U.S. Department of Energy
Hanford Site

24-SGD-0044

September 23, 2024

Mr. Roberto C. Armijo
Remedial Project Manager
Hanford Project Office
U.S. Environmental Protection Agency, Region 10
825 Jadwin Avenue, Suite 210
Richland, Washington 99352

Dear Mr. Armijo:

TRANSMITTAL OF 100-KR-4 GROUNDWATER OPERABLE UNIT WELL INSTALLATION SAMPLING AND ANALYSIS PLAN, ADDENDUM 2: WELLS 199-K-244, AND 199-K-245, DOE/RL-2019-16-ADD2, REVISION 0

This letter transmits the approved 100-KR-4 Groundwater Operable Unit Well Installation Sampling and Analysis Plan, Addendum 2: Wells 199-K-244, and 199-K-245, DOE/RL-2019-16-ADD2, Revision 0, and the associated review comment record, DOE/RL-2019-16, ADD2, Draft A, to the U. S. Environmental Protection Agency.

If you have any questions please contact me, or you may contact Ellwood Glossbrenner, Project Lead, Soil and Groundwater Division, at (509) 376-5828.

Sincerely,

NAOMI JASCHKE

Digitally signed by NAOMI JASCHKE
Date: 2024.09.23 09:31:48 -07'00'

Naomi M. Jaschke, Director
Soil and Groundwater Division

SGD:ETG

Attachments

cc: See page 2

Attachments:
1. DOE/RL-2019-16, Rev 0, Addendum 2
2. DOE/RL-2019-16, ADD2, Draft A RCR

cc w/attachs:
A. L. Boyd, Ecology
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cc w/o attachs:
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L. K. O'Mara, CPCCo
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Attachment 1
24-SGD-0044

100-KR-4 Groundwater Operable Unit
Well Installation Sampling and Analysis Plan
Addendum 2: Wells 199-K-244 and 199-K-245
DOE/RL-2019-16, Rev 0, ADD2

(19 pages including cover sheet)

DOE/RL-2019-16
Revision 0
Addendum 2

100-KR-4 Groundwater Operable Unit Well Installation Sampling and Analysis Plan, Addendum 2: Wells 199-K-244 and 199-K-245

Date Published
August 2024

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

U.S. DEPARTMENT OF ENERGY | Richland Operations Office
P.O. Box 550
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APPROVED
By Sarah Harrison at 10:47 am, Aug 14, 2024

Release Approval Date

Approved for Public Release;
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Signature Page

Title: *100-KR-4 Groundwater Operable Unit Well Installation Sampling and Analysis Plan, Addendum 2: Wells 199-K-244 and 199-K-245*

NAOMI JASCHKE Digitally signed by NAOMI JASCHKE
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U.S. Department of Energy, Richland Operations Office		

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Date: 2024.08.22 08:08:29 -07'00'

Print Name	Signature	Date
U.S. Environmental Protection Agency		

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1 Introduction

This sampling and analysis plan (SAP) addendum supports ongoing groundwater remediation efforts as described in DOE/RL-2013-33, *Remedial Design/Remedial Action Work Plan for the 100-KR-4 Groundwater Operable Unit Interim Action* (as modified by TPA-CN-0858 and TPA-CN-0930, *Tri-Party Agreement Change Notice Form: DOE/RL-2013-33, Remedial Design/Remedial Action Work Plan for the 100-KR-4 Groundwater Operable Unit Interim Action, Rev. 0*). This addendum contains site-specific field sampling plans for the wells identified in Table 1.

Table 1. Proposed Wells

Borehole ID	Well			Easting*	Northing*
	Name	Type	Diameter		
D0286	199-K-244	Monitoring	6 in.	569220.55	146780.33
D0287	199-K-245	Extraction		568305.66	146558.81

*Coordinates are estimates in NAD83, *North American Datum of 1983*, Washington State Plane South (meters).

ID = identification

Figure 1 shows the locations of the proposed wells identified in Table 1. Detailed information regarding well construction, quality assurance, and sampling is provided in DOE/RL-2019-16, *Well Installation Sampling and Analysis Plan for 100-KR-4 Groundwater Operable Unit.* Figure 2 presents a general well construction diagram for these 6 in. diameter wells.

2 Technical Justification Summary

Table 2 lists the technical justifications for each well identified in this SAP addendum. Wells are intended to support the following 100-K tasks beginning in fiscal year 2025:

1. Delineation and future remediation of the carbon-14 plume in the K East area originating from the 116-KE-1 Gas Condensate Crib (monitoring/extraction well).
2. Maintaining or increasing capture of hexavalent chromium (Cr(VI))-contaminated groundwater during demolition and remedial activities in the KW Reactor area. Multiple active extraction wells are planned for removal during excavation activities (monitoring/extraction well).

The two wells will be constructed as dual-purpose (monitoring/extraction) wells.

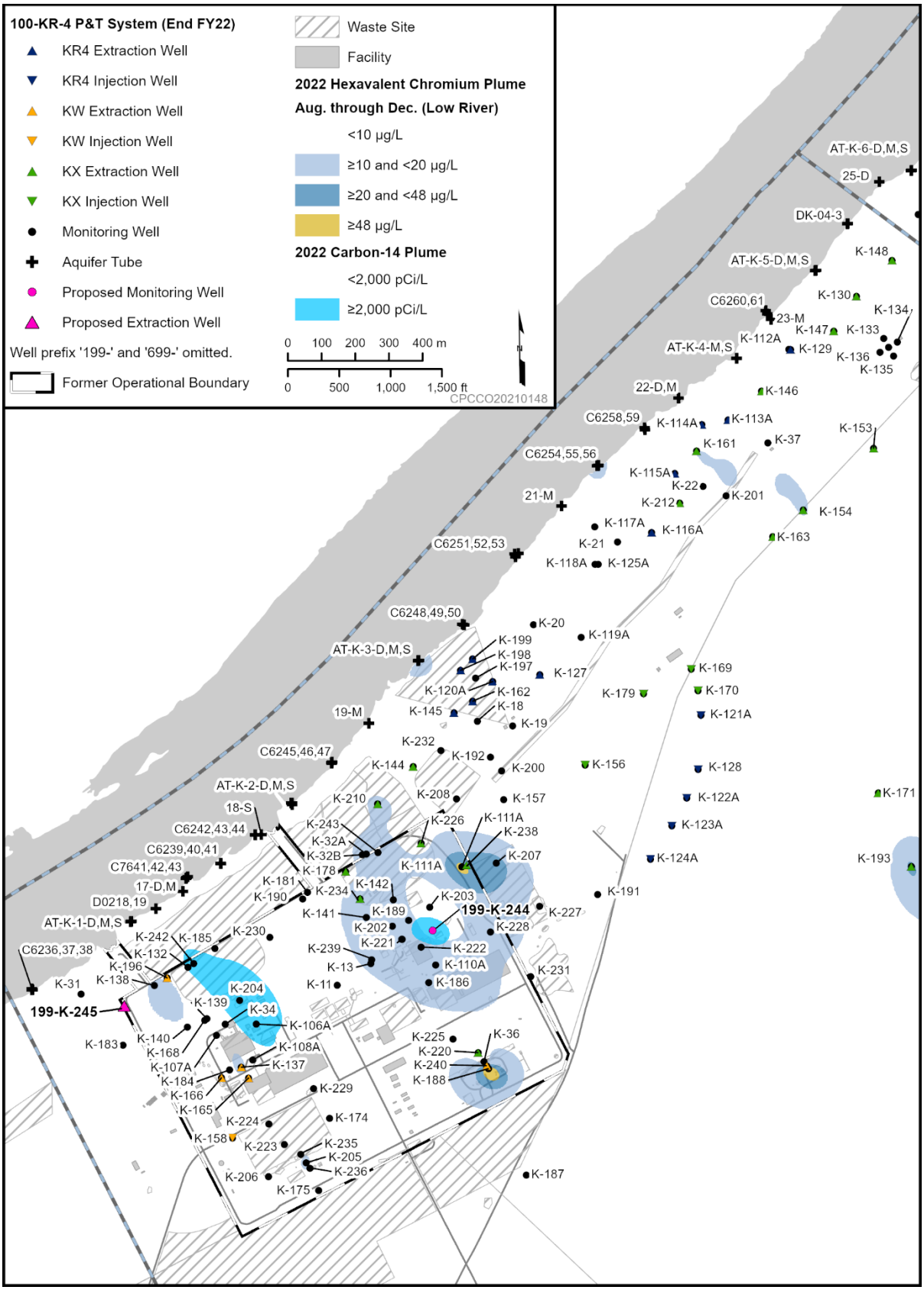

Figure 1. Proposed Well Locations

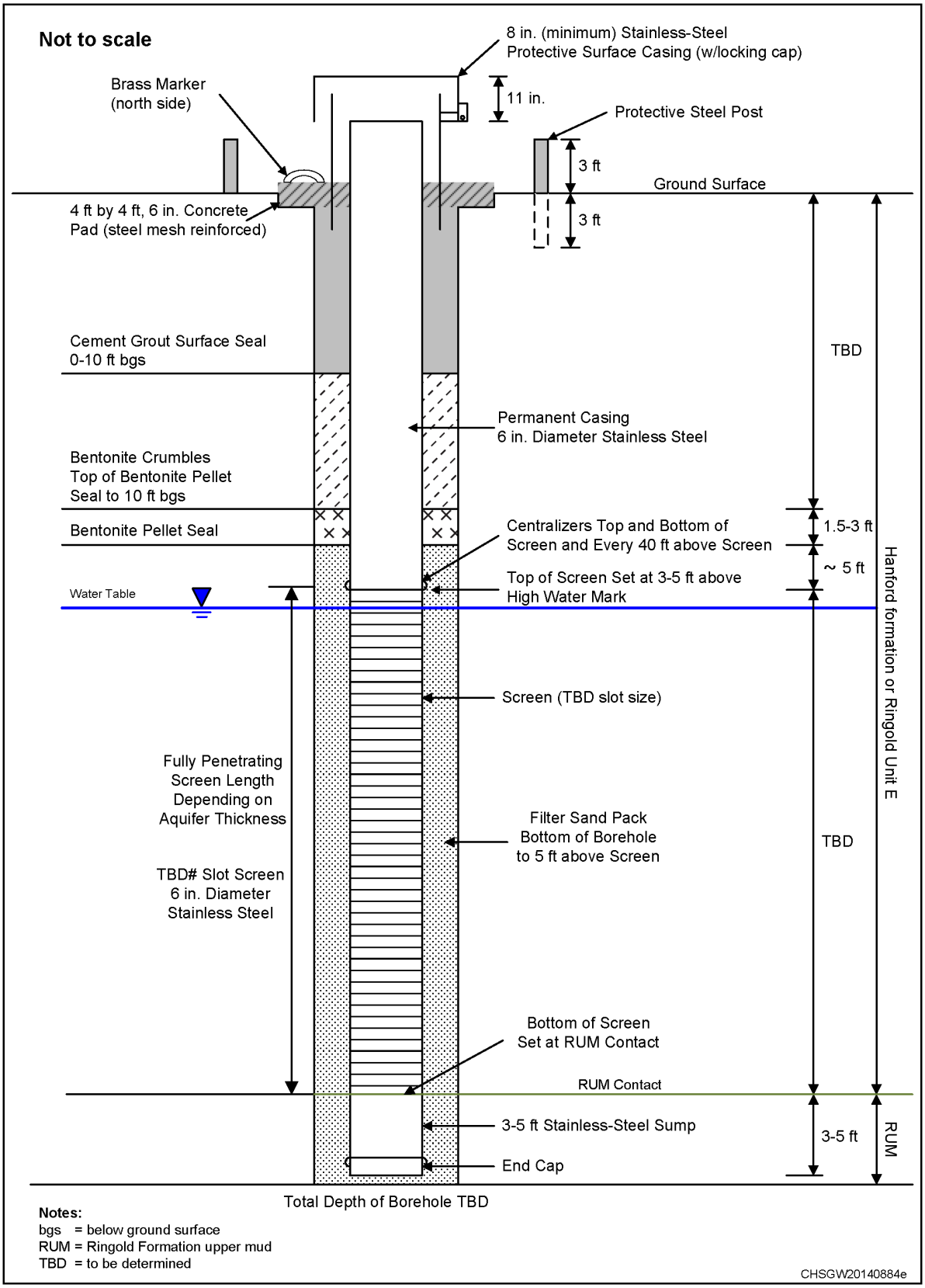

Figure 2. Generalized Well Construction Diagram for 6 in. Diameter Well

Table 2. Technical Justification Summary

Proposed Well	Technical Justification	Well Use
199-K-244	Well to address delineation and future treatment of carbon-14 originating from the 116-KE-1 Gas Condensate Crib. The carbon-14 plume originating from the 116-KE-1 Gas Condensate Crib was previously delineated by decommissioned wells 199-K-29 and 199-K-30. The purpose of the well is to (1) evaluate the current presence or extent of the carbon-14 plume; and (2) if applicable, extract groundwater for treatment. Due to the treatment of carbon-14 being in early planning and design phase, projected flow rates for the extraction wells have not been established but are expected to be about 30 gal/min or less.	Monitoring
199-K-245	Well to maintain or increase capture of Cr(VI)-contaminated groundwater during demolition and soil excavation activities planned around the KW Reactor. The activities will remove active extraction wells 199-K-137, 199-K-165, and 199-K-166. While 199-K-245 will not be a direct replacement for any of these soon-to-be impacted wells, it is planned as a downgradient replacement well to maintain capture and treatment of the Cr(VI) plume. The planned flow rate is about 30 gal/min. Inclusion of this new well into the P&T network will be addressed in the operations and maintenance plan.	Extraction

Cr(VI) = hexavalent chromium
P&T = pump and treat

3 Systematic Planning Summary

Systematic planning defines the criteria that a data collection design should satisfy. This process is used to ensure that the type, quantity, and quality of collected data will be appropriate for the intended application. Systematic planning was used to develop sampling requirements for wells identified in Table 1. Samples collected and analyzed as part of this SAP addendum will provide information to refine the contaminant distribution conceptual site model (CSM) for specific contaminant plume areas. Construction of groundwater monitoring wells is typically performed in a standardized manner with a minimal quantity of well-specific data being collected (e.g., vertical distribution of contaminants of interest over the thickness of the aquifer to target well-screen placement, and formation particle size distribution to support definition of well-screen sizing).

For this well construction evolution, a limited systematic planning process was used to address the following project-related questions:

- What issue or problem requires new data to make a decision?
  - Soil and groundwater data are needed to assess the vertical distribution of contamination to delineate the continuing source of groundwater contamination originating from the 116-KE-1 Gas Condensate Crib.
  - Groundwater data are needed to assess the vertical distribution of groundwater contamination to better delineate applicable groundwater plumes as well as optimize the location for the placement of extraction well pumps and future extraction wells along the KW shorelines.

  - The hydraulic conductivity data are needed to better define the hydrogeologic areas near the 116-KE-1 Gas Condensate Crib, KW Reactor, and upgradient of the 116-K-2 Trench for continued CSM refinement.

- What data are needed to support the decision?
  - Aquifer particle size distribution data are needed to specify screen slot size and filter pack requirements per standard practice.
  - For well 199-K-244, vertical distribution of Cr(VI) and carbon-14 contamination in soil, as well as Cr(VI), carbon-14, nitrate, and tritium contamination in groundwater are needed to better delineate contaminant concentrations above applicable standards downgradient of the 116-KE-1 Gas Condensate Crib and KE Reactor.
  - For well 199-K-245, vertical distribution of Cr(VI) and trichloroethene contamination in groundwater are needed to better delineate contaminant concentrations above applicable standards downgradient of the KW Reactor.
  - Aquifer hydraulic conductivity distribution will be used, where applicable, in future updates to the 100-KR-4 CSM and groundwater modeling.
  - After well construction, the applicable groundwater contaminant concentrations and geochemical parameters described in Table 1-3 in DOE/RL-2013-29, *Sampling and Analysis Plan for 100-KR-4 Groundwater Operable Unit Monitoring*, collected at the top of the aquifer are needed to establish baseline conditions in the aquifer.
- How will data be used to resolve the problem or issue?
  - Particle size distribution over the anticipated screen interval will be compared to well design standards to determine the appropriate screen slot size and filter pack.
  - Vertical profile soil and groundwater data collected during drilling will be compared to adjacent wells to determine the lateral extent of contamination and help optimize the appropriate depth to install the extraction well pump.
  - Post-development groundwater data will be used to establish baseline conditions in support of evaluation of subsequent groundwater data from each well.

Figures 3 and 4 show the estimated split-spoon sample depths and expected lithology to be encountered during drilling at each well location. Table 3 provides a summary of anticipated geology, expected water levels, and total drill depths. Tables 4 and 5 present sample collection depths and analytes at each well location.

After installation, these wells will be added to DOE/RL-2013-29 through Ecology et al., 1989, *Hanford Federal Facility Agreement and Consent Order*, via a change notice. Groundwater monitoring will be conducted for a minimum of 2 years at triannual sampling (i.e., three times per year) to establish baseline conditions. Sampling added to DOE/RL-2013-29 will include the same list of parameters as described for post-development, unless the reported contaminant concentration is below the detection limit.

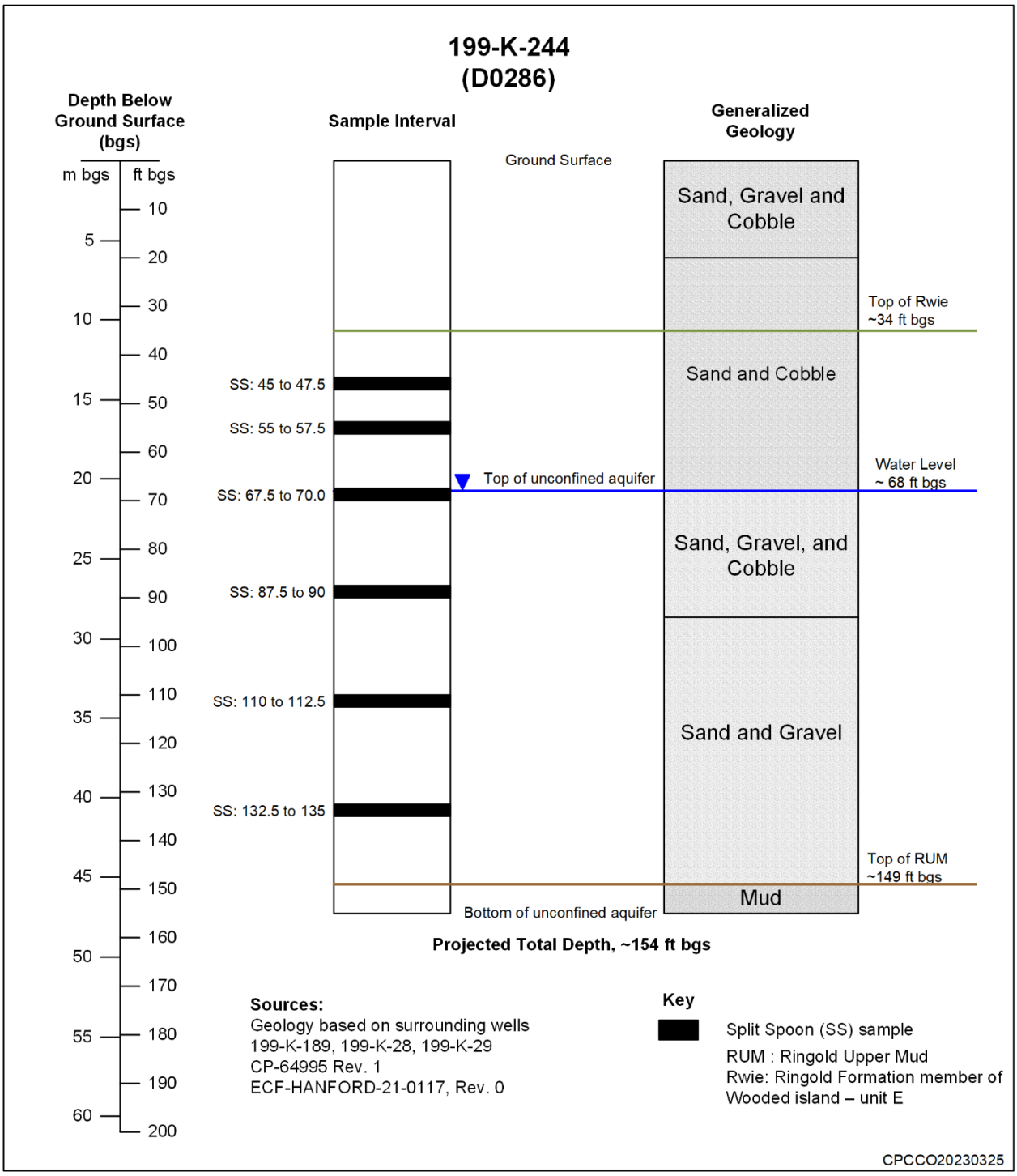

Figure 3. Well 199-K-244 Expected Stratigraphy and Sampling Intervals

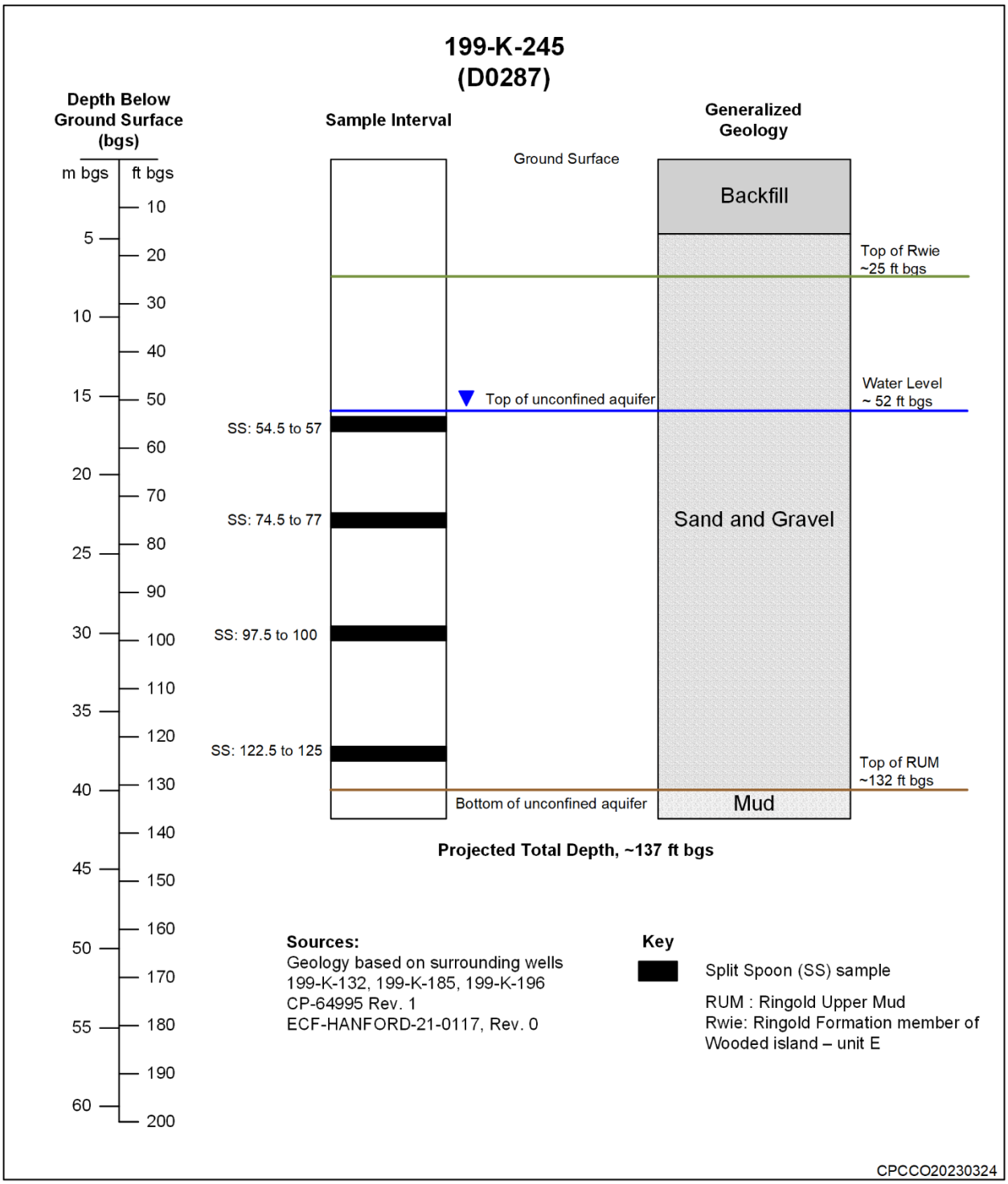

Figure 4. Well 199-K-245 Expected Stratigraphy and Sampling Intervals

Table 3. Summary of Geologic Information

Borehole ID	Well Name	Expected Depth (ft bgs)			
		To Water*	To Ringold Formation Member of Wooded Island – Unit E	To Ringold Formation Upper Mud Unit	Total
D0286	199-K-244	68	35	149	154
D0287	199-K-245	52	25	132	137

*Expected depth to water will vary based on the time of year wells are drilled, and on interpolated 2021 water levels.

bgs = below ground surface

ID = identification

Table 4. Soil and Geologic Sampling

Sample Type	Comments	Well Name	Estimated Depth (ft bgs)	Analytes
Grab	Archival purposes	All wells	Every 5 ft and at lithology changes	None
	Screen selection		Every 5 ft of screened interval within unconfined aquifer	Grain size (field measurement)
Split spoon[a]	Vadose	199-K-244 (D0286)	45 to 47.5 ft 55 to 57.5 ft	Cr(VI) and carbon-14
	Unconfined aquifer		67.5 to 70 (upper aquifer)[b] 87.5 to 90 (upper middle aquifer) 110 to 112.5 (lower middle aquifer) 132.5 to 135 (bottom aquifer)	Hydraulic conductivity Cr(VI), carbon-14, nitrate, and tritium[c]

Table 4. Soil and Geologic Sampling

Sample Type	Comments	Well Name	Estimated Depth (ft bgs)	Analytes
	Unconfined aquifer	199-K-245 (D0287)	54.5 to 57 (upper aquifer)[b] 74.5 to 77 (upper middle aquifer) 97.5 to 100 (lower middle aquifer) 122.5 to 125 (bottom aquifer)	Hydraulic conductivity

a. If air-rotary or similar drilling method is used, samples will be collected via split spoon.

b. Upper aquifer split-spoon samples target the top of the unconfined aquifer and should be adjusted in the field to match encountered conditions.

c. Identified contaminants only apply to the first split-spoon interval.

bgs = below ground surface

Cr(VI) = hexavalent chromium

Table 5. Groundwater Sampling

Sample Type	Comments	Well Name	Estimated Depth (ft bgs)	Analytes
During drilling[a]	Top, middle, and bottom of the screened interval	199-K-244 (D0286)	67.5 to 70 (upper aquifer)[b] 87.5 to 90 (upper middle aquifer) 110 to 112.5 (lower middle aquifer) 132.5 to 135 (bottom aquifer)	Cr(VI) – filtered Nitrate – unfiltered Carbon-14 and tritium – unfiltered
		199-K-245 (D0287)	54.5 to 57 (upper aquifer)[b] 74.5 to 77 (upper middle aquifer) 97.5 to 100 (lower middle aquifer) 122.5 to 125 (bottom aquifer)	Cr(VI) – filtered Carbon-14 Trichloroethene – unfiltered
Post-development; common analyte list	Depth of sample will be at the top of the aquifer, which is needed to establish baseline conditions in the aquifer	Both wells	Screened interval	Metals (Cr(VI) filtered; total chromium, calcium, magnesium, potassium, and sodium) on filtered and unfiltered aliquots Anions (chloride, fluoride, nitrate, phosphate, and sulfate) on unfiltered aliquots Alkalinity (bicarbonate) on unfiltered aliquots Volatile organics analysis (trichloroethene) on unfiltered aliquot Carbon-14, strontium-90, tritium – unfiltered

a. Water samples collected during drilling will be on expedited turnaround times to aid in setting well screens.

b. First water sample is targeted for the top of the aquifer but will be adjusted in the field to allow adequate sample depth for a pumped sample. The sampling will be completed at approximately 5 ft below the top of the aquifer to allow for pump placement.

bgs = below ground surface

Cr(VI) = hexavalent chromium

4 Sampling and Analysis Protocol

The quality assurance project plan outlining the project management structure, data generation and acquisition, analytical procedures, and quality control is provided in Chapter 2 of DOE/RL-2019-16. Chapters 3 through 5 of DOE/RL-2019-16 provide the sampling protocols (e.g., sampling methods, sample handling and custody, management of waste, and health and safety considerations).

5 Documentation and Reporting

The analytical results collected under this SAP addendum will be summarized and included in the Hanford Site annual groundwater reports (e.g., DOE/RL-2021-51, *Hanford Site Groundwater Monitoring Report for 2021*), as appropriate.

6 References

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Modified by:

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Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: https://www.hanford.gov/page.cfm/TriParty/TheAgreement.

NAD83, 1991, *North American Datum of 1983*, as revised, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland. Available at: https://www.ngs.noaa.gov/datums/horizontal/north-american-datum-1983.shtml.

Attachment 2
24-SGD-0044

Review Comment Record
100-KR-4 Groundwater Operable Unit
Well Installation Sampling and Analysis Plan
Addendum 2: Wells 199-K-244, 199-K-245
DOE/RL-2019-16, ADD2, Draft A

(2 pages including cover sheet)

Tracking_ID	Chapter	Section	Page	Line	Table_Figure							Comment_Basis	Agency Commenter	Disposition				Response_to_Comment	Concurrence	Date_Concurrence
GWSAP-EPA-001	1	2										In conjunction with Yakama Nation's comment #4 regarding the justification of the C-14 plume that merits discussion between EPA, DOE, and Yakama Nation, there is the question of the potential effectiveness of this proposed monitoring well. There are several monitoring wells nearby (e.g., K-189, K-221, K-203, K- 222) that are still in operation. Additional justification and discussion is needed for the proposed placement and well screening depth of monitoring well 199-K-244.	EPA	No Change				While other monitoring wells are located in the surround area, none are located in the modeled plumed area of highest C-14 concentration. Well 199-K-244 would be installed to capture this region of the plume to gain valuable insights into the true COC concentrations here. Concerning the screen depth - nearby wells 199-K-203 and 199-K-228 are both screened at similar lengths (~90 ft.) as fully-penetrating screens. This is the planned construction design for proposed well 199-K-244 based on Rwie depth estimates of ~79 - 159 ft. bgs. Samples collected during drilling will provide information on the optimal depth for well placement to capture the highest COC zone. Due to the proposed well's proximity to the Columbia River, there may be seasonal variability of the water column height in the well, and a longer screen will allow for consistent sampling of the highest COC zone of the Rwie and proper setting of the pump depth. In addition, while proposed well 199-K-244 will initially be a monitoring well, the well will eventually be used as an extraction well to support C-14 remediation. This further necessitates the construction of a fully penetrating screen. This would not take place until a final remedy is selected.	Yes	7/30/2024
GWSAP-EPA-002	1	2										Change " (one dual-purpose well) " to " (one monitoring well) ".	EPA	Accept with Modification				All wells drilled in 100-KR are dual purpose wells with the strategy that the wells are initially used for monitoring purposes and can then be re-purposed as pump and treat wells to support remediation. The description was revised as follows: "*1. Delineation and future remediation of the carbon-14 plume in the K East area originating from the 116-KE-1 Gas Condensate Crib (monitoring/extraction well).* "	Yes	7/30/2024
GWSAP-EPA-003	1	2										This requires further discussion in conjuction with Yakama Nation's comment #5. As it stands explained within the document, the geographic placement of the proposed injection wells away from the existing injection wells is not sufficient. Additional justification is required to support why the new placement is viable.	EPA	Not Accepted				Wells 199-K-246 and 199-K-247 are no longer proposed wells in this SAP. Comment not accepted since the text in question has been removed.	Yes	7/30/2024
GWSAP-EPA-004	4	2			Table 2							At the end of the technical justification for proposed well 199-K- 244, insert additional language "....and will be addressed in a future TPA-CN."	EPA	Accept with Modification				Changes to wells in the P&T network are made in the operations and maintenance plan, not the groundwater monitoring plan. Table 2, well 199-K-244, Technical Justification was edited as follows: "*...Due to the treatment of carbon-14 being in early planning and design phase, projected flow rates for the extraction well have not been established but are expected to be about 30 gal/min or less. Inclusion of this new well into the P&T network will be addressed in the operations and maintenance plan.*"	Yes	7/30/2024
GWSAP-EPA-005	4	2			Table 2							For proposed well 199-K-245, specify in technical justification if the new well is replacing a specific well or the previously mentioned wells (199-K-137, 199-K-165, 199-K-166) in body text.	EPA	Accept with Modification				Table 2 has been edited as follows: "*The activities will remove active extraction wells 199-K-137, 199 K 165, and 199-K-166. ~~The new well~~ While 199-K-245 will not be a direct replacement for any of these soon-to-be impacted wells, it is planned as a downgradient replacement well to maintain capture and treatment of the Cr(VI) plume.*"	Yes	7/30/2024
GWSAP-EPA-006	4	2			Table 2							For proposed well 199-K-245, has the timing of the installation been compared to any ongoing construction/remedial activities?	EPA	No Change				Yes - we are proposing this well because we know that future activities in the K-West area will impact existing extraction wells.	Yes	7/30/2024