm is comprised of twelve 75 ft diameter underground tanks each with a 758,000 gallon capacity. The B-BX-BY Tank Farm is located in the northern portion of

the 200 East Area, near B Plant. The tank farm has stored hazardous, radioactive mixed wastes for several decades.

WMA B-BX-BY tanks were designed with dish-shaped bottoms and the larger diameter tanks were constructed with cascade overflow lines in a three-tank series that allow gravity flow of liquid waste between the tanks. The end of the cascade series in the BX Tank Farm hooked to the first cascade tank in the BY Tank Farm. Ten of the 16 SSTs in B Tank Farm, 5 of the 12 SSTs in BX Tank Farm, and 5 of the 12 SSTs in BY Tank Farm are classified as assumed leakers.

WMA B-BX-BY was placed in the RCRA groundwater monitoring assessment in 1996, because of elevated specific conductance in down gradient monitoring wells. Groundwater contaminants that exceed the drinking water standards in this area include; nitrate, technetium-99, uranium, cyanide, chromium, iodine-129.

2.1.2.2 WMA A-AX (200-PO-1 OU)

The A-AX Tank Farm is composed of two SST farms; A Tank Farm is comprised of six 75 ft diameter underground tanks each with a 1,000,000 gallon capacity, AX Tank Farm is comprised of four 75 ft diameter underground tanks also each with a 1,000,000 gallon capacity. The A-AX Tank Farm is located in the eastern portion of the 200 East Area, near the Plutonium-Extraction Plant. The tank farm has stored hazardous, radioactive mixed wastes for several decades.

WMA A-AX tanks were designed to receive and store boiling wastes and have flat bottoms. The tanks within WMA A-AX are connected with overflow lines, but they do not cascade. Five of the nine total tanks between the two farms are classified as assumed or confirmed leakers.

The A-AX Tank Farm was placed on the RCRA groundwater monitoring assessment in 2005. Groundwater contamination that exceeds the drinking water standards in this area include; nitrate and technetium-99.

2.2 Geology

The Hanford Site is situated within the semi-arid, shrub-steppe Pasco Basin of south-central Washington. The Pasco Basin is one of a number of topographic depressions located within a broad basin located between the Cascade Range and the Rocky Mountains. The Pasco Basin is bounded on the north by the Saddle Mountains, on the west by the Umtanum Ridge, Yakima Ridge, and the Rattlesnake Hills, and on the east by the Palouse slope (WHC-008, 1992).

Estimated depths to the geologic units at the five monitoring wells are summarized in Table 2.

Table 2. Estimated Depths to Geologic Units

Well Name	Well ID	Water Table (ft bgs)	Cold Creek Unit Silts (ft bgs)	Cold Creek Unit Gravels (ft bgs)	Ringold Fm., Unit E (ft bgs)	Ringold Fm., Lower Mud (ft bgs)	Ringold Fm., Unit A (ft bgs)	Basalt (ft bgs)
299-E33-360	C8923	254.0	216	245	NP	NP	NP	260
299-E33-361	C8924	260.0	176	190	NP	NP	UNK	275
299-W18-260	C8925	235.0	122	NP	138	452	476	538
299-W22-113	C8943	232.0	124	157	175	455	537	569

Table 2. Estimated Depths to Geologic Units

Well Name	Well ID	Water Table (ft bgs)	Cold Creek Unit Silts (ft bgs)	Cold Creek Unit Gravels (ft bgs)	Ringold Fm., Unit E (ft bgs)	Ringold Fm., Lower Mud (ft bgs)	Ringold Fm., Unit A (ft bgs)	Basalt (ft bgs)
299-E25-237	C8922	297.0	274	NP	NP	NP	363	373

bgs = below ground surface
Fm = formation (formal)
ID = identification
NP = not present
UNK = unknown

2.2.1 200 West Area

This area is similar to locations elsewhere at the Hanford Site, in that a two-tiered stratigraphy occurs, consisting of basalt/basalt-related volcanic and sedimentary rock and overlying unconsolidated sedimentary deposits. The foremost units of the Hanford Site's 200 West Area include, from youngest to oldest:

- Holocene (approximately 11,700 years ago to present) surficial deposits
- Pleistocene (approximately 2.6M years ago to approximately 11,700 years ago) Hanford formation sediments
- Post-Ringold/Pre-Hanford deposits (Cold Creek Unit [CCU])
- Miocene-Pliocene (approximately 23M years ago to approximately 5.3M years ago and approximately 5.3M years ago to 2.6M years ago) Ringold Formation sediments
- Miocene (approximately 23M to approximately 5.3M years ago) Columbia River Basalt Group basalt flows and interbedded Miocene Ellensburg Formation sediments.

The local stratigraphy beneath WMA U and WMA S-SX consists of unconsolidated to semi-consolidated sediments overlying basalt bedrock of the Columbia River Basalt Group. The suprabasalt sediments in this area include sand, gravel, and lesser amounts of silt-dominated deposits from Pleistocene cataclysmic floods, collectively referred to as the Hanford formation. The Hanford formation is subdivided into a gravel dominated sequence and a sand dominated sequence, which contains several thin, fine-grained silty lenses. A lower coarse grained gravel dominated unit may be present beneath the sand sequence. Beneath the Hanford formation lays the CCU which is composed of two facies (1) the shallower facies, which is generally a fine-grained silt or sandy silt; and (2) the deeper facies (caliche), which is a carbonate cemented coarse-grained sand and gravel. The Ringold Formation comprises the deepest portion of the sedimentary sequence and consists (in descending order) of an upper fine grained unit, a silty sandy gravel unit (Unit E), the lower mud unit, and basal silty sandy gravel (Unit A).

2.2.2 200 East Area

This area is similar to locations elsewhere at the Hanford Site, in that a two-tiered stratigraphy occurs, consisting of basalt/basalt-related volcanic and sedimentary rock and overlying unconsolidated

sedimentary deposits. The foremost units of the Hanford Site's 200 East Area include, from youngest to oldest:

- Holocene (approximately 11,700 years ago to present) surficial deposits
- Pleistocene (approximately 2.6M years ago to approximately 11,700 years ago) Hanford formation sediments
- Post-Ringold/Pre-Hanford deposits (CCU)
- Miocene-Pliocene (approximately 23M years ago to approximately 5.3M years ago and approximately 5.3M years ago to 2.6M years ago) Ringold Formation sediments
- Miocene (approximately 23M to approximately 5.3M years ago) Columbia River Basalt Group basalt flows and interbedded Miocene Ellensburg Formation sediments.

The local stratigraphy beneath WMA B-BX-BY consists of suprabasalt sediments that include sand, gravel, and lesser amounts of silt-dominated deposits from Pleistocene cataclysmic floods, collectively referred to as the Hanford formation. In the vicinity of WMA B-BX-BY, the Hanford formation is subdivided into gravel dominated sequence and a sand dominated sequence, which contains several thin, fine-grained silty lenses. Beneath the Hanford formation lays the CCU, which is composed of two facies (1) the shallower facies, which is generally a fine-grained; and (2) coarse-grained gravel dominated sand and silt. Based on surrounding well data, perched water is anticipated within the CCU silt unit that lies above the gravel.

The stratigraphy beneath WMA A-AX consists of consists of sand, gravel, and lesser amounts of silt-dominated Hanford formation deposits. The sand dominated facies of the Hanford formation extends from about 11 to 266 ft below ground surface (bgs) with some coarse to fine sand interbeds. At 266 ft bgs, the gravel dominated facies of the Hanford formation is encounted. The upper most unconfined aquifer, from about 280 to 317 ft bgs, is composed primarily of the gravel-dominated facies of the lower Hanford formation, although this unit is described by some as re-worked Ringold Formation sediments of Hanford age (CCU gravel), referred to as pre-Missoula gravel. Ringold Formation, Unit A maybe also be present beneath these units. Less than 3 feet of Ringold Formation, Unit A was encountered in existing well 299-E25-93, at approximately 38 ft below the top of the unconfined aquifer. The Ringold Formation lower mud (RLM) unit is not present above Unit A at this location. The Ringold Formation extends down to basalt.

2.3 Hydrogeology

Content provided in this section are excerpts from WHC-SD-EN-TI-014, *Hydrologic Model for the 200 West Groundwater Aggregate Area,* and WHC-SD-EN-TI-019, *Hydrologic Model for the 200 East Groundwater Aggregate Area* unless otherwise cited.

2.3.1 200 West Area

2.3.1.1 Vadose Zone

The vadose zone is the region above the water table in which the pore spaces of the sediments are usually only partially filled with water. This zone in the 200 West Area encompasses, in ascending order, the following major lithologic units: Ringold Formation, Unit E; upper Ringold Unit; CCU; Hanford formation. Movement of water through these sediments to the water table is controlled by the following factors: (1) depth to water table; (2) amount of both natural and artificial recharge; (3) thickness, location,

and dip of the underlying sediments; and (4) the hydraulic properties and moisture content of these sediments.

2.3.1.2 Saturated Zone

The saturated zone within the 200 West Area consists of the unconfined aquifer within the Ringold Formation, Unit E sediments, the confined aquifer within the Ringold Formation, Unit A sediments beneath the RLM, and the confined aquifers within the basalt.

2.3.1.3 Unconfined Aquifer

The water table underlying the 200 West Area is contained within the Ringold Formation, Unit E. Unit E is a clast-supported granule to cobble gravel with a sandy matrix. Intercalated sands and muds are also found. The bottom of the unconfined aquifer may either be the RLM or the basalt where the RLM is absent. The RLM thins in the north and east part of the 200 West Area.

2.3.1.4 Confined Aquifer

The uppermost confined aquifer is contained either within the Ringold Formation, Unit A or the basalts and interbeds of the Columbia River Basalt Group.

2.3.2 200 East Area

2.3.2.1 Vadose Zone

The vadose zone is the region above the water table in which the pore spaces of the sediments are usually only partially filled with water. This zone in the area of interest in the 200 East Area includes, in ascending order, the following major lithologic units: Cold Creek Units; and the Hanford formation. The primary sediments that will be encountered during drilling at the three well sites in 200 East, in descending order are: the Hanford gravels; the Hanford sands; the Cold Creek silts; and the Cold Creek gravels. Moisture content in the vadose zone is generally 6 to 8%; however, a perched water horizon is present at well location 299-E33-360 within the Cold Creek silts. The perched water horizon is expected at ~ 225 ft bgs and expected to extend to ~ 240 ft bgs. The perched water horizon contains contaminants that exceed the drinking water standards for the following: chromium; fluoride; iodine-129; nitrate; technetium-99; tritium; and uranium. Beneath the perched horizon, Cold Creek gravels extend to the water table with minimal moisture. Perched water is not expected at the other two well sites in the 200 East Area. Current interpretations of the Cold Creek at 299-E33-361 consists of silty sandy gravels to gravelly silty sands, starting ~ 200 ft bgs. This stratigraphic unit extends into the aquifer. Current interpretations of the Cold Creek at 299-E25-237 consists of slightly silty sand to silt, starting ~ 265 ft bgs. The silt horizon appears to extend to ~ 280 ft bgs. Moisture in this area may vary from normal at 6 to 8% to nearly saturated. Neutron-moisture logs at nearby existing well 299-E25-236, showed significant moisture between 275 and 280 ft bgs. The Cold Creek texture changes to a sandy gravel to gravelly sand beneath this horizon and extends beyond the water table.

2.3.2.2 Saturated Zone

The saturated zone is the region above the Elephant Mountain basalt in which the pore spaces of the sediments are entirely filled with water. This zone in the area of interest in the 200 East Area includes mainly Cold Creek gravels. The gravels are generally described as gravelly sands to gravels, but may contain some silt within the unit.

2.3.2.3 Unconfined Aquifer

The unconfined aquifer system within 200 East Area ranges in thickness from ~ 6 to 75 ft. The aquifer should be encountered at well 299-E33-360 at ~ 254 ft bgs and basalt should be encountered at ~ 260 ft

bgs based on nearby well profiles. The aquifer should be encountered at well 299-E33-361 at ~ 254 ft bgs based on preliminary ground elevation surveys. The basalt at well 299-E33-361 should be encountered between 275 and 280 ft bgs based on current top of basalt interpretations. The aquifer should be encountered at well 299-E25-237 at ~ 295 ft bgs based on nearby well profiles. The basalt at well 299-E25-237 should be encountered between 365 and 370 ft bgs based on current top of basalt interpretations.

Groundwater contaminants that exceed the drinking water standards in the area near WMA B-BX-BY include: chromium; cyanide; iodine-129; nitrate; technetium-99; tritium; and uranium. Groundwater contaminates that exceed the drinking water standards in the area near WMA A-AX include: iodine-129; nitrate, and technetium-99.

2.4 Contaminants of Potential Concern

Contaminants of potential concern, displayed in Tables 3 and 4 below, were taken from IHSP-SGRP-14-015-00, *CHRPC Soil and Groundwater Industrial Hygiene Sampling Plan*, RHSF-GW-14-020, CHPRC Radiological Hazards Screening Form: *Three Wells (C8922, C8923, C8924) will be Drilled in 200 East and Two Wells (C8925, C8943) will be Drilled in 200 West*, RPP-7884, *Field Investigation Report for Waste Management Area S-SX*, RPP-10098, *Field Investigation Report for Waste Management Area B-BX-BY*, RPP-35484, *Field Investigation Report for Waste Management Areas C and A-AX*, RPP-35485, *Field Investigation Report for Waste Management Area U*, DOE/RL- 2014-30 and SGW-57810.

2.4.1 200 West Area

Table 3. Contaminants of Potential Concern - 200 West

Radiological Contaminants	Non-Radiological Contaminants
Cesium-137 (Cs-137)	Ammonia (NH_3)
Gross beta (Gross β)	Carbon tetrachloride (CCl_4)
Iodine-129 (I-129)	Chromium (Cr^{+3})
Strontium-90 (Sr-90)	Hydrogen Sulfide (H_2S)
Technetium-99 (Tc-99)	Methane (CH_4)
Tritium (H-3)	Nitrate (NO_3)
Uranium (U)	

2.4.2 200 East Area

Table 4. Contaminants of Potential Concern - 200 East

Radiological Contaminants	Non-Radiological Contaminants
Carbon-14 (C-14)	Ammonia (NH_3)
Cesium-137 (Cs-137)	Carbon tetrachloride (CCl_4)
Iodine-129 (I-129)	Chromium (Cr^{+3})
Strontium-90 (Sr-90)	Cyanide (CN)
Technitium-99 (Tc-99)	Hydrogen Sulfide (H_2S)
Tritium (H-3)	Methane (CH_4)
Uranium (U)	Nitrate (NO_3)

3 Description of Work Activities

Activities to be conducted at each well include site preparation, drilling, sampling, well construction, and well development. All activities described within this document will be conducted in accordance with the guidelines and requirements set forth in GRP-EE-02-14.1, *Drilling, Remediating, and Decommissioning Resource Protection Wells and Geotechnical Soil Borings* and shall conform to minimum resource protection well standards as defined in WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells." The WDOH (2008), *The Department of Energy Hanford Site Radioactive Air Emissions License #FF-01*, Enclosure 3, "ALARACT Agreements, ALARACT 18, "Environmental Restoration Program ALARACT Demonstration for Drilling," shall also apply. All drilling and well construction work will be performed by a licensed drilling subcontractor. Information for major subtasks is included in the following sections.

3.1 Well Site Preparation

Each well has been staked and assigned a unique well number. Drilling sites will be accessible by existing roads whenever possible, limited access roads will be constructed as necessary. Limited well access roads will be graveled for stabilization, dust, and contamination control; if necessary. Drill pads will be constructed as needed, to provide stable foundations and workspace during drilling and/or sampling activities. Grub surveys will be performed by radiation control technicians for each site prior to the drill pad and access road construction. Ground penetrating radar surveys will also be conducted as necessary and excavation permits will be obtained as part of site preparations prior to the start of drilling.

3.2 Drilling

The drilling contractor will be responsible for complying with all well drilling and construction standards defined in WAC 173-160 and all applicable CHPRC procedures. Drilling activities at the well sites will be documented by the Buyer's field geologist on daily field activity report sheets. The field geologist will examine the material from the boreholes and prepare borehole logs as specified in GRP-EE-01-7.0, *Geologic Logging*.

Boreholes will be drilled using temporary casing diameters to accommodate the construction standards for specific well types. The nominal casing diameter for the boreholes that will go to total depth (TD) shall be no less than 8-in. for 4-in. wells and 12-in. for 8-in. wells. This assures that the completion of each well will retain a minimum 2-in. annulus required under WAC 173-160. Estimated total drilling and construction depths for the four wells plus one option well are presented in Table 6. The actual borehole drill depth will be determined by CHPRC's Field Geologist or Hydrogeologist and may vary from anticipated depths depending on hydrogeologic conditions encountered. The final well screen interval and well design will also be determined by CHPRC depending on the hydrogeologic conditions.

The boreholes are to be drilled through unconsolidated clays, silts, gravels, boulders, semi-consolidated materials or hard cemented zones containing these materials. The Drilling Contractor's selected equipment and methods shall be capable of advancing through the anticipated geological formations, and maintaining an open borehole, free of drilling cuttings and other obtrusive materials to the depth explored and at individually selected sampling depths, as applicable. In addition, the Contractor's selected equipment and method shall be capable of installing and removing all temporary casing. Drilling aids such as bentonite, other clay-based agents, water or any foreign matter capable of affecting the characteristics of the sediment and/or groundwater will not be placed in the well without prior approval of

CHPRC. Lubricants used on down hole equipment shall be environmentally compatible; hydrocarbon based lubricants are not acceptable.

During drilling and sampling all reasonable efforts will be made to minimize, or eliminate, the addition of water to the borehole. If water addition is necessary, the volume added should be kept to the smallest volume required and added with the approval of the Buyer's Technical Representative (BTR) or project lead. Only potable water will be added during drilling. Water addition of 1 to 3 gallons should be sufficient to aid in drilling and/or sampling. If conditions indicate the need for water addition in greater volumes, the field personnel will contact the BTR and the project technical lead for direction.

Prior to the start of the project and between each well, the drill rig and all down-hole equipment shall be decontaminated by high temperature pressure washing to minimize potential cross-contamination.

Drilling activities for the wells listed in this DOW will be evaluated by radiological controls based on site history, sampling of nearby waste sites, known contaminant plumes, and existing wells. Based on the results of the evaluation, worker protection requirements will be determined. Wells will also be evaluated by the environmental group per WDOH (2008) criteria. Well activities determined to have a low radiological hazard with specific controls under the WDOH (2008) risk assessment are not restricted to any particular drilling method, unless required by the radiological controls organization for worker protection. Based on this assessment, the planned frequency for industrial hygiene monitoring is AM/PM monitoring during drilling, well construction, and well development activities and continuous monitoring during groundwater sampling activities. Additional air sampling and/or passive badge personal sampling will be conducted per the Certified Industrial Hygienist's direction. The frequency for radiological monitoring while in the vadose zone is AM/PM monitoring for wells 299-E25-237, 299-E33-361, 299-W22-113, and 299-W18-260 and continuous monitoring for 299-E33-360. While in the saturated zone radiological monitoring will be on elevated status for all wells except 299-E33-360, which will continue to receive continuous radiological monitoring.

If radiological contamination is detected above CHPRC-00073, *CH2M HILL Plateau Remediation Company Radiological Control Manual*, Table 2-2 limits during drilling, the work shall be immediately stopped, and the boring may be upgraded to either "medium" or "high" radiological hazard and a Radiological Work Permit (RWP) may be developed to instruct workers concerning the radiological requirements. In the event unanticipated radiological contamination in the soil column or perched water is encountered, drill casing diameter must be reduced to prevent contamination drag-down into a lower-hazard zone. If elevated chemical contamination is encountered, work shall be immediately stopped, the Contractor's BTR contacted, and an appropriate chemical monitoring plan prepared by CHPRC.

It is anticipated that a perched water zone will be encountered at well 299-E33-360. This perched water zone is expected to be highly contaminated and extends from approximately 225 ft bgs to 240 ft bgs. The perched water zone is being held by CCU silt that is less than 5 ft thick and occurs as the first silt zone at the base of the saturated sand (perched water). As required by WAC 173-160, drilling must stop immediately when this silt is encountered and the temporary casing must be sealed and downsized prior to drilling beyond this point. Special attention must be given to this zone.

All drill cuttings from the boreholes will be handled as specified in Section 4.0 of this DOW.

3.3 Data Collection

Details of data collection associated with this scope of work are included in DOE/RL-2014-30 and SGW-57810. Sampling requirements for the boreholes include sediment and groundwater sampling. Depth below the water table will be the primary reference point for sample collection. Sediment sampling is to

include: (1) geologic archive samples of drill cuttings; (2) sieve grab samples; and (3) split spoon samples. Groundwater samples will be collected for chemical analysis. A sample summary is presented in Table 5.

Blow counts will be collected for all holes, by the Buyer's Field Geologist, for both split spoon sampling and while driving casing during drilling.

Table 5. Sample Summary

Well Name (Well ID)	Geologic Grab Sample	Sieve Analysis Grab Sample	Groundwater Samples	Sediment Samples
299-E33-360 (C8923)	Every 5 ft or where lithologic changes occur; using one set of pint glass mason jars and plastic chip trays. Samples will be taken from drill cuttings.	Sieve grab samples collected at 5 ft intervals throughout the aquifer. Composite samples into one bulk sample for sieve analysis for selection of the filter pack and screen slot size.	Sample at 235 ft bgs. Total of 1 sample.	Two split spoon samples collected at 227.5 to 230 ft and 233 to 235.5 ft bgs.
299-E33-361 (C8924)			Sample at 5 ft into the aquifer at ~ 260 ft bgs and at the bottom of the aquifer at ~ 273 ft bgs. Total of 2 samples.	Two grab samples will be collected at 5 ft and 17.5 ft below the water table for sieve analysis.
299-W18-260 (C8925)			Every 20-ft starting 10-ft below the water table to 90-ft below the water table. Total of 5 samples to be taken. Purge and pump samples are preferred. Bailed samples can be collected if the purge-and-pump method is not practicable, as determined by the technical lead.	N/A
299-W22-113 (C8943)			N/A	N/A
299-E25-237 (C8922)			Samples collected at 10, 30, 50, and 70 ft below the water table, and the bottom of the aquifer. Total of 5 samples.	Continuous split spoon sampling from 260 ft bgs to 280 ft bgs. Total of 7 samples.

N/A = not applicable

3.3.1 Geologic Archive Samples

The Buyer's Field Geologist will collect drill cuttings every 5 ft throughout the borehole and at changes in lithology for the purpose of geologic description and archived storage. Cuttings will be collected in pint-sized glass mason jars and plastic chip trays.

If radiological contamination is detected by radiological control technician's field-screening equipment, no archive samples will be retained. Detailed geologic descriptions will be performed according to CHPRC procedure GRP-EE-01-7.0.

3.3.2 Sieve Grab Samples

Grab samples will be collected at 5–ft intervals below the water table and composited into a bulk sample for every 20 ft of collection. It is anticipated that only one bulk sample, per well, will be collected for conducting sieve analysis across the entire area to be screened. The analysis results will be used for the selection of the filter pack mesh size and the corresponding well screen slot size. Two depth discrete grab samples shall be collected at 299-E33-361 at 1.5 m (5 ft) and 5.33 m (17.5 ft) below the water table for sieve analysis only. These samples will not be composited and results will be reported to the project lead.

3.3.3 Split Spoon Samples

Split spoon soil samples will be collected, continuously starting at 260 ft bgs and progressing to 280 ft bgs, in polycarbonate or stainless steel liners for analysis by PNNL at the 299-E25-237 (C8922) location. Samples will be collected in 2.5 ft intervals from 260 ft to 280 ft bgs (e.g., 260 ft to 262.5 ft bgs, 262.5 ft to 265 ft bgs, 265 ft to 267.5 ft bgs, 267.5 ft to 270 ft bgs, 270 ft to 272.5 ft bgs, 272.5 ft to 275 ft bgs, 275 ft to 277.5 ft bgs, and 277.5 ft to 280 ft bgs). This sample zone is to investigate possible elevated chloride porewater which was attributed to the advanced casing corrosion of previous well in the area (near WMA A-AX).

Two split spoon samples will be collected at well 299-E33-360 (C8923) during drilling from 227.5 to 230 ft and 233 to 235.5 ft bgs. The samples will investigate the variability of contamination with depth in the perched horizons.

The split spoon samples will be photographed, geologically described and analyzed for the constituents defined in DOE/RL-2014-30 and SGW-57810. The porewater from the split spoons will also be centrifuged and analyzed for the required constituents. Should additional water be required, the amount of water added will be recorded so appropriate analytical results are reported.

3.3.4 Water Samples

Depth discrete water samples will be collected during the drilling of 299-W18-260, 299-E25-237, 299-E33-360, and 299-E33-361.

- Groundwater samples for well 299-E25-237 will be collected at 10 ft, 30 ft, 50 ft, and 70 ft below the water table and the bottom of the aquifer.
- Groundwater sample for well 299-E33-360 will be obtained at 235 ft bgs.
- Groundwater samples for well 299-E33-361 will be obtained at 5-ft below the water table and at the depth of the basalt.
- Groundwater samples for well 299-W18-260 will be obtained every 20 ft starting 10 ft below the water table and continuing to 90 ft below the water table.

Groundwater samples will be purged and pumped at selected intervals, although the use of a bailer (or similar device) is acceptable under specific circumstances (e.g., insufficient head may preclude the use of a sample pump, or turbidity is high enough to interfere with pumping); the conditions that may require a bailed sample will be determined by the Project Technical Lead. Prior to sample capture, the pump will be operated for a period sufficient to purge and provide stabilized field readings (pH, water temperature, conductivity, and dissolved oxygen [as applicable]) per GRP-FS-04-G-028, *Field Characterization and Treatment Monitoring Activities Groundwater Sampling*. Unless otherwise indicated, water samples will be filtered to remove drilling solids.

3.3.5 Geophysical Logging

Geophysical logging will be performed through each single string of casing (i.e., before reducing casing sizes or telescoping) to produce a geophysical log of the entire length of the borehole. A Spectral Gamma Logging System will be passed from ground surface to the TD of the borehole for all drilled wells to determine the vertical distribution of gamma-emitting radionuclides. A Neutron-Moisture Logging System will also be passed from ground surface to the top of the water table to determine soil moisture. These logs will assist in stratigraphic and lithologic differentiation.

3.4 Construction

The final well design will be confirmed by the BTR and/or CHPRC Project Lead prior to initiating well construction. The design of the wells will meet the minimum standards required by WAC 173-160 for construction of resource protection wells. Final well design, including screen placement and length, will be determined by concurrence of the Field Geologist, Drilling BTR, and OU Lead based upon field conditions. If completion is different from WAC 173-160 requirements, then State approved variances will be obtained from the Washington State Department of Ecology. Expected well design/construction parameters are provided in Table 6.

Boreholes must pass a straightness test prior to initiating well construction per WAC 173-160-191-15 and its subparts. The straightness test will involve lowering a solid pipe 20-ft in length with a continuous diameter no less than 1-in smaller than the inside diameter of the temporary casing. The test pipe must descend freely of its own weight and then be withdrawn without binding. The straightness test shall be performed in the presence of the CHPRC BTR or delegate. In the event that the straightness test fails, CHPRC and the Drilling Contractor will determine the best alternative forward under the terms set forth in the drilling contract.

Wells 299-W18-260 and 299-W22-113 will be completed in the unconfined aquifer occurring in the Ringold Formation, Unit E sediment. Wells 299-E33-360 and 299-E33-361 will be drilled to basalt and screened across the entire unconfined aquifer. Well construction at well 299-E33-360, due to the contaminated perched water zone, shall also consist of a hydrated bentonite or cement seal across the perched water zone to prevent the spread of the contaminated water to the unconfined aquifer. Well 299-E33-360 will be drilled approximately 12 ft into the basalt for sump placement. Optional well 299-E25-237 will be drilled to basalt and completed in the unconfined aquifer (screened from the water table to 35 ft below the water table).

Table 6. Proposed Well Construction Summary for the Tri-Party Agreement M-24 Wells

Well Name/Well ID	Casing Size (In)	Est. Depth to Water (ft bgs)	Est. Drill Depth (ft bgs)	Screen Length (ft)/Interval (ft bgs)	Backfill Interval [b] (ft bgs)	Filter Pack Interval (ft bgs)	Bentonite Pellet Seal Interval (ft bgs)	Granular Bentonite Seal Interval (ft bgs)	Bentonite Pellet Seal Interval (ft bgs)	Granular Bentonite Seal Interval (ft bgs)	Cement Seal Interval (ft bgs)	Concrete Well Pad (ft bgs)
299-W18-260 (C8925)	4	235	325	30/ 265-235	325-271	271-230	230-227	N/A	N/A	227-10	10-0.5	0.5-0
299-W22-113 (C8943)	4	232	267	30/ 262-232	N/A	267-227	227-224	N/A	N/A	224-10	10-0.5	0.5-0
299-E33-360 (C8923)	8	225*/254	272	20[d]/ 271-251	N/A	272-248	248-243	TBD	TTBD [e] (5 ft interval)	TBD-10	10-0.5	0.5-0
299-E33-361 (C8924)	8	254	285	25[d]/ 280-255	N/A	285-250	250-247	N/A	N/A	247-10	10-0.5	0.5-0
299-E25-237[a] (C8922)	4	295	370	35/ 365-290	N/A	370-285	285-282	N/A	N/A	282-10	10-0.5	0.5-0

Note: Information presented on this table are estimates. Final drill depth, position of well screen, backfill interval, filter pack interval, and bentonite seals will be determined based upon actual borehole conditions.

*Approximate depth of contaminated perched water interval.

a. Optional well, once awarded the contractor will re-prioritize the drilling sequence to expedite this well completion in cooperation with Tank Farm activities.

b. Bentonite backfill.

c. Filter pack interval, mesh size, and screen slot-size subject to change depending on field conditions.

d. Screen across the entire aquifer with the sump placed into the basalt which is expected at 280 ft bgs.

e. Pellet seal and casing downsizing required to prevent the perched water to contaminate the unconfined aquifer.

TBD = to be determined

3.4.1 Screen and Sump

Well screens, casing, and sump shall be constructed with 4-in. diameter schedule 10 stainless steel Type 304, 304L, 316 or 316L except for 299-E33-360, 299-E33-361, and 299-E25-237. Well 299-E33-360 and 299-E33-361 shall be constructed with 8-in. diameter schedule 10 stainless steel Type 316L as these wells may be re-purposed as extraction wells in the future. Optional well 299-E25-237 shall be constructed with 4-in. diameter schedule 40 polyvinyl chloride (PVC) casing due to previous chloride corrosion of stainless steel in nearby existing wells.

Casing joints shall be flush joint with box-thread design and Viton rubber O-rings. Environmentally-compatible non-petroleum based lubricant, such as Jet-Lube Well Guard[1] thread compound or equivalent, may be used to lubricate the threads on the permanent casing. The well screens shall be V-Slot continuous wire-wrap design. Well screens shall also have flush joint threaded couplings with O-ring seals and shall be compatible with the casing couplings, or by use of an adapter. The screened interval for each well may vary in length depending upon chemical, geological, and hydrogeological conditions. Chemical and sediment analysis will determine the final length and positioning of the screen in the borehole. It is anticipated that 20-slot screens and 8-12 mesh filter pack will be used in the construction of the four monitoring wells, however the filter pack mesh size and screen slot size will be determined/confirmed based upon particle size distribution (sieve analysis) testing results. Stainless steel centering guides (centralizers) shall be placed from the bottom of the screen to the top of the casing at no greater than 40 ft intervals. Centralizers will not be required if the contractor uses a drilling method that provides an equivalent centering effect for the permanent casing (such as Dual Wall casing).

Well construction will not be carried out until the filter pack mesh size, screen length and screen slot size are confirmed by standard sieve analyses, sediment examination, and sediment and/or water sample analytical results. Contractors are required to use clean gloves when handling well materials that will be placed below the groundwater.

3.4.2 Annular Seal and Filter Pack

Boreholes extending below the designed depth shall be decommissioned from TD to 5 to 10 ft below the depth equivalent to the bottom of the proposed sump. National Sanitary Foundation/American National Standards Institute approved clean sand or CHPRC approved equivalent shall be used to decommission boreholes extending through aquifers. Bentonite shall be used to seal major confining layers to prevent inter-aquifer communication as described in WAC 173-160. Cement seals shall be of non-shrinking, neat cement grout containing no more than 5% bentonite by weight and no more than 6 gallons of water per 94 pounds of grout. The cement seals shall be emplaced using tremie pipe while maintaining the tremie nozzle inside the cement to prevent dilution of the cement. The cement must be allowed to cure for a minimum of 8 hours before additional well construction activities take place.

A generalized well construction diagram is presented in Figure 3; a generalized well construction diagram for 299-E33-360 is presented in Figure 4. Table 6 provides a summary of anticipated well construction parameters.

[1] Well Guard is a registered trademark of Jet-Lube, Inc., Houston, Texas

3.4.3 Wellhead

Surface protection for each well will be installed in accordance with WAC 173-160-420 and GRP-EE-02-14.1 with the following modifications:

- The protective casing shall be a minimum of 2-in. larger in diameter than the permanent casing. Protective casing shall be of schedule 20 or thicker, Type 304 or higher, stainless steel or schedule 40 PVC, if applicable
- The protective casing shall be sealed into the surface concrete pad, shall rise 3 ft above the ground surface, and shall be centered over the permanent well casing
- The protective casing shall be fitted with a lockable cap to extend 15-in. above the top of the protective casing and shall have inner tabs to fit plumb. The cap shall be easily removed from the protective casing, yet remain firmly in place when the cap is locked
- An access port will also be installed in the protective casing and holes for ground lugs will be approximately 1 ft below the top of the protective casing (Figure 5)
- Concrete pads for wells shall be 4 ft by 4 ft square by 6-in. thick and shall be steel reinforced with 6-in. by 6-in. W1.4XW1.4 (metric wire gage, approximately equivalent to 16 gage) welded wire fabric as a minimum standard
- A brass survey marker with the well identification number, well name, and date of completion shall be installed on the north side of the pad. Lettering shall be 3/8-in. tall. An Washington State Department of Ecology well number tag shall be attached to the outside of the protective casing
- Four protective posts shall be placed around the concrete pad. The posts shall be at least 3-in. in diameter. Three of the posts shall extend at least 3 ft above and below ground and shall be cemented at least 3 ft into the ground. The fourth post shall be removable for well access. Posts shall be located no more than 1 ft from the corners of the concrete pad and shall be primed and painted yellow per ANSI (1991), *ANSI Z535.1, Safety Color Code*, for marking physical hazards. Primer and paint materials shall conform to the following federal specifications:
  - Primer for metal parts: TT-P-645
  - Finish enamel: TT-E-489F, Class A

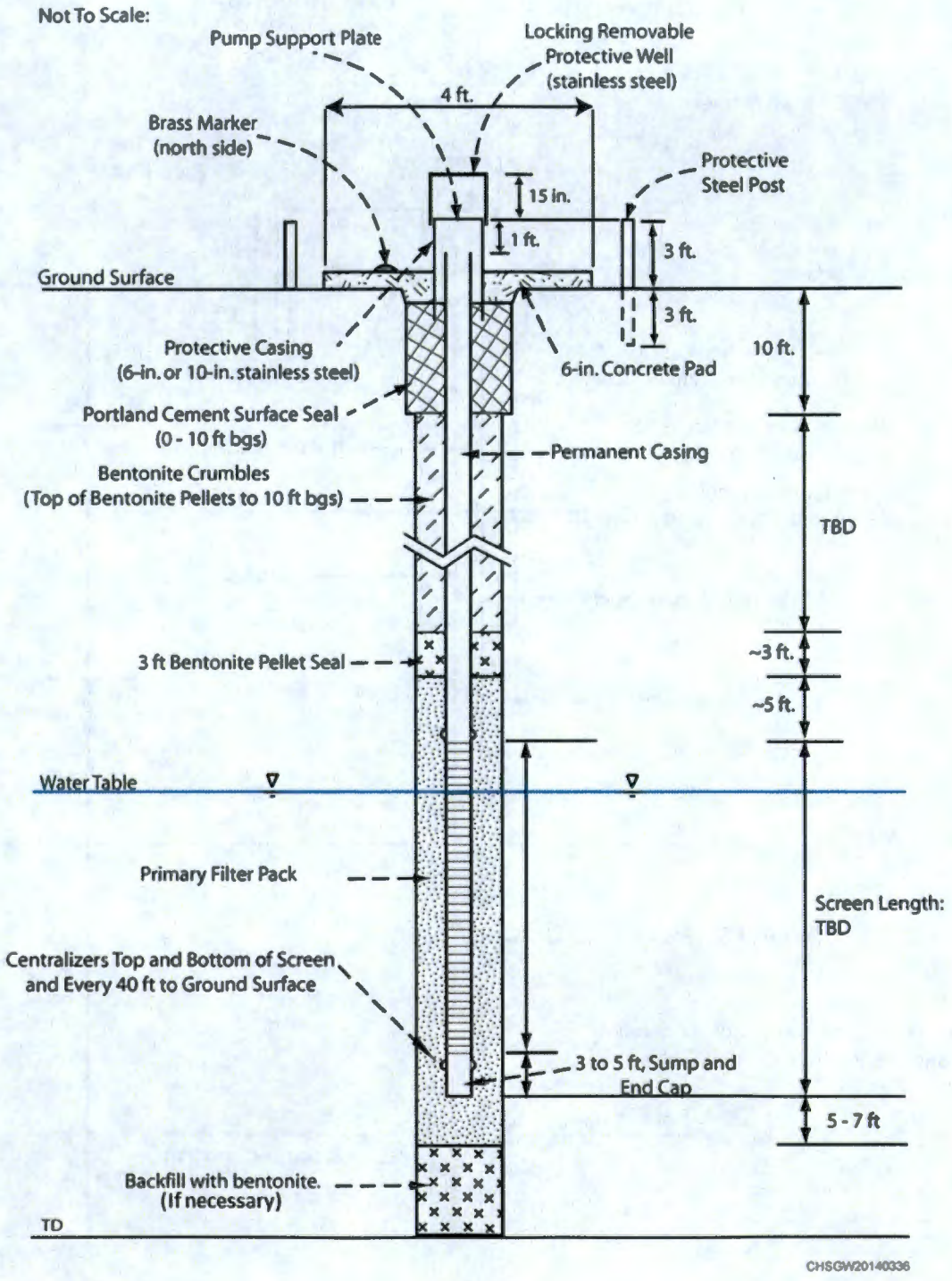

Figure 3. General Well Construction Diagram for Tri-Party Agreement M-24 Wells

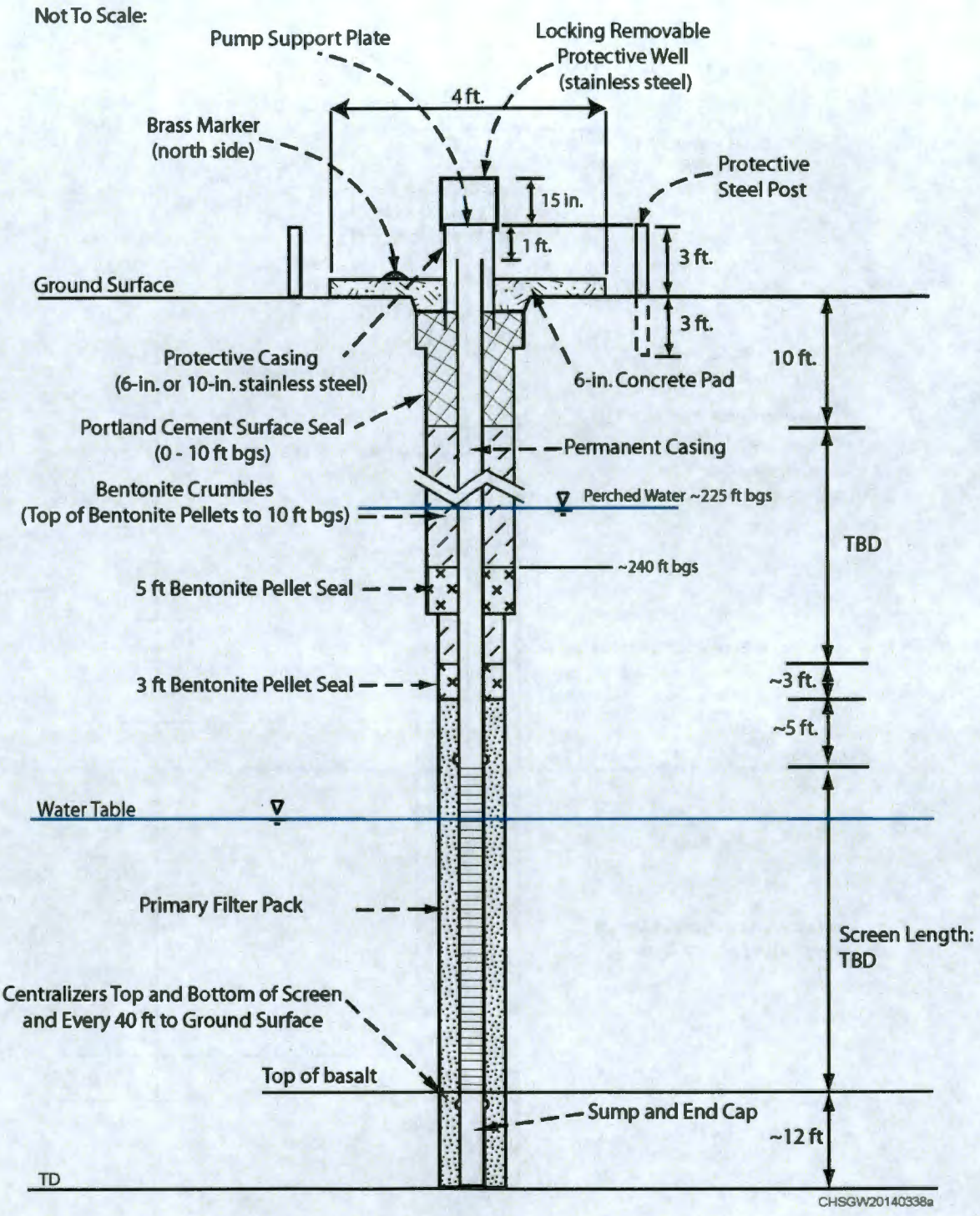

Figure 4. General Well Construction Design for 299-E33-360

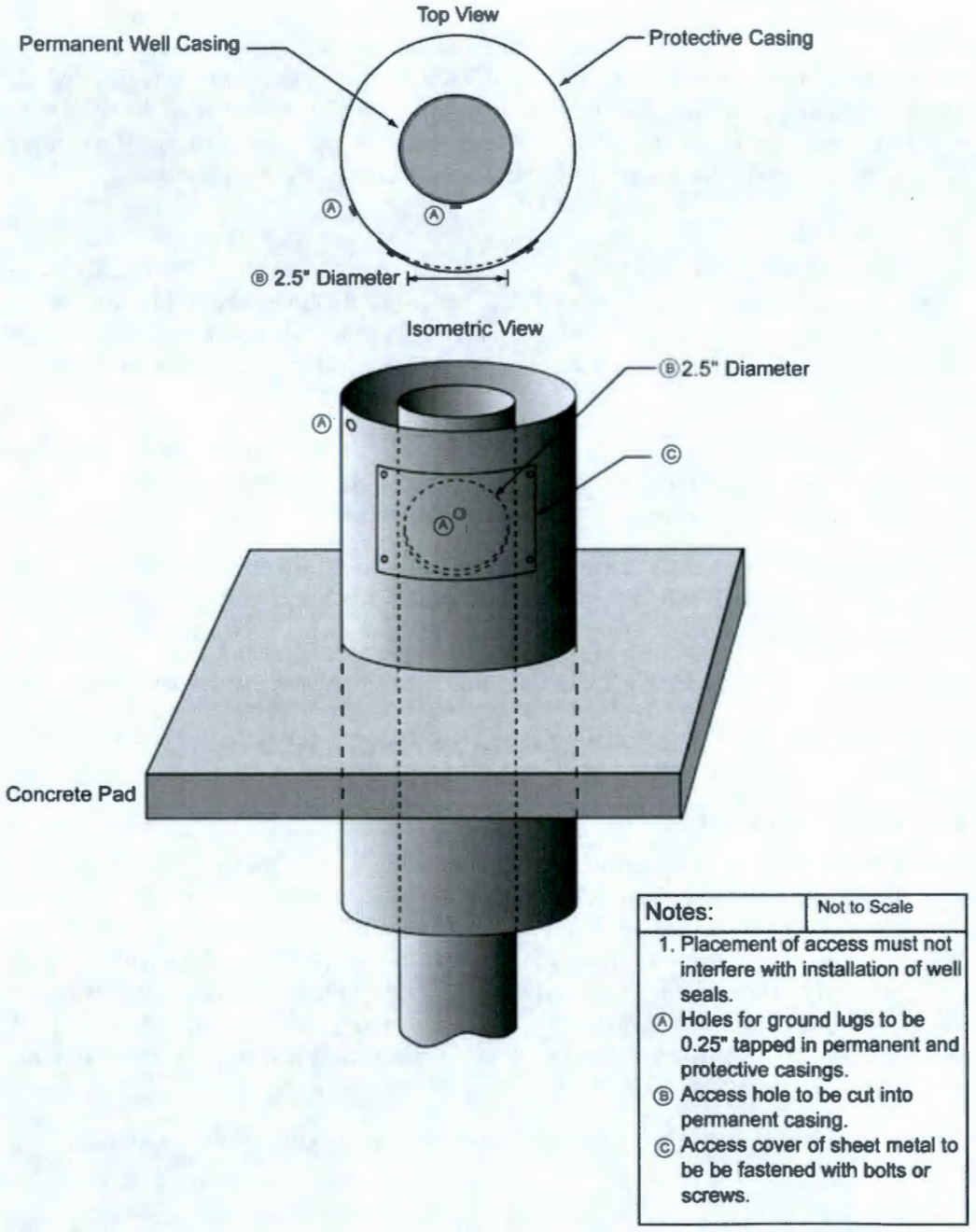

Figure 5. Diagram Showing Configuration of Access Port in Protective Casing

3.5 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 shall be conducted in two stages with initial development performed during well construction and final development performed after the wells are completed. Well development activities are directed toward ensuring adequate aquifer communication by removing fine-grained sediments from the aquifer, repairing borehole wall damage incurred during drilling, and settling the filter pack. To this end, the Drilling Contractor shall be able to provide a variety of well development tools and capabilities.

3.5.1 Screen Surging

Initial development shall be performed during well construction in conjunction with placement of the filter pack with the use of a dual-flange surge block to both settle the filter pack and to develop communication across the borehole wall. Combining surging with the filter pack placement will provide an abrasive action on the borehole wall that will enhance borehole efficiency. This initial development is performed as follows:

- Following final placement of the screen and permanent stainless steel casing, the Drilling Contractors shall add an appropriate amount of filter pack silica while withdrawing the temporary casing in no more than 10 ft intervals, depending on the length of the screen
- Surging is carried out with a dual-flange surge block of sufficient weight to ensure a surging motion over intervals not to exceed more than 10 ft of filter pack silica at a given time. Surging shall be considered complete with the filter pack silica level settles no more than 0.1 ft in 15 minutes
- Surging continues until the Field Geologist confirms completion of the initial development
- Fines shall be removed from the well as necessary to keep the screen free from sediment buildup during surging, by use of a bailing device (i.e., sand pump, dart bailer, etc.).

3.5.2 Final Well Development

Final well development and pump installation shall not be started sooner than 12 hours following placement of the annular cement grout seal, but shall take place within two weeks of installation of the well screen/casing for each well. The contractor shall notify the BTR 24 hours prior to the anticipated final well development time in order to arrange for purgewater transportation, hydrogeologic support, and other support necessary to implement final development. The Drilling Contractor shall provide a submersible pump with a check valve, flow meter, and all necessary support equipment capable of pumping no less than 150 gpm. The average well development time is assumed to take approximately 12 hours. Final well development shall be performed as follows:

- Bail fines from the well to within 0.5 ft of the bottom of the sump in preparation for final development
- Develop the well at a minimum of 2 intervals throughout the length of the screen using a submersible pump capable of producing at a minimum 150 gpm at the well head
- The field geologist will periodically collect water parameter readings of turbidity, water temperature, pH, conductivity, and dissolved oxygen (as applicable) using field instruments over the course of the final development. The drilling contractor needs to place a small valve on the restricting manifold with the flow meter to facilitate sampling

- Development will continue until the well produces clear water (≤ 5 nephelometric turbidity units) and the water temperature, pH, and conductivity have stabilized (at least three consecutive measurements with less than 10% mean variance).

CHPRC's Field Geologist will monitor aquifer response and recovery time utilizing a data logger in conjunction with a pressure transducer (or similar device) or manually using an e-tape. During recovery monitoring, the pump and all down-hole monitoring equipment must remain in place. Recovery monitoring is expected to take at least 60 minutes after the final development stage.

The Field Geologist will determine when development is complete in accordance with GRP-EE-01-6.3, *Well Development and Testing*. Should these conditions not be met, CHPRC's BTR, the concurrence of CHPRC's representative Field Geologist, and the project technical lead, shall determine when the development is adequate.

3.6 Final Report

A borehole summary report will be prepared after well completion to document well construction. The purpose of this document is to compile and archive records, observations, and measurements associated with the drilling and well construction. The borehole summary report includes the field notes and forms prepared during the drilling and construction of each well, well construction details, and well development data. Additional information presented in the report includes the geologic log based on the borehole cuttings, the results of the civil survey with elevation and depth corrections to measurements made while drilling, records of the management and disposition of drilling-derived waste, and the well acceptance documents.

4 Waste Management

The following are the major assumptions for handling and management of wastes derived during the drilling and construction of the wells discussed in this DOW. These wastes may include drill cuttings, purgewater, decontamination waste, personal protective equipment, and miscellaneous solid waste. Waste generated in the scope of this project will be managed according to DOE/RL-2000-51, *Interim Action Waste Management Plan for the 200-UP-1 Operable Unit*, DOE/RL-2003-30, *Waste Control Plan for the 200-BP-5 Operable Unit*, and DOE/RL-2004-18, *Waste Control Plan for the 200-PO-1 Operable Unit.*

Vadose and saturated zone soil cuttings and miscellaneous solid waste will be stored and managed as investigation-derived waste and surveyed by the Industrial Health and Radiation Control Technicians in accordance with the site-specific Health and Safety Plan. The contractor shall be responsible for packaging and handling all wastes generated during construction, testing, decontamination, and demobilization. The CHPRC Waste Management Specialist will provide final waste management instructions for the project.

Purewater will be collected and contained at the well head until it is either transported to the Modular Storage Unit or, if waste acceptance criteria can be met, the Effluent Treatment Facility, or to an appropriate pump-and-treat facility. Purgewater, groundwater samples, and decontamination fluids generated during well drilling, sample screening, and analysis shall be managed as purgewater in accordance with puregewater guidance provided in DOE/RL-2009-39, *Investigation-Derived Waste Purgewater Management Action Memorandum*, and DOE/RL-2009-80, *Investigation Derived Waste Purgewater Management Work Plan.*

5 Quality Assurance

CHPRC issued document PRC-MP-QA-599, *Quality Assurance Program*, describes how CHPRC implements the quality assurance (QA) requirements conveyed in U.S. Department of Energy Order 414.1D, *Quality Assurance*, and 10 CFR 830.121, *Nuclear Safety Management*. PRC-MP-QA-599 also shows how Ecology et al. (1989) and DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document (HASQARD)* apply to the Environmental QA Program Plans. CHPRC has also issued CHPRC-00189, *CHPRC Environmental Quality Assurance Program Plan.*

All CHPRC employees and subcontractors performing environmental cleanup activities are responsible for performing work in accordance with the requirements set forth in CHPRC-00189. All work performed under this DOW will be performed in compliance with Project Hanford Management System overall QA program design (PRC-MP-QA-599). A project specific QA program plan for the Soil and Groundwater Remediation Project scope is presented in Appendix C of CHPRC-00189.

All operations including drilling, sampling, and well completion/decommissioning, testing and associated documentation are subject to surveillance by CHPRC, CHPRC's authorizing agent and/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.

Technical procedures to be followed are listed in Section 7 of this document.

6 Schedule

The Tri-Party Agreement M-24 RCRA monitoring well installation effort begins July, 2014 and must be completed by September 30, 2014. Post installation reports shall be completed no later than October 31, 2014.

7 Technical Procedures

This section identifies technical procedures/specifications applicable to field activities performed under this DOW. Activities associated with the drilling and installation of these wells and management of waste generated by these activities will adhere to, at a minimum, the following procedures and requirements:

- 0000X-DC-W0001, *Supplemental Waste Acceptance Criteria for Disposal at Environmental Restoration Disposal Facility*
- GRP-EE-01-1.11, *Purgewater Management*
- GRP-EE-01-6.2, *Field Cleaning and/or Decontamination of GeoProbe® and Drilling Equipment*
- GRP-EE-01-6.3, *Well Development and Testing*
- GRP-EE-01-7.0, *Geologic Logging*
- GRP-EE-01-7.4, *Requirements for Use of Hydrogeologic Field Measurement & Monitoring Equipment*
- GRP-EE-02-14.1, *Drilling, Remediating, and Decommissioning Resource Protection Wells and Geotechnical Soil Borings*
- GRP-EE-02-14.5, *Returning Vadose Zone Drill Cuttings/Soils to the Environment*
- GRP-EE-05-1.21, *Particle Size Distribution of Soil – Wet Sieve Analysis*

- GRP-FS-04-G-005, *Control of Monitoring Instruments*
- GRP-FS-04-G-012, *Sample Packaging, Transporting and Shipping*
- GRP-FS-04-G-016, *Chain of Custody/Sample Analysis Request*
- GRP-FS-04-G-028, *Field Characterization & Treatment Monitoring Activities Groundwater Sampling*
- GRP-FS-04-G-029, *Non-VOC Soil and Sediment Sampling*
- GRP-FS-04-G-030, *VOC Soil and Sediment Sampling*
- PRC-PRO-IRM-8310, *Document Control Processes*
- PRC-PRO-IRM-10863, *Control of Notebooks and Logbooks*
- PRC-PRO-EP-15333, *Environmental Protection Processes*
- PRC-PRO-EP-15334, *Effluent and Environmental Monitoring for Radionuclide Airborne Emissions*
- PRC-PRO-EP-15335, *Environmental Permitting and Document Preparation*
- PRC-RD-EP-15332, *Environmental Protection Requirements*
- SGRP-PRO-OP-50120, *Waste Packaging and Handling at S&GRP*
- WAC 173-160, *Minimum Standards for Construction and Maintenance of Wells*
- WCH-191, *Environmental Restoration and Disposal Facility Waste Acceptance Criteria.*

8 General Requirements

All personnel working at the drilling sites will have completed, at a minimum:

- Occupational Safety and Health Administration 40-hour Hazardous Waste Operations and Emergency Response training, [29 CFR 1910.120]
- CHPRC General Employee Training
- Hanford Radiation Worker II training, as applicable.

Work will be performed in accordance with the following procedures:

- CHPRC-00073, *CH2M HILL Plateau Remediation Company Radiological Control Manual*
- Soil and Groundwater Remediation Project Radiological Control Procedures
- CHPRC Occupational Safety and Health Procedures
- Site specific plans, as applicable:
  - Health and safety plans
  - Radiological Work Permit, as applicable
  - Activity hazard analysis/job safety analysis.

9 Project Documentation

Document requirements for these activities are separated into scoping documents, field activity documents, and reporting documents. The following documents will be prepared to support the project activity:

- Scoping Documents
  - DOW (this document)
  - Drilling specifications/subcontractor scope of work (procurement package)
  - Excavation permit
  - Additional waste management documents, as required.
- Field Documentation
  - Well drilling/decommissioning planning form
  - Daily field activity reports (includes water level measurements)
  - Sample collection, custody, and shipment documentation for waste samples
  - Sample collection, custody, and shipment documentation for soil and groundwater samples
  - Well logs (borehole, lithologic, and completion)
  - Field logbook
  - Well construction summary report
  - Well summary sheet
  - Field cleaning and/or decommissioning sheets
  - Well development and test data sheets
  - Sieve analysis sheets
  - Well survey data report
  - Well acceptance report.
- Reporting Documents
  - Borehole summary report
  - State of Washington Resource Protection Well Report (generated by the driller)
  - Field documentation will be transmitted to the Geoscience Support for incorporation into the well database.

The records produced for this project will undergo technical and management review in accordance with CHPRC practices and procedures. The required reviewers will be indentified prior to document completion and the review time will be established as soon as practical.

10 References

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GRP-EE-01-1.11, *Purgewater Management*

GRP-EE-01-6.2, *Field Cleaning and/or Decontamination of GeoProbe® and Drilling Equipment*

GRP-EE-01-6.3, *Well Development and Testing*

GRP-EE-01-7.0, *Geologic Logging*

GRP-EE-01-7.4, *Requirements for Use of Hydrogeologic Field Measurement & Monitoring Equipment*

GRP-EE-02-14.1, *Drilling, Remediating, and Decommissioning Resource Protection Wells and Geotechnical Soil Borings*

GRP-EE-02-14.5, *Returning Vadose Zone Drill Cuttings/Soils to the Environment*

GRP-EE-05-1.21, *Particle Size Distribution of Soil-Wet Sieve Analysis*

GRP-FS-04-G-005, *Control of Monitoring Instruments*

GRP-FS-04-G-012, *Sample Packaging, Transporting and Shipping*

GRP-FS-04-G-016, *Chain of Custody/Sample Analysis Request*

GRP-FS-04-G-028, *Field Characterization & Treatment Monitoring Activities Groundwater Sampling*

GRP-FS-04-G-029, *Non-VOC Soil and Sediment Sampling*

GRP-FS-04-G-030, *VOC Soil and Sediment Sampling*

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PRC-PRO-IRM-10863, *Control of Notebooks and Logbooks*

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